**** WARNING ** WARNING ** WARNING ** WARNING ****
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STATE OF CALIFORNIA

DEPARTMENT OF TRANSPORTATION

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# NOTICE TO CONTRACTORS

# AND

# SPECIAL PROVISIONS

## FOR CONSTRUCTION ON STATE HIGHWAY IN

**LOS ANGELES COUNTY IN DIAMOND BAR AND CITY OF INDUSTRY FROM 0.1 KM NORTH OF PATHFINDER ROAD OVERCROSSING TO ROUTE 57/60 INTERCHANGE AND 0.8 KM WEST OF BREA CANYON ROAD TO 0.6 KM EAST OF GRAND AVENUE**

**DISTRICT 07, ROUTES 57,60**

---

**For Use in Connection with Standard Specifications Dated JULY 1999, Standard Plans Dated JULY 1999, and Labor Surcharge and Equipment Rental Rates.**

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**CONTRACT NO. 07-1257U4**

**07-LA-57,60-R5.2/R7.3**
**R36.1/R40.0**

**Federal Aid Project**

**ACSTP-X037(114)E**

**Bids Open: February 27, 2003**

**Dated: December 30, 2002**

**DRB**
**OSD**

**********

# IMPORTANT SPECIAL NOTICES

**********

- Attention is directed to the Notice to Contractors regarding the bid opening location.
- Attention is directed to Section 1, "Specifications and Plans," of these special provisions for Amendments To July 1999 Standard Specifications. Amendments to the various sections of the Standard Specification have been consolidated into Section 1 and dated to reflect the most recent revision.
- The bidder's attention is directed to Section 5 of these Special Provisions regarding possible establishment of a Dispute Review Board (DRB) for the project.
- The specifications for this project require the production of asphalt-rubber binder. The Air Quality Management District must approve the production and placement of asphalt-rubber binder and rubberized asphalt concrete, in addition to the Operating Permits required to produce asphalt concrete. Air Quality Management Districts have stopped production of these products due to failure to obtain necessary approvals.

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# STANDARD PLANS LIST

The Standard Plan sheets applicable to this contract include, but are not limited to those indicated below. The Revised Standard Plans (RSP) and New Standard Plans (NSP) which apply to this contract are included as individual sheets of the project plans.

| | |
|---|---|
| A10A | Abbreviations |
| A10B | Symbols |
| A20A | Pavement Markers and Traffic Lines, Typical Details |
| A20B | Pavement Markers and Traffic Lines, Typical Details |
| A20C | Pavement Markers and Traffic Lines, Typical Details |
| A20D | Pavement Markers and Traffic Lines, Typical Details |
| A24A | Pavement Markings - Arrows |
| A24B | Pavement Markings - Arrows |
| A24C | Pavement Markings - Symbols and Numerals |
| A24D | Pavement Markings - Words |
| A24E | Pavement Markings - Words and Crosswalks |
| RSP A35B | Portland Cement Concrete Pavement (Doweled Transverse Joints) |
| A35C | Portland Cement Concrete Pavement Joint and End Anchor Details |
| A62A | Excavation and Backfill - Miscellaneous Details |
| A62B | Limits of Payment for Excavation and Backfill - Bridge Surcharge and Wall |
| A62D | Excavation and Backfill - Concrete Pipe Culverts |
| RSP A62DA | Excavation and Backfill - Concrete Pipe Culverts |
| A62E | Excavation and Backfill - Cast-In-Place Reinforced Concrete Box and Arch Culverts |
| A62F | Excavation and Backfill - Metal and Plastic Culverts |
| A73A | Object Markers |
| A73B | Markers |
| RSP A73C | Delineators, Channelizers and Barricades |
| A76A | Concrete Barrier Type 60 |
| A76B | Concrete Barrier Type 60 |
| A76C | Concrete Barrier Type 60E |
| A76H | Concrete Barrier Type 60S |
| A77A | Metal Beam Guard Railing – Typical Wood Post With Wood Block |
| A77AA | Metal Beam Guard Railing – Typical Steel Post With Wood Block |
| A77B | Metal Beam Guard Railing - Standard Hardware |
| A77C | Metal Beam Guard Railing – Wood Post and Wood Block Details |
| A77D | Metal Beam Guard Railing – Typical Layouts |
| A77E | Metal Beam Guard Railing – Typical Layouts |
| A77F | Metal Beam Guard Railing – Typical Embankment Widening for End Treatments |
| A77FA | Metal Beam Guard Railing – Typical Line Post Installation |
| RSP A77G | Metal Beam Guard Railing – End Treatment, Terminal Anchor Assembly (Type SFT) |
| A77H | Metal Beam Guard Railing - Anchor Cable and Anchor Plate Details |
| A77J | Metal Beam Guard Railing Connections to Bridge Railings, Retaining Walls and Abutments |
| RSP A77L | Metal Beam Guard Railing and Single Faced Barrier Railing Terminal System - End Treatments |
| A81A | Crash Cushion, Sand Filled (Unidirectional) |
| RSP A82A | Crash Cushion (Type CAT) |
| A82B | Crash Cushion (Type ADIEM) |
| A85 | Chain Link Fence |
| A87 | Curbs, Dikes and Driveways |

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|---|---|
| A88A | Curb Ramp Details |
| D73 | Drainage Inlets |
| D74B | Drainage Inlets |
| D74C | Drainage Inlet Details |
| D75C | Pipe Inlets |
| D77A | Grate Details |
| D77B | Bicycle Proof Grate Details |
| D79 | Precast Reinforced Concrete Pipe - Direct Design Method |
| D80 | Cast-in-Place Reinforced Concrete Single Box Culvert |
| D81 | Cast-in-Place Reinforced Concrete Double Box Culvert |
| RSP D82 | Cast-in-Place Reinforced Concrete Culvert Miscellaneous Details |
| D86A | Box Culvert Warped Wingwalls |
| D87D | Overside Drains |
| D88 | Construction Loads On Culverts |
| D93A | Pipe Riser Connections |
| D93B | Drainage Inlet Riser Connections |
| D94B | Concrete Flared End Sections |
| D97E | Corrugated Metal Pipe Coupling Details No. 5 - Standard Joint |
| D97F | Corrugated Metal Pipe Coupling Details No. 6 - Positive Joint |
| D97H | Reinforced Concrete Pipe or Non-Reinforced Concrete Pipe - Standard and Positive Joints |
| D98C | Grated Line Drain Details |
| D99A | Structural Section Drainage System Details |
| D99B | Edge Drain Outlet and Vent Details |
| D99C | Edge Drain Cleanout and Vent Details |
| D99D | Cross Drain Interceptor Details |
| H1 | Planting and Irrigation - Abbreviations |
| H2 | Planting and Irrigation - Symbols |
| H3 | Planting and Irrigation Details |
| H4 | Planting and Irrigation Details |
| H5 | Planting and Irrigation Details |
| H6 | Planting and Irrigation Details |
| H7 | Planting and Irrigation Details |
| H8 | Planting and Irrigation Details |
| T1A | Temporary Crash Cushion, Sand Filled (Unidirectional) |
| T1B | Temporary Crash Cushion, Sand Filled (Bidirectional) |
| RSP T2 | Temporary Crash Cushion, Sand Filled (Shoulder Installations) |
| T3 | Temporary Railing (Type K) |
| T4 | Temporary Traffic Screen |
| T5 | Temporary Terminal Section (Type K) |
| T7 | Construction Project Funding Identification Signs |
| T10 | Traffic Control System for Lane Closure On Freeways and Expressways |
| T10A | Traffic Control System for Lane and Complete Closures On Freeways and Expressways |
| T11 | Traffic Control System for Lane Closure On Multilane Conventional Highways |
| T12 | Traffic Control System for Lane Closure On Multilane Conventional Highways |
| T14 | Traffic Control System for Ramp Closure |
| T15 | Traffic Control System for Moving Lane Closure On Multilane Highways |
| T16 | Traffic Control System for Moving Lane Closure On Multilane Highways |
| RSP B3-1 | Retaining Wall Type 1 - H=1200 Through 9100 mm |
| RSP B3-2 | Retaining Wall Type 1 - H=9700 Through 10 900 mm |
| RSP B3-8 | Retaining Wall Details No. 1 |
| B3-9 | Retaining Wall Details No. 2 |
| B6-10 | Utility Openings, T-Beam |
| B7-6 | Deck Drains - Types D-1 and D-2 |
| B7-11 | Utility Details |
| RSP B11-56 | Concrete Barrier Type 736 |
| RS1 | Roadside Signs, Typical Installation Details No. 1 |

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| RS2 | Roadside Signs - Wood Post, Typical Installation Details No. 2 |
| RS4 | Roadside Signs, Typical Installation Details No. 4 |
| RSP S1 | Overhead Signs - Truss, Instructions and Examples |
| RSP S2 | Overhead Signs - Truss, Single Post Type - Post Types II Thru VII |
| RSP S3 | Overhead Signs - Truss, Two Post Type - Post Types I-S Thru VII-S |
| S4 | Overhead Signs - Truss, Single Post Type - Structural Frame Members |
| RSP S5 | Overhead Signs - Truss Two Post Type - Structural Frame Members |
| RSP S6 | Overhead Signs - Truss, Structural Frame Details |
| RSP S7 | Overhead Signs -Truss, Frame Juncture Details |
| RSP S8C | Overhead Signs - Truss, Sign Mounting Details, Laminated Panel - Type A |
| S9 | Overhead Signs - Walkway Details No. 1 |
| S10 | Overhead Signs - Walkway Details No. 2 |
| RSP S11 | Overhead Signs - Walkway Safety Railing Details |
| RSP S13 | Overhead Signs - Truss, Pile Foundation |
| S14A | Overhead Signs - Lightweight Balanced - Single Steel Post Connection and Mounting Details |
| S16 | Overhead Signs - Lightweight, Type B, Connection Details |
| RSP S17 | Overhead Signs - Lightweight, Type C, Connection Details |
| S18A | Overhead Signs - Lightweight, Sign Panel Mounting Details, Laminated Panel - Type A |
| RSP S20A | Overhead Signs - Lightweight, Post Details |
| RSP S20B | Overhead Signs - Lightweight, Foundation Details |
| S40N | Overhead Signs- Tubular, Instructions and Examples |
| S40P | Overhead Signs - Tubular, Single Post Type, Layout and Pipe Selection |
| RSP S40Q | Overhead Signs - Tubular, Two Post Type, Layout and Pipe Selection |
| S40R | Overhead Signs - Tubular, Structural Frame Details No. 1 |
| RSP S40S | Overhead Signs - Tubular, Structural Frame Details No. 2 |
| RSP S40T | Overhead Signs - Tubular, Base Plate and Anchorage Details |
| RSP S40U | Overhead Signs - Tubular, Foundation Details |
| ES-1A | Signal, Lighting and Electrical Systems - Symbols and Abbreviations |
| ES-1B | Signal, Lighting and Electrical Systems - Symbols and Abbreviations |
| ES-2C | Signal, Lighting and Electrical Systems - Service Equipment Notes, Type III Series |
| ES-2E | Signal, Lighting and Electrical Systems - Service Equipment and Typical Wiring Diagram Type III-B Series |
| ES-2F | Signal, Lighting and Electrical Systems - Service Equipment and Typical Wiring Diagram Type III-C Series |
| ES-3A | Signal, Lighting and Electrical Systems - Controller Cabinet Details |
| ES-3B | Signal, Lighting and Electrical Systems - Controller Cabinet Details |
| ES-3C | Signal, Lighting and Electrical Systems - Controller Cabinet Details |
| ES-4A | Signal, Lighting and Electrical Systems - Signal Heads and Mountings |
| ES-4B | Signal, Lighting and Electrical Systems - Signal Heads and Mountings |
| ES-4C | Signal, Lighting and Electrical Systems - Signal Heads and Mountings |
| ES-4D | Signal, Lighting and Electrical Systems - Signal Heads and Mountings |
| ES-5A | Signal, Lighting and Electrical Systems - Detectors |
| ES-5B | Signal, Lighting and Electrical Systems - Detectors |
| ES-5C | Signal, Lighting and Electrical Systems - Detectors |
| ES-5D | Signal, Lighting and Electrical Systems - Detectors |
| ES-5E | Signal, Lighting and Electrical Systems - Detectors |
| RSP ES-6A | Lighting Standards - Types 15, 21 and 22 |
| RSP ES-6B | Lighting Standards - Types 15 AND 21, Barrier Rail Mounted Details |
| ES-6D | Lighting Standards - Types 15D, 21D and 22D Double Luminaire Arm |
| ES-6E | Lighting Standards - Types 30 and 31 |
| RSP ES-6F | Lighting Standards - Type 30 and 31 Base Plate Details |
| ES-7B | Signal and Lighting Standards - Type 1 Standards and Equipment Numbering |
| RSP ES-7D | Signal and Lighting Standards - Case 2 Arm Loading, Wind Velocity = 129 km/h, Arm Lengths 4.6 m to 9.1 m |
| RSP ES-7E | Signal and Lighting Standards - Case 3 Arm Loading, Wind Velocity = 129 km/h, Arm |

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|---|---|
| | Lengths 4.6 m to 13.7 m |
| ES-7K | Signal, Lighting and Electrical Systems - Cantilever Flashing Beacon, Types 9, 9A and 9B |
| ES-7L | Signal, Lighting and Electrical Systems - Cantilever Flashing Beacon, Types 9, 9A and 9B |
| ES-7M | Signal and Lighting Standards - Details No. 1 |
| ES-7N | Signal and Lighting Standards - Details No. 2 |
| ES-8 | Signal, Lighting and Electrical Systems - Pull Box Details |
| ES-9A | Signal, Lighting and Electrical Systems - Electrical Details, Structure Installations |
| ES-9B | Signal, Lighting and Electrical Systems - Electrical Details, Structure Installations |
| ES-9C | Signal, Lighting and Electrical Systems - Electrical Details, Structure Installations |
| ES-9D | Signal, Lighting and Electrical Systems - Electrical Details, Structure Installations |
| ES-9E | Signal, Lighting and Electrical Systems - Electrical Details, Structure Installations |
| ES-10 | Signal, Lighting and Electrical Systems - Isolux Diagrams |
| ES-11 | Signal, Lighting and Electrical Systems - Foundation Installations |
| ES-13A | Signal, Lighting and Electrical Systems - Splicing Details |
| ES-13B | Signal, Lighting and Electrical Systems - Wiring Details and Fuse Ratings |
| ES-14A | Signal, Lighting and Electrical Systems - Extinguishable Message Sign, 250 mm Letters |
| ES-14B | Signal, Lighting and Electrical Systems - Extinguishable Message Sign, 250 mm Letters |
| ES-14C | Signal, Lighting and Electrical Systems - Extinguishable Message Sign and Flashing Beacons |
| ES-15A | Sign Illumination - Mercury Vapor Sign Illumination Equipment |
| ES-15C | Sign Illumination - Sign Illumination Equipment |
| ES-15D | Sign Illumination - Sign Illumination Control |
| ES-16A | Closed Circuit Television Pole Details |

**DEPARTMENT OF TRANSPORTATION**

# NOTICE TO CONTRACTORS

**CONTRACT NO. 07-1257U4**

**07-LA-57,60-R5.2/R7.3**
**R36.1/R40.0**

Sealed proposals for the work shown on the plans entitled:

**STATE OF CALIFORNIA; DEPARTMENT OF TRANSPORTATION; PROJECT PLANS FOR CONSTRUCTION ON STATE HIGHWAY IN LOS ANGELES COUNTY IN DIAMOND BAR AND CITY OF INDUSTRY FROM 0.1 KM NORTH OF PATHFINDER ROAD OVERCROSSING TO ROUTE 57/60 INTERCHANGE AND 0.8 KM WEST OF BREA CANYON ROAD TO 0.6 KM EAST OF GRAND AVENUE**

will be received at the Department of Transportation, 3347 Michelson Drive, Suite 100, Irvine, CA 92612-1692, until 2 o'clock p.m. on February 27, 2003, at which time they will be publicly opened and read in Room C - 1116 at the same address.

Proposal forms for this work are included in a separate book entitled:

**STATE OF CALIFORNIA; DEPARTMENT OF TRANSPORTATION; PROPOSAL AND CONTRACT FOR CONSTRUCTION ON STATE HIGHWAY IN LOS ANGELES COUNTY IN DIAMOND BAR AND CITY OF INDUSTRY FROM 0.1 KM NORTH OF PATHFINDER ROAD OVERCROSSING TO ROUTE 57/60 INTERCHANGE AND 0.8 KM WEST OF BREA CANYON ROAD TO 0.6 KM EAST OF GRAND AVENUE**

General work description: Two cast-in-place prestressed concrete box girder bridges, retaining walls, and masonry block sound walls to be constructed.

This project has a goal of 15 percent disadvantaged business enterprise (DBE) participation.

No prebid meeting is scheduled for this project.

**THIS PROJECT IS SUBJECT TO THE "BUY AMERICA" PROVISIONS OF THE SURFACE TRANSPORTATION ASSISTANCE ACT OF 1982 AS AMENDED BY THE INTERMODAL SURFACE TRANSPORTATION EFFICIENCY ACT OF 1991.**

Bids are required for the entire work described herein.

At the time this contract is awarded, the Contractor shall possess either a Class A license or a combination of Class C licenses which constitutes a majority of the work.

This contract is subject to state contract nondiscrimination and compliance requirements pursuant to Government Code, Section 12990.

Project plans, special provisions, and proposal forms for bidding this project can only be obtained at the Department of Transportation, Plans and Bid Documents, Room 0200, MS #26, Transportation Building, 1120 N Street, Sacramento, California 95814, FAX No. (916) 654-7028, Telephone No. (916) 654-4490. Use FAX orders to expedite orders for project plans, special provisions and proposal forms. FAX orders must include credit card charge number, card expiration date and authorizing signature. Project plans, special provisions, and proposal forms may be seen at the above Department of Transportation office and at the offices of the District Directors of Transportation at Irvine, Oakland, and the district in which the work is situated. Standard Specifications and Standard Plans are available through the State of California,

Department of Transportation, Publications Unit, 1900 Royal Oaks Drive, Sacramento, CA 95815, Telephone No. (916) 445-3520.

Cross sections for this project are not available.

The successful bidder shall furnish a payment bond and a performance bond.

The Department of Transportation hereby notifies all bidders that it will affirmatively insure that in any contract entered into pursuant to this advertisement, disadvantaged business enterprises will be afforded full opportunity to submit bids in response to this invitation.

The U.S. Department of Transportation (DOT) provides a toll-free "hotline" service to report bid rigging activities. Bid rigging activities can be reported Mondays through Fridays, between 8:00 a.m. and 5:00 p.m., eastern time, Telephone No. 1-800-424-9071. Anyone with knowledge of possible bid rigging, bidder collusion, or other fraudulent activities should use the "hotline" to report these activities. The "hotline" is part of the DOT's continuing effort to identify and investigate highway construction contract fraud and abuse and is operated under the direction of the DOT Inspector General. All information will be treated confidentially and caller anonymity will be respected.

Pursuant to Section 1773 of the Labor Code, the general prevailing wage rates in the county, or counties, in which the work is to be done have been determined by the Director of the California Department of Industrial Relations. These wages are set forth in the General Prevailing Wage Rates for this project, available at the Labor Compliance Office at the offices of the District Director of Transportation for the district in which the work is situated, and available from the California Department of Industrial Relations' internet web site at: http://www.dir.ca.gov. The Federal minimum wage rates for this project as predetermined by the United States Secretary of Labor are available through the California Department of Transportation's Electronic Project Document Distribution Site on the internet at http://hqidoc1.dot.ca.gov/. Addenda to modify the Federal minimum wage rates, if necessary, will be issued to holders of "Proposal and Contract" books. Future effective general prevailing wage rates which have been predetermined and are on file with the California Department of Industrial Relations are referenced but not printed in the general prevailing wage rates.

If there is a difference between the minimum wage rates predetermined by the United States Secretary of Labor and the general prevailing wage rates determined by the Director of the California Department of Industrial Relations for similar classifications of labor, the Contractor and subcontractors shall pay not less than the higher wage rate. The Department will not accept lower State wage rates not specifically included in the Federal minimum wage determinations. This includes "helper" (or other classifications based on hours of experience) or any other classification not appearing in the Federal wage determinations. Where Federal wage determinations do not contain the State wage rate determination otherwise available for use by the Contractor and subcontractors, the Contractor and subcontractors shall pay not less than the Federal minimum wage rate which most closely approximates the duties of the employees in question.

DEPARTMENT OF TRANSPORTATION

Deputy Director Transportation Engineering

Dated December 30, 2002

ASF

**COPY OF ENGINEER'S ESTIMATE**

**(NOT TO BE USED FOR BIDDING PURPOSES)**

**07-1257U4**

| Item | Item Code | Item | Unit of Measure | Estimated Quantity |
|---|---|---|---|---|
| 1 | 070012 | PROGRESS SCHEDULE (CRITICAL PATH METHOD) | LS | LUMP SUM |
| 2 | 070018 | TIME-RELATED OVERHEAD | WDAY | 800 |
| 3 | 074019 | PREPARE STORM WATER POLLUTION PREVENTION PLAN | LS | LUMP SUM |
| 4 | 074020 | WATER POLLUTION CONTROL | LS | LUMP SUM |
| 5 (S) | 120090 | CONSTRUCTION AREA SIGNS | LS | LUMP SUM |
| 6 (S) | 120100 | TRAFFIC CONTROL SYSTEM | LS | LUMP SUM |
| 7 (S) | 120120 | TYPE III BARRICADE | EA | 15 |
| 8 (S) | 120149 | TEMPORARY PAVEMENT MARKING (PAINT) | M2 | 50 |
| 9 (S) | 120159 | TEMPORARY TRAFFIC STRIPE (PAINT) | M | 52 000 |
| 10 (S) | 120165 | CHANNELIZER (SURFACE MOUNTED) | EA | 620 |
| 11 (S) | 120300 | TEMPORARY PAVEMENT MARKER | EA | 33 900 |
| 12 (S) | 121161 | TEMPORARY TERMINAL SECTION (TYPE K) | EA | 2 |
| 13 (S) | 129000 | TEMPORARY RAILING (TYPE K) | M | 26 100 |
| 14 (S) | 129100 | TEMPORARY CRASH CUSHION MODULE | EA | 640 |
| 15 (S) | 150241 | ABANDON SEWER | M | 750 |
| 16 | 150305 | CONCRETE SURFACING | M2 | 200 |
| 17 (S) | 150608 | REMOVE CHAIN LINK FENCE | M | 1810 |
| 18 (S) | 150662 | REMOVE METAL BEAM GUARD RAILING | M | 810 |
| 19 (S) | 150710 | REMOVE TRAFFIC STRIPE | M | 23 000 |
| 20 (S) | 150714 | REMOVE THERMOPLASTIC TRAFFIC STRIPE | M | 17 000 |

| Item | Item Code | Item | Unit of Measure | Estimated Quantity |
|---|---|---|---|---|
| 21 (S) | 150715 | REMOVE THERMOPLASTIC PAVEMENT MARKING | M2 | 30 |
| 22 (S) | 150722 | REMOVE PAVEMENT MARKER | EA | 15 900 |
| 23 | 150742 | REMOVE ROADSIDE SIGN | EA | 29 |
| 24 | 150760 | REMOVE SIGN STRUCTURE | EA | 7 |
| 25 | 150806 | REMOVE PIPE | M | 400 |
| 26 | 150820 | REMOVE INLET | EA | 35 |
| 27 | 150821 | REMOVE HEADWALL | EA | 2 |
| 28 (S) | 150824 | REMOVE SEWER MANHOLE | EA | 10 |
| 29 (S) | 150841 | REMOVE SEWER PIPE | M | 7 |
| 30 | 150846 | REMOVE CONCRETE PAVEMENT | M2 | 3830 |
| 31 (S) | 151540 | RECONSTRUCT CHAIN LINK FENCE | M | 150 |
| 32 (S) | 151554 | RECONSTRUCT CHAIN LINK GATE | EA | 1 |
| 33 (S) | 151625 | RECONSTRUCT METAL BEAM GUARD RAILING (WOOD POST) | M | 170 |
| 34 | 152386 | RELOCATE ROADSIDE SIGN-ONE POST | EA | 18 |
| 35 | 152387 | RELOCATE ROADSIDE SIGN-TWO POST | EA | 14 |
| 36 | 152604 | MODIFY INLET | EA | 7 |
| 37 (S) | 153153 | COLD PLANE ASPHALT CONCRETE PAVEMENT (45 MM MAXIMUM) | M2 | 900 |
| 38 (S) | 153155 | COLD PLANE ASPHALT CONCRETE PAVEMENT (75 MM MAXIMUM) | M2 | 2170 |
| 39 | 153210 | REMOVE CONCRETE | M3 | 110 |
| 40 | 153214 | REMOVE CONCRETE CURB | M | 2400 |

| Item | Item Code | Item | Unit of Measure | Estimated Quantity |
|---|---|---|---|---|
| 41 | 153218 | REMOVE CONCRETE SIDEWALK | M2 | 120 |
| 42 | 153221 | REMOVE CONCRETE BARRIER | M | 1497 |
| 43 | 153531 | ACCESS OPENING, SOFFIT | EA | 2 |
| 44 | 030568 | CAP INLET AND RISER | EA | 5 |
| 45 (S) | 156585 | REMOVE CRASH CUSHION | EA | 1 |
| 46 | 160101 | CLEARING AND GRUBBING | LS | LUMP SUM |
| 47 | 190101 | ROADWAY EXCAVATION | M3 | 70 000 |
| 48 | 190103 | ROADWAY EXCAVATION (TYPE Y) (AERIALLY DEPOSITED LEAD) | M3 | 11 700 |
| 49 | 190110 | LEAD COMPLIANCE PLAN | LS | LUMP SUM |
| 50 (F) | 192001 | STRUCTURE EXCAVATION | M3 | 203 |
| 51 (F) | 192003 | STRUCTURE EXCAVATION (BRIDGE) | M3 | 1413 |
| 52 (F) | 192025 | STRUCTURE EXCAVATION (CULVERT) | M3 | 388 |
| 53 (F) | 192037 | STRUCTURE EXCAVATION (RETAINING WALL) | M3 | 22 130 |
| 54 (F) | 192051 | STRUCTURE EXCAVATION (TYPE Y) (AERIALLY DEPOSITED LEAD) | M3 | 7574 |
| 55 (F) | 193001 | STRUCTURE BACKFILL | M3 | 130 |
| 56 (F) | 193003 | STRUCTURE BACKFILL (BRIDGE) | M3 | 801 |
| 57 (F) | 193004 | STRUCTURE BACKFILL (CULVERT) | M3 | 80 |
| 58 (F) | 193013 | STRUCTURE BACKFILL (RETAINING WALL) | M3 | 20 407 |
| 59 (F) | 049224 | GRAVEL FILL | M3 | 2542 |
| 60 | 193031 | PERVIOUS BACKFILL MATERIAL (RETAINING WALL) | M3 | 630 |

| Item | Item Code | Item | Unit of Measure | Estimated Quantity |
|---|---|---|---|---|
| 61 (S) | 049225 | SOIL CEMENT | M3 | 1505 |
| 62 (F) | 197021 | EARTH RETAINING STRUCTURE, LOCATION A | M2 | 847 |
| 63 (F) | 197022 | EARTH RETAINING STRUCTURE, LOCATION B | M2 | 4710 |
| 64 (F) | 197023 | EARTH RETAINING STRUCTURE, LOCATION C | M2 | 553 |
| 65 (S) | 197060 | SOIL NAIL ASSEMBLY | M | 2429 |
| 66 | 198001 | IMPORTED BORROW | M3 | 5360 |
| 67 | 198009 | IMPORTED BORROW (LIGHTWEIGHT AGGREGATE) | M3 | 8230 |
| 68 (S) | 200001 | HIGHWAY PLANTING | LS | LUMP SUM |
| 69 (S) | 202007 | DUFF | HA | 6 |
| 70 (S) | 203003 | STRAW (EROSION CONTROL) | TONN | 23 |
| 71 (S) | 203014 | FIBER (EROSION CONTROL) | KG | 4490 |
| 72 (S) | 203024 | COMPOST (EROSION CONTROL) | KG | 22 500 |
| 73 (S) | 203026 | MOVE-IN/MOVE-OUT (EROSION CONTROL) | EA | 3 |
| 74 (S) | 203045 | PURE LIVE SEED (EROSION CONTROL) | KG | 200 |
| 75 (S) | 203061 | STABILIZING EMULSION (EROSION CONTROL) | KG | 890 |
| 76 (S) | 204099 | PLANT ESTABLISHMENT WORK | LS | LUMP SUM |
| 77 (S) | 208000 | IRRIGATION SYSTEM | LS | LUMP SUM |
| 78 (S) | 208731 | 200 MM CORRUGATED HIGH DENSITY POLYETHYLENE PIPE CONDUIT | M | 170 |
| 79 (S) | 208909 | EXTEND 200 MM CONDUIT | M | 180 |
| 80 | 250401 | CLASS 4 AGGREGATE SUBBASE | M3 | 4980 |

| Item | Item Code | Item | Unit of Measure | Estimated Quantity |
|---|---|---|---|---|
| 81 | 260201 | CLASS 2 AGGREGATE BASE | M3 | 4510 |
| 82 | 260210 | AGGREGATE BASE (APPROACH SLAB) | M3 | 80 |
| 83 | 260301 | CLASS 3 AGGREGATE BASE | M3 | 19 300 |
| 84 | 280000 | LEAN CONCRETE BASE | M3 | 13 500 |
| 85 | 390160 | ASPHALT CONCRETE (TYPE B) | TONN | 7000 |
| 86 | 390206 | RUBBERIZED ASPHALT CONCRETE (TYPE G) | TONN | 470 |
| 87 | 394001 | PLACE ASPHALT CONCRETE DIKE | M | 5280 |
| 88 | 394002 | PLACE ASPHALT CONCRETE (MISCELLANEOUS AREA) | M2 | 1250 |
| 89 | 401000 | CONCRETE PAVEMENT | M3 | 25 400 |
| 90 | 401066 | CONCRETE PAVEMENT (RAMP TERMINI) | M3 | 170 |
| 91 | 401108 | REPLACE CONCRETE PAVEMENT (RAPID STRENGTH CONCRETE) | M3 | 370 |
| 92 | 404092 | SEAL PAVEMENT JOINT | M | 16 000 |
| 93 | 404094 | SEAL LONGITUDINAL ISOLATION JOINT | M | 12 500 |
| 94 | 406003 | TIE BAR (DRILL AND BOND) | EA | 260 |
| 95 (S) | 420201 | GRIND EXISTING CONCRETE PAVEMENT | M2 | 7460 |
| 96 | 490656 | 450 MM CAST-IN-DRILLED-HOLE CONCRETE PILING | M | 103 |
| 97 (S) | 490657 | 600 MM CAST-IN-DRILLED-HOLE CONCRETE PILING | M | 859 |
| 98 (S) | 490661 | 1.2 M CAST-IN-DRILLED-HOLE CONCRETE PILING | M | 77 |
| 99 (S) | 490665 | 1.8 M CAST-IN-DRILLED-HOLE CONCRETE PILING | M | 56 |
| 100 (S) | 490671 | 2.4 M CAST-IN-DRILLED-HOLE CONCRETE PILING | M | 98 |

| Item | Item Code | Item | Unit of Measure | Estimated Quantity |
|---|---|---|---|---|
| 101 (S) | 490673 | 3.0 M CAST-IN-DRILLED-HOLE CONCRETE PILING | M | 98 |
| 102 (S) | 049226 | 3.4 M CAST-IN-DRILLED-HOLE CONCRETE PILING | M | 200 |
| 103 (S) | 490675 | 900 MM CAST-IN-DRILLED-HOLE CONCRETE PILING | M | 187 |
| 104 (S) | 049227 | 900 MM CAST-IN-DRILLED HOLE CONCRETE PILING (ROCK SOCKET) | M | 68 |
| 105 (S) | 049228 | 1.2 M CAST-IN-DRILLED HOLE CONCRETE PILING (ROCK SOCKET) | M | 10 |
| 106 (S) | 049229 | 1.8 M CAST-IN-DRILLED HOLE CONCRETE PILING (ROCK SOCKET) | M | 23 |
| 107 (S) | 049230 | 2.4 M CAST-IN-DRILLED-HOLE CONCRETE PILING (ROCK SOCKET) | M | 104 |
| 108 (S) | 049231 | 3.0 M CAST-IN-DRILLED-HOLE CONCRETE PILING (ROCK SOCKET) | M | 141 |
| 109 (S) | 049232 | 3.4 M CAST-IN-DRILLED-HOLE CONCRETE PILING (ROCK SOCKET) | M | 269 |
| 110 (S) | 500001 | PRESTRESSING CAST-IN-PLACE CONCRETE | LS | LUMP SUM |
| 111 (S) | 500050 | TIEBACK ANCHOR | EA | 65 |
| 112 (F) | 510051 | STRUCTURAL CONCRETE, BRIDGE FOOTING | M3 | 145 |
| 113 (F) | 510053 | STRUCTURAL CONCRETE, BRIDGE | M3 | 16 265 |
| 114 (F) | 510060 | STRUCTURAL CONCRETE, RETAINING WALL | M3 | 7503 |
| 115 (F) | 510072 | STRUCTURAL CONCRETE, BARRIER SLAB | M3 | 1549 |
| 116 (F) | 510086 | STRUCTURAL CONCRETE, APPROACH SLAB (TYPE N) | M3 | 182 |
| 117 | 510087 | STRUCTURAL CONCRETE, APPROACH SLAB (TYPE R) | M3 | 111 |
| 118 (F) | 049233 | STRUCTURAL CONCRETE, APPROACH SLAB (TYPE R MODIFIED) | M3 | 6 |
| 119 (F) | 510413 | CLASS 1 CONCRETE (BOX CULVERT) | M3 | 80 |
| 120 (F) | 510502 | MINOR CONCRETE (MINOR STRUCTURE) | M3 | 196 |

| Item | Item Code | Item | Unit of Measure | Estimated Quantity |
|---|---|---|---|---|
| 121 | 510504 | MINOR CONCRETE (PIPE ENCASEMENT) | M3 | 3.1 |
| 122 | 510526 | MINOR CONCRETE (BACKFILL) | M3 | 120 |
| 123 | 510800 | PAVING NOTCH EXTENSION | M3 | 3 |
| 124 (F) | 511035 | ARCHITECTURAL TREATMENT | M2 | 70 |
| 125 (F) | 511064 | FRACTURED RIB TEXTURE | M2 | 1761 |
| 126 (S) | 515074 | CORE CONCRETE (101 MM - 150 MM) | M | 6 |
| 127 (S-F) | 517961 | SOUND WALL (BARRIER) (MASONRY BLOCK) | M2 | 2337 |
| 128 (S-F) | 518002 | SOUND WALL (MASONRY BLOCK) | M2 | 1794 |
| 129 (S) | 518050 | PTFE BEARING | EA | 20 |
| 130 | 518051 | PTFE SPHERICAL BEARING | EA | 25 |
| 131 (S) | 519120 | JOINT SEAL (MR 15 MM) | M | 41 |
| 132 (S) | 519129 | JOINT SEAL ASSEMBLY (MR 101 MM - 160 MM) | M | 45 |
| 133 (S) | 519130 | JOINT SEAL ASSEMBLY (MR 161 MM - 240 MM) | M | 69 |
| 134 (S) | 519131 | JOINT SEAL ASSEMBLY (MR 241 MM - 320 MM) | M | 31 |
| 135 (S-F) | 520102 | BAR REINFORCING STEEL (BRIDGE) | KG | 4 591 100 |
| 136 (S-F) | 520103 | BAR REINFORCING STEEL (RETAINING WALL) | KG | 504 740 |
| 137 (S-F) | 520107 | BAR REINFORCING STEEL (BOX CULVERT) | KG | 5459 |
| 138 (S-F) | 520120 | HEADED BAR REINFORCEMENT | EA | 15 587 |
| 139 (S-F) | 530100 | SHOTCRETE | M3 | 194 |
| 140 (S-F) | 049234 | ISOLATION CASING | KG | 82 400 |

| Item | Item Code | Item | Unit of Measure | Estimated Quantity |
|---|---|---|---|---|
| 141 (S-F) | 560208 | FURNISH SIGN STRUCTURE (TUBULAR) | KG | 19 686 |
| 142 (S-F) | 560209 | INSTALL SIGN STRUCTURE (TUBULAR) | KG | 19 686 |
| 143 (F) | 560218 | FURNISH SIGN STRUCTURE (TRUSS) | KG | 114 530 |
| 144 (S-F) | 560219 | INSTALL SIGN STRUCTURE (TRUSS) | KG | 114 530 |
| 145 (S) | 561008 | 760 MM CAST-IN-DRILLED-HOLE CONCRETE PILE (SIGN FOUNDATION) | M | 9 |
| 146 (S) | 561009 | 920 MM CAST-IN-DRILLED-HOLE CONCRETE PILE (SIGN FOUNDATION) | M | 65 |
| 147 (S) | 561010 | 1070 MM CAST-IN-DRILLED-HOLE CONCRETE PILE (SIGN FOUNDATION) | M | 20 |
| 148 (S) | 030569 | 1370 MM CAST-IN-DRILLED-HOLE CONCRETE PILE (SIGN FOUNDATION) | M | 34 |
| 149 | 562002 | METAL (BARRIER MOUNTED SIGN) | KG | 1120 |
| 150 | 030570 | METAL (WALL MOUNTED SIGN) | KG | 230 |
| 151 | 566011 | ROADSIDE SIGN - ONE POST | EA | 13 |
| 152 | 568001 | INSTALL SIGN (STRAP AND SADDLE BRACKET METHOD) | EA | 8 |
| 153 | 568016 | INSTALL SIGN PANEL ON EXISTING FRAME | M2 | 28 |
| 154 | 650069 | 450 MM REINFORCED CONCRETE PIPE | M | 150 |
| 155 | 650075 | 600 MM REINFORCED CONCRETE PIPE | M | 1610 |
| 156 | 650077 | 750 MM REINFORCED CONCRETE PIPE | M | 24 |
| 157 (S) | 049235 | PREFABRICATED VERTICAL DRAIN | M | 64 960 |
| 158 | 681134 | 80 MM PLASTIC PIPE (EDGE DRAIN) | M | 6490 |
| 159 | 681137 | 80 MM PLASTIC PIPE (EDGE DRAIN OUTLET) | M | 430 |
| 160 | 703233 | GRATED LINE DRAIN | M | 170 |

| Item | Item Code | Item | Unit of Measure | Estimated Quantity |
|---|---|---|---|---|
| 161 | 703271 | 450 MM CORRUGATED STEEL PIPE RISER (2.01 MM THICK) | M | 10 |
| 162 | 705224 | 600 MM CONCRETE FLARED END SECTION | EA | 1 |
| 163 | 707242 | 600 MM PRECAST CONCRETE PIPE MANHOLE | M | 1.8 |
| 164 (S) | 030571 | 200 MM CAST IRON PIPE | M | 11 |
| 165 (S) | 030572 | 200 MM VITRIFIED CLAY PIPE (EXTRA STRENGTH) | M | 130 |
| 166 (S) | 030573 | 250 MM VITRIFIED CLAY PIPE (EXTRA STRENGTH) | M | 630 |
| 167 (S) | 030574 | 300 MM VITRIFIED CLAY PIPE (EXTRA STRENGTH) | M | 11 |
| 168 (S) | 719210 | CONCRETE SEWER MANHOLE | EA | 10 |
| 169 | 721009 | ROCK SLOPE PROTECTION (FACING, METHOD B) | M3 | 4.3 |
| 170 | 030575 | SLOPE PAVING (SPLIT FACE PAVERS) | M2 | 5330 |
| 171 | 727901 | MINOR CONCRETE (DITCH LINING) | M3 | 93 |
| 172 | 727905 | MINOR CONCRETE (CHANNEL LINING) | M3 | 650 |
| 173 | 731502 | MINOR CONCRETE (MISCELLANEOUS CONSTRUCTION) | M3 | 200 |
| 174 (F) | 731517 | MINOR CONCRETE (GUTTER) | M | 730 |
| 175 (S-F) | 750001 | MISCELLANEOUS IRON AND STEEL | KG | 25 582 |
| 176 (S) | 750010 | MANHOLE FRAME AND COVER | EA | 10 |
| 177 (S-F) | 750498 | MISCELLANEOUS METAL (RESTRAINER - CABLE TYPE) | KG | 11 570 |
| 178 (S-F) | 049236 | MISCELLANEOUS METAL, DECK DRAIN | KG | 22 300 |
| 179 (S-F) | 750501 | MISCELLANEOUS METAL (BRIDGE) | KG | 9860 |
| 180 (S) | 800391 | CHAIN LINK FENCE (TYPE CL-1.8) | M | 1790 |

| Item | Item Code | Item | Unit of Measure | Estimated Quantity |
|---|---|---|---|---|
| 181 | 820118 | GUARD RAILING DELINEATOR | EA | 4 |
| 182 | 820180 | INSTALL MEDIAN MILEAGE PANEL | EA | 36 |
| 183 (S) | 832003 | METAL BEAM GUARD RAILING (WOOD POST) | M | 660 |
| 184 (F) | 839483 | CONCRETE BARRIER (TYPE 50A) | M | 9 |
| 185 (S-F) | 839521 | CABLE RAILING | M | 625 |
| 186 (S) | 839565 | TERMINAL SYSTEM (TYPE SRT) | EA | 20 |
| 187 (S) | 839566 | TERMINAL SYSTEM (TYPE CAT) | EA | 1 |
| 188 (S) | 839567 | TERMINAL SYSTEM (TYPE CAT) BACKUP | EA | 1 |
| 189 (S) | 839568 | TERMINAL ANCHOR ASSEMBLY (TYPE SFT) | EA | 26 |
| 190 (S) | 839591 | CRASH CUSHION, SAND FILLED | EA | 2 |
| 191 (S) | 839603 | CRASH CUSHION (ADIEM) | EA | 2 |
| 192 | 839701 | CONCRETE BARRIER (TYPE 60) | M | 2300 |
| 193 | 030576 | CONCRETE BARRIER (TYPE 60W) | M | 280 |
| 194 (F) | 839702 | CONCRETE BARRIER (TYPE 60A) | M | 973 |
| 195 | 839703 | CONCRETE BARRIER (TYPE 60C) | M | 660 |
| 196 (F) | 839704 | CONCRETE BARRIER (TYPE 60D) | M | 434 |
| 197 (F) | 049237 | CONCRETE BARRIER (TYPE 60D MOD) | M | 442 |
| 198 | 839705 | CONCRETE BARRIER (TYPE 60E) | M | 380 |
| 199 (F) | 839725 | CONCRETE BARRIER (TYPE 736) | M | 2719 |
| 200 (F) | 049238 | CONCRETE BARRIER (TYPE 736 MOD) | M | 1505 |

| Item | Item Code | Item | Unit of Measure | Estimated Quantity |
|---|---|---|---|---|
| 201 (F) | 839726 | CONCRETE BARRIER (TYPE 736A) | M | 1978 |
| 202 (F) | 049239 | CONCRETE BARRIER (TYPE 736A MOD) | M | 801 |
| 203 (S) | 840515 | THERMOPLASTIC PAVEMENT MARKING | M2 | 390 |
| 204 (S) | 840561 | 100 MM THERMOPLASTIC TRAFFIC STRIPE | M | 57 400 |
| 205 (S) | 840563 | 200 MM THERMOPLASTIC TRAFFIC STRIPE | M | 5000 |
| 206 (S) | 840564 | 200 MM THERMOPLASTIC TRAFFIC STRIPE (BROKEN 3.66 M - 0.92 M) | M | 2870 |
| 207 (S) | 840570 | 100 MM THERMOPLASTIC TRAFFIC STRIPE (BROKEN 10.98 M - 3.66 M) | M | 44 400 |
| 208 (S) | 840571 | 100 MM THERMOPLASTIC TRAFFIC STRIPE (BROKEN 5.18 M - 2.14 M) | M | 860 |
| 209 (S) | 840574 | 200 MM THERMOPLASTIC TRAFFIC STRIPE (BROKEN 10.98 M - 3.66 M) | M | 1480 |
| 210 (S) | 850101 | PAVEMENT MARKER (NON-REFLECTIVE) | EA | 12 100 |
| 211 (S) | 850111 | PAVEMENT MARKER (RETROREFLECTIVE) | EA | 8090 |
| 212 (S) | 860400 | LIGHTING (TEMPORARY) | LS | LUMP SUM |
| 213 (S) | 030577 | HIGHWAY ADVISORY RADIO (LOCATION OR043) | LS | LUMP SUM |
| 214 (S) | 030578 | SIZE 78 CONDUIT (TRENCHED IN UNPAVED AREA) | M | 210 |
| 215 (S) | 030579 | SIZE 78 TYPE 1 CONDUIT (JACKED) | M | 80 |
| 216 (S) | 030580 | TWO-SIZE 103 CONDUITS (TRENCHED IN UNPAVED AREA) | M | 480 |
| 217 (S) | 030581 | TWO-SIZE 103 CONDUITS (TRENCHED IN ASPHALT) | M | 950 |
| 218 (S) | 030582 | TWO-SIZE 103 TYPE 1 CONDUITS (JACKED) | M | 230 |
| 219 (S) | 030583 | TWO-SIZE 103 TYPE 1 CONDUITS (TRENCHED IN CONCRETE) | M | 2700 |
| 220 (S) | 030584 | SIZE 25 INNERDUCT | M | 12 100 |

| Item | Item Code | Item | Unit of Measure | Estimated Quantity |
|---|---|---|---|---|
| 221 (S) | 860767 | SIZE 32 INNERDUCT | M | 6510 |
| 222 (S-F) | 860792 | COMMUNICATION CONDUIT (BRIDGE) | M | 232 |
| 223 (S) | 860889 | MODIFY TRAFFIC MONITORING STATION | LS | LUMP SUM |
| 224 (S) | 030585 | TRAFFIC MONITORING STATION (RELOCATE - LOCATION 2714) | LS | LUMP SUM |
| 225 (S) | 030586 | TRAFFIC MONITORING STATION (LOCATION 2163) | LS | LUMP SUM |
| 226 (S) | 030587 | TRAFFIC MONITORING STATION (LOCATION 2363) | LS | LUMP SUM |
| 227 (S) | 030588 | CLOSED CIRCUIT TELEVISION CAMERA (RELOCATE - LOCATION PO226) | LS | LUMP SUM |
| 228 (S) | 030589 | CLOSED CIRCUIT TELEVISION CAMERA (LOCATION OR043) | LS | LUMP SUM |
| 229 (S) | 030590 | CLOSED CIRCUIT TELEVISION CAMERA (LOCATION PO247) | LS | LUMP SUM |
| 230 (S) | 030591 | CABLE NODE (RELOCATE - LOCATION PO237) | LS | LUMP SUM |
| 231 (S) | 030592 | VIDEO NODE (LOCATION PO247) | LS | LUMP SUM |
| 232 (S) | 030593 | EQUIPMENT AT SAN GABRIEL VALLEY HUB | LS | LUMP SUM |
| 233 (S) | 030594 | COLLECTOR METERING SYSTEM | LS | LUMP SUM |
| 234 (S) | 861101 | RAMP METERING SYSTEM (LOCATION 1) | LS | LUMP SUM |
| 235 (S) | 861102 | RAMP METERING SYSTEM (LOCATION 2) | LS | LUMP SUM |
| 236 (S) | 861497 | MODIFY SIGNAL AND LIGHTING (LOCATION 1) | LS | LUMP SUM |
| 237 (S) | 861498 | MODIFY SIGNAL AND LIGHTING (LOCATION 2) | LS | LUMP SUM |
| 238 (S) | 861504 | MODIFY LIGHTING AND SIGN ILLUMINATION | LS | LUMP SUM |
| 239 (S) | 867014 | 12 SINGLEMODE FIBER OPTIC CABLE | M | 2780 |
| 240 (S) | 030595 | 36 SINGLEMODE FIBER OPTIC CABLE | M | 5080 |

| Item | Item Code | Item | Unit of Measure | Estimated Quantity |
|---|---|---|---|---|
| 241 (S) | 867017 | 48 SINGLEMODE FIBER OPTIC | M | 3060 |
| 242 (S) | 867021 | 72 SINGLEMODE FIBER OPTIC | M | 3050 |
| 243 (S) | 867130 | FIBER OPTIC SPLICE CLOSURE | EA | 7 |
| 244 (S) | 867135 | TWISTED PAIR SPLICE CLOSURE | EA | 4 |
| 245 (S) | 869025 | TWISTED PAIR CABLE (6 PAIR) | M | 300 |
| 246 (S) | 869029 | TWISTED PAIR CABLE (50 PAIR) | M | 2080 |
| 247 (S) | 869036 | NO. 6 PULL BOX | EA | 5 |
| 248 (S) | 869039 | COMMUNICATION PULL BOX | EA | 19 |
| 249 (S) | 869043 | REMOVE PULL BOX | EA | 8 |
| 250 (S) | 869047 | SPLICE VAULT | EA | 5 |
| 251 (S) | 869075 | SYSTEM TESTING AND DOCUMENTATION | LS | LUMP SUM |
| 252 | 999990 | MOBILIZATION | LS | LUMP SUM |

**STATE OF CALIFORNIA**

**DEPARTMENT OF TRANSPORTATION**

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# SPECIAL PROVISIONS

**Annexed to Contract No. 07-1257U4**

**SECTION 1. SPECIFICATIONS AND PLANS**

The work embraced herein shall conform to the provisions in the Standard Specifications dated July 1999, and the Standard Plans dated July 1999, of the Department of Transportation insofar as the same may apply, and these special provisions.

In case of conflict between the Standard Specifications and these special provisions, the special provisions shall take precedence over and shall be used in lieu of the conflicting portions.

# AMENDMENTS TO JULY 1999 STANDARD SPECIFICATIONS

**UPDATED NOVEMBER 18, 2002**

Amendments to the Standard Specifications set forth in these special provisions shall be considered as part of the Standard Specifications for the purposes set forth in Section 5-1.04, "Coordination and Interpretation of Plans, Standard Specifications and Special Provisions," of the Standard Specifications. Whenever either the term "Standard Specifications is amended" or the term "Standard Specifications are amended" is used in the special provisions, the text or table following the term shall be considered an amendment to the Standard Specifications. In case of conflict between such amendments and the Standard Specifications, the amendments shall take precedence over and be used in lieu of the conflicting portions.

**SECTION 2: PROPOSAL REQUIREMENTS AND CONDITIONS**

Issue Date: June 6, 2002

Section 2-1.03, "Examination of Plans, Specifications, Contract, and Site of Work," of the Standard Specifications is amended to read:

**2-1.03 Examination of Plans, Specifications, Contract, and Site of Work**

- The bidder shall examine carefully the site of the work contemplated, the plans and specifications, and the proposal and contract forms therefor. The submission of a bid shall be conclusive evidence that the bidder has investigated and is satisfied as to the general and local conditions to be encountered, as to the character, quality and scope of work to be performed, the quantities of materials to be furnished and as to the requirements of the proposal, plans, specifications and the contract.
- The submission of a bid shall also be conclusive evidence that the bidder is satisfied that the character, quality and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information was reasonably ascertainable from an inspection of the site and the records of exploratory work done by the Department as shown in the bid documents, as well as from the plans and specifications made a part of the contract.

• Where the Department has made investigations of site conditions including subsurface conditions in areas where work is to be performed under the contract, or in other areas, some of which may constitute possible local material sources, bidders or contractors may, upon written request, inspect the records of the Department as to those investigations subject to and upon the conditions hereinafter set forth.

• Where there has been prior construction by the Department or other public agencies within the project limits, records of the prior construction that are currently in the possession of the Department and which have been used by, or are known to, the designers and administrators of the project will be made available for inspection by bidders or contractors, upon written request, subject to the conditions hereinafter set forth. The records may include, but are not limited to, as-built drawings, design calculations, foundation and site studies, project reports and other data assembled in connection with the investigation, design, construction and maintenance of the prior projects.

• Inspection of the records of investigations and project records may be made at the office of the district in which the work is situated, or in the case of records of investigations related to structure work, at the Transportation Laboratory in Sacramento, California.

• When a log of test borings or other record of geotechnical data obtained by the Department's investigation of surface and subsurface conditions is included with the contract plans, it is furnished for the bidders' or Contractor's information and its use shall be subject to the conditions and limitations set forth in this Section 2-1.03.

• In some instances, information considered by the Department to be of possible interest to bidders or contractors has been compiled as "Materials Information." The use of the "Materials Information" shall be subject to the conditions and limitations set forth in this Section 2-1.03 and Section 6-2, "Local Materials."

• When cross sections are not included with the plans, but are available, bidders or contractors may inspect the cross sections and obtain copies for their use, at their expense.

• When cross sections are included with the contract plans, it is expressly understood and agreed that the cross sections do not constitute part of the contract, do not necessarily represent actual site conditions or show location, character, dimensions and details of work to be performed, and are included in the plans only for the convenience of bidders and their use is subject to the conditions and limitations set forth in this Section 2-1.03.

• When contour maps were used in the design of the project, the bidders may inspect those maps, and if available, they may obtain copies for their use.

• The availability or use of information described in this Section 2-1.03 is not to be construed in any way as a waiver of the provisions of the first paragraph in this Section 2-1.03 and bidders and contractors are cautioned to make independent investigations and examinations as they deem necessary to be satisfied as to conditions to be encountered in the performance of the work and, with respect to possible local material sources, the quality and quantity of material available from the property and the type and extent of processing that may be required in order to produce material conforming to the requirements of the specifications.

• The Department assumes no responsibility for conclusions or interpretations made by a bidder or contractor based on the information or data made available by the Department. The Department does not assume responsibility for representation made by its officers or agents before the execution of the contract concerning surface or subsurface conditions, unless that representation is expressly stated in the contract.

• No conclusions or interpretations made by a bidder or contractor from the information and data made available by the Department will relieve a bidder or contractor from properly fulfilling the terms of the contract.

## SECTION 5: CONTROL OF WORK

Issue Date: December 31, 2001

Section 5-1.02A, "Trench Excavation Safety Plans," of the Standard Specifications is amended to read:

### 5-1.02A Excavation Safety Plans

• The Construction Safety Orders of the Division of Occupational Safety and Health shall apply to all excavations. For all excavations 1.5 m or more in depth, the Contractor shall submit to the Engineer a detailed plan showing the design and details of the protective systems to be provided for worker protection from the hazard of caving ground during excavation. The detailed plan shall include any tabulated data and any design calculations used in the preparation of the plan. Excavation shall not begin until the detailed plan has been reviewed and approved by the Engineer.

• Detailed plans of protective systems for which the Construction Safety Orders require design by a registered professional engineer shall be prepared and signed by an engineer who is registered as a Civil Engineer in the State of California, and shall include the soil classification, soil properties, soil design calculations that demonstrate adequate stability of the protective system, and any other design calculations used in the preparation of the plan.

- No plan shall allow the use of a protective system less effective than that required by the Construction Safety Orders.
- If the detailed plan includes designs of protective systems developed only from the allowable configurations and slopes, or Appendices, contained in the Construction Safety Orders, the plan shall be submitted at least 5 days before the Contractor intends to begin excavation. If the detailed plan includes designs of protective systems developed from tabulated data, or designs for which design by a registered professional engineer is required, the plan shall be submitted at least 3 weeks before the Contractor intends to begin excavation.
- Attention is directed to Section 7-1.01E, "Trench Safety."

## SECTION 9: MEASUREMENT AND PAYMENT

Issue Date: November 18, 2002

Section 9-1.04, "Notice of Potential Claim," of the Standard Specifications is amended to read:

### 9-1.04 NOTICE OF POTENTIAL CLAIM

- It is the intention of this section that disputes between the parties arising under and by virtue of the contract be brought to the attention of the Engineer at the earliest possible time in order that the matters may be resolved, if possible, or other appropriate action promptly taken.
- Disputes will not be considered unless the Contractor has first complied with specified notice or protest requirements, including Section 4-1.03, "Changes," Section 5-1.116, "Differing Site Conditions," Section 8-1.06, "Time of Completion," Section 8-1.07, "Liquidated Damages," and Section 8-1.10, "Utility and Non-Highway Facilities."
- For disputes arising under and by virtue of the contract, including an act or failure to act by the Engineer, the Contractor shall provide a signed written initial notice of potential claim to the Engineer within 5 days from the date the dispute first arose. The initial notice of potential claim shall provide the nature and circumstances involved in the dispute which shall remain consistent through the dispute. The initial notice of potential claim shall be submitted on Form CEM-6201A furnished by the Department and shall be certified with reference to the California False Claims Act, Government Code Sections 12650-12655. The Contractor shall assign an exclusive identification number for each dispute, determined by chronological sequencing, based on the date of the dispute.
- The exclusive identification number for each dispute shall be used on the following corresponding documents:

A. Initial notice of potential claim.
B. Supplemental notice of potential claim.
C. Full and final documentation of potential claim.
D. Corresponding claim included in the Contractor's written statement of claims.

- The Contractor shall provide the Engineer the opportunity to examine the site of work within 5 days from the date of the initial notice of potential claim. The Contractor shall proceed with the performance of contract work unless otherwise specified or directed by the Engineer.
- Throughout the disputed work, the Contractor shall maintain records that provide a clear distinction between the incurred direct costs of disputed work and that of undisputed work. The Contractor shall allow the Engineer access to the Contractor's project records deemed necessary by the Engineer to evaluate the potential claim within 20 days of the date of the Engineer's written request.
- Within 15 days of submitting the initial notice of potential claim, the Contractor shall provide a signed supplemental notice of potential claim to the Engineer that provides the following information:

A. The complete nature and circumstances of the dispute which caused the potential claim.
B. The contract provisions that provide the basis of claim.
C. The estimated cost of the potential claim, including an itemized breakdown of individual costs and how the estimate was determined.
D. A time impact analysis of the project schedule that illustrates the effect on the scheduled completion date due to schedule changes or disruptions where a request for adjustment of contract time is made.

- The information provided in items A and B above shall provide the Contractor's complete reasoning for additional compensation or adjustments.
- The supplemental notice of potential claim shall be submitted on Form CEM-6201B furnished by the Department and shall be certified with reference to the California False Claims Act, Government Code Sections 12650-12655. The

Engineer will evaluate the information presented in the supplemental notice of potential claim and provide a written response to the Contractor within 20 days of its receipt. If the estimated cost or effect on the scheduled completion date changes, the Contractor shall update information in items C and D above as soon as the change is recognized and submit this information to the Engineer.

- Within 30 days of the completion of work related to the potential claim, the Contractor shall provide the full and final documentation of potential claim to the Engineer that provides the following information:

A. A detailed factual narration of events fully describing the nature and circumstances that caused the dispute, including, but not limited to, necessary dates, locations, and items of work affected by the dispute.
B. The specific provisions of the contract that support the potential claim and a statement of the reasons these provisions support and provide a basis for entitlement of the potential claim.
C. When additional monetary compensation is requested, the exact amount requested calculated in conformance with Section 9-1.03, "Force Account Payment," or Section 8-1.09, "Right of Way Delays," including an itemized breakdown of individual costs. These costs shall be segregated into the following cost categories:

    1. Labor – A listing of individuals, classifications, regular hours and overtime hours worked, dates worked, and other pertinent information related to the requested reimbursement of labor costs.
    2. Materials – Invoices, purchase orders, location of materials either stored or incorporated into the work, dates materials were transported to the project or incorporated into the work, and other pertinent information related to the requested reimbursement of material costs.
    3. Equipment – Listing of detailed description (make, model, and serial number), hours of use, dates of use and equipment rates. Equipment rates shall be at the applicable State rental rate as listed in the Department of Transportation publication entitled "Labor Surcharge and Equipment Rental Rates," in effect when the affected work related to the dispute was performed.
    4. Other categories as specified by the Contractor or the Engineer.

D. When an adjustment of contract time is requested the following information shall be provided:

    1. The specific dates for which contract time is being requested.
    2. The specific reasons for entitlement to a contract time adjustment.
    3. The specific provisions of the contract that provide the basis for the requested contract time adjustment.
    4. A detailed time impact analysis of the project schedule. The time impact analysis shall show the effect of changes or disruptions on the scheduled completion date to demonstrate entitlement to a contract time adjustment.

E. The identification and copies of the Contractor's documents and the substance of oral communications that support the potential claim.

- The full and final documentation of the potential claim shall be submitted on Form CEM-6201C furnished by the Department and shall be certified with reference to the California False Claims Act, Government Code Sections 12650-12655.
- Pertinent information, references, arguments, and data to support the potential claim shall be included in the full and final documentation of potential claim. Information submitted subsequent to the full and final documentation submittal will not be considered. Information required in the full and final documentation of potential claim, as listed in items A to E above, that is not applicable to the dispute may be exempted as determined by the Engineer. No full and final documentation of potential claim will be considered that does not have the same nature and circumstances, and basis of claim as those specified on the initial and supplemental notices of potential claim.
- The Engineer will evaluate the information presented in the full and final documentation of potential claim and provide a written response to the Contractor within 30 days of its receipt unless otherwise specified. The Engineer's receipt of the full and final documentation of potential claim shall be evidenced by postal receipt or the Engineer's written receipt if delivered by hand. If the full and final documentation of potential claim is submitted by the Contractor after acceptance of the work by the Director, the Engineer need not provide a written response.
- Provisions in this section shall not apply to those claims for overhead costs and administrative disputes that occur after issuance of the proposed final estimate. Administrative disputes are disputes of administrative deductions or retentions, contract item quantities, contract item adjustments, interest payments, protests of contract change orders as provided in Section 4-1.03A, "Procedure and Protest," and protests of the weekly statement of working days as provided in Section 8-1.06, "Time of Completion." Administrative disputes that occur prior to issuance of the proposed final estimate shall follow applicable requirements of this section. Information listed in the supplemental notice and full and final

documentation of potential claim that is not applicable to the administrative dispute may be exempted as determined by the Engineer.

- Unless otherwise specified in the special provisions, the Contractor may pursue the administrative claim process pursuant to Section 9-1.07B, "Final Payment and Claims," for any potential claim found by the Engineer to be without merit.
- Failure of the Contractor to conform to specified dispute procedures shall constitute a failure to pursue diligently and exhaust the administrative procedures in the contract, and is deemed as the Contractor's waiver of the potential claim and a waiver of the right to a corresponding claim for the disputed work in the administrative claim process in conformance with Section 9-1.07B, "Final Payment of Claims," and shall operate as a bar to arbitration pursuant to Section 10240.2 of the California Public Contract Code.

Section 9-1.07B, "Final Payment and Claims," of the Standard Specifications is amended to read:

**9-1.07B Final Payment and Claims**

- After acceptance by the Director, the Engineer will make a proposed final estimate in writing of the total amount payable to the Contractor, including an itemization of the total amount, segregated by contract item quantities, extra work and other bases for payment, and shall also show each deduction made or to be made for prior payments and amounts to be kept or retained under the provisions of the contract. Prior estimates and payments shall be subject to correction in the proposed final estimate. The Contractor shall submit written approval of the proposed final estimate or a written statement of claims arising under or by virtue of the contract so that the Engineer receives the written approval or statement of claims no later than close of business of the thirtieth day after receiving the proposed final estimate. If the thirtieth day falls on a Saturday, Sunday or legal holiday, then receipt of the written approval or statement of claims by the Engineer shall not be later than close of business of the next business day. The Contractor's receipt of the proposed final estimate shall be evidenced by postal receipt. The Engineer's receipt of the Contractor's written approval or statement of claims shall be evidenced by postal receipt or the Engineer's written receipt if delivered by hand.
- On the Contractor's approval, or if the Contractor files no claim within the specified period of 30 days, the Engineer will issue a final estimate in writing in conformance with the proposed final estimate submitted to the Contractor, and within 30 days thereafter the State will pay the entire sum so found to be due. That final estimate and payment thereon shall be conclusive and binding against both parties to the contract on all questions relating to the amount of work done and the compensation payable therefor, except as otherwise provided in Sections 9-1.03C, "Records," and 9-1.09, "Clerical Errors."
- If the Contractor within the specified period of 30 days files claims, the Engineer will issue a semifinal estimate in conformance with the proposed final estimate submitted to the Contractor and within 30 days thereafter the State will pay the sum found to be due. The semifinal estimate and corresponding payment shall be conclusive and binding against both parties to the contract on each question relating to the amount of work done and the compensation payable therefor, except insofar as affected by the claims filed within the time and in the manner required hereunder and except as otherwise provided in Sections 9-1.03C, "Records," and 9-1.09, "Clerical Errors."
- Except for claims for overhead costs and administrative disputes that occur after issuance of the proposed final estimate, the Contractor shall only provide the following two items of information for each claim:

A. The exclusive identification number that corresponds to the supporting full and final documentation of potential claim.
B. The final amount of requested additional compensation.

- If the final amount of requested additional compensation is different than the amount of requested compensation included in the full and final documentation of potential claim, the Contractor shall provide in the written statement of claims the reasons for the changed amount, the specific provisions of the contract which support the changed amount, and a statement of the reasons the provisions support and provide a basis for the changed amount. If the Contractor's claim fails to provide an exclusive identification number or if there is a disparity in the provided exclusive identification number, the Engineer will notify the Contractor of the omission or disparity. The Contractor shall have 15 days after receiving notification from the Engineer to correct the omission or disparity. If after the 15 days has elapsed, there is still an omission or disparity of the exclusive identification number assigned to the claim, the Engineer will assign the number. No claim will be considered that has any of the following deficiencies:

A. The claim does not have the same nature, circumstances, and basis as the corresponding full and final documentation of potential claim.
B. The claim does not have a corresponding full and final documentation of potential claim.
C. The claim was not included in the written statement of claims.

D. The Contractor did not comply with applicable notice or protest requirements of Sections 4-1.03, "Changes," 5-1.116, "Differing Site Condition," 8-1.06, "Time of Completion," 8-1.07, "Liquidated Damages," 8-1.10, "Utility and Non-Highway Facilities," and 9-1.04, "Notice of Potential Claim."

- Administrative disputes that occur after issuance of the proposed final estimate shall be included in the Contractor's written statement of claims in sufficient detail to enable the Engineer to ascertain the basis and amounts of those claims.
- The Contractor shall keep full and complete records of the costs and additional time incurred for work for which a claim for additional compensation is made. The Engineer or designated claim investigators or auditors shall have access to those records and any other records as may be required by the Engineer to determine the facts or contentions involved in the claims. Failure to permit access to those records shall be sufficient cause for denying the claims.
- The written statement of claims submitted by the Contractor shall be accompanied by a notarized certificate containing the following language:

Under the penalty of law for perjury or falsification and with specific reference to the California False Claims Act, Government Code Section 12650 et. seq., the undersigned,

_____
*(name)*

_____
*(title)*

_____
*(company)*

hereby certifies that the claim for the additional compensation and time, if any, made herein for the work on this contract is a true statement of the actual costs incurred and time sought, and is fully documented and supported under the contract between parties.

Dated _____

/s/ _____

Subscribed and sworn before me this _____

of _____

_____
*(Notary Public)*
My Commission Expires _____

- Failure to submit the notarized certificate will be sufficient cause for denying the claim.
- Claims for overhead type expenses or costs, in addition to being certified as stated above, shall be supported and accompanied by an audit report of an independent Certified Public Accountant. Omission of a supporting audit report of an independent Certified Public Accountant shall result in denial of the claim and shall operate as a bar to arbitration, as to the claim, in conformance with the requirements in Section 10240.2 of the California Public Contract Code. Claims for overhead type expenses or costs shall be subject to audit by the State at its discretion. The costs of performing an audit examination and submitting the report shall be borne by the Contractor. The Certified Public Accountant's audit examination shall be performed in conformance with the requirements of the American Institute of Certified Public Accountants Attestation Standards. The audit examination and report shall depict the Contractor's project and company-wide financial records and shall specify the actual overall average daily rates for both field and home office overhead for the entire duration of the project, and whether the costs have been properly allocated. The rates of field and home office overhead shall exclude unallowable costs as determined in Title 48 of the Federal Acquisition Regulations, Chapter 1, Part 31. The audit examination and report shall determine if the rates of field and home office overhead are:

A. Allowable in conformance with the requirements in Title 48 of the Federal Acquisition Regulations, Chapter 1, Part 31.

B. Adequately supported by reliable documentation.
C. Related solely to the project under examination.

• Costs or expenses incurred by the State in reviewing or auditing claims that are not supported by the Contractor's cost accounting or other records shall be deemed to be damages incurred by the State within the meaning of the California False Claims Act.

• If the Contractor files a timely written statement of claims in response to the proposed final estimate, the District that administers the contract will submit a claim position letter to the Contractor by hand delivery or deposit in the U.S. mail within 135 days of acceptance of the contract. The claim position letter will delineate the District's position on the Contractor's claims. If the Contractor disagrees with the claim position letter, the Contractor shall submit a written notification of its disagreement and a written request to meet with the board of review, to be received by the District not later than 15 days after the Contractor's receipt of the claim position letter. The written notification of disagreement shall set forth the basis for the Contractor's disagreement and be submitted to the office designated in the claim position letter. The Contractor's failure to provide a timely written notification of disagreement or timely written request to meet with the board of review shall constitute the Contractor's acceptance and agreement with the determinations provided in the claim position letter and with final payment pursuant to the claim position letter.

• If the Contractor files a timely notification of disagreement with the District claim position letter and a timely request to meet with the board of review, then the board of review, designated by the District Director to review claims that remain in dispute, will meet with the Contractor within 45 days after receipt by the District of the notification of disagreement.

• If the District fails to submit a claim position letter to the Contractor within 135 days after the acceptance of the contract and the Contractor has claims that remain in dispute, the Contractor may request a meeting with the board of review designated by the District Director to review claims that remain in dispute. The Contractor's request for a meeting shall identify the claims that remain in dispute. If the Contractor files a request for a meeting, the board of review will meet with the Contractor within 45 days after the District receives the request for the meeting.

• Attendance by the Contractor at the board of review meeting shall be mandatory. The board of review will review those claims and make a written recommendation thereon to the District Director. The final determination of claims, made by the District Director, will be sent to the Contractor by hand delivery or deposit in the U.S. mail. The Engineer will then make and issue the Engineer's final estimate in writing and within 30 days thereafter the State will pay the entire sum, if any, found due thereon. That final estimate shall be conclusive and binding against both parties to the contract on all questions relating to the amount of work done and the compensation payable therefor, except as otherwise provided in Sections 9-1.03C, "Records," and 9-1.09, "Clerical Errors."

• Failure of the Contractor to conform to the specified dispute procedures shall constitute a failure to pursue diligently and exhaust the administrative procedures in the contract and shall operate as a bar to arbitration in conformance with the requirements in Section 10240.2 of the California Public Contract Code.

## SECTION 19: EARTHWORK

Issue Date: December 31, 2001

The third paragraph of Section 19-1.02, "Preservation of Property," of the Standard Specifications is amended to read:

• In addition to the provisions in Sections 5-1.02, "Plans and Working Drawings," and 5-1.02A, "Excavation Safety Plans," detailed plans of the protective systems for excavations on or affecting railroad property will be reviewed for adequacy of protection provided for railroad facilities, property, and traffic. These plans shall be submitted at least 9 weeks before the Contractor intends to begin excavation requiring the protective systems. Approval by the Engineer of the detailed plans for the protective systems will be contingent upon the plans being satisfactory to the railroad company involved.

## SECTION 42: GROOVE AND GRIND PAVEMENT

Issue Date: December 31, 2001

The last sentence of the first subparagraph of the third paragraph in Section 42-2.02, "Construction," of the Standard Specifications is amended to read:

> After grinding has been completed, the pavement shall conform to the straightedge and profile requirements specified in Section 40-1.10, "Final Finishing."

## SECTION 49: PILING

Issue Date: December 31, 2001

Section 49-1.05, "Driving Equipment," of the Standard Specifications is amended by adding the following paragraph after the seventh paragraph:

• The use of followers or underwater hammers for driving piles will be permitted if authorized in writing by the Engineer. When a follower or underwater hammer is used, its efficiency shall be verified by furnishing the first pile in each bent or footing sufficiently long and driving the pile without the use of a follower or underwater hammer.

The first and second paragraphs in Section 49-4.01, "Description," of the Standard Specifications are amended to read:

• Cast-in-place concrete piles shall consist of one of the following:

A. Steel shells driven permanently to the required bearing value and penetration and filled with concrete.
B. Steel casings installed permanently to the required penetration and filled with concrete.
C. Drilled holes filled with concrete.
D. Rock sockets filled with concrete.

• The drilling of holes shall conform to the provisions in these specifications. Concrete filling for cast-in-place concrete piles is designated by compressive strength and shall have a minimum 28-day compressive strength of 25 MPa. At the option of the Contractor, the combined aggregate grading for the concrete shall be either the 25-mm maximum grading, the 12.5-mm maximum grading, or the 9.5-mm maximum grading. Concrete shall conform to the provisions in Section 90, "Portland Cement Concrete," and Section 51, "Concrete Structures." Reinforcement shall conform to the provisions in Section 52, "Reinforcement."

The fourth paragraph in Section 49-4.03, "Drilled Holes," of the Standard Specifications is amended to read:

• After placing reinforcement and prior to placing concrete in the drilled hole, if caving occurs or deteriorated foundation material accumulates on the bottom of the hole, the bottom of the drilled hole shall be cleaned. The Contractor shall verify that the bottom of the drilled hole is clean.

The third paragraph in Section 49-6.02, "Payment," of the Standard Specifications is amended to read:

• The contract price paid per meter for cast-in-drilled-hole concrete piling shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all work involved in drilling holes, disposing of material resulting from drilling holes, temporarily casing holes and removing water when necessary, furnishing and placing concrete and reinforcement, and constructing reinforced concrete extensions, complete in place, to the required penetration, as shown on the plans, as specified in these specifications and in the special provisions, and as directed by the Engineer.

## SECTION 50: PRESTRESSING CONCRETE

Issue Date: November 18, 2002

Section 50-1.02, "Drawings," of the Standard Specifications is amended by adding the following paragraph after the second paragraph:

• Each working drawing submittal shall consist of plans for a single bridge or portion thereof. For multi-frame bridges, each frame shall require a separate working drawing submittal.

Section 50-1.05, "Prestressing Steel," of the Standard Specifications is amended to read:

• Prestressing steel shall be high-tensile wire conforming to the requirements in ASTM Designation: A 421, including Supplement I; high-tensile seven-wire strand conforming to the requirements in ASTM Designation: A 416; or

uncoated high-strength steel bars conforming to the requirements in ASTM Designation: A 722, including all supplementary requirements. The maximum mass requirement of ASTM Designation: A 722 will not apply.

- In addition to the requirements of ASTM Designation: A 722, for deformed bars, the reduction of area shall be determined from a bar from which the deformations have been removed. The bar shall be machined no more than necessary to remove the deformations over a length of 300 mm, and reduction will be based on the area of the machined portion.
- In addition to the requirements specified herein, epoxy-coated seven-wire prestressing steel strand shall be grit impregnated and filled in conformance with the requirements in ASTM Designation: A 882/A 882M, including Supplement I, and the following:

A. The coating material shall be on the Department's list of approved coating materials for epoxy-coated strand, available from the Transportation Laboratory.
B. The film thickness of the coating after curing shall be 381 µm to 1143 µm.
C. Prior to coating the strand, the Contractor shall furnish to the Transportation Laboratory a representative 230-g sample from each batch of epoxy coating material to be used. Each sample shall be packaged in an airtight container identified with the manufacturer's name and batch number.
D. Prior to use of the epoxy-coated strand in the work, written certifications referenced in ASTM Designation: A 882/A 882M, including a representative load-elongation curve for each size and grade of strand to be used and a copy of the quality control tests performed by the manufacturer, shall be furnished to the Engineer.
E. In addition to the requirements in Section 50-1.10, "Samples for Testing," four 1.5-m long samples of coated strand and one 1.5-m long sample of uncoated strand of each size and reel shall be furnished to the Engineer for testing. These samples, as selected by the Engineer, shall be representative of the material to be used in the work.
F. Epoxy-coated strand shall be cut using an abrasive saw.
G. All visible damage to coatings caused by shipping and handling, or during installation, including cut ends, shall be repaired in conformance with the requirements in ASTM Designation: A 882/A 882M. The patching material shall be furnished by the manufacturer of the epoxy powder and shall be applied in conformance with the manufacturer's written recommendations. The patching material shall be compatible with the original epoxy coating material and shall be inert in concrete.

- All bars in any individual member shall be of the same grade, unless otherwise permitted by the Engineer.
- When bars are to be extended by the use of couplers, the assembled units shall have a tensile strength of not less than the manufacturer's minimum guaranteed ultimate tensile strength of the bars. Failure of any one sample to meet this requirement will be cause for rejection of the heat of bars and lot of couplers. The location of couplers in the member shall be subject to approval by the Engineer.
- Wires shall be straightened if necessary to produce equal stress in all wires or wire groups or parallel lay cables that are to be stressed simultaneously or when necessary to ensure proper positioning in the ducts.
- Where wires are to be button-headed, the buttons shall be cold formed symmetrically about the axes of the wires. The buttons shall develop the minimum guaranteed ultimate tensile strength of the wire. No cold forming process shall be used that causes indentations in the wire. Buttonheads shall not contain wide open splits, more than 2 splits per head, or splits not parallel with the axis of the wire.
- Prestressing steel shall be protected against physical damage and rust or other results of corrosion at all times from manufacture to grouting or encasing in concrete. Prestressing steel that has sustained physical damage at any time shall be rejected. The development of visible rust or other results of corrosion shall be cause for rejection, when ordered by the Engineer.
- Epoxy-coated prestressing steel strand shall be covered with an opaque polyethylene sheeting or other suitable protective material to protect the strand from exposure to sunlight, salt spray, and weather. For stacked coils, the protective covering shall be draped around the perimeter of the stack. The covering shall be adequately secured; however, it should allow for air circulation around the strand to prevent condensation under the covering. Epoxy-coated strand shall not be stored within 300 m of ocean or tidal water for more than 2 months.
- Prestressing steel shall be packaged in containers or shipping forms for the protection of the steel against physical damage and corrosion during shipping and storage. Except for epoxy-coated strand, a corrosion inhibitor which prevents rust or other results of corrosion, shall be placed in the package or form, or shall be incorporated in a corrosion inhibitor carrier type packaging material, or when permitted by the Engineer, may be applied directly to the steel. The corrosion inhibitor shall have no deleterious effect on the steel or concrete or bond strength of steel to concrete. Packaging or forms damaged from any cause shall be immediately replaced or restored to original condition.
- The shipping package or form shall be clearly marked with a statement that the package contains high-strength prestressing steel, and the type of corrosion inhibitor used, including the date packaged.
- Prestressing steel for post-tensioning which is installed in members prior to placing and curing of the concrete, and which is not epoxy-coated, shall be continuously protected against rust or other results of corrosion, until grouted, by means

of a corrosion inhibitor placed in the ducts or applied to the steel in the duct. The corrosion inhibitor shall conform to the provisions specified herein.

- When steam curing is used, prestressing steel for post-tensioning shall not be installed until the steam curing is completed.
- Water used for flushing ducts shall contain either quick lime (calcium oxide) or slaked lime (calcium hydroxide) in the amount of 0.01-kg/L. Compressed air used to blow out ducts shall be oil free.
- When prestressing steel for post-tensioning is installed in the ducts after completion of concrete curing, and if stressing and grouting are completed within 10 days after the installation of the prestressing steel, rust which may form during those 10 days will not be cause for rejection of the steel. Prestressing steel installed, tensioned, and grouted in this manner, all within 10 days, will not require the use of a corrosion inhibitor in the duct following installation of the prestressing steel. Prestressing steel installed as above but not grouted within 10 days shall be subject to all the requirements in this section pertaining to corrosion protection and rejection because of rust. The requirements in this section pertaining to tensioning and grouting within 10 days shall not apply to epoxy-coated prestressing steel strand.
- Any time prestressing steel for pretensioning is placed in the stressing bed and is exposed to the elements for more than 36 hours prior to encasement in concrete, adequate measures shall be taken by the Contractor, as approved by the Engineer, to protect the steel from contamination or corrosion.
- After final fabrication of the seven-wire prestressing steel strand, no electric welding of any form shall be performed on the prestressing steel. Whenever electric welding is performed on or near members containing prestressing steel, the welding ground shall be attached directly to the steel being welded.
- Pretensioned prestressing steel shall be cut off flush with the end of the member. For epoxy-coated prestressing steel, only abrasive saws shall be used to cut the steel. The exposed ends of the prestressing steel and a 25-mm strip of adjoining concrete shall be cleaned and painted. Cleaning shall be by wire brushing or abrasive blast cleaning to remove all dirt and residue on the metal or concrete surfaces. Immediately after cleaning, the surfaces shall be covered with one application of unthinned zinc-rich primer (organic vehicle type) conforming to the provisions in Section 91, "Paint," except that 2 applications shall be applied to surfaces which will not be covered by concrete or mortar. Aerosol cans shall not be used. The paint shall be thoroughly mixed at the time of application and shall be worked into any voids in the prestressing tendons.

The thirteenth paragraph in Section 50-1.08, "Prestressing," of the Standard Specifications is amended to read:

- Prestressing steel in pretensioned members shall not be cut or released until the concrete in the member has attained a compressive strength of not less than the value shown on the plans or 28 MPa, whichever is greater. In addition to these concrete strength requirements, when epoxy-coated prestressing steel strand is used, the steel shall not be cut or released until the temperature of the concrete surrounding the strand is less than 65°C, and falling.

The fifth paragraph in Section 50-1.10, "Samples for Testing," of the Standard Specifications is amended to read:

- The following samples of materials and tendons, selected by the Engineer from the prestressing steel at the plant or jobsite, shall be furnished by the Contractor to the Engineer well in advance of anticipated use:

  A. For wire or bars, one 2-m long sample and for strand, one 1.5-m long sample, of each size shall be furnished for each heat or reel.

  B. For epoxy-coated strand, one 1.5-m long sample of uncoated strand of each size shall be furnished for each reel.

  C. If the prestressing tendon is a bar, one 2-m long sample shall be furnished and in addition, if couplers are to be used with the bar, two 1.25-m long samples of bar, equipped with one coupler and fabricated to fit the coupler, shall be furnished.

The second paragraph in Section 50-1.11, "Payment," of the Standard Specifications is amended to read:

- The contract lump sum prices paid for prestressing cast-in-place concrete of the types listed in the Engineer's Estimate shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all work involved in furnishing, placing, and tensioning the prestressing steel in cast-in-place concrete structures, complete in place, as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.

## SECTION 51: CONCRETE STRUCTURES

Issue Date: November 18, 2002

The first and second paragraph in Section 51-1.06A, "Falsework Design and Drawings," of the Standard Specifications are amended to read:

- The Contractor shall submit to the Engineer working drawings and design calculations for falsework proposed for use at bridges. For bridges where the height of any portion of the falsework, as measured from the ground line to the soffit of the superstructure, exceeds 4.25 m; or where any individual falsework clear span length exceeds 4.85 m; or where provision for vehicular, pedestrian, or railroad traffic through the falsework is made; the drawings shall be signed by an engineer who is registered as a Civil Engineer in the State of California. Six sets of the working drawings and 2 copies of the design calculations shall be furnished. Additional working drawings and design calculations shall be submitted to the Engineer when specified in "Railroad Relations and Insurance" of the special provisions.
- The falsework drawings shall include details of the falsework erection and removal operations showing the methods and sequences of erection and removal and the equipment to be used. The details of the falsework erection and removal operations shall demonstrate the stability of all or any portions of the falsework during all stages of the erection and removal operations.

The seventh paragraph in Section 51-1.06A, "Falsework Design and Drawings," of the Standard Specifications is amended to read:

- In the event that several falsework plans are submitted simultaneously, or an additional plan is submitted for review before the review of a previously submitted plan has been completed, the Contractor shall designate the sequence in which the plans are to be reviewed. In such event, the time to be provided for the review of any plan in the sequence shall be not less than the review time specified above for that plan, plus 2 weeks for each plan of higher priority which is still under review. A falsework plan submittal shall consist of plans for a single bridge or portion thereof. For multi-frame bridges, each frame shall require a separate falsework plan submittal.

Section 51-1.06A, "Falsework Design and Drawings," of the Standard Specifications is amended by adding the following paragraphs:

- If structural composite lumber is proposed for use, the falsework drawings shall clearly identify the structural composite lumber members by grade (E value), species, and type. The Contractor shall provide technical data from the manufacturer showing the tabulated working stress values of the composite lumber. The Contractor shall furnish a certificate of compliance as specified in Section 6-1.07, "Certificates of Compliance," for each delivery of structural composite lumber to the project site.
- For falsework piles with a calculated loading capacity greater than 900 kN, the falsework piles shall be designed by an engineer who is registered as either a Civil Engineer or a Geotechnical Engineer in the State of California, and the calculations shall be submitted to the Engineer.

The first paragraph in Section 51-1.06A(1), "Design Loads," of the Standard Specifications is amended to read:

- The design load for falsework shall consist of the sum of dead and live vertical loads, and an assumed horizontal load. The minimum total design load for any falsework, including members that support walkways, shall be not less than 4800 $N/m^2$ for the combined live and dead load regardless of slab thickness.

The eighth paragraph in Section 51-1.06A(1), "Design Loads," of the Standard Specifications is amended to read:

- In addition to the minimum requirements specified in this Section 51-1.06A, falsework for box girder structures with internal falsework bracing systems using flexible members capable of withstanding tensile forces only, shall be designed to include the vertical effects caused by the elongation of the flexible member and the design horizontal load combined with the dead and live loads imposed by concrete placement for the girder stems and connected bottom slabs. Falsework comprised of individual steel towers with bracing systems using flexible members capable of withstanding tensile forces only to resist overturning, shall be exempt from these additional requirements.

The third paragraph in Section 51-1.06B, "Falsework Construction," of the Standard Specifications is amended to read:

- When falsework is supported on piles, the piles shall be driven and the actual bearing value assessed in conformance with the provisions in Section 49, "Piling."

Section 51-1.06B, "Falsework Construction," of the Standard Specifications is amended by adding the following paragraphs:

- For falsework piles with a calculated loading capacity greater than 900 kN, the Contractor shall conduct dynamic monitoring of pile driving and conduct penetration and bearing analyses based on a wave equation analysis. These analyses shall be signed by an engineer who is registered as a Civil Engineer in the State of California and submitted to the Engineer prior to completion of falsework erection.
- Prior to the placement of falsework members above the stringers, the final bracing system for the falsework shall be installed.

Section 51-1.06C, "Removing Falsework," of the Standard Specifications is amended by adding the following paragraph:

- The falsework removal operation shall be conducted in such a manner that any portion of the falsework not yet removed remains in a stable condition at all times.

The sixth paragraph in Section 51-1.09, "Placing Concrete," of the Standard Specifications is amended to read:

- Vibrators used to consolidate concrete containing epoxy-coated bar reinforcement or epoxy-coated prestressing steel shall have a resilient covering to prevent damage to the epoxy-coating on the reinforcement or prestressing steel.

The table in the ninth paragraph of Section 51-1.12H(1), "Plain and Fabric Reinforced Elastomeric Bearing Pads," of the Standard Specifications is amended to read:

| | |
|---|---|
| Tensile strength, percent | -15 |
| Elongation at break, percent | -40; but not less than 300% total elongation of the material |
| Hardness, points | +10 |

The first sentence of the fourth paragraph in Section 51-1.17, "Finish Bridge Decks," of the Standard Specifications is amended to read:

- The smoothness of completed roadway surfaces of structures, approach slabs and the adjacent 15 m of approach pavement, and the top surfaces of concrete decks which are to be covered with another material, will be tested by the Engineer with a bridge profilograph in conformance with the requirements in California Test 547 and the requirements herein.

Section 51-1.17, "Finishing Bridge Decks," of the Standard Specifications is amended by deleting the seventh, thirteenth and fourteenth paragraphs.

The fourteenth paragraph in Section 51-1.23, "Payment," of the Standard Specifications is amended by deleting "and injecting epoxy in cracks".

## SECTION 52: REINFORCEMENT

Issue Date: December 31, 2001

The third paragraph in Section 52-1.04, "Inspection," of the Standard Specifications is amended to read:

- A Certificate of Compliance conforming to the provisions in Section 6-1.07, "Certificates of Compliance," shall also be furnished for each shipment of epoxy-coated bar reinforcement or wire reinforcement certifying that the coated reinforcement conforms to the requirements in ASTM Designation: A 775/A 775M or A 884/A 884M, respectively, and the provisions in Section 52-1.02B, "Epoxy-coated Reinforcement." The Certificate of Compliance shall include all of the certifications specified in ASTM Designation: A 775/A 775M or A 884/A 884M respectively, and a statement that the coating material has been prequalified by acceptance testing performed by the Valley Forge Laboratories, Inc., Devon, Pennsylvania.

The third paragraph in Section 52-1.08C, "Mechanical Butt Splices," of the Standard Specifications is amended to read:

- The total slip of the reinforcing bars within the splice sleeve after loading in tension to 200 MPa and relaxing to 20 MPa shall not exceed the values listed in the following table. The slip shall be measured between gage points that are clear of the splice sleeve.

| Reinforcing Bar Number | Total Slip (μm) |
|---|---|
| 13 | 250 |
| 16 | 250 |
| 19 | 250 |
| 22 | 350 |
| 25 | 350 |
| 29 | 350 |
| 32 | 450 |
| 36 | 450 |
| 43 | 600 |
| 57 | 750 |

The first paragraph in Section 52-1.08C(5), "Sleeve-Lockshear Bolt Mechanical Butt Splices," of the Standard Specifications is amended to read:

- The sleeve-lockshear bolt type of mechanical butt splices shall consist of a seamless steel sleeve, center hole with centering pin, and bolts that are tightened until the bolt heads shear off with the bolt ends left embedded in the reinforcing bars. The seamless steel sleeve shall be either formed into a V configuration or shall have 2 serrated steel strips welded to the inside of the sleeve.

Section 52-1.08F, "Nondestructive Splice Tests," of the Standard Specifications is amended by deleting the seventh paragraph.

## SECTION 55: STEEL STRUCTURES

Issue Date: December 31, 2001

Section 55-3.14, "Bolted Connections," of the Standard Specifications is amended by adding the following after the ninth paragraph:

- If a torque multiplier is used in conjunction with a calibrated wrench as a method for tightening fastener assemblies to the required tension, both the multiplier and the wrench shall be calibrated together as a system. The same length input and output sockets and extensions that will be used in the work shall also be included in the calibration of the system. The manufacturer's torque multiplication ratio shall be adjusted during calibration of the system, such that when this adjusted ratio is multiplied by the actual input calibrated wrench reading, the product is a calculated output torque that is within 2 percent of the true output torque. When this system is used in the work to perform any installation tension testing, rotational capacity testing, fastener tightening, or tension verification, it shall be used, intact as calibrated.

The sixth paragraph of Section 55-4.02, "Payment," of the Standard Specifications is amended to read:

- If a portion or all of the structural steel is fabricated more than 480 air line kilometers from both Sacramento and Los Angeles, additional shop inspection expenses will be sustained by the State. Whereas it is and will be impracticable and extremely difficult to ascertain and determine the actual increase in these expenses, it is agreed that payment to the Contractor for furnishing the structural steel from each fabrication site located more than 480 air line kilometers from both Sacramento and Los Angeles will be reduced $5000 or by an amount computed at $0.044 per kilogram of structural steel fabricated, whichever is greater, or in the case of each fabrication site located more than 4800 air line kilometers from both Sacramento and Los Angeles, payment will be reduced $8000 or by $0.079 per kilogram of structural steel fabricated, whichever is greater.

## SECTION 56: SIGNS

Issue Date: December 31, 2001

Section 56-1.01, "Description," of the Standard Specifications is amended by deleting the third paragraph.

The sixth through the thirteenth paragraphs in Section 56-1.03, "Fabrication," of the Standard Specifications are amended to read:

- High-strength bolted connections, where shown on the plans, shall conform to the provisions in Section 55-3.14, "Bolted Connections," except that only fastener assemblies consisting of a high-strength bolt, nut, hardened washer, and direct tension indicator shall be used.
- High-strength fastener assemblies, and any other bolts, nuts, and washers attached to sign structures shall be zinc-coated by the mechanical deposition process.
- An alternating snugging and tensioning pattern for anchor bolts and high-strength bolted splices shall be used. Once tensioned, high-strength fastener components and direct tension indicators shall not be reused.
- For bolt diameters less than 10 mm, the diameter of the bolt hole shall be not more than 0.80-mm larger than the nominal bolt diameter. For bolt diameters greater than or equal to 10 mm, the diameter of the bolt hole shall be not more than 1.6 mm larger than the nominal bolt diameter.
- Sign structures shall be fabricated into the largest practical sections prior to galvanizing.
- Ribbed sheet metal panels for box beam closed truss sign structures shall be fastened to the truss members by cap screws or bolts as shown on the plans, or by 4.76 mm stainless steel blind rivets conforming to Industrial Fasteners Institute, Standard IFI-114, Grade 51. The outside diameter of the large flange rivet head shall be not less than 15.88 mm in diameter. Web splices in ribbed sheet metal panels may be made with similar type blind rivets of a size suitable for the thickness of material being connected.
- Spalling or chipping of concrete structures shall be repaired by the Contractor at the Contractor's expense.
- Overhead sign supports shall have an aluminum identification plate permanently attached near the base, adjacent to the traffic side on one of the vertical posts, using either stainless steel rivets or stainless steel screws. As a minimum, the information on the plate shall include the name of the manufacturer, the date of manufacture and the contract number.

## SECTION 59: PAINTING

Issue Date: December 31, 2001

Section 59-2.01, "General," of the Standard Specifications is amended by adding the following paragraphs after the first paragraph:

- Unless otherwise specified, no painting Contractors or subcontractors will be permitted to commence work without having the following current "SSPC: The Society for Protective Coatings" (formerly the Steel Structures Painting Council) certifications in good standing:

A. For cleaning and painting structural steel in the field, certification in conformance with the requirements in Qualification Procedure No. 1, "Standard Procedure For Evaluating Painting Contractors (Field Application to Complex Industrial Structures)" (SSPC-QP 1).
B. For removing paint from structural steel, certification in conformance with the requirements in Qualification Procedure No. 2, "Standard Procedure For Evaluating Painting Contractors (Field Removal of Hazardous Coatings from Complex Structures)" (SSPC-QP 2).
C. For cleaning and painting structural steel in a permanent painting facility, certification in conformance with the requirements in Qualification Procedure No. 3, "Standard Procedure For Evaluating Qualifications of Shop Painting Applicators" (SSPC-QP 3). The AISC's Sophisticated Paint Endorsement (SPE) quality program will be considered equivalent to SSPC-QP 3.

The third paragraph of Section 59-2.03, "Blast Cleaning," of the Standard Specifications is amended to read:

- Exposed steel or other metal surfaces to be blast cleaned shall be cleaned in conformance with the requirements in Surface Preparation Specification No. 6, "Commercial Blast Cleaning," of the "SSPC: The Society for Protective Coatings."

Blast cleaning shall leave all surfaces with a dense, uniform, angular anchor pattern of not less than 35 µm as measured in conformance with the requirements in ASTM Designation: D 4417.

The first paragraph of Section 59-2.06, "Hand Cleaning," of the Standard Specifications is amended to read:

- Dirt, loose rust and mill scale, or paint which is not firmly bonded to the surfaces shall be removed in conformance with the requirements in Surface Preparation Specification No. 2, "Hand Tool Cleaning," of the "SSPC: The Society for Protective Coatings." Edges of old remaining paint shall be feathered.

The fourth paragraph of Section 59-2.12, "Painting," of the Standard Specifications is amended to read:

- The dry film thickness of the paint will be measured in place with a calibrated Type 2 magnetic film thickness gage in conformance with the requirements of specification SSPC-PA2 of the "SSPC: The Society for Protective Coatings."

## SECTION 75: MISCELLANEOUS METAL

Issue Date: December 31, 2001

The table in the tenth paragraph of Section 75-1.02, "Miscellaneous Iron and Steel," of the Standard Specifications is amended to read:

| Material | Specification |
|---|---|
| Steel bars, plates and shapes | ASTM Designation: A 36/A 36M or A 575, A 576 (AISI or M Grades 1016 through 1030 except Grade 1017) |
| Steel fastener components for general applications: | |
| Bolts and studs | ASTM Designation: A 307 |
| Headed anchor bolts | ASTM Designation: A 307, Grade B, including S1 supplementary requirements |
| Nonheaded anchor bolts | ASTM Designation: A 307, Grade C, including S1 supplementary requirements and S1.6 of AASHTO Designation: M 314 supplementary requirements<br>or AASHTO Designation: M 314, Grade 36 or 55, including S1 supplementary requirements |
| High-strength bolts and studs, threaded rods, and nonheaded anchor bolts | ASTM Designation: A 449, Type 1 |
| Nuts | ASTM Designation: A 563, including Appendix X1* |
| Washers | ASTM Designation: F 844 |
| Components of high-strength steel fastener assemblies for use in structural steel joints: | |
| Bolts | ASTM Designation: A 325, Type 1 |
| Tension control bolts | ASTM Designation: F 1852, Type 1 |
| Nuts | ASTM Designation: A 563, including Appendix X1* |
| Hardened washers | ASTM Designation: F 436, Type 1, Circular, including S1 supplementary requirements |
| Direct tension indicators | ASTM Designation: F 959, Type 325, zinc-coated |
| Stainless steel fasteners (Alloys 304 & 316) for general applications: | |
| Bolts, screws, studs, threaded rods, and nonheaded anchor bolts | ASTM Designation: F 593 or F 738M |
| Nuts | ASTM Designation: F 594 or F 836M |
| Washers | ASTM Designation: A 240/A 240M and ANSI B 18.22M |
| Carbon-steel castings | ASTM Designation: A 27/A 27M, Grade 65-35 [450-240], Class 1 |
| Malleable iron castings | ASTM Designation: A 47, Grade 32510 or A 47M, Grade 22010 |
| Gray iron castings | ASTM Designation: A 48, Class 30B |
| Ductile iron castings | ASTM Designation: A 536, Grade 65-45-12 |
| Cast iron pipe | Commercial quality |
| Steel pipe | Commercial quality, welded or extruded |
| Other parts for general applications | Commercial quality |

* Zinc-coated nuts that will be tightened beyond snug or wrench tight shall be furnished with a dyed dry lubricant conforming to Supplementary Requirement S2 in ASTM Designation: A 563.

The table in the eighteenth paragraph of Section 75-1.03, "Miscellaneous Bridge Metal," of the Standard Specifications is amended to read:

| Stud Diameter (millimeters) | Sustained Tension Test Load (kilonewtons) |
|---|---|
| 29.01-33.00 | 137.9 |
| 23.01-29.00 | 79.6 |
| 21.01-23.00 | 64.1 |
| * 18.01-21.00 | 22.2 |
| 15.01-18.00 | 18.2 |
| 12.01-15.00 | 14.2 |
| 9.01-12.00 | 9.34 |
| 6.00-9.00 | 4.23 |

* Maximum stud diameter permitted for mechanical expansion anchors.

The table in the nineteenth paragraph of Section 75-1.03, "Miscellaneous Bridge Metal," of the Standard Specifications is amended to read:

| Stud Diameter (millimeters) | Ultimate Tensile Load (kilonewtons) |
|---|---|
| 30.01-33.00 | 112.1 |
| 27.01-30.00 | 88.1 |
| 23.01-27.00 | 71.2 |
| 20.01-23.00 | 51.6 |
| 16.01-20.00 | 32.0 |
| 14.01-16.00 | 29.4 |
| 12.00-14.00 | 18.7 |

The table in the twenty-second paragraph of Section 75-1.03, "Miscellaneous Bridge Metal," of the Standard Specifications is amended to read:

Installation Torque Values, (newton meters)

| Stud Diameter (millimeters) | Shell Type Mechanical Expansion Anchors | Integral Stud Type Mechanical Expansion Anchors | Resin Capsule Anchors and Cast-in-Place Inserts |
|---|---|---|---|
| 29.01-33.00 | — | — | 540 |
| 23.01-29.00 | — | — | 315 |
| 21.01-23.00 | — | — | 235 |
| 18.01-21.00 | 110 | 235 | 200 |
| 15.01-18.00 | 45 | 120 | 100 |
| 12.01-15.00 | 30 | 65 | 40 |
| 9.01-12.00 | 15 | 35 | 24 |
| 6.00-9.00 | 5 | 10 | — |

## SECTION 83: RAILINGS AND BARRIERS

Issue Date: June 13, 2002

The ninth paragraph in Section 83-1.02B, "Metal Beam Guard Railing," of the Standard Specifications is amended to read:

- The grades and species of wood posts and blocks shall be No. 1 timbers (also known as No. 1 structural) Douglas fir or No. 1 timbers Southern yellow pine. Wood posts and blocks shall be graded in conformance with the provisions in

Section 57-2, "Structural Timber," of the Standard Specifications, except allowances for shrinkage after mill cutting shall in no case exceed 5 percent of the American Lumber Standards minimum sizes, at the time of installation.

The eleventh paragraph in Section 83-1.02B, "Metal Beam Guard Railing," of the Standard Specifications is amended to read:

• Wood posts and blocks shall be pressure treated after fabrication in conformance with the provisions in Section 58, "Preservative Treatment of Lumber, Timber and Piling," of the Standard Specifications with creosote, creosote coal tar solution, creosote petroleum solution (50-50), pentachlorophenol in hydrocarbon solvent, copper naphthenate, ammoniacal copper arsenate, or ammoniacal copper zinc arsenate. In addition to the preservatives listed above, Southern yellow pine may also be pressure treated with chromated copper arsenate. When other than one of the creosote processes is used, blocks shall have a minimum retention of 6.4 $Kg/m^3$, and need not be incised.

## SECTION 86: SIGNALS, LIGHTING AND ELECTRICAL SYSTEMS

Issue Date: February 28, 2002

The seventh paragraph of Section 86-2.03, "Foundations," of the Standard Specifications is amended to read:

• Forms shall be true to line and grade. Tops of foundations for posts and standards, except special foundations, shall be finished to curb or sidewalk grade or as directed by the Engineer. Forms shall be rigid and securely braced in place. Conduit ends and anchor bolts shall be placed in proper position and to proper height, and anchor bolts shall be held in place by means of rigid templates. Anchor bolts shall not be installed more than 1:40 from vertical.

The twelfth paragraph of Section 86-2.03, "Foundations," of the Standard Specifications is amended to read:

• Plumbing of the standards shall be accomplished by adjusting the leveling nuts before placing the mortar or before the foundation is finished to final grade. Shims, or other similar devices shall not be used for plumbing or raking of posts, standards or pedestals. After final adjustments of both top nuts and leveling nuts on anchorage assemblies have been made, firm contact shall exist between all bearing surfaces of the anchor bolt nuts, washers, and the base plate.

Section 86-8.01, "Payment," of the Standard Specifications is amended to read by adding the following paragraph after the first paragraph:

• If a portion or all of the traffic signal and lighting standards, pursuant to Standard Specification Section 86, "Signals, Lighting and Electrical Systems," are fabricated more than 480 air line kilometers from both Sacramento and Los Angeles, additional shop inspection expenses will be sustained by the State. Whereas it is and will be impracticable and extremely difficult to ascertain and determine the actual increase in such expenses, it is agreed that payment to the Contractor for furnishing such items from each fabrication site located more than 480 air line kilometers from both Sacramento and Los Angeles will be reduced $5000; in addition, in the case where a fabrication site is located more than 4800 air line kilometers from both Sacramento and Los Angeles, payment will be reduced an additional $3000 per each fabrication site ($8000 total per site).

## SECTION 88: ENGINEERING FABRIC

Issue Date: January 15, 2002

Section 88-1.02, "Pavement Reinforcing Fabric," of the Standard Specifications is amended to read:

• Pavement reinforcing fabric shall be 100 percent polypropylene staple fiber fabric material, needle-punched, thermally bonded on one side, and conform to the following:

| Specification | Requirement |
|---|---|
| Weight, grams per square meter<br>ASTM Designation: D 5261 | 140 |
| Grab tensile strength<br>(25-mm grip), kilonewtons, min. in each direction<br>ASTM Designation: D 4632 | 0.45 |
| Elongation at break, percent min.<br>ASTM Designation: D 4632 | 50 |
| Asphalt retention by fabric, grams per square meter. (Residual Minimum)<br>ASTM Designation: D 6140 | 900 |

Note: Weight, grab, elongation and asphalt retention are based on Minimum Average Roll Value (MARV)

## SECTION 90: PORTLAND CEMENT CONCRETE

Issue Date: March 12, 2002

Section 90, "Portland Cement Concrete," of the Standard Specifications is amended to read:

## SECTION 90: PORTLAND CEMENT CONCRETE
## 90-1 GENERAL

### 90-1.01 DESCRIPTION

• Portland cement concrete shall be composed of cementitious material, fine aggregate, coarse aggregate, admixtures if used, and water, proportioned and mixed as specified in these specifications.

• The Contractor shall determine the mix proportions for all concrete except pavement concrete. The Engineer will determine the mix proportions for pavement concrete. Concrete for which the mix proportions are determined either by the Contractor or the Engineer shall conform to the requirements of this Section 90.

• Unless otherwise specified, cementitious material shall be a combination of cement and mineral admixture. Cementitious material shall be either:

1. "Type IP (MS) Modified" cement; or
2. A combination of "Type II Modified" portland cement and mineral admixture; or
3. A combination of Type V portland cement and mineral admixture.

• Type III portland cement shall be used only as allowed in the special provisions or with the approval of the Engineer.

• Class 1 concrete shall contain not less than 400 kg of cementitious material per cubic meter.

• Class 2 concrete shall contain not less than 350 kg of cementitious material per cubic meter.

• Class 3 concrete shall contain not less than 300 kg of cementitious material per cubic meter.

• Class 4 concrete shall contain not less than 250 kg of cementitious material per cubic meter.

• Minor concrete shall contain not less than 325 kg of cementitious material per cubic meter unless otherwise specified in these specifications or the special provisions.

• Unless otherwise designated on the plans or specified in these specifications or the special provisions, the amount of cementitious material used per cubic meter of concrete in structures or portions of structures shall conform to the following:

| Use | Cementitious Material Content (kg/m3) |
|---|---|
| Concrete designated by compressive strength: | |
| Deck slabs and slab spans of bridges | 400 min., 475 max. |
| Roof sections of exposed top box culverts | 400 min., 475 max. |
| Other portions of structures | 350 min., 475 max. |
| Concrete not designated by compressive strength: | |
| Deck slabs and slab spans of bridges | 400 min. |
| Roof sections of exposed top box culverts | 400 min. |
| Prestressed members | 400 min. |
| Seal courses | 400 min. |
| Other portions of structures | 350 min. |
| Concrete for precast members | 350 min., 550 max. |

• Whenever the 28-day compressive strength shown on the plans is greater than 25 MPa, the concrete shall be designated by compressive strength. If the plans show a 28-day compressive strength that is 28 MPa or greater, an additional 14 days will be allowed to obtain the specified strength. The 28-day compressive strengths shown on the plans that are 25 MPa or less are shown for design information only and are not a requirement for acceptance of the concrete.

• Concrete designated by compressive strength shall be proportioned such that the concrete will attain the strength shown on the plans or specified in the special provisions.

• Before using concrete for which the mix proportions have been determined by the Contractor, or in advance of revising those mix proportions, the Contractor shall submit in writing to the Engineer a copy of the mix design.

• Compliance with cementitious material content requirements will be verified in conformance with procedures described in California Test 518 for cement content. For testing purposes, mineral admixture shall be considered to be cement. Batch proportions shall be adjusted as necessary to produce concrete having the specified cementitious material content.

• If any concrete has a cementitious material, portland cement, or mineral admixture content that is less than the minimum required, the concrete shall be removed. However, if the Engineer determines that the concrete is structurally adequate, the concrete may remain in place and the Contractor shall pay to the State $0.55 for each kilogram of cementitious material, portland cement, or mineral admixture that is less than the minimum required. The Department may deduct the amount from any moneys due, or that may become due, the Contractor under the contract. The deductions will not be made unless the difference between the contents required and those actually provided exceeds the batching tolerances permitted by Section 90-5, "Proportioning." No deductions will be made based on the results of California Test 518.

• The requirements of the preceding paragraph shall not apply to minor concrete or commercial quality concrete.

## 90-2 MATERIALS

### 90-2.01 CEMENT

• Unless otherwise specified, cement shall be either "Type IP (MS) Modified" cement, "Type II Modified" portland cement or Type V portland cement.

• "Type IP (MS) Modified" cement shall conform to the requirements for Type IP (MS) cement in ASTM Designation: C 595, and shall be comprised of an intimate and uniform blend of Type II cement and not more than 35 percent by mass of mineral admixture. The type and minimum amount of mineral admixture used in the manufacture of "Type IP (MS) Modified" cement shall be in conformance with the provisions in Section 90-4.08, "Required Use of Mineral Admixtures."

• "Type II Modified" portland cement shall conform to the requirements for Type II portland cement in ASTM Designation: C 150.

• In addition, "Type IP (MS) Modified" cement and "Type II Modified" portland cement shall conform to the following requirements:

A. The cement shall not contain more than 0.60 percent by mass of alkalies, calculated as the percentage of $Na_2O$ plus 0.658 times the percentage of $K_2O$, when determined by either direct intensity flame photometry or by the atomic absorption method. The instrument and procedure used shall be qualified as to precision and accuracy in conformance with the requirements in ASTM Designation: C 114;

B. The autoclave expansion shall not exceed 0.50 percent; and
C. Mortar, containing the cement to be used and Ottawa sand, when tested in conformance with California Test 527, shall not expand in water more than 0.010 percent and shall not contract in air more than 0.048 percent, except that when cement is to be used for precast prestressed concrete piling, precast prestressed concrete members, or steam cured concrete products, the mortar shall not contract in air more than 0.053 percent.

• Type III and Type V portland cements shall conform to the requirements in ASTM Designation: C 150 and the additional requirements listed above for "Type II Modified" portland cement, except that when tested in conformance with California Test 527, mortar containing Type III portland cement shall not contract in air more than 0.075 percent.

• Cement used in the manufacture of cast-in-place concrete for exposed surfaces of like elements of a structure shall be from the same cement mill.

• Cement shall be protected from exposure to moisture until used. Sacked cement shall be piled to permit access for tally, inspection, and identification of each shipment.

• Adequate facilities shall be provided to assure that cement meeting the provisions specified in this Section 90-2.01 shall be kept separate from other cement in order to prevent any but the specified cement from entering the work. Safe and suitable facilities for sampling cement shall be provided at the weigh hopper or in the feed line immediately in advance of the hopper, in conformance with California Test 125.

• If cement is used prior to sampling and testing as provided in Section 6-1.07, "Certificates of Compliance," and the cement is delivered directly to the site of the work, the Certificate of Compliance shall be signed by the cement manufacturer or supplier of the cement. If the cement is used in ready-mixed concrete or in precast concrete products purchased as such by the Contractor, the Certificate of Compliance shall be signed by the manufacturer of the concrete or product.

• Cement furnished without a Certificate of Compliance shall not be used in the work until the Engineer has had sufficient time to make appropriate tests and has approved the cement for use.

**90-2.02 AGGREGATES**

• Aggregates shall be free from deleterious coatings, clay balls, roots, bark, sticks, rags, and other extraneous material.

• Natural aggregates shall be thoroughly and uniformly washed before use.

• The Contractor, at the Contractor's expense, shall provide safe and suitable facilities, including necessary splitting devices for obtaining samples of aggregates, in conformance with California Test 125.

• Aggregates shall be of such character that it will be possible to produce workable concrete within the limits of water content provided in Section 90-6.06, "Amount of Water and Penetration."

• Aggregates shall have not more than 10 percent loss when tested for soundness in conformance with the requirements in California Test 214. The soundness requirement for fine aggregate will be waived, provided that the durability index, $D_f$, of the fine aggregate is 60, or greater, when tested for durability in conformance with California Test 229.

• If the results of any one or more of the Cleanness Value, Sand Equivalent, or aggregate grading tests do not meet the requirements specified for "Operating Range" but all meet the "Contract Compliance" requirements, the placement of concrete shall be suspended at the completion of the current pour until tests or other information indicate that the next material to be used in the work will comply with the requirements specified for "Operating Range."

• If the results of either or both the Cleanness Value and coarse aggregate grading tests do not meet the requirements specified for "Contract Compliance," the concrete that is represented by the tests shall be removed. However, if the Engineer determines that the concrete is structurally adequate, the concrete may remain in place, and the Contractor shall pay to the State $4.60 per cubic meter for paving concrete and $7.20 per cubic meter for all other concrete for the concrete represented by these tests and left in place. The Department may deduct the amount from any moneys due, or that may become due, the Contractor under the contract.

• If the results of either or both the Sand Equivalent and fine aggregate grading tests do not meet the requirements specified for "Contract Compliance," the concrete which is represented by the tests shall be removed. However, if the Engineer determines that the concrete is structurally adequate, the concrete may remain in place, and the Contractor shall pay to the State $4.60 per cubic meter for paving concrete and $7.20 per cubic meter for all other concrete for the concrete represented by these tests and left in place. The Department may deduct the amount from any moneys due, or that may become due, the Contractor under the contract.

• The 2 preceding paragraphs apply individually to the "Contract Compliance" requirements for coarse aggregate and fine aggregate. When both coarse aggregate and fine aggregate do not conform to the "Contract Compliance" requirements, both paragraphs shall apply. The payments specified in those paragraphs shall be in addition to any payments made in conformance with the provisions in Section 90-1.01, "Description."

• No single Cleanness Value, Sand Equivalent or aggregate grading test shall represent more than 250 $m^3$ of concrete or one day's pour, whichever is smaller.

• Aggregates specified for freeze-thaw resistance shall pass the freezing and thawing test, California Test 528.

• The Contractor shall notify the Engineer of the proposed source of freeze-thaw resistant concrete aggregates at least 4 months before intended use. Should the Contractor later propose a different source of concrete aggregates, the Contractor shall again notify the Engineer at least 4 months before intended use. Blending of fine or coarse aggregates from untested sources with acceptable aggregates will not be permitted. Provisions for the time of submission of samples as provided in Section 40-1.015, "Cement Content," are superseded by the foregoing.

• Concurrently with notification of proposed sources of freeze-thaw resistant concrete aggregates, the Contractor shall furnish samples in the quantity ordered by the Engineer. The samples shall be secured under the direct supervision of the Engineer. Samples from existing stockpiles of processed aggregate shall be taken from washed materials and shall be visibly damp. Samples from materials in place in a material source shall be taken at depths from the existing surface that will ensure the presence of the full quantity of ground water. Excavations for the purpose of securing samples shall be made to the full depth of intended source operations. Samples shall be protected against loss of contained water until they are delivered to the Engineer.

• The Engineer will waive the above freeze-thaw test and the 4-month advance notice, required in this Section, provided aggregates are to be obtained from sources that have previously passed this test and test results are currently applicable.

• No extension of contract time will be allowed for the time required to perform the freezing and thawing test.

• When the source of an aggregate is changed, except for pavement concrete, the Contractor shall adjust the mix proportions and submit in writing to the Engineer a copy of the mix design before using the aggregates. When the source of an aggregate is changed for pavement concrete, the Engineer shall be allowed sufficient time to adjust the mix, and the aggregates shall not be used until necessary adjustments are made.

**90-2.02A Coarse Aggregate**

• Coarse aggregate shall consist of gravel, crushed gravel, crushed rock, crushed air-cooled iron blast furnace slag or combinations thereof. Crushed air-cooled blast furnace slag shall not be used in reinforced or prestressed concrete.

• Coarse aggregate shall conform to the following quality requirements:

| Tests | California Test | Requirements |
|---|---|---|
| Loss in Los Angeles Rattler (after 500 revolutions) | 211 | 45% max. |
| Cleanness Value | | |
| Operating Range | 227 | 75 min. |
| Contract Compliance | 227 | 71 min. |

• In lieu of the above Cleanness Value requirements, a Cleanness Value "Operating Range" limit of 71, minimum, and a Cleanness Value "Contract Compliance" limit of 68, minimum, will be used to determine the acceptability of the coarse aggregate if the Contractor furnishes a Certificate of Compliance, as provided in Section 6-1.07, "Certificates of Compliance," certifying that:

1. coarse aggregate sampled at the completion of processing at the aggregate production plant had a Cleanness Value of not less than 82 when tested by California Test 227; and
2. prequalification tests performed in conformance with the requirements in California Test 549 indicated that the aggregate would develop a relative strength of not less than 95 percent and would have a relative shrinkage not greater than 105 percent, based on concrete.

**90-2.02B Fine Aggregate**

• Fine aggregate shall consist of natural sand, manufactured sand produced from larger aggregate or a combination thereof. Manufactured sand shall be well graded.

• Fine aggregate shall conform to the following quality requirements:

| Test | California Test | Requirements |
|---|---|---|
| Organic Impurities | 213 | Satisfactory[a] |
| Mortar Strengths Relative to Ottawa Sand | 515 | 95%, min. |
| Sand Equivalent: | | |
| Operating Range | 217 | 75, min. |
| Contract Compliance | 217 | 71, min. |

a Fine aggregate developing a color darker than the reference standard color solution may be accepted if it is determined by the Engineer, from mortar strength tests, that a darker color is acceptable.

• In lieu of the above Sand Equivalent requirements, a Sand Equivalent "Operating Range" limit of 71 minimum and a Sand Equivalent "Contract Compliance" limit of 68 minimum will be used to determine the acceptability of the fine aggregate if the Contractor furnishes a Certificate of Compliance, as provided in Section 6-1.07, "Certificates of Compliance," certifying that:

1. fine aggregate sampled at the completion of processing at the aggregate production plant had a Sand Equivalent value of not less than 82 when tested by California Test 217; and
2. prequalification tests performed in conformance with California Test 549 indicated that the aggregate would develop a relative strength of not less than 95 percent and would have a relative shrinkage not greater than 105 percent, based on concrete.

**90-2.03 WATER**

• In conventionally reinforced concrete work, the water for curing, for washing aggregates, and for mixing shall be free from oil and shall not contain more than 1000 parts per million of chlorides as Cl, when tested in conformance with California Test 422, nor more than 1300 parts per million of sulfates as $SO_4$, when tested in conformance with California Test 417. In prestressed concrete work, the water for curing, for washing aggregates, and for mixing shall be free from oil and shall not contain more than 650 parts per million of chlorides as Cl, when tested in conformance with California Test 422, nor more than 1300 parts per million of sulfates as $SO_4$, when tested in conformance with California Test 417. In no case shall the water contain an amount of impurities that will cause either: 1) a change in the setting time of cement of more than 25 percent when tested in conformance with the requirements in ASTM Designation: C 191 or ASTM Designation: C 266 or 2) a reduction in the compressive strength of mortar at 14 days of more than 5 percent, when tested in conformance with the requirements in ASTM Designation: C 109, when compared to the results obtained with distilled water or deionized water, tested in conformance with the requirements in ASTM Designation: C 109.

• In non-reinforced concrete work, the water for curing, for washing aggregates and for mixing shall be free from oil and shall not contain more than 2000 parts per million of chlorides as Cl, when tested in conformance with California Test 422, or more than 1500 parts per million of sulfates as $SO_4$, when tested in conformance with California Test 417.

• In addition to the above provisions, water for curing concrete shall not contain impurities in a sufficient amount to cause discoloration of the concrete or produce etching of the surface.

• Water reclaimed from mixer wash-out operations may be used in mixing concrete. The water shall not contain coloring agents or more than 300 parts per million of alkalis ($Na_2O$ + 0.658 $K_2O$) as determined on the filtrate. The specific gravity of the water shall not exceed 1.03 and shall not vary more than ±0.010 during a day's operations.

**90-2.04 ADMIXTURE MATERIALS**

• Admixture materials shall conform to the requirements in the following ASTM Designations:

A. Chemical Admixtures—ASTM Designation: C 494.
B. Air-entraining Admixtures—ASTM Designation: C 260.
C. Calcium Chloride—ASTM Designation: D 98.

D. Mineral Admixtures—Coal fly ash; raw or calcined natural pozzolan as specified in ASTM Designation: C618; silica fume conforming to the requirements in ASTM Designation: C1240, with reduction of mortar expansion of 80 percent, minimum, using the cement from the proposed mix design.

• Unless otherwise specified in the special provisions, mineral admixtures shall be used in conformance with the provisions in Section 90-4.08, "Required Use of Mineral Admixtures."

## 90-3 AGGREGATE GRADINGS

### 90-3.01 GENERAL

• Before beginning concrete work, the Contractor shall submit in writing to the Engineer the gradation of the primary aggregate nominal sizes that the Contractor proposes to furnish. If a primary coarse aggregate or the fine aggregate is separated into 2 or more sizes, the proposed gradation shall consist of the gradation for each individual size, and the proposed proportions of each individual size, combined mathematically to indicate one proposed gradation. The proposed gradation shall meet the grading requirements shown in the table in this section, and shall show the percentage passing each of the sieve sizes used in determining the end result.

• The Engineer may waive, in writing, the gradation requirements in this Section 90-3.01 and in Sections 90-3.02, "Coarse Aggregate Grading," 90-3.03, "Fine Aggregate Grading," and 90-3.04, "Combined Aggregate Gradings," if, in the Engineer's opinion, furnishing the gradation is not necessary for the type or amount of concrete work to be constructed.

• Gradations proposed by the Contractor shall be within the following percentage passing limits:

| Primary Aggregate Nominal Size | Sieve Size | Limits of Proposed Gradation |
|---|---|---|
| 37.5-mm x 19-mm | 25-mm | 19 - 41 |
| 25-mm x 4.75-mm | 19-mm | 52 - 85 |
| 25-mm x 4.75-mm | 9.5-mm | 15 - 38 |
| 12.5-mm x 4.75-mm | 9.5-mm | 40 - 78 |
| 9.5-mm x 2.36-mm | 9.5-mm | 50 - 85 |
| Fine Aggregate | 1.18-mm | 55 - 75 |
| Fine Aggregate | 600-µm | 34 - 46 |
| Fine Aggregate | 300-µm | 16 - 29 |

• Should the Contractor change the source of supply, the Contractor shall submit in writing to the Engineer the new gradations before their intended use.

### 90-3.02 COARSE AGGREGATE GRADING

• The grading requirements for coarse aggregates are shown in the following table for each size of coarse aggregate:

| | Percentage Passing Primary Aggregate Nominal Sizes | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 37.5-mm x 19-mm | | 25-mm x 4.75-mm | | 12.5-mm x 4.75-mm | | 9.5-mm x 2.36-mm | |
| Sieve Sizes | Operating Range | Contract Compliance | Operating Range | Contract Compliance | Operating Range | Contract Compliance | Operating Range | Contract Compliance |
| 50-mm | 100 | 100 | — | — | — | — | — | — |
| 37.5-mm | 88-100 | 85-100 | 100 | 100 | — | — | — | — |
| 25-mm | x ± 18 | X ± 25 | 88-100 | 86-100 | — | — | — | — |
| 19-mm | 0-17 | 0-20 | X ± 15 | X ± 22 | 100 | 100 | — | — |
| 12.5-mm | — | — | — | — | 82-100 | 80-100 | 100 | 100 |
| 9.5-mm | 0-7 | 0-9 | X ± 15 | X ± 22 | X ± 15 | X ± 22 | X ± 15 | X ± 20 |
| 4.75-mm | — | — | 0-16 | 0-18 | 0-15 | 0-18 | 0-25 | 0-28 |
| 2.36-mm | — | — | 0-6 | 0-7 | 0-6 | 0-7 | 0-6 | 0-7 |

• In the above table, the symbol X is the gradation that the Contractor proposes to furnish for the specific sieve size as provided in Section 90-3.01, "General."

• Coarse aggregate for the 37.5-mm, maximum, combined aggregate grading as provided in Section 90-3.04, "Combined Aggregate Gradings," shall be furnished in 2 or more primary aggregate nominal sizes. Each primary aggregate nominal size may be separated into 2 sizes and stored separately, provided that the combined material conforms to the grading requirements for that particular primary aggregate nominal size.

• When the 25-mm, maximum, combined aggregate grading as provided in Section 90-3.04, "Combined Aggregate Gradings," is to be used, the coarse aggregate may be separated into 2 sizes and stored separately, provided that the combined material shall conform to the grading requirements for the 25-mm x 4.75-mm primary aggregate nominal size.

### 90-3.03 FINE AGGREGATE GRADING

• Fine aggregate shall be graded within the following limits:

| Sieve Sizes | Percentage Passing | |
|---|---|---|
| | Operating Range | Contract Compliance |
| 9.5-mm | 100 | 100 |
| 4.75-mm | 95-100 | 93-100 |
| 2.36-mm | 65-95 | 61-99 |
| 1.18-mm | X ± 10 | X ± 13 |
| 600-µm | X ± 9 | X ± 12 |
| 300-µm | X ± 6 | X ± 9 |
| 150-µm | 2-12 | 1-15 |
| 75-µm | 0-8 | 0-10 |

• In the above table, the symbol X is the gradation that the Contractor proposes to furnish for the specific sieve size as provided in Section 90-3.01, "General."

• In addition to the above required grading analysis, the distribution of the fine aggregate sizes shall be such that the difference between the total percentage passing the 1.18-mm sieve and the total percentage passing the 600-µm sieve shall be between 10 and 40, and the difference between the percentage passing the 600-µm and 300-µm sieves shall be between 10 and 40.

• Fine aggregate may be separated into 2 or more sizes and stored separately, provided that the combined material conforms to the grading requirements specified in this Section 90-3.03.

### 90-3.04 COMBINED AGGREGATE GRADINGS

• Combined aggregate grading limits shall be used only for the design of concrete mixes. Concrete mixes shall be designed so that aggregates are combined in proportions that shall produce a mixture within the grading limits for combined aggregates as specified herein. Within these limitations, the relative proportions shall be as ordered by the Engineer, except as otherwise provided in Section 90-1.01, "Description."

• The combined aggregate grading used in portland cement concrete pavement shall be the 37.5-mm, maximum grading.

• The combined aggregate grading used in concrete for structures and other concrete items, except when specified otherwise in these specifications or the special provisions, shall be either the 37.5-mm, maximum grading, or the 25-mm, maximum grading, at the option of the Contractor.

Grading Limits of Combined Aggregates

| Sieve Sizes | Percentage Passing | | | |
|---|---|---|---|---|
| | 37.5-mm Max. | 25-mm Max. | 12.5-mm Max. | 9.5-mm Max. |
| 50-mm | 100 | — | — | — |
| 37.5-mm | 90-100 | 100 | — | — |
| 25-mm | 50-86 | 90-100 | — | — |
| 19-mm | 45-75 | 55-100 | 100 | — |
| 12.5-mm | — | — | 90-100 | 100 |
| 9.5-mm | 38-55 | 45-75 | 55-86 | 50 - 100 |
| 4.75-mm | 30-45 | 35-60 | 45-63 | 45 - 63 |
| 2.36-mm | 23-38 | 27-45 | 35-49 | 35 - 49 |
| 1.18-mm | 17-33 | 20-35 | 25-37 | 25 - 37 |
| 600-µm | 10-22 | 12-25 | 15-25 | 15 - 25 |
| 300-µm | 4-10 | 5-15 | 5-15 | 5 - 15 |
| 150-µm | 1-6 | 1-8 | 1-8 | 1 - 8 |
| 75-µm | 0-3 | 0-4 | 0-4 | 0 - 4 |

- Changes from one grading to another shall not be made during the progress of the work unless permitted by the Engineer.

## 90-4 ADMIXTURES

### 90-4.01 GENERAL

- Admixtures used in portland cement concrete shall conform to and be used in conformance with the provisions in this Section 90-4 and the special provisions. Admixtures shall be used when specified or ordered by the Engineer and may be used at the Contractor's option as provided herein.
- Chemical admixtures and air-entraining admixtures containing chlorides as Cl in excess of one percent by mass of admixture, as determined by California Test 415, shall not be used in prestressed or reinforced concrete.
- Calcium chloride shall not be used in concrete containing steel reinforcement or other embedded metals.
- Mineral admixture used in concrete for exposed surfaces of like elements of a structure shall be from the same source and of the same percentage.
- Admixtures shall be uniform in properties throughout their use in the work. Should it be found that an admixture as furnished is not uniform in properties, its use shall be discontinued.
- If more than one admixture is used, the admixtures shall be compatible with each other so that the desirable effects of all admixtures used will be realized.

### 90-4.02 MATERIALS

- Admixture materials shall conform to the provisions in Section 90–2.04, "Admixture Materials."

### 90-4.03 ADMIXTURE APPROVAL

- No admixture brand shall be used in the work unless it is on the Department's current list of approved brands for the type of admixture involved.
- Admixture brands will be considered for addition to the approved list if the manufacturer of the admixture submits to the Transportation Laboratory a sample of the admixture accompanied by certified test results demonstrating that the admixture complies with the requirements in the appropriate ASTM Designation and these specifications. The sample shall be sufficient to permit performance of all required tests. Approval of admixture brands will be dependent upon a determination as to compliance with the requirements, based on the certified test results submitted, together with tests the Department may elect to perform.
- When the Contractor proposes to use an admixture of a brand and type on the current list of approved admixture brands, the Contractor shall furnish a Certificate of Compliance from the manufacturer, as provided in Section 6-1.07, "Certificates of Compliance," certifying that the admixture furnished is the same as that previously approved. If a previously approved admixture is not accompanied by a Certificate of Compliance, the admixture shall not be used in the work until the Engineer has had sufficient time to make the appropriate tests and has approved the admixture for use. The Engineer may take samples for testing at any time, whether or not the admixture has been accompanied by a Certificate of Compliance.
- If a mineral admixture is delivered directly to the site of the work, the Certificate of Compliance shall be signed by the manufacturer or supplier of the mineral admixture. If the mineral admixture is used in ready-mix concrete or in precast

concrete products purchased as such by the Contractor, the Certificate of Compliance shall be signed by the manufacturer of the concrete or product.

### 90-4.04 REQUIRED USE OF CHEMICAL ADMIXTURES AND CALCIUM CHLORIDE

- When the use of a chemical admixture or calcium chloride is specified or ordered by the Engineer, the admixture shall be used at the dosage specified or ordered, except that if no dosage is specified or ordered, the admixture shall be used at the dosage normally recommended by the manufacturer of the admixture.
- Calcium chloride shall be dispensed in liquid, flake, or pellet form. Calcium chloride dispensed in liquid form shall conform to the provisions for dispensing liquid admixtures in Section 90-4.10, "Proportioning and Dispensing Liquid Admixtures."

### 90-4.05 OPTIONAL USE OF CHEMICAL ADMIXTURES

- The Contractor will be permitted to use Type A or F, water-reducing; Type B, retarding; or Type D or G, water-reducing and retarding admixtures as described in ASTM Designation: C 494 to conserve cementitious material or to facilitate any concrete construction application subject to the following conditions:

A. When a water-reducing admixture or a water-reducing and retarding admixture is used, the cementitious material content specified or ordered may be reduced by a maximum of 5 percent by mass, except that the resultant cementitious material content shall be not less than 300 kilograms per cubic meter; and
B. When a reduction in cementitious material content is made, the dosage of admixture used shall be the dosage used in determining approval of the admixture.

- Unless otherwise specified, a Type C accelerating chemical admixture conforming to the requirements in ASTM Designation: C 494, may be used in portland cement concrete. Inclusion in the mix design submitted for approval will not be required provided that the admixture is added to counteract changing conditions that contribute to delayed setting of the portland cement concrete, and the use or change in dosage of the admixture is approved in writing by the Engineer.

### 90-4.06 REQUIRED USE OF AIR-ENTRAINING ADMIXTURES

- When air-entrainment is specified or ordered by the Engineer, the air-entraining admixture shall be used in amounts to produce a concrete having the specified air content as determined by California Test 504.

### 90-4.07 OPTIONAL USE OF AIR-ENTRAINING ADMIXTURES

- When air-entrainment has not been specified or ordered by the Engineer, the Contractor will be permitted to use an air-entraining admixture to facilitate the use of any construction procedure or equipment provided that the average air content, as determined by California Test 504, of 3 successive tests does not exceed 4 percent, and no single test value exceeds 5.5 percent. If the Contractor elects to use an air-entraining admixture in concrete for pavement, the Contractor shall so indicate at the time the Contractor designates the source of aggregate as provided in Section 40-1.015, "Cement Content."

### 90-4.08 REQUIRED USE OF MINERAL ADMIXTURES

- Unless otherwise specified, mineral admixture shall be combined with cement to make cementitious material.
- The calcium oxide content of mineral admixtures shall not exceed 10 percent and the available alkali, as sodium oxide equivalent, shall not exceed 1.5 percent when determined in conformance with the requirements in ASTM Designation: C 618.
- The amounts of cement and mineral admixture used in cementitious material shall be sufficient to satisfy the minimum cementitious material content requirements specified in Section 90-1.01, "Description," or Section 90-4.05, "Optional Use of Chemical Admixtures," and shall conform to the following:

A. The minimum amount of cement shall not be less than 75 percent by mass of the specified minimum cementitious material content;
B. The minimum amount of mineral admixture to be combined with cement shall be determined using one of the following criteria:

    1. When the calcium oxide content of a mineral admixture is equal to or less than 2 percent by mass, the amount of mineral admixture shall not be less than 15 percent by mass of the total amount of cementitious material to be used in the mix;

2. When the calcium oxide content of a mineral admixture is greater than 2 percent, the amount of mineral admixture shall not be less than 25 percent by mass of the total amount of cementitious material to be used in the mix;
3. When a mineral admixture that conforms to the provisions for silica fume in Section 90-2.04, "Admixture Materials," is used, the amount of mineral admixture shall not be less than 10 percent by mass of the total amount of cementitious material to be used in the mix

C. The total amount of mineral admixture shall not exceed 35 percent by mass of the total amount of cementitious material to be used in the mix. Where Section 90-1.01, "Description," specifies a maximum cementitious content in kilograms per cubic meter, the total mass of cement and mineral admixture per cubic meter shall not exceed the specified maximum cementitious material content.

**90-4.09 BLANK**

**90-4.10 PROPORTIONING AND DISPENSING LIQUID ADMIXTURES**

• Chemical admixtures and air-entraining admixtures shall be dispensed in liquid form. Dispensers for liquid admixtures shall have sufficient capacity to measure at one time the prescribed quantity required for each batch of concrete. Each dispenser shall include a graduated measuring unit into which liquid admixtures are measured to within ±5 percent of the prescribed quantity for each batch. Dispensers shall be located and maintained so that the graduations can be accurately read from the point at which proportioning operations are controlled to permit a visual check of batching accuracy prior to discharge. Each measuring unit shall be clearly marked for the type and quantity of admixture.

• Each liquid admixture dispensing system shall be equipped with a sampling device consisting of a valve located in a safe and readily accessible position such that a sample of the admixture may be withdrawn slowly by the Engineer.

• If more than one liquid admixture is used in the concrete mix, each liquid admixture shall have a separate measuring unit and shall be dispensed by injecting equipment located in such a manner that the admixtures are not mixed at high concentrations and do not interfere with the effectiveness of each other. When air-entraining admixtures are used in conjunction with other liquid admixtures, the air-entraining admixture shall be the first to be incorporated into the mix.

• When automatic proportioning devices are required for concrete pavement, dispensers for liquid admixtures shall operate automatically with the batching control equipment. The dispensers shall be equipped with an automatic warning system in good operating condition that will provide a visible or audible signal at the point at which proportioning operations are controlled when the quantity of admixture measured for each batch of concrete varies from the preselected dosage by more than 5 percent, or when the entire contents of the measuring unit are not emptied from the dispenser into each batch of concrete.

• Unless liquid admixtures are added to premeasured water for the batch, their discharge into the batch shall be arranged to flow into the stream of water so that the admixtures are well dispersed throughout the batch, except that air-entraining admixtures may be dispensed directly into moist sand in the batching bins provided that adequate control of the air content of the concrete can be maintained.

• Liquid admixtures requiring dosages greater than 2.5 $L/m^3$ shall be considered to be water when determining the total amount of free water as specified in Section 90-6.06, "Amount of Water and Penetration."

• Special admixtures, such as "high range" water reducers that may contribute to a high rate of slump loss, shall be measured and dispensed as recommended by the admixture manufacturer and as approved by the Engineer.

**90-4.11 STORAGE, PROPORTIONING, AND DISPENSING OF MINERAL ADMIXTURES**

• Mineral admixtures shall be protected from exposure to moisture until used. Sacked material shall be piled to permit access for tally, inspection and identification for each shipment.

• Adequate facilities shall be provided to assure that mineral admixtures meeting the specified requirements are kept separate from other mineral admixtures in order to prevent any but the specified mineral admixtures from entering the work. Safe and suitable facilities for sampling mineral admixtures shall be provided at the weigh hopper or in the feed line immediately in advance of the hopper.

• Mineral admixtures shall be incorporated into concrete using equipment conforming to the requirements for cement weigh hoppers, and charging and discharging mechanisms in ASTM Designation: C 94, in Section 90-5.03, "Proportioning," and in this Section 90-4.11.

• When concrete is completely mixed in stationary paving mixers, the mineral admixture shall be weighed in a separate weigh hopper conforming to the provisions for cement weigh hoppers and charging and discharging mechanisms in Section 90-5.03A, "Proportioning for Pavement," and the mineral admixture and cement shall be introduced simultaneously into the mixer proportionately with the aggregate. If the mineral admixture is not weighed in a separate weigh hopper, the

Contractor shall provide certification that the stationary mixer is capable of mixing the cement, admixture, aggregates and water uniformly prior to discharge. Certification shall contain the following:

A. Test results for 2 compressive strength test cylinders of concrete taken within the first one-third and 2 compressive strength test cylinders of concrete taken within the last one-third of the concrete discharged from a single batch from the stationary paving mixer. Strength tests and cylinder preparation will be in conformance with the provisions of Section 90-9, "Compressive Strength;"
B. Calculations demonstrating that the difference in the averages of 2 compressive strengths taken in the first one-third is no greater than 7.5 percent different than the averages of 2 compressive strengths taken in the last one-third of the concrete discharged from a single batch from the stationary paving mixer. Strength tests and cylinder preparation will be in conformance with the provisions of Section 90-9, "Compressive Strength;" and
C. The mixer rotation speed and time of mixing prior to discharge that are required to produce a mix that meets the requirements above.

## 90-5 PROPORTIONING

### 90-5.01 STORAGE OF AGGREGATES

• Aggregates shall be stored or stockpiled in such a manner that separation of coarse and fine particles of each size shall be avoided and also that the various sizes shall not become intermixed before proportioning.

• Aggregates shall be stored or stockpiled and handled in a manner that shall prevent contamination by foreign materials. In addition, storage of aggregates at batching or mixing facilities that are erected subsequent to the award of the contract and that furnish concrete to the project shall conform to the following:

A. Intermingling of the different sizes of aggregates shall be positively prevented. The Contractor shall take the necessary measures to prevent intermingling. The preventive measures may include, but are not necessarily limited to, physical separation of stockpiles or construction of bulkheads of adequate length and height; and
B. Contamination of aggregates by contact with the ground shall be positively prevented. The Contractor shall take the necessary measures to prevent contamination. The preventive measures shall include, but are not necessarily limited to, placing aggregates on wooden platforms or on hardened surfaces consisting of portland cement concrete, asphalt concrete, or cement treated material.

• In placing aggregates in storage or in moving the aggregates from storage to the weigh hopper of the batching plant, any method that may cause segregation, degradation, or the combining of materials of different gradings that will result in any size of aggregate at the weigh hopper failing to meet the grading requirements, shall be discontinued. Any method of handling aggregates that results in excessive breakage of particles shall be discontinued. The use of suitable devices to reduce impact of falling aggregates may be required by the Engineer.

### 90-5.02 PROPORTIONING DEVICES

• Weighing, measuring, or metering devices used for proportioning materials shall conform to the requirements in Section 9-1.01, "Measurement of Quantities," and this Section 90-5.02. In addition, automatic weighing systems shall comply with the requirements for automatic proportioning devices in Section 90-5.03A, "Proportioning for Pavement." Automatic devices shall be automatic to the extent that the only manual operation required for proportioning the aggregates, cement, and mineral admixture for one batch of concrete is a single operation of a switch or starter.

• Proportioning devices shall be tested at the expense of the Contractor as frequently as the Engineer may deem necessary to ensure their accuracy.

• Weighing equipment shall be insulated against vibration or movement of other operating equipment in the plant. When the plant is in operation, the mass of each batch of material shall not vary from the mass designated by the Engineer by more than the tolerances specified herein.

• Equipment for cumulative weighing of aggregate shall have a zero tolerance of ±0.5 percent of the designated total batch mass of the aggregate. For systems with individual weigh hoppers for the various sizes of aggregate, the zero tolerance shall be ±0.5 percent of the individual batch mass designated for each size of aggregate. Equipment for cumulative weighing of cement and mineral admixtures shall have a zero tolerance of ±0.5 percent of the designated total batch mass of the cement and mineral admixture. Equipment for weighing cement or mineral admixture separately shall have a zero tolerance of ±0.5 percent of their designated individual batch masses. Equipment for measuring water shall have a zero tolerance of ±0.5 percent of its designated mass or volume.

• The mass indicated for any batch of material shall not vary from the preselected scale setting by more than the following:

A. Aggregate weighed cumulatively shall be within 1.0 percent of the designated total batch mass of the aggregate. Aggregates weighed individually shall be within 1.5 percent of their respective designated batch masses; and
B. Cement shall be within 1.0 percent of its designated batch mass. When weighed individually, mineral admixture shall be within 1.0 percent of its designated batch mass. When mineral admixture and cement are permitted to be weighed cumulatively, cement shall be weighed first to within 1.0 percent of its designated batch mass, and the total for cement and mineral admixture shall be within 1.0 percent of the sum of their designated batch masses; and
C. Water shall be within 1.5 percent of its designated mass or volume.

• Each scale graduation shall be approximately 0.001 of the total capacity of the scale. The capacity of scales for weighing cement, mineral admixture, or cement plus mineral admixture and aggregates shall not exceed that of commercially available scales having single graduations indicating a mass not exceeding the maximum permissible mass variation above, except that no scale shall be required having a capacity of less than 500 kg, with 0.5-kg graduations.

**90-5.03 PROPORTIONING**

• Proportioning shall consist of dividing the aggregates into the specified sizes, each stored in a separate bin, and combining them with cement, mineral admixture, and water as provided in these specifications. Aggregates shall be proportioned by mass.

• At the time of batching, aggregates shall have been dried or drained sufficiently to result in a stable moisture content such that no visible separation of water from aggregate will take place during transportation from the proportioning plant to the point of mixing. In no event shall the free moisture content of the fine aggregate at the time of batching exceed 8 percent of its saturated, surface-dry mass.

• Should separate supplies of aggregate material of the same size group, but of different moisture content or specific gravity or surface characteristics affecting workability, be available at the proportioning plant, withdrawals shall be made from one supply exclusively and the materials therein completely exhausted before starting upon another.

• Bulk "Type IP (MS) Modified" cement shall be weighed in an individual hopper and shall be kept separate from the aggregates until the ingredients are released for discharge into the mixer.

• Bulk cement and mineral admixture may be weighed in separate, individual weigh hoppers or may be weighed in the same weigh hopper and shall be kept separate from the aggregates until the ingredients are released for discharge into the mixer. If the cement and mineral admixture are weighed cumulatively, the cement shall be weighed first.

• When cement and mineral admixtures are weighed in separate weigh hoppers**,** the weigh systems for the proportioning of the aggregate, the cement, and the mineral admixture shall be individual and distinct from all other weigh systems. Each weigh system shall be equipped with a hopper, a lever system, and an indicator to constitute an individual and independent material weighing device. The cement and the mineral admixture shall be discharged into the mixer simultaneously with the aggregate.

• The scales and weigh hoppers for bulk weighing cement, mineral admixture, or cement plus mineral admixture shall be separate and distinct from the aggregate weighing equipment.

• For batches with a volume of one cubic meter or more, the batching equipment shall conform to one of the following combinations:

A. Separate boxes and separate scale and indicator for weighing each size of aggregate.
B. Single box and scale indicator for all aggregates.
C. Single box or separate boxes and automatic weighing mechanism for all aggregates.

• In order to check the accuracy of batch masses, the gross mass and tare mass of batch trucks, truck mixers, truck agitators, and non-agitating hauling equipment shall be determined when ordered by the Engineer. The equipment shall be weighed at the Contractor's expense on scales designated by the Engineer.

**90-5.03A Proportioning for Pavement**

• Aggregates and bulk cement, mineral admixture, and cement plus mineral admixture for use in pavement shall be proportioned by mass by means of automatic proportioning devices of approved type conforming to these specifications.

• The Contractor shall install and maintain in operating condition an electronically actuated moisture meter that will indicate, on a readily visible scale, changes in the moisture content of the fine aggregate as it is batched within a sensitivity of 0.5 percent by mass of the fine aggregate.

• The batching of cement, mineral admixture, or cement plus mineral admixture and aggregate shall be interlocked so that a new batch cannot be started until all weigh hoppers are empty, the proportioning devices are within zero tolerance, and the discharge gates are closed. The interlock shall permit no part of the batch to be discharged until all aggregate hoppers

and the cement and mineral admixture hoppers or the cement plus mineral admixture hopper are charged with masses that are within the tolerances specified in Section 90-5.02, "Proportioning Devices."

- When interlocks are required for cement and mineral admixture charging mechanisms and cement and mineral admixtures are weighed cumulatively, their charging mechanisms shall be interlocked to prevent the introduction of mineral admixture until the mass of cement in the cement weigh hopper is within the tolerances specified in Section 90-5.02, "Proportioning Devices."
- The discharge gate on the cement and mineral admixture hoppers or the cement plus mineral admixture hopper shall be designed to permit regulating the flow of cement, mineral admixture, or cement plus mineral admixture into the aggregate as directed by the Engineer.
- When separate weigh boxes are used for each size of aggregate, the discharge gates shall permit regulating the flow of each size of aggregate as directed by the Engineer.
- Material discharged from the several bins shall be controlled by gates or by mechanical conveyors. The means of withdrawal from the several bins, and of discharge from the weigh box, shall be interlocked so that not more than one bin can discharge at a time, and so that the weigh box cannot be tripped until the required quantity from each of the several bins has been deposited therein. Should a separate weigh box be used for each size of aggregate, all may be operated and discharged simultaneously.
- When the discharge from the several bins is controlled by gates, each gate shall be actuated automatically so that the required mass is discharged into the weigh box, after which the gate shall automatically close and lock.
- The automatic weighing system shall be designed so that all proportions required may be set on the weighing controller at the same time.

## 90-6 MIXING AND TRANSPORTING

### 90-6.01 GENERAL

- Concrete shall be mixed in mechanically operated mixers, except that when permitted by the Engineer, batches not exceeding 0.25 $m^3$ may be mixed by hand methods in conformance with the provisions in Section 90-6.05, "Hand-Mixing."
- Equipment having components made of aluminum or magnesium alloys that would have contact with plastic concrete during mixing, transporting, or pumping of portland cement concrete shall not be used.
- Concrete shall be homogeneous and thoroughly mixed, and there shall be no lumps or evidence of undispersed cement, mineral admixture, or cement plus mineral admixture.
- Uniformity of concrete mixtures will be determined by differences in penetration as determined by California Test 533, or slump as determined by ASTM Designation: C 143, and by variations in the proportion of coarse aggregate as determined by California Test 529.
- When the mix design specifies a penetration value, the difference in penetration, determined by comparing penetration tests on 2 samples of mixed concrete from the same batch or truck mixer load, shall not exceed 10 mm. When the mix design specifies a slump value, the difference in slump, determined by comparing slump tests on 2 samples of mixed concrete from the same batch or truck mixer load, shall not exceed the values given in the table below. Variation in the proportion of coarse aggregate will be determined by comparing the results of tests of 2 samples of mixed concrete from the same batch or truck mixer load and the difference between the 2 results shall not exceed 100 kg per cubic meter of concrete.

| Average Slump | Maximum Permissible Difference |
|---|---|
| Less than 100-mm | 25-mm |
| 100-mm to 150-mm | 38-mm |
| Greater than 150-mm to 225-mm | 50-mm |

- The Contractor, at the Contractor's expense, shall furnish samples of the freshly mixed concrete and provide satisfactory facilities for obtaining the samples.

### 90-6.02 MACHINE MIXING

- Concrete mixers may be of the revolving drum or the revolving blade type, and the mixing drum or blades shall be operated uniformly at the mixing speed recommended by the manufacturer. Mixers and agitators that have an accumulation of hard concrete or mortar shall not be used.
- The temperature of mixed concrete, immediately before placing, shall be not less than 10°C or more than 32°C. Aggregates and water shall be heated or cooled as necessary to produce concrete within these temperature limits. Neither aggregates nor mixing water shall be heated to exceed 65°C. If ice is used to cool the concrete, discharge of the mixer will not be permitted until all ice is melted.

- The batch shall be so charged into the mixer that some water will enter in advance of cementitious materials and aggregates. All water shall be in the drum by the end of the first one - fourth of the specified mixing time.
- Cementitious materials shall be batched and charged into the mixer by means that will not result either in loss of cementitious materials due to the effect of wind, in accumulation of cementitious materials on surfaces of conveyors or hoppers, or in other conditions that reduce or vary the required quantity of cementitious material in the concrete mixture.
- Paving and stationary mixers shall be operated with an automatic timing device. The timing device and discharge mechanism shall be interlocked so that during normal operation no part of the batch will be discharged until the specified mixing time has elapsed.
- The total elapsed time between the intermingling of damp aggregates and all cementitious materials and the start of mixing shall not exceed 30 minutes.
- The size of batch shall not exceed the manufacturer's guaranteed capacity.
- When producing concrete for pavement or base, suitable batch counters shall be installed and maintained in good operating condition at jobsite batching plants and stationary mixers. The batch counters shall indicate the exact number of batches proportioned and mixed.
- Concrete shall be mixed and delivered to the jobsite by means of one of the following combinations of operations:

A. Mixed completely in a stationary mixer and the mixed concrete transported to the point of delivery in truck agitators or in non-agitating hauling equipment (central-mixed concrete).
B. Mixed partially in a stationary mixer, and the mixing completed in a truck mixer (shrink-mixed concrete).
C. Mixed completely in a truck mixer (transit-mixed concrete).
D. Mixed completely in a paving mixer.

- Agitators may be truck mixers operating at agitating speed or truck agitators. Each mixer and agitator shall have attached thereto in a prominent place a metal plate or plates on which is plainly marked the various uses for which the equipment is designed, the manufacturer's guaranteed capacity of the drum or container in terms of the volume of mixed concrete and the speed of rotation of the mixing drum or blades.
- Truck mixers shall be equipped with electrically or mechanically actuated revolution counters by which the number of revolutions of the drum or blades may readily be verified.
- When shrink-mixed concrete is furnished, concrete that has been partially mixed at a central plant shall be transferred to a truck mixer and all requirements for transit-mixed concrete shall apply. No credit in the number of revolutions at mixing speed shall be allowed for partial mixing in a central plant.

**90-6.03 TRANSPORTING MIXED CONCRETE**

- Mixed concrete may be transported to the delivery point in truck agitators or truck mixers operating at the speed designated by the manufacturer of the equipment as agitating speed, or in non-agitating hauling equipment, provided the consistency and workability of the mixed concrete upon discharge at the delivery point is suitable for adequate placement and consolidation in place, and provided the mixed concrete after hauling to the delivery point conforms to the provisions in Section 90-6.01, "General."
- Truck agitators shall be loaded not to exceed the manufacturer's guaranteed capacity and shall maintain the mixed concrete in a thoroughly mixed and uniform mass during hauling.
- Bodies of non-agitating hauling equipment shall be constructed so that leakage of the concrete mix, or any part thereof, will not occur at any time.
- Concrete hauled in open-top vehicles shall be protected during hauling against rain or against exposure to the sun for more than 20 minutes when the ambient temperature exceeds 24°C.
- No additional mixing water shall be incorporated into the concrete during hauling or after arrival at the delivery point, unless authorized by the Engineer. If the Engineer authorizes additional water to be incorporated into the concrete, the drum shall be revolved not less than 30 revolutions at mixing speed after the water is added and before discharge is commenced.
- The rate of discharge of mixed concrete from truck mixer-agitators shall be controlled by the speed of rotation of the drum in the discharge direction with the discharge gate fully open.
- When a truck mixer or agitator is used for transporting concrete to the delivery point, discharge shall be completed within 1.5 hours or before 250 revolutions of the drum or blades, whichever occurs first, after the introduction of the cement to the aggregates. Under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 30°C or above, the time allowed may be less than 1.5 hours.
- When non-agitating hauling equipment is used for transporting concrete to the delivery point, discharge shall be completed within one hour after the addition of the cement to the aggregates. Under conditions contributing to quick

stiffening of the concrete, or when the temperature of the concrete is 30°C or above, the time between the introduction of cement to the aggregates and discharge shall not exceed 45 minutes.

- Each load of concrete delivered at the jobsite shall be accompanied by a weighmaster certificate showing the mix identification number, non-repeating load number, date and time at which the materials were batched, the total amount of water added to the load, and for transit-mixed concrete, the reading of the revolution counter at the time the truck mixer is charged with cement. This weighmaster certificate shall also show the actual scale masses (kilograms) for the ingredients batched. Theoretical or target batch masses shall not be used as a substitute for actual scale masses.
- Weighmaster certificates shall be provided in printed form, or if approved by the Engineer, the data may be submitted in electronic media. Electronic media shall be presented in a tab-delimited format on a 90 mm diskette with a capacity of at least 1.4 megabytes. Captured data, for the ingredients represented by each batch shall be "line feed, carriage return" (LFCR) and "one line, separate record" with allowances for sufficient fields to satisfy the amount of data required by these specifications.
- The Contractor may furnish a weighmaster certificate accompanied by a separate certificate that lists the actual batch masses or measurements for a load of concrete provided that both certificates are imprinted with the same non-repeating load number that is unique to the contract and delivered to the jobsite with the load.
- Weighmaster certificates furnished by the Contractor shall conform to the provisions in Section 9-1.01, "Measurement of Quantities."

### 90-6.04 TIME OR AMOUNT OF MIXING

- Mixing of concrete in paving or stationary mixers shall continue for the required mixing time after all ingredients, except water and admixture, if added with the water, are in the mixing compartment of the mixer before any part of the batch is released. Transfer time in multiple drum mixers shall not be counted as part of the required mixing time.
- The required mixing time, in paving or stationary mixers, of concrete used for concrete structures, except minor structures, shall be not less than 90 seconds or more than 5 minutes, except that when directed by the Engineer in writing, the requirements of the following paragraph shall apply.
- The required mixing time, in paving or stationary mixers, except as provided in the preceding paragraph, shall be not less than 50 seconds or more than 5 minutes.
- The minimum required revolutions at the mixing speed for transit-mixed concrete shall not be less than that recommended by the mixer manufacturer, but in no case shall the number of revolutions be less than that required to consistently produce concrete conforming to the provisions for uniformity in Section 90-6.01, "General."

### 90-6.05 HAND-MIXING

- Hand-mixed concrete shall be made in batches of not more than 0.25 $m^3$ and shall be mixed on a watertight, level platform. The proper amount of coarse aggregate shall be measured in measuring boxes and spread on the platform and the fine aggregate shall be spread on this layer, the 2 layers being not more than 0.3 meters in total depth. On this mixture shall be spread the dry cement and mineral admixture and the whole mass turned no fewer than 2 times dry; then sufficient clean water shall be added, evenly distributed, and the whole mass again turned no fewer than 3 times, not including placing in the carriers or forms.

### 90-6.06 AMOUNT OF WATER AND PENETRATION

- The amount of water used in concrete mixes shall be regulated so that the penetration of the concrete as determined by California Test 533 or the slump of the concrete as determined by ASTM Designation: C 143 is within the "Nominal" values shown in the following table. When the penetration or slump of the concrete is found to exceed the nominal values listed, the mixture of subsequent batches shall be adjusted to reduce the penetration or slump to a value within the nominal range shown. Batches of concrete with a penetration or slump exceeding the maximum values listed shall not be used in the work. When Type F or Type G chemical admixtures are added to the mix, the penetration requirements shall not apply and the slump shall not exceed 225 mm after the chemical admixtures are added.

| Type of Work | Nominal | | Maximum | |
|---|---|---|---|---|
| | Penetration (mm) | Slump (mm) | Penetration (mm) | Slump (mm) |
| Concrete Pavement | 0-25 | — | 40 | — |
| Non-reinforced concrete facilities | 0-35 | — | 50 | — |
| Reinforced concrete structures | | | | |
| Sections over 300-mm thick | 0-35 | — | 65 | — |
| Sections 300-mm thick or less | 0-50 | — | 75 | — |
| Concrete placed under water | — | 150-200 | — | 225 |
| Cast-in-place concrete piles | 65-90 | 130-180 | 100 | 200 |

- The amount of free water used in concrete shall not exceed 183 kg/m$^3$, plus 20 kg for each required 100 kg of cementitious material in excess of 325 kg/m$^3$.
- The term free water is defined as the total water in the mixture minus the water absorbed by the aggregates in reaching a saturated surface-dry condition.
- Where there are adverse or difficult conditions that affect the placing of concrete, the above specified penetration and free water content limitations may be exceeded providing the Contractor is granted permission by the Engineer in writing to increase the cementitious material content per cubic meter of concrete. The increase in water and cementitious material shall be at a ratio not to exceed 30 kg of water per added 100 kg of cementitious material per cubic meter. The cost of additional cementitious material and water added under these conditions shall be at the Contractor's expense and no additional compensation will be allowed therefor.
- The equipment for supplying water to the mixer shall be constructed and arranged so that the amount of water added can be measured accurately. Any method of discharging water into the mixer for a batch shall be accurate within 1.5 percent of the quantity of water required to be added to the mix for any position of the mixer. Tanks used to measure water shall be designed so that water cannot enter while water is being discharged into the mixer and discharge into the mixer shall be made rapidly in one operation without dribbling. All equipment shall be arranged so as to permit checking the amount of water delivered by discharging into measured containers.

## 90-7 CURING CONCRETE

### 90-7.01 METHODS OF CURING

- Newly placed concrete shall be cured by the methods specified in this Section 90-7.01 and the special provisions.

#### 90-7.01A Water Method

- The concrete shall be kept continuously wet by the application of water for a minimum curing period of 7 days after the concrete has been placed.
- When a curing medium consisting of cotton mats, rugs, carpets, or earth or sand blankets is to be used to retain the moisture, the entire surface of the concrete shall be kept damp by applying water with a nozzle that so atomizes the flow that a mist and not a spray is formed, until the surface of the concrete is covered with the curing medium. The moisture from the nozzle shall not be applied under pressure directly upon the concrete and shall not be allowed to accumulate on the concrete in a quantity sufficient to cause a flow or wash the surface. At the expiration of the curing period, the concrete surfaces shall be cleared of all curing mediums.
- When concrete bridge decks and flat slabs are to be cured without the use of a curing medium, the entire surface of the bridge deck or slab shall be kept damp by the application of water with an atomizing nozzle as specified in the preceding paragraph, until the concrete has set, after which the entire surface of the concrete shall be sprinkled continuously with water for a period of not less than 7 days.

#### 90-7.01B Curing Compound Method

- Surfaces of the concrete that are exposed to the air shall be sprayed uniformly with a curing compound.
- Curing compounds to be used shall be as follows:

1. Pigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 2, Class B, except the resin type shall be poly-alpha-methylstyrene.
2. Pigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 2, Class B.
3. Pigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 2, Class A.
4. Non-pigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 1, Class B.

5. Non-pigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 1, Class A.
6. Non-pigmented curing compound with fugitive dye conforming to the requirements in ASTM Designation: C 309, Type 1-D, Class A.

- The infrared scan for the dried vehicle from curing compound (1) shall match the infrared scan on file at the Transportation Laboratory.
- The loss of water for each type of curing compound, when tested in conformance with the requirements in California Test 534, shall not be more than 0.15-kg/$m^2$ in 24 hours or more than 0.45-kg/$m^2$ in 72 hours.
- The curing compound to be used will be specified elsewhere in these specifications or in the special provisions.
- When the use of curing compound is required or permitted elsewhere in these specifications or in the special provisions and no specific kind is specified, any of the curing compounds listed above may be used.
- Curing compound shall be applied at a nominal rate of 3.7 $m^2$/L, unless otherwise specified.
- At any point, the application rate shall be within ±1.2 $m^2$/L of the nominal rate specified, and the average application rate shall be within ±0.5 $m^2$/L of the nominal rate specified when tested in conformance with the requirements in California Test 535. Runs, sags, thin areas, skips, or holidays in the applied curing compound shall be evidence that the application is not satisfactory.
- Curing compounds shall be applied using power operated spray equipment. The power operated spraying equipment shall be equipped with an operational pressure gage and a means of controlling the pressure. Hand spraying of small and irregular areas that are not reasonably accessible to mechanical spraying equipment, in the opinion of the Engineer, may be permitted.
- The curing compound shall be applied to the concrete following the surface finishing operation, immediately before the moisture sheen disappears from the surface, but before any drying shrinkage or craze cracks begin to appear. In the event of any drying or cracking of the surface, application of water with an atomizing nozzle as specified in Section 90-7.01A, "Water Method," shall be started immediately and shall be continued until application of the compound is resumed or started; however, the compound shall not be applied over any resulting freestanding water. Should the film of compound be damaged from any cause before the expiration of 7 days after the concrete is placed in the case of structures and 72 hours in the case of pavement, the damaged portion shall be repaired immediately with additional compound.
- At the time of use, compounds containing pigments shall be in a thoroughly mixed condition with the pigment uniformly dispersed throughout the vehicle. A paddle shall be used to loosen all settled pigment from the bottom of the container, and a power driven agitator shall be used to disperse the pigment uniformly throughout the vehicle.
- Agitation shall not introduce air or other foreign substance into the curing compound.
- The manufacturer shall include in the curing compound the necessary additives for control of sagging, pigment settling, leveling, de-emulsification, or other requisite qualities of a satisfactory working material. Pigmented curing compounds shall be manufactured so that the pigment does not settle badly, does not cake or thicken in the container, and does not become granular or curdled. Settlement of pigment shall be a thoroughly wetted, soft, mushy mass permitting the complete and easy vertical penetration of a paddle. Settled pigment shall be easily redispersed, with minimum resistance to the sideways manual motion of the paddle across the bottom of the container, to form a smooth uniform product of the proper consistency.
- Curing compounds shall remain sprayable at temperatures above 4°C and shall not be diluted or altered after manufacture.
- The curing compound shall be packaged in clean 210-L barrels or round 19-L containers or shall be supplied from a suitable storage tank located at the jobsite. The containers shall comply with "Title 49, Code of Federal Regulations, Hazardous Materials Regulations." The 210-L barrels shall have removable lids and airtight fasteners. The 19-L containers shall be round and have standard full open head and bail. Lids with bungholes shall not be permitted. On-site storage tanks shall be kept clean and free of contaminants. Each tank shall have a permanent system designed to completely redisperse settled material without introducing air or other foreign substances.
- Steel containers and lids shall be lined with a coating that will prevent destructive action by the compound or chemical agents in the air space above the compound. The coating shall not come off the container or lid as skins. Containers shall be filled in a manner that will prevent skinning. Plastic containers shall not react with the compound.
- Each container shall be labeled with the manufacturer's name, kind of curing compound, batch number, volume, date of manufacture, and volatile organic compound (VOC) content. The label shall also warn that the curing compound containing pigment shall be well stirred before use. Precautions concerning the handling and the application of curing compound shall be shown on the label of the curing compound containers in conformance with the Construction Safety Orders and General Industry Safety Orders of the State of California.
- Containers of curing compound shall be labeled to indicate that the contents fully comply with the rules and regulations concerning air pollution control in the State of California.
- When the curing compound is shipped in tanks or tank trucks, a shipping invoice shall accompany each load. The invoice shall contain the same information as that required herein for container labels.

- Curing compound will be sampled by the Engineer at the source of supply or at the jobsite or at both locations.
- Curing compound shall be formulated so as to maintain the specified properties for a minimum of one year. The Engineer may require additional testing before use to determine compliance with these specifications if the compound has not been used within one year or whenever the Engineer has reason to believe the compound is no longer satisfactory.
- Tests will be conducted in conformance with the latest ASTM test methods and methods in use by the Transportation Laboratory.

**90-7.01C Waterproof Membrane Method**

- The exposed finished surfaces of concrete shall be sprayed with water, using a nozzle that so atomizes the flow that a mist and not a spray is formed, until the concrete has set, after which the curing membrane shall be placed. The curing membrane shall remain in place for a period of not less than 72 hours.
- Sheeting material for curing concrete shall conform to the requirements in AASHTO Designation: M 171 for white reflective materials.
- The sheeting material shall be fabricated into sheets of such width as to provide a complete cover for the entire concrete surface. Joints in the sheets shall be securely cemented together in such a manner as to provide a waterproof joint. The joint seams shall have a minimum lap of 100 mm.
- The sheets shall be securely weighted down by placing a bank of earth on the edges of the sheets or by other means satisfactory to the Engineer.
- Should any portion of the sheets be broken or damaged before the expiration of 72 hours after being placed, the broken or damaged portions shall be immediately repaired with new sheets properly cemented into place.
- Sections of membrane that have lost their waterproof qualities or have been damaged to such an extent as to render them unfit for curing the concrete shall not be used.

**90-7.01D Forms-In-Place Method**

- Formed surfaces of concrete may be cured by retaining the forms in place. The forms shall remain in place for a minimum period of 7 days after the concrete has been placed, except that for members over 0.5-m in least dimension the forms shall remain in place for a minimum period of 5 days.
- Joints in the forms and the joints between the end of forms and concrete shall be kept moisture tight during the curing period. Cracks in the forms and cracks between the forms and the concrete shall be resealed by methods subject to the approval of the Engineer.

**90-7.02 CURING PAVEMENT**

- The entire exposed area of the pavement, including edges, shall be cured by the waterproof membrane method, or curing compound method using curing compound (1) or (2) as the Contractor may elect. Should the side forms be removed before the expiration of 72 hours following the start of curing, the exposed pavement edges shall also be cured. If the pavement is cured by means of the curing compound method, the sawcut and all portions of the curing compound that have been disturbed by sawing operations shall be restored by spraying with additional curing compound.
- Curing shall commence as soon as the finishing process provided in Section 40-1.10, "Final Finishing," has been completed. The method selected shall conform to the provisions in Section 90-7.01, "Methods of Curing."
- When the curing compound method is used, the compound shall be applied to the entire pavement surface by mechanical sprayers. Spraying equipment shall be of the fully atomizing type equipped with a tank agitator that provides for continual agitation of the curing compound during the time of application. The spray shall be adequately protected against wind, and the nozzles shall be so oriented or moved mechanically transversely as to result in the minimum specified rate of coverage being applied uniformly on exposed faces. Hand spraying of small and irregular areas, and areas inaccessible to mechanical spraying equipment, in the opinion of the Engineer, will be permitted. When the ambient air temperature is above 15°C, the Contractor shall fog the surface of the concrete with a fine spray of water as specified in Section 90-7.01A, "Water Method." The surface of the pavement shall be kept moist between the hours of 10:00 a.m. and 4:30 p.m. on the day the concrete is placed. However, the fogging done after the curing compound has been applied shall not begin until the compound has set sufficiently to prevent displacement. Fogging shall be discontinued if ordered in writing by the Engineer.

**90-7.03 CURING STRUCTURES**

- Newly placed concrete for cast-in-place structures, other than highway bridge decks, shall be cured by the water method, the forms-in-place method, or, as permitted herein, by the curing compound method, in conformance with the provisions in Section 90-7.01, "Methods of Curing."
- The curing compound method using a pigmented curing compound may be used on concrete surfaces of construction joints, surfaces that are to be buried underground, and surfaces where only Ordinary Surface Finish is to be

applied and on which a uniform color is not required and that will not be visible from a public traveled way. If the Contractor elects to use the curing compound method on the bottom slab of box girder spans, the curing compound shall be curing compound (1).

- The top surface of highway bridge decks shall be cured by both the curing compound method and the water method. The curing compound shall be curing compound (1).
- Concrete surfaces of minor structures, as defined in Section 51-1.02, "Minor Structures," shall be cured by the water method, the forms-in-place method or the curing compound method.
- When deemed necessary by the Engineer during periods of hot weather, water shall be applied to concrete surfaces being cured by the curing compound method or by the forms-in-place method, until the Engineer determines that a cooling effect is no longer required. Application of water for this purpose will be paid for as extra work as provided in Section 4-1.03D, "Extra Work."

**90-7.04 CURING PRECAST CONCRETE MEMBERS**

- Precast concrete members shall be cured in conformance with any of the methods specified in Section 90-7.01, "Methods of Curing." Curing shall be provided for the minimum time specified for each method or until the concrete reaches its design strength, whichever is less. Steam curing may also be used for precast members and shall conform to the following provisions:

A. After placement of the concrete, members shall be held for a minimum 4-hour presteaming period. If the ambient air temperature is below 10°C, steam shall be applied during the presteaming period to hold the air surrounding the member at a temperature between 10°C and 32°C.
B. To prevent moisture loss on exposed surfaces during the presteaming period, members shall be covered as soon as possible after casting or the exposed surfaces shall be kept wet by fog spray or wet blankets.
C. Enclosures for steam curing shall allow free circulation of steam about the member and shall be constructed to contain the live steam with a minimum moisture loss. The use of tarpaulins or similar flexible covers will be permitted, provided they are kept in good repair and secured in such a manner as to prevent the loss of steam and moisture.
D. Steam at the jets shall be at low pressure and in a saturated condition. Steam jets shall not impinge directly on the concrete, test cylinders, or forms. During application of the steam, the temperature rise within the enclosure shall not exceed 22°C per hour. The curing temperature throughout the enclosure shall not exceed 65°C and shall be maintained at a constant level for a sufficient time necessary to develop the required transfer strength. Control cylinders shall be covered to prevent moisture loss and shall be placed in a location where temperature is representative of the average temperature of the enclosure.
E. Temperature recording devices that will provide an accurate, continuous, permanent record of the curing temperature shall be provided. A minimum of one temperature recording device per 60 m of continuous bed length will be required for checking temperature.
F. Members in pretension beds shall be detensioned immediately after the termination of steam curing while the concrete and forms are still warm, or the temperature under the enclosure shall be maintained above 15°C until the stress is transferred to the concrete.
G. Curing of precast concrete will be considered completed after termination of the steam curing cycle.

**90-7.05 CURING PRECAST PRESTRESSED CONCRETE PILES**

- Newly placed concrete for precast prestressed concrete piles shall be cured in conformance with the provisions in Section 90-7.04, "Curing Precast Concrete Members," except that piles with a class designation ending in C (corrosion resistant) shall be cured as follows:

A. Piles shall be either steam cured or water cured. If water curing is used, the piles shall be kept continuously wet by the application of water in conformance with the provisions in Section 90-7.01A, "Water Method."
B. If steam curing is used, the steam curing provisions in Section 90-7.04, "Curing Precast Concrete Members," shall apply except that the piles shall be kept continuously wet for their entire length for a period of not less than 3 days, including the holding and steam curing periods.

**90-7.06 CURING SLOPE PROTECTION**

- Concrete slope protection shall be cured in conformance with any of the methods specified in Section 90-7.01, "Methods of Curing."

• Concreted-rock slope protection shall be cured in conformance with any of the methods specified in Section 90-7.01, "Methods of Curing," or with a blanket of earth kept wet for 72 hours, or by sprinkling with a fine spray of water every 2 hours during the daytime for a period of 3 days.

### 90-7.07 CURING MISCELLANEOUS CONCRETE WORK

• Exposed surfaces of curbs shall be cured by pigmented curing compounds as specified in Section 90-7.01B, "Curing Compound Method."

• Concrete sidewalks, gutter depressions, island paving, curb ramps, driveways, and other miscellaneous concrete areas shall be cured in conformance with any of the methods specified in Section 90-7.01, "Methods of Curing."

• Shotcrete shall be cured for at least 72 hours by spraying with water, or by a moist earth blanket, or by any of the methods provided in Section 90-7.01, "Methods of Curing."

• Mortar and grout shall be cured by keeping the surface damp for 3 days.

• After placing, the exposed surfaces of sign structure foundations, including pedestal portions, if constructed, shall be cured for at least 72 hours by spraying with water, or by a moist earth blanket, or by any of the methods provided in Section 90-7.01, "Methods of Curing."

## 90-8 PROTECTING CONCRETE

### 90-8.01 GENERAL

• In addition to the provisions in Section 7-1.16, "Contractor's Responsibility for the Work and Materials," the Contractor shall protect concrete as provided in this Section 90-8.

• Concrete shall not be placed on frozen or ice-coated ground or subgrade nor on ice-coated forms, reinforcing steel, structural steel, conduits, precast members, or construction joints.

• Under rainy conditions, placing of concrete shall be stopped before the quantity of surface water is sufficient to damage surface mortar or cause a flow or wash of the concrete surface, unless the Contractor provides adequate protection against damage.

• Concrete that has been frozen or damaged by other causes, as determined by the Engineer, shall be removed and replaced by the Contractor at the Contractor's expense.

### 90-8.02 PROTECTING CONCRETE STRUCTURES

• Structure concrete and shotcrete used as structure concrete shall be maintained at a temperature of not less than 7°C for 72 hours after placing and at not less than 4°C for an additional 4 days. When required by the Engineer, the Contractor shall submit a written outline of the proposed methods for protecting the concrete.

### 90-8.03 PROTECTING CONCRETE PAVEMENT

• Pavement concrete shall be maintained at a temperature of not less than 4°C for 72 hours. When required by the Engineer, the Contractor shall submit a written outline of the proposed methods for protecting the concrete.

• Except as provided in Section 7-1.08, "Public Convenience," the Contractor shall protect concrete pavement against construction and other activities that abrade, scar, discolor, reduce texture depth, lower coefficient of friction, or otherwise damage the surface. Stockpiling, drifting, or excessive spillage of soil, gravel, petroleum products, and concrete or asphalt mixes on the surface of concrete pavement is prohibited unless otherwise specified in these specifications, the special provisions or permitted by the Engineer.

• When ordered by the Engineer or shown on the plans or specified in the special provisions, pavement crossings shall be constructed for the convenience of public traffic. The material and work necessary for the construction of the crossings, and their subsequent removal and disposal, will be paid for at the contract unit prices for the items of work involved and if there are no contract items for the work involved, payment for pavement crossings will be made by extra work as provided in Section 4-1.03D, "Extra Work.". Where public traffic will be required to cross over the new pavement, Type III portland cement may be used in concrete, if permitted in writing by the Engineer. The pavement may be opened to traffic as soon as the concrete has developed a modulus of rupture of 3.8 MPa. The modulus of rupture will be determined by California Test 523.

• No traffic or Contractor's equipment, except as hereinafter provided, will be permitted on the pavement before a period of 10 days has elapsed after the concrete has been placed, nor before the concrete has developed a modulus of rupture of at least 3.8 MPa. Concrete that fails to attain a modulus of rupture of 3.8 MPa within 10 days shall not be opened to traffic until directed by the Engineer.

• Equipment for sawing weakened plane joints will be permitted on the pavement as specified in Section 40-1.08B, "Weakened Plane Joints."

• When requested in writing by the Contractor, the tracks on one side of paving equipment will be permitted on the pavement after a modulus of rupture of 2.4 MPa has been attained, provided that:

A. Unit pressure exerted on the pavement by the paver shall not exceed 135 kPa;
B. Tracks with cleats, grousers, or similar protuberances shall be modified or shall travel on planks or equivalent protective material, so that the pavement is not damaged; and
C. No part of the track shall be closer than 0.3-m from the edge of pavement.

• In case of visible cracking of, or other damage to the pavement, operation of the paving equipment on the pavement shall be immediately discontinued.

• Damage to the pavement resulting from early use of pavement by the Contractor's equipment as provided above shall be repaired by the Contractor at the Contractor's expense.

• The State will furnish the molds and machines for testing the concrete for modulus of rupture, and the Contractor, at the Contractor's expense, shall furnish the material and whatever labor the Engineer may require.

## 90-9 COMPRESSIVE STRENGTH

### 90-9.01 GENERAL

• Concrete compressive strength requirements consist of a minimum strength that shall be attained before various loads or stresses are applied to the concrete and, for concrete designated by strength, a minimum strength at the age of 28 days or at the age otherwise allowed in Section 90-1.01, "Description." The various strengths required are specified in these specifications or the special provisions or are shown on the plans.

• The compressive strength of concrete will be determined from test cylinders that have been fabricated from concrete sampled in conformance with the requirements of California Test 539. Test cylinders will be molded and initially field cured in conformance with California Test 540. Test cylinders will be cured and tested after receipt at the testing laboratory in conformance with the requirements of California Test 521. A strength test shall consist of the average strength of 2 cylinders fabricated from material taken from a single load of concrete, except that, if any cylinder should show evidence of improper sampling, molding, or testing, that cylinder shall be discarded and the strength test shall consist of the strength of the remaining cylinder.

• When concrete compressive strength is specified as a prerequisite to applying loads or stresses to a concrete structure or member, test cylinders for other than steam cured concrete will be cured in conformance with Method 1 of California Test 540. The compressive strength of concrete determined for these purposes will be evaluated on the basis of individual tests.

• When concrete is designated by 28-day compressive strength rather than by cementitious material content, the concrete strength to be used as a basis for acceptance of other than steam cured concrete will be determined from cylinders cured in conformance with Method 1 of California Test 540. If the result of a single compressive strength test at the maximum age specified or allowed is below the specified strength but is 95 percent or more of the specified strength, the Contractor shall, at the Contractor's expense, make corrective changes, subject to approval of the Engineer, in the mix proportions or in the concrete fabrication procedures, before placing additional concrete, and shall pay to the State $14 for each in-place cubic meter of concrete represented by the deficient test. If the result of a single compressive strength test at the maximum age specified or allowed is below 95 percent of the specified strength, but is 85 percent or more of the specified strength, the Contractor shall make the corrective changes specified above, and shall pay to the State $20 for each in place cubic meter of concrete represented by the deficient test. In addition, such corrective changes shall be made when the compressive strength of concrete tested at 7 days indicates, in the judgment of the Engineer, that the concrete will not attain the required compressive strength at the maximum age specified or allowed. Concrete represented by a single test that indicates a compressive strength of less than 85 percent of the specified 28-day compressive strength will be rejected in conformance with the provisions in Section 6-1.04, "Defective Materials."

• If the test result indicates that the compressive strength at the maximum curing age specified or allowed is below the specified strength, but is 85 percent or more of the specified strength, payments to the State as required above shall be made, unless the Contractor, at the Contractor's expense, obtains and submits evidence acceptable to the Engineer that the strength of the concrete placed in the work meets or exceeds the specified 28-day compressive strength. If the test result indicates a compressive strength at the maximum curing age specified or allowed below 85 percent, the concrete represented by that test will be rejected, unless the Contractor, at the Contractor's expense, obtains and submits evidence acceptable to the Engineer that the strength and quality of the concrete placed in the work are acceptable. If the evidence consists of tests made on cores taken from the work, the cores shall be obtained and tested in conformance with the requirements in ASTM Designation: C 42.

• No single compressive strength test shall represent more than 250 $m^3$.

- When a precast concrete member is steam cured, the compressive strength of the concrete will be determined from test cylinders that have been handled and stored in conformance with Method 3 of California Test 540. The compressive strength of steam cured concrete will be evaluated on the basis of individual tests representing specific portions of production. When the concrete is designated by 28-day compressive strength rather than by cementitious material content, the concrete shall be considered to be acceptable whenever its compressive strength reaches the specified 28-day compressive strength provided that strength is reached in not more than the maximum number of days specified or allowed after the member is cast.
- When concrete is specified by compressive strength, prequalification of materials, mix proportions, mixing equipment, and procedures proposed for use will be required prior to placement of the concrete. Prequalification shall be accomplished by the submission of acceptable certified test data or trial batch reports by the Contractor. Prequalification data shall be based on the use of materials, mix proportions, mixing equipment, procedures, and size of batch proposed for use in the work.
- Certified test data, in order to be acceptable, shall indicate that not less than 90 percent of at least 20 consecutive tests exceed the specified strength at the maximum number of cure days specified or allowed, and none of those tests are less than 95 percent of specified strength. Strength tests included in the data shall be the most recent tests made on concrete of the proposed mix design and all shall have been made within one year of the proposed use of the concrete.
- Trial batch test reports, in order to be acceptable, shall indicate that the average compressive strength of 5 consecutive concrete cylinders, taken from a single batch, at not more than 28 days (or the maximum age allowed) after molding shall be at least 4 MPa greater than the specified 28-day compressive strength, and no individual cylinder shall have a strength less than the specified strength at the maximum age specified or allowed. Data contained in the report shall be from trial batches that were produced within one year of the proposed use of specified strength concrete in the project. Whenever air-entrainment is required, the air content of trial batches shall be equal to or greater than the air content specified for the concrete without reduction due to tolerances.
- Tests shall be performed in conformance with either the appropriate California Test methods or the comparable ASTM test methods. Equipment employed in testing shall be in good condition and shall be properly calibrated. If the tests are performed during the life of the contract, the Engineer shall be notified sufficiently in advance of performing the tests in order to witness the test procedures.
- The certified test data and trial batch test reports shall include the following information:

A. Date of mixing.
B. Mixing equipment and procedures used.
C. The size of batch in cubic meters and the mass, type, and source of all ingredients used.
D. Penetration of the concrete.
E. The air content of the concrete if an air-entraining admixture is used.
F. The age at time of testing and strength of all concrete cylinders tested.

- Certified test data and trial batch test reports shall be signed by an official of the firm that performed the tests.
- When approved by the Engineer, concrete from trial batches may be used in the work at locations where concrete of a lower quality is required and the concrete will be paid for as the type or class of concrete required at that location.
- After materials, mix proportions, mixing equipment, and procedures for concrete have been prequalified for use, additional prequalification by testing of trial batches will be required prior to making changes that, in the judgment of the Engineer, could result in a strength of concrete below that specified.
- The Contractor's attention is directed to the time required to test trial batches and the Contractor shall be responsible for production of trial batches at a sufficiently early date so that the progress of the work is not delayed.
- When precast concrete members are manufactured at the plant of an established manufacturer of precast concrete members, the mix proportions of the concrete shall be determined by the Contractor, and a trial batch and prequalification of the materials, mix proportions, mixing equipment, and procedures will not be required.

## 90-10 MINOR CONCRETE

### 90-10.01 GENERAL

- Concrete for minor structures, slope paving, curbs, sidewalks and other concrete work, when designated as minor concrete on the plans, in the specifications, or in the contract item, shall conform to the provisions specified herein.
- The Engineer, at the Engineer's discretion, will inspect and test the facilities, materials and methods for producing the concrete to ensure that minor concrete of the quality suitable for use in the work is obtained.

## 90-10.02 MATERIALS

- Minor concrete shall conform to the following requirements:

### 90-10.02A Cementitious Material

- Cementitious material shall conform to the provisions in Section 90-1.01, "Description."

### 90-10.02B Aggregate

- Aggregate shall be clean and free from deleterious coatings, clay balls, roots, and other extraneous materials.
- The Contractor shall submit to the Engineer for approval, a grading of the combined aggregate proposed for use in the minor concrete. After acceptance of the grading, aggregate furnished for minor concrete shall conform to that grading, unless a change is authorized in writing by the Engineer.
- The Engineer may require the Contractor to furnish periodic test reports of the aggregate grading furnished. The maximum size of aggregate used shall be at the option of the Contractor, but in no case shall the maximum size be larger than 37.5 mm or smaller than 19 mm.
- The Engineer may waive, in writing, the gradation requirements in this Section 90-10.02B, if, in the Engineer's opinion, the furnishing of the gradation is not necessary for the type or amount of concrete work to be constructed.

### 90-10.02C Water

- Water used for washing, mixing, and curing shall be free from oil, salts, and other impurities that would discolor or etch the surface or have an adverse affect on the quality of the concrete.

### 90-10.02D Admixtures

- The use of admixtures shall conform to the provisions in Section 90-4, "Admixtures."

## 90-10.03 PRODUCTION

- Cementitious material, water, aggregate, and admixtures shall be stored, proportioned, mixed, transported, and discharged in conformance with recognized standards of good practice that will result in concrete that is thoroughly and uniformly mixed, that is suitable for the use intended, and that conforms to requirements specified herein. Recognized standards of good practice are outlined in various industry publications such as are issued by American Concrete Institute, AASHTO, or the Department.
- The cementitious material content of minor concrete shall conform to the provisions in Section 90-1.01, "Description."
- The amount of water used shall result in a consistency of concrete conforming to the provisions in Section 90-6.06, "Amount of Water and Penetration." Additional mixing water shall not be incorporated into the concrete during hauling or after arrival at the delivery point, unless authorized by the Engineer.
- Discharge of ready-mixed concrete from the transporting vehicle shall be made while the concrete is still plastic and before stiffening occurs. An elapsed time of 1.5 hours (one hour in non-agitating hauling equipment), or more than 250 revolutions of the drum or blades, after the introduction of the cementitious material to the aggregates, or a temperature of concrete of more than 32°C will be considered conditions contributing to the quick stiffening of concrete. The Contractor shall take whatever action is necessary to eliminate quick stiffening, except that the addition of water will not be permitted.
- The required mixing time in stationary mixers shall be not less than 50 seconds or more than 5 minutes.
- The minimum required revolutions at mixing speed for transit-mixed concrete shall be not less than that recommended by the mixer manufacturer, and shall be increased, if necessary, to produce thoroughly and uniformly mixed concrete.
- Each load of ready-mixed concrete shall be accompanied by a weighmaster certificate that shall be delivered to the Engineer at the discharge location of the concrete, unless otherwise directed by the Engineer. The weighmaster certificate shall be clearly marked with the date and time of day when the load left the batching plant and, if hauled in truck mixers or agitators, the time the mixing cycle started.
- A Certificate of Compliance conforming to the provisions in Section 6–1.07, "Certificates of Compliance," shall be furnished to the Engineer, prior to placing minor concrete from a source not previously used on the contract, stating that minor concrete to be furnished meets contract requirements, including minimum cementitious material content specified.

## 90-10.04 CURING MINOR CONCRETE

- Curing minor concrete shall conform to the provisions in Section 90-7, "Curing Concrete."

### 90-10.05 PROTECTING MINOR CONCRETE

• Protecting minor concrete shall conform to the provisions in Section 90-8, "Protecting Concrete," except the concrete shall be maintained at a temperature of not less than 4°C for 72 hours after placing.

### 90-10.06 MEASUREMENT AND PAYMENT

• Minor concrete will be measured and paid for in conformance with the provisions specified in the various sections of these specifications covering concrete construction when minor concrete is specified in the specifications, shown on the plans, or indicated by contract item in the Engineer's Estimate.

## 90-11 MEASUREMENT AND PAYMENT

### 90-11.01 MEASUREMENT

• Portland cement concrete will be measured in conformance with the provisions specified in the various sections of these specifications covering construction requiring concrete.

• When it is provided that concrete will be measured at the mixer, the volume in cubic meters shall be computed as the total mass of the batch in kilograms divided by the density of the concrete in kilograms per cubic meter. The total mass of the batch shall be calculated as the sum of all materials, including water, entering the batch. The density of the concrete will be determined in conformance with the requirements in California Test 518.

### 90-11.02 PAYMENT

• Portland cement concrete will be paid for in conformance with the provisions specified in the various sections of these specifications covering construction requiring concrete.

• Full compensation for furnishing and incorporating admixtures required by these specifications or the special provisions will be considered as included in the contract prices paid for the concrete involved and no additional compensation will be allowed therefor.

• Should the Engineer order the Contractor to incorporate any admixtures in the concrete when their use is not required by these specifications or the special provisions, furnishing the admixtures and adding them to the concrete will be paid for as extra work as provided in Section 4-1.03D, "Extra Work."

• Should the Contractor use admixtures in conformance with the provisions in Section 90-4.05, "Optional Use of Chemical Admixtures," or Section 90-4.07, "Optional Use of Air-entraining Admixtures," or should the Contractor request and obtain permission to use other admixtures for the Contractor's benefit, the Contractor shall furnish those admixtures and incorporate them into the concrete at the Contractor's expense and no additional compensation will be allowed therefor.

# END OF AMENDMENTS

## SECTION 2. PROPOSAL REQUIREMENTS AND CONDITIONS

### 2-1.01 GENERAL

The bidder's attention is directed to the provisions in Section 2, "Proposal Requirements and Conditions," of the Standard Specifications and these special provisions for the requirements and conditions which the bidder must observe in the preparation of the Proposal form and the submission of the bid.

In addition to the subcontractors required to be listed in conformance with Section 2-1.054, "Required Listing of Proposed Subcontractors," of the Standard Specifications, each proposal shall have listed therein the portion of work that will be performed by each subcontractor listed.

The Bidder's Bond form mentioned in the last paragraph in Section 2-1.07, "Proposal Guaranty," of the Standard Specifications will be found following the signature page of the Proposal.

Submit request for substitution of an "or equal" item, and the data substantiating the request to the Department of Transportation, Construction Division Chief, 801 South Grand Avenue, 4th Floor, Los Angeles, CA 90017, so that the request is received by the Department by close of business on the fourth day, not including Saturdays, Sundays and legal holidays, following bid opening.

In conformance with Public Contract Code Section 7106, a Noncollusion Affidavit is included in the Proposal. Signing the Proposal shall also constitute signature of the Noncollusion Affidavit.

The contractor, sub recipient or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR part 26 in the award and administration of DOT-assisted contracts. Failure by the contractor to carry out these requirements is a material breach of

this contract, which may result in the termination of this contract or such other remedy as the recipient deems appropriate. Each subcontract signed by the bidder must include this assurance.

### 2-1.015 FEDERAL LOBBYING RESTRICTIONS

Section 1352, Title 31, United States Code prohibits Federal funds from being expended by the recipient or any lower tier subrecipient of a Federal-aid contract to pay for any person for influencing or attempting to influence a Federal agency or Congress in connection with the awarding of any Federal-aid contract, the making of any Federal grant or loan, or the entering into of any cooperative agreement.

If any funds other than Federal funds have been paid for the same purposes in connection with this Federal-aid contract, the recipient shall submit an executed certification and, if required, submit a completed disclosure form as part of the bid documents.

A certification for Federal-aid contracts regarding payment of funds to lobby Congress or a Federal agency is included in the Proposal. Standard Form - LLL, "Disclosure of Lobbying Activities," with instructions for completion of the Standard Form is also included in the Proposal. Signing the Proposal shall constitute signature of the Certification.

The above-referenced certification and disclosure of lobbying activities shall be included in each subcontract and any lower-tier contracts exceeding $100,000. All disclosure forms, but not certifications, shall be forwarded from tier to tier until received by the Engineer.

The Contractor, subcontractors and any lower-tier contractors shall file a disclosure form at the end of each calendar quarter in which there occurs any event that requires disclosure or that materially affects the accuracy of the information contained in any disclosure form previously filed by the Contractor, subcontractors and any lower-tier contractors. An event that materially affects the accuracy of the information reported includes:

A. A cumulative increase of $25,000 or more in the amount paid or expected to be paid for influencing or attempting to influence a covered Federal action; or
B. A change in the person(s) or individual(s) influencing or attempting to influence a covered Federal action; or,
C. A change in the officer(s), employee(s), or Member(s) contacted to influence or attempt to influence a covered Federal action.

### 2-1.02 DISADVANTAGED BUSINESS ENTERPRISE (DBE)

This project is subject to Part 26, Title 49, Code of Federal Regulations entitled "Participation by Disadvantaged Business Enterprises in Department of Transportation Financial Assistance Programs." The Regulations in their entirety are incorporated herein by this reference.

Bidders shall be fully informed respecting the requirements of the Regulations and the Department's Disadvantaged Business Enterprise (DBE) program developed pursuant to the Regulations; particular attention is directed to the following matters:

A. A DBE must be a small business concern as defined pursuant to Section 3 of U.S. Small Business Act and relevant regulations promulgated pursuant thereto.
B. A DBE may participate as a prime contractor, subcontractor, joint venture partner with a prime or subcontractor, vendor of material or supplies, or as a trucking company.
C. A DBE bidder, not bidding as a joint venture with a non-DBE, will be required to document one or a combination of the following:

    1. The bidder will meet the goal by performing work with its own forces.
    2. The bidder will meet the goal through work performed by DBE subcontractors, suppliers or trucking companies.
    3. The bidder, prior to bidding, made adequate good faith efforts to meet the goal.

D. A DBE joint venture partner must be responsible for specific contract items of work, or portions thereof. Responsibility means actually performing, managing and supervising the work with its own forces. The DBE joint venture partner must share in the capital contribution, control, management, risks and profits of the joint venture. The DBE joint venturer must submit the joint venture agreement with the proposal or the DBE Information form required in the Section entitled "Submission of DBE Information" of these special provisions.
E. A DBE must perform a commercially useful function, i.e., must be responsible for the execution of a distinct element of the work and must carry out its responsibility by actually performing, managing and supervising the work.

F. DBEs must be certified by either the California Department of Transportation, or by a participating State of California or local agency which certifies in conformance with Title 49, Code of Federal Regulations, Part 26, as of the date of bid opening. It is the Contractor's responsibility to verify that DBEs are certified. Listings of DBEs certified by the Department are available from the following sources:

1. The Department's DBE Directory, which is published quarterly. This Directory may be obtained from the Department of Transportation, Materiel Operations Branch, Publication Distribution Unit, 1900 Royal Oaks Drive, Sacramento, California 95815, Telephone: (916) 445-3520.
2. The Department's Electronic Information Bulletin Board Service, which is accessible by modem and is updated weekly. The Bulletin Board may be accessed by first contacting the Department's Business Enterprise Program at Telephone: (916) 324-1097 and obtaining a user identification and password.
3. The Department's web site at http://www.dot.ca.gov/hq/bep/index.htm.
4. The organizations listed in the Section entitled "DBE Goal for this Project" of these special provisions.

G. Credit for materials or supplies purchased from DBEs will be as follows:

1. If the materials or supplies are obtained from a DBE manufacturer, 100 percent of the cost of the materials or supplies will count toward the DBE goal. A DBE manufacturer is a firm that operates or maintains a factory or establishment that produces, on the premises, the materials, supplies, articles, or equipment required under the contract and of the general character described by the specifications.
2. If the materials or supplies are purchased from a DBE regular dealer, 60 percent of the cost of the materials or supplies will count toward the DBE goal. A DBE regular dealer is a firm that owns, operates, or maintains a store, warehouse, or other establishment in which the materials, supplies, articles or equipment of the general character described by the specifications and required under the contract are bought, kept in stock, and regularly sold or leased to the public in the usual course of business. To be a DBE regular dealer, the firm must be an established, regular business that engages, as its principal business and under its own name, in the purchase and sale or lease of the products in question. A person may be a DBE regular dealer in such bulk items as petroleum products, steel, cement, gravel, stone, or asphalt without owning, operating, or maintaining a place of business as provided in this paragraph G.2. if the person both owns and operates distribution equipment for the products. Any supplementing of regular dealers' own distribution equipment shall be by a long-term lease agreement and not on an ad hoc or contract-by-contract basis. Packagers, brokers, manufacturers' representatives, or other persons who arrange or expedite transactions are not DBE regular dealers within the meaning of this paragraph G.2.
3. Credit for materials or supplies purchased from a DBE which is neither a manufacturer nor a regular dealer will be limited to the entire amount of fees or commissions charged for assistance in the procurement of the materials and supplies, or fees or transportation charges for the delivery of materials or supplies required on a job site, provided the fees are reasonable and not excessive as compared with fees charged for similar services.

H. Credit for DBE trucking companies will be as follows:

1. The DBE must be responsible for the management and supervision of the entire trucking operation for which it is responsible on a particular contract, and there cannot be a contrived arrangement for the purpose of meeting the DBE goal.
2. The DBE must itself own and operate at least one fully licensed, insured, and operational truck used on the contract.
3. The DBE receives credit for the total value of the transportation services it provides on the contract using trucks its owns, insures, and operates using drivers it employs.
4. The DBE may lease trucks from another DBE firm, including an owner-operator who is certified as a DBE. The DBE who leases trucks from another DBE receives credit for the total value of the transportation services the lessee DBE provides on the contract.
5. The DBE may also lease trucks from a non-DBE firm, including an owner-operator. The DBE who leases trucks from a non-DBE is entitled to credit only for the fee or commission it receives as a result of the lease arrangement. The DBE does not receive credit for the total value of the transportation services provided by the lessee, since these services are not provided by a DBE.
6. For the purposes of this paragraph H, a lease must indicate that the DBE has exclusive use of and control over the truck. This does not preclude the leased truck from working for others during the term of the lease with the consent of the DBE, so long as the lease gives the DBE absolute priority for use of the leased truck. Leased trucks must display the name and identification number of the DBE.

I. Noncompliance by the Contractor with the requirements of the regulations constitutes a breach of this contract and may result in termination of the contract or other appropriate remedy for a breach of this contract.
J. Bidders are encouraged to use services offered by financial institutions owned and controlled by DBEs.

**2-1.02A DBE GOAL FOR THIS PROJECT**

The Department has established the following goal for Disadvantaged Business Enterprise (DBE) participation for this project:

Disadvantaged Business Enterprise (DBE): 15 percent

Bidders may use the services of the following firms to contact interested DBEs. These firms are available to assist DBEs in preparing bids for subcontracting or supplying materials.

The following firms may be contacted for projects in the following locations:

| Districts 04, 05 (except San Luis Obispo and Santa Barbara Counties), 06 (except Kern County) and 10: | Districts 08 and 11: |
|---|---|
| Triaxial Management Services, Inc.<br>- Oakland<br><br>1545 Willow Street, 1st Floor<br>Oakland, CA 94607<br>Telephone: (510) 286-1313<br>FAX No.: (510) 286-6792 | Padilla & Associates<br>- San Diego<br><br>2725 Congress Street, Suite 1D<br>San Diego, CA 92110<br>Telephone: (619) 725-0843<br>FAX No.: (619) 725-0854 |

| Districts 07, 08, and 12; in San Luis Obispo and Santa Barbara Counties in District 05; and in Kern County in District 06: | Districts 01, 02, 03 and 09: |
|---|---|
| Padilla & Associates<br>- Los Angeles<br><br>5675 East Telegraph Rd., Suite A-260<br>Los Angeles, CA 90040<br>Telephone: (323) 728-8847<br>FAX No.: (323) 728-8867 | Triaxial Management Services, Inc.<br>- Sacramento<br><br>930 Alhambra Blvd., #205<br>Sacramento, CA 95816<br>Telephone: (916) 553-4172<br>FAX No.: (916) 553-4173 |

**2-1.02B SUBMISSION OF DBE INFORMATION**

The required DBE information shall be submitted on the "CALTRANS BIDDER - DBE INFORMATION" form included in the Proposal. If the DBE information is not submitted with the bid, the DBE Information form shall be removed from the documents prior to submitting the bid.

It is the bidder's responsibility to make enough work available to DBEs and to select those portions of the work or material needs consistent with the available DBEs to meet the goal for DBE participation or to provide information to establish that, prior to bidding, the bidder made adequate good faith efforts to do so.

If DBE information is not submitted with the bid, the apparent successful bidder (low bidder), the second low bidder and the third low bidder shall submit DBE information to the Department of Transportation, 1120 N Street, Room 0200, MS #26, Sacramento, California 95814 so the information is received by the Department no later than 4:00 p.m. on the fourth day, not including Saturdays, Sundays and legal holidays, following bid opening. DBE information sent by U.S. Postal Service certified mail with return receipt and certificate of mailing and mailed on or before the third day, not including Saturdays, Sundays and legal holidays, following bid opening will be accepted even if it is received after the fourth day following bid opening. Failure to submit the required DBE information by the time specified will be grounds for finding the bid or proposal nonresponsive. Other bidders need not submit DBE information unless requested to do so by the Department.

The bidder's DBE information shall establish that good faith efforts to meet the DBE goal have been made. To establish good faith efforts, the bidder shall demonstrate that the goal will be met or that, prior to bidding, adequate good faith efforts to meet the goal were made.

Bidders are cautioned that even though their submittal indicates they will meet the stated DBE goal, their submittal should also include their adequate good faith efforts information along with their DBE goal information to protect their eligibility for award of the contract in the event the Department, in its review, finds that the goal has not been met.

The bidder's DBE information shall include the names, addresses and phone numbers of DBE firms that will participate, with a complete description of work or supplies to be provided by each, the dollar value of each DBE transaction, and a written confirmation from the DBE that it is participating in the contract. A copy of the DBE's quote will serve as written confirmation that the DBE is participating in the contract. When 100 percent of a contract item of work is not to be performed or furnished by a DBE, a description of the exact portion of that work to be performed or furnished by that DBE shall be included in the DBE information, including the planned location of that work. The work that a DBE prime contractor has committed to performing with its own forces as well as the work that it has committed to be performed by DBE subcontractors, suppliers and trucking companies will count toward the goal.

The information necessary to establish the bidder's adequate good faith efforts to meet the DBE goal should include:

A. The names and dates of each publication in which a request for DBE participation for this project was placed by the bidder.
B. The names and dates of written notices sent to certified DBEs soliciting bids for this project and the dates and methods used for following up initial solicitations to determine with certainty whether the DBEs were interested.
C. The items of work which the bidder made available to DBE firms, including, where appropriate, any breaking down of the contract work items (including those items normally performed by the bidder with its own forces) into economically feasible units to facilitate DBE participation. It is the bidder's responsibility to demonstrate that sufficient work to meet the DBE goal was made available to DBE firms.
D. The names, addresses and phone numbers of rejected DBE firms, the firms selected for that work, and the reasons for the bidder's choice.
E. Efforts made to assist interested DBEs in obtaining bonding, lines of credit or insurance, and any technical assistance or information related to the plans, specifications and requirements for the work which was provided to DBEs.
F. Efforts made to assist interested DBEs in obtaining necessary equipment, supplies, materials, or related assistance or services, excluding supplies and equipment the DBE subcontractor purchases or leases from the prime contractor or its affiliate.
G. The names of agencies contacted to provide assistance in contacting, recruiting and using DBE firms.
H. Any additional data to support a demonstration of good faith efforts.

## SECTION 3. AWARD AND EXECUTION OF CONTRACT

The bidder's attention is directed to the provisions in Section 3, "Award and Execution of Contract," of the Standard Specifications and these special provisions for the requirements and conditions concerning award and execution of contract.

The award of the contract, if it be awarded, will be to the lowest responsible bidder whose proposal complies with all the requirements prescribed and who has met the goal for DBE participation or has demonstrated, to the satisfaction of the Department, adequate good faith efforts to do so. Meeting the goal for DBE participation or demonstrating, to the satisfaction of the Department, adequate good faith efforts to do so is a condition for being eligible for award of contract.

A "Payee Data Record" form will be included in the contract documents to be executed by the successful bidder. The purpose of the form is to facilitate the collection of taxpayer identification data. The form shall be completed and returned to the Department by the successful bidder with the executed contract and contract bonds. For the purposes of the form, payee shall be deemed to mean the successful bidder. The form is not to be completed for subcontractors or suppliers. Failure to complete and return the "Payee Data Record" form to the Department as provided herein will result in the retention of 31 percent of payments due the contractor and penalties of up to $20,000. This retention of payments for failure to complete the "Payee Data Record" form is in addition to any other retention of payments due the Contractor.

## SECTION 4. BEGINNING OF WORK, TIME OF COMPLETION AND LIQUIDATED DAMAGES

Attention is directed to the provisions in Sections 8-1.03, "Beginning of Work," 8-1.06, "Time of Completion," 8-1.07, "Liquidated Damages," and 20-4.08, "Plant Establishment Work," of the Standard Specifications and these special provisions.

The Contractor shall begin work within 15 calendar days after the contract has been approved by the Attorney General or the attorney appointed and authorized to represent the Department of Transportation.

The Contractor shall furnish the Engineer with a statement from the vendor that the order for Communication equipment, Communication System Routing and the electrical materials required for this contract has been received and accepted by the vendor; and the statement shall be furnished within 15 calendar days after the contract has been approved by the Attorney General, or the attorney appointed and authorized to represent the Department of Transportation. The statement shall give the date that the electrical materials will be shipped. If the Contractor has the necessary materials on hand, the Contractor will not be required to furnish the vendor's statement.

The work (except plant establishment work) shall be diligently prosecuted to completion before the expiration of **800 WORKING DAYS** beginning on the fifteenth calendar day after approval of the contract.

The Contractor shall pay to the State of California the sum of $ 9,600 per day, for each and every calendar day's delay in finishing the work (except plant establishment work) in excess of the number of working days prescribed above.

The Contractor shall diligently prosecute all work (including plant establishment) to completion before the expiration of **920 WORKING DAYS** beginning on the fifteenth calendar day after approval of the contract.

The Contractor shall pay to the State of California the sum of $600 per day, for each and every calendar day's delay in completing the work in excess of the number of working days prescribed above.

In no case will liquidated damages of more than $ 9,600 per day be assessed.

## SECTION 5. GENERAL

## SECTION 5-1. MISCELLANEOUS

### 5-1.01 PLANS AND WORKING DRAWINGS

When the specifications require working drawings to be submitted to the Division of Structure Design, the drawings shall be submitted to: Division of Structure Design, Documents Unit, Mail Station 9, 1801 30th Street, Sacramento, CA 95816, Telephone 916 227-8252.

### 5-1.011 EXAMINATION OF PLANS, SPECIFICATIONS, CONTRACT, AND SITE OF WORK

Attention is directed to "Differing Site Conditions" of these special provisions regarding physical conditions at the site which may differ from those indicated in "Materials Information," log of test borings or other geotechnical information obtained by the Department's investigation of site conditions.

### 5-1.012 DIFFERING SITE CONDITIONS

Attention is directed to Section 5-1.116, "Differing Site Conditions," of the Standard Specifications.

During the progress of the work, if subsurface or latent conditions are encountered at the site differing materially from those indicated in the "Materials Information," log of test borings, other geotechnical data obtained by the Department's investigation of subsurface conditions, or an examination of the conditions above ground at the site, the party discovering those conditions shall promptly notify the other party in writing of the specific differing conditions before they are disturbed and before the affected work is performed.

The Contractor will be allowed 15 days from the notification of the Engineer's determination of whether or not an adjustment of the contract is warranted, in which to file a notice of potential claim in conformance with the provisions of Section 9-1.04, "Notice of Potential Claim," of the Standard Specifications and as specified herein; otherwise the decision of the Engineer shall be deemed to have been accepted by the Contractor as correct. The notice of potential claim shall set forth in what respects the Contractor's position differs from the Engineer's determination and provide any additional information obtained by the Contractor, including but not limited to additional geotechnical data. The notice of potential claim shall be accompanied by the Contractor's certification that the following were made in preparation of the bid: a review of the contract, a review of the "Materials Information," a review of the log of test borings and other records of geotechnical data to the extent they were made available to bidders prior to the opening of bids, and an examination of the conditions above ground at the site. Supplementary information, obtained by the Contractor subsequent to the filing of the notice of potential claim, shall be submitted to the Engineer in an expeditious manner.

### 5-1.013 LINES AND GRADES

Attention is directed to Section 5-1.07, "Lines and Grades," of the Standard Specifications.

Stakes or marks will be set by the Engineer in conformance with the requirements in Chapter 12, "Construction Surveys," of the Department's Surveys Manual.

**5-1.015 LABORATORY**

When a reference is made in the specifications to the "Laboratory," the reference shall mean Division of Engineering Services - Materials Engineering and Testing Services and Division of Engineering Services - Geotechnical Services of the Department of Transportation, or established laboratories of the various Districts of the Department, or other laboratories authorized by the Department to test materials and work involved in the contract. When a reference is made in the specifications to the "Transportation Laboratory," the reference shall mean Division of Engineering Services - Materials Engineering and Testing Services and Division of Engineering Services - Geotechnical Services, located at 5900 Folsom Boulevard, Sacramento, CA 95819, Telephone (916) 227-7000.

**5-1.017 CONTRACT BONDS**

Attention is directed to Section 3-1.02, "Contract Bonds," of the Standard Specifications and these special provisions.

The payment bond shall be in a sum not less than one hundred percent of the total amount payable by the terms of the contract.

**5-1.019 COST REDUCTION INCENTIVE**

Attention is directed to Section 5-1.14, "Cost Reduction Incentive," of the Standard Specifications.

Prior to preparing a written cost reduction proposal, the Contractor shall request a meeting with the Engineer to discuss the proposal in concept. Items of discussion will also include permit issues, impact on other projects, impact on the project schedule, peer reviews, overall merit of the proposal, and review times required by the Department and other agencies.

If a cost reduction proposal submitted by the Contractor, and subsequently approved by the Engineer, provides for a reduction in contract time, 50 percent of that contract time reduction shall be credited to the State by reducing the contract working days, not including plant establishment. Attention is directed to "Beginning of Work, Time of Completion and Liquidated Damages" of these special provisions regarding the working days.

If a cost reduction proposal submitted by the Contractor, and subsequently approved by the Engineer, provides for a reduction in traffic congestion or avoids traffic congestion during construction, 60 percent of the estimated net savings in construction costs attributable to the cost reduction proposal will be paid to the Contractor. In addition to the requirements in Section 5-1.14, "Cost Reduction Incentive," of the Standard Specifications, the Contractor shall provide detailed comparisons of the traffic handling between the existing contract and the proposed change, and estimates of the traffic volumes and congestion.

**5-1.02 LABOR NONDISCRIMINATION**

Attention is directed to the following Notice that is required by Chapter 5 of Division 4 of Title 2, California Code of Regulations.

**NOTICE OF REQUIREMENT FOR NONDISCRIMINATION PROGRAM**

**(GOV. CODE, SECTION 12990)**

Your attention is called to the "Nondiscrimination Clause", set forth in Section 7-1.01A(4), "Labor Nondiscrimination," of the Standard Specifications, which is applicable to all nonexempt State contracts and subcontracts, and to the "Standard California Nondiscrimination Construction Contract Specifications" set forth therein. The specifications are applicable to all nonexempt State construction contracts and subcontracts of $5000 or more.

**5-1.022 PAYMENT OF WITHHELD FUNDS**

Payment of withheld funds shall conform to Section 9-1.065, "Payment of Withheld Funds," of the Standard Specifications and these special provisions.

Funds withheld from progress payments to ensure performance of the contract that are eligible for payment into escrow or to an escrow agent pursuant to Section 10263 of the California Public Contract Code do not include funds withheld or deducted from payment due to failure of the Contractor to fulfill a contract requirement.

**5-1.03 INTEREST ON PAYMENTS**

Interest shall be payable on progress payments, payments after acceptance, final payments, extra work payments, and claim payments as follows:

A. Unpaid progress payments, payment after acceptance, and final payments shall begin to accrue interest 30 days after the Engineer prepares the payment estimate.

B. Unpaid extra work bills shall begin to accrue interest 30 days after preparation of the first pay estimate following receipt of a properly submitted and undisputed extra work bill. To be properly submitted, the bill must be submitted within 7 days of the performance of the extra work and in conformance with the provisions in Section 9-1.03C, "Records," and Section 9-1.06, "Partial Payments," of the Standard Specifications. An undisputed extra work bill not submitted within 7 days of performance of the extra work will begin to accrue interest 30 days after the preparation of the second pay estimate following submittal of the bill.
C. The rate of interest payable for unpaid progress payments, payments after acceptance, final payments, and extra work payments shall be 10 percent per annum.
D. The rate of interest payable on a claim, protest or dispute ultimately allowed under this contract shall be 6 percent per annum. Interest shall begin to accrue 61 days after the Contractor submits to the Engineer information in sufficient detail to enable the Engineer to ascertain the basis and amount of said claim, protest or dispute.

The rate of interest payable on any award in arbitration shall be 6 percent per annum if allowed under the provisions of Civil Code Section 3289.

**5-1.031 FINAL PAYMENT AND CLAIMS**

Attention is directed to Section 9-1.07B, "Final Payment and Claims," of the Standard Specifications.

If the Contractor files a timely written statement of claims in response to the proposed final estimate, the District that administers the contract will submit a claim position letter to the Contractor by hand delivery or deposit in the U.S. mail within 135 days of acceptance of the contract. The claim position letter will delineate the District's position on the Contractor's claims. If the Contractor disagrees with the claim position letter, the Contractor shall submit a written notification of its disagreement to be received by the District not later than 15 days after the Contractor's receipt of the claim position letter. The written notification of disagreement shall set forth the basis for the Contractor's disagreement and be submitted to the office designated in the claim position letter. The Contractor's failure to provide a timely, written notification of disagreement shall constitute the Contractor's acceptance and agreement with the determinations provided in the claim position letter and with final payment pursuant to the claim position letter.

If the Contractor files a timely notification of disagreement with the District claim position letter, the board of review designated by the District Director to review claims that remain in dispute will meet with the Contractor within 45 days after receipt by the District of the notification of disagreement. Attendance by the Contractor at the board of review meeting shall be mandatory.

If the District fails to submit a claim position letter to the Contractor within 135 days after the acceptance of the contract and the Contractor has claims that remain in dispute, the Contractor may request a meeting with the board of review designated by the District Director to review claims that remain in dispute. The Contractor's request for a meeting shall identify the claims that remain in dispute. If the Contractor files a request for a meeting, the board of review will meet with the Contractor within 45 days after the District receives the request for the meeting. Attendance by the Contractor at the District Director's board of review meeting shall be mandatory.

Failure of the Contractor to file a timely written statement of claims in response to the proposed final estimate, or to file a timely notification of disagreement with the District claim position letter, or to attend the District Director's board of review meeting shall constitute a failure to pursue diligently and exhaust the administrative procedures in the contract and shall be a bar to arbitration in conformance with the requirements in Section 10240.2 of the California Public Contract Code.

**5-1.04 PUBLIC SAFETY**

The Contractor shall provide for the safety of traffic and the public in conformance with the provisions in Section 7-1.09, "Public Safety," of the Standard Specifications and these special provisions.

The Contractor shall install temporary railing (Type K) between a lane open to public traffic and an excavation, obstacle or storage area when the following conditions exist:

A. Excavations**.—**The near edge of the excavation is 3.6 m or less from the edge of the lane, except:

1. Excavations covered with sheet steel or concrete covers of adequate thickness to prevent accidental entry by traffic or the public.
2. Excavations less than 0.3-m deep.
3. Trenches less than 0.3-m wide for irrigation pipe or electrical conduit, or excavations less than 0.3-m in diameter.
4. Excavations parallel to the lane for the purpose of pavement widening or reconstruction.
5. Excavations in side slopes, where the slope is steeper than 1:4 (vertical:horizontal).
6. Excavations protected by existing barrier or railing.

B. Temporarily Unprotected Permanent Obstacles.—The work includes the installation of a fixed obstacle together with a protective system, such as a sign structure together with protective railing, and the Contractor elects to install the obstacle prior to installing the protective system; or the Contractor, for the Contractor's convenience and with permission of the Engineer, removes a portion of an existing protective railing at an obstacle and does not replace such railing complete in place during the same day.

C. Storage Areas.—Material or equipment is stored within 3.6 m of the lane and the storage is not otherwise prohibited by the provisions of the Standard Specifications and these special provisions.

The approach end of temporary railing (Type K), installed in conformance with the provisions in this section "Public Safety" and in Section 7-1.09, "Public Safety," of the Standard Specifications, shall be offset a minimum of 4.6 m from the edge of the traffic lane open to public traffic. The temporary railing shall be installed on a skew toward the edge of the traffic lane of not more than 0.3-m transversely to 3 m longitudinally with respect to the edge of the traffic lane. If the 4.6-m minimum offset cannot be achieved, the temporary railing shall be installed on the 10 to 1 skew to obtain the maximum available offset between the approach end of the railing and the edge of the traffic lane, and an array of temporary crash cushion modules shall be installed at the approach end of the temporary railing.

Temporary railing (Type K) shall conform to the provisions in Section 12-3.08, "Temporary Railing (Type K)," of the Standard Specifications. Temporary railing (Type K), conforming to the details shown on 1999 Standard Plan T3, may be used. Temporary railing (Type K) fabricated prior to January 1, 1993, and conforming to 1988 Standard Plan B11-30 may be used, provided the fabrication date is printed on the required Certificate of Compliance.

Temporary crash cushion modules shall conform to the provisions in "Temporary Crash Cushion Module" of these special provisions.

Except for installing, maintaining and removing traffic control devices, whenever work is performed or equipment is operated in the following work areas, the Contractor shall close the adjacent traffic lane unless otherwise provided in the Standard Specifications and these special provisions:

| Approach Speed of Public Traffic (Posted Limit) (Kilometers Per Hour) | Work Areas |
|---|---|
| Over 72 (45 Miles Per Hour) | Within 1.8 m of a traffic lane but not on a traffic lane |
| 56 to 72 (35 to 45 Miles Per Hour) | Within 0.9-m of a traffic lane but not on a traffic lane |

The lane closure provisions of this section shall not apply if the work area is protected by permanent or temporary railing or barrier.

When traffic cones or delineators are used to delineate a temporary edge of a traffic lane, the line of cones or delineators shall be considered to be the edge of the traffic lane, however, the Contractor shall not reduce the width of an existing lane to less than 3 m without written approval from the Engineer.

When work is not in progress on a trench or other excavation that required closure of an adjacent lane, the traffic cones or portable delineators used for the lane closure shall be placed off of and adjacent to the edge of the traveled way. The spacing of the cones or delineators shall be not more than the spacing used for the lane closure.

Suspended loads or equipment shall not be moved nor positioned over public traffic or pedestrians.

Full compensation for conforming to the provisions in this section "Public Safety," including furnishing and installing temporary railing (Type K) and temporary crash cushion modules, shall be considered as included in the contract prices paid for the various items of work involved and no additional compensation will be allowed therefor.

### 5-1.05 TESTING

Testing of materials and work shall conform to the provisions in Section 6-3, "Testing," of the Standard Specifications and these special provisions.

Whenever the provisions of Section 6-3.01, "General," of the Standard Specifications refer to tests or testing, it shall mean tests to assure the quality and to determine the acceptability of the materials and work.

The Engineer will deduct the costs for testing of materials and work found to be unacceptable, as determined by the tests performed by the Department, and the costs for testing of material sources identified by the Contractor which are not used for the work, from moneys due or to become due to the Contractor. The amount deducted will be determined by the Engineer.

### 5-1.06 REMOVAL OF ASBESTOS AND HAZARDOUS SUBSTANCES

When the presence of asbestos or hazardous substances are not shown on the plans or indicated in the specifications and the Contractor encounters materials which the Contractor reasonably believes to be asbestos or a hazardous substance as defined in Section 25914.1 of the Health and Safety Code, and the asbestos or hazardous substance has not been rendered

harmless, the Contractor may continue work in unaffected areas reasonably believed to be safe. The Contractor shall immediately cease work in the affected area and report the condition to the Engineer in writing.

In conformance with Section 25914.1 of the Health and Safety Code, removal of asbestos or hazardous substances including exploratory work to identify and determine the extent of the asbestos or hazardous substance will be performed by separate contract.

If delay of work in the area delays the current controlling operation, the delay will be considered a right of way delay and the Contractor will be compensated for the delay in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

**5-1.07 YEAR 2000 COMPLIANCE**

This contract is subject to Year 2000 Compliance for automated devices in the State of California.

Year 2000 compliance for automated devices in the State of California is achieved when embedded functions have or create no logical or mathematical inconsistencies when dealing with dates prior to and beyond 1999. The year 2000 is recognized and processed as a leap year. The product shall operate accurately in the manner in which the product was intended for date operation without requiring manual intervention.

The Contractor shall provide the Engineer a Certificate of Compliance from the manufacturer in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for all automated devices furnished for the project.

**5-1.075 BUY AMERICA REQUIREMENTS**

Attention is directed to the "Buy America" requirements of the Surface Transportation Assistance Act of 1982 (Section 165) and the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) Sections 1041(a) and 1048(a), and the regulations adopted pursuant thereto. In conformance with the law and regulations, all manufacturing processes for steel and iron materials furnished for incorporation into the work on this project shall occur in the United States; with the exception that pig iron and processed, pelletized and reduced iron ore manufactured outside of the United States may be used in the domestic manufacturing process for such steel and iron materials. The application of coatings, such as epoxy coating, galvanizing, painting, and other coatings that protect or enhance the value of steel or iron materials shall be considered a manufacturing process subject to the "Buy America" requirements.

A Certificate of Compliance conforming to the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications shall be furnished for steel and iron materials. The certificates, in addition to certifying that the materials comply with the specifications, shall specifically certify that all manufacturing processes for the materials occurred in the United States, except for the above exceptions.

The requirements imposed by the law and regulations do not prevent a minimal use of foreign steel and iron materials if the total combined cost of the materials used does not exceed one-tenth of one percent (0.1 percent) of the total contract cost or $2500, whichever is greater. The Contractor shall furnish the Engineer acceptable documentation of the quantity and value of the foreign steel and iron prior to incorporating the materials into the work.

**5-1.08 SUBCONTRACTOR AND DBE RECORDS**

The Contractor shall maintain records showing the name and business address of each first-tier subcontractor. The records shall also show the name and business address of every DBE subcontractor, DBE vendor of materials and DBE trucking company, regardless of tier. The records shall show the date of payment and the total dollar figure paid to all of these firms. DBE prime contractors shall also show the date of work performed by their own forces along with the corresponding dollar value of the work.

Upon completion of the contract, a summary of these records shall be prepared on Form CEM-2402 (F) and certified correct by the Contractor or the Contractor's authorized representative, and shall be furnished to the Engineer. The form shall be furnished to the Engineer within 90 days from the date of contract acceptance. $10,000 will be withheld from payment until the Form CEM-2402 (F) is submitted. The amount will be returned to the Contractor when a satisfactory Form CEM-2402 (F) is submitted.

Prior to the fifteenth of each month, the Contractor shall submit documentation to the Engineer showing the amount paid to DBE trucking companies listed in the Contractor's DBE information. This monthly documentation shall indicate the portion of the revenue paid to DBE trucking companies which is claimed toward DBE participation. The Contractor shall also obtain and submit documentation to the Engineer showing the amount paid by DBE trucking companies to all firms, including owner-operators, for the leasing of trucks. The DBE who leases trucks from a non-DBE is entitled to credit only for the fee or commission it receives as a result of the lease arrangement. The records must confirm that the amount of credit claimed toward DBE participation conforms with Section 2-1.02, "Disadvantaged Business Enterprise," of these special provisions.

The Contractor shall also obtain and submit documentation to the Engineer showing the truck number, owner's name, California Highway Patrol CA number, and if applicable, the DBE certification number of the owner of the truck for all trucks used during that month for which DBE participation will be claimed. This documentation shall be submitted on Form CEM-2404 (F).

**5-1.083 DBE CERTIFICATION STATUS**

If a DBE subcontractor is decertified during the life of the project, the decertified subcontractor shall notify the Contractor in writing with the date of decertification. If a subcontractor becomes a certified DBE during the life of the project, the subcontractor shall notify the Contractor in writing with the date of certification. The Contractor shall furnish the written documentation to the Engineer.

Upon completion of the contract, Form CEM-2403 (F) indicating the DBE's existing certification status shall be signed and certified correct by the Contractor. The certified form shall be furnished to the Engineer within 90 days from the date of contract acceptance.

**5-1.086 PERFORMANCE OF DBE SUBCONTRACTORS AND SUPPLIERS**

The DBEs listed by the Contractor in response to the provisions in Section 2-1.02B, "Submission of DBE Information," and Section 3, "Award and Execution of Contract," of these special provisions, which are determined by the Department to be certified DBEs, shall perform the work and supply the materials for which they are listed, unless the Contractor has received prior written authorization to perform the work with other forces or to obtain the materials from other sources.

Authorization to use other forces or sources of materials may be requested for the following reasons:

A. The listed DBE, after having had a reasonable opportunity to do so, fails or refuses to execute a written contract, when such written contract, based upon the general terms, conditions, plans and specifications for the project, or on the terms of such subcontractor's or supplier's written bid, is presented by the Contractor.
B. The listed DBE becomes bankrupt or insolvent.
C. The listed DBE fails or refuses to perform the subcontract or furnish the listed materials.
D. The Contractor stipulated that a bond was a condition of executing a subcontract and the listed DBE subcontractor fails or refuses to meet the bond requirements of the Contractor.
E. The work performed by the listed subcontractor is substantially unsatisfactory and is not in substantial conformance with the plans and specifications, or the subcontractor is substantially delaying or disrupting the progress of the work.
F. It would be in the best interest of the State.

The Contractor shall not be entitled to any payment for such work or material unless it is performed or supplied by the listed DBE or by other forces (including those of the Contractor) pursuant to prior written authorization of the Engineer.

**5-1.09 SUBCONTRACTING**

Attention is directed to the provisions in Section 8-1.01, "Subcontracting," of the Standard Specifications, and Section 2, "Proposal Requirements and Conditions," and Section 3, "Award and Execution of Contract," of these special provisions.

Pursuant to the provisions of Section 1777.1 of the Labor Code, the Labor Commissioner publishes and distributes a list of contractors ineligible to perform work as a subcontractor on a public works project. This list of debarred contractors is available from the Department of Industrial Relations web site at:

http://www.dir.ca.gov/DLSE/Debar.html.

The provisions in the third paragraph of Section 8-1.01, "Subcontracting," of the Standard Specifications, that the Contractor shall perform with the Contractor's own organization contract work amounting to not less than 50 percent of the original contract price, is not changed by the Federal Aid requirement specified under "Required Contract Provisions Federal-Aid Construction Contracts" in Section 14 of these special provisions that the Contractor perform not less than 30 percent of the original contract work with the Contractor's own organization.

Each subcontract and any lower tier subcontract that may in turn be made shall include the "Required Contract Provisions Federal-Aid Construction Contracts" in Section 14 of these special provisions. This requirement shall be enforced as follows:

A. Noncompliance shall be corrected. Payment for subcontracted work involved will be withheld from progress payments due, or to become due, until correction is made. Failure to comply may result in termination of the contract.

In conformance with the Federal DBE regulations Sections 26.53(f)(1) and 26.53(f)(2) Part 26, Title 49 CFR:

A. The Contractor shall not terminate for convenience a DBE subcontractor listed in response to Section 2-1.02B, "Submission of DBE Information," and then perform that work with its own forces, or those of an affiliate without the written consent of the Department, and
B. If a DBE subcontractor is terminated or fails to complete its work for any reason, the Contractor will be required to make good faith efforts to substitute another DBE subcontractor for the original DBE subcontractor, to the extent needed to meet the contract goal.

The requirement in Section 2-1.02, "Disadvantaged Business Enterprise (DBE)," of these special provisions that DBEs must be certified on the date bids are opened does not apply to DBE substitutions after award of the contract.

**5-1.10 PROMPT PROGRESS PAYMENT TO SUBCONTRACTORS**

Attention is directed to the provisions in Sections 10262 and 10262.5 of the Public Contract Code and Section 7108.5 of the Business and Professions Code concerning prompt payment to subcontractors.

**5-1.102 PROMPT PAYMENT OF WITHHELD FUNDS TO SUBCONTRACTORS**

The Contractor shall return all moneys withheld in retention from the subcontractor within 30 days after receiving payment for work satisfactorily completed, even if the other contract work is not completed and has not been accepted in conformance with Section 7-1.17, "Acceptance of Contract," of the Standard Specifications. This requirement shall not be construed to limit or impair any contractual, administrative, or judicial remedies otherwise available to the Contractor or subcontractor in the event of a dispute involving late payment or nonpayment by the Contractor or deficient subcontract performance or noncompliance by a subcontractor.

**5-1.103 RECORDS**

The Contractor shall maintain cost accounting records for the contract pertaining to, and in such a manner as to provide a clear distinction between, the following six categories of costs of work during the life of the contract:

A. Direct costs of contract item work.
B. Direct costs of changes in character in conformance with Section 4-1.03C, "Changes in Character of Work," of the Standard Specifications.
C. Direct costs of extra work in conformance with Section 4-1.03D, "Extra Work," of the Standard Specifications.
D. Direct costs of work not required by the contract and performed for others.
E. Direct costs of work performed under a notice of potential claim in conformance with the provisions in Section 9-1.04, "Notice of Potential Claim," of the Standard Specifications.
F. Indirect costs of overhead.

Cost accounting records shall include the information specified for daily extra work reports in Section 9-1.03C, "Records," of the Standard Specifications. The requirements for furnishing the Engineer completed daily extra work reports shall only apply to work paid for on a force account basis.

The cost accounting records for the contract shall be maintained separately from other contracts, during the life of the contract, and for a period of not less than 3 years after the date of acceptance of the contract. If the Contractor intends to file claims against the Department, the Contractor shall keep the cost accounting records specified above until complete resolution of all claims has been reached.

**5-1.11 PARTNERING**

The State will promote the formation of a "Partnering" relationship with the Contractor in order to effectively complete the contract to the benefit of both parties. The purpose of this relationship is to maintain a cooperative communication and to mutually resolve conflicts at the lowest responsible management level.

The Contractor may request the formation of a "Partnering" relationship by submitting a request in writing to the Engineer after approval of the contract. If the Contractor's request for "Partnering" is approved by the Engineer, scheduling of a "Partnering Workshop," selecting the "Partnering" facilitator and workshop site, and other administrative details shall be as agreed to by both parties. If agreed to by the parties, additional "Partnering Workshops" will be conducted as needed throughout the life of the contract.

A one-day "Training in Partnering Concepts" session will be conducted regardless of whether the Contractor requests the formation of a "Partnering" relationship. The "Training in Partnering Concepts" session will be conducted locally for the Contractor's and the Engineer's project representatives. The Contractor shall be represented by a minimum of 2 representatives, one being the Contractor's authorized representative pursuant to Section 5-1.06, "Superintendence," of the Standard Specifications. Scheduling of the "Training in Partnering Concepts" session and selection of the trainer and training site shall be determined cooperatively by the Contractor and the Engineer. If, upon the Contractor's request, "Partnering" is approved by the Engineer, the "Training in Partnering Concepts" session shall be conducted prior to the initial "Partnering Workshop."

The costs involved in providing the "Training in Partnering Concepts" trainer and training site will be borne entirely by the State. The costs will be determined in conformance with the provisions in Section 9-1.03B, "Work Performed by Special Forces or Other Special Services," of the Standard Specifications, and paying to the Contractor the sum of that cost, except no markups will be allowed.

The costs involved in providing the "Partnering Workshop" facilitator and workshop site will be borne equally by the State and the Contractor. The division of cost will be made by determining the cost in providing the "Partnering Workshop" facilitator and workshop site in conformance with the provisions in Section 9-1.03B, "Work Performed by Special Forces or Other Special Services," of the Standard Specifications, and paying to the Contractor one-half of that cost, except no markups will be allowed.

All other costs associated with "Training in Partnering Concepts" and "Partnering Workshops" will be borne separately by the party incurring the costs, such as wages and travel expenses, and no additional compensation will be allowed therefor.

The establishment of a "Partnering" relationship will not change or modify the terms and conditions of the contract and will not relieve either party of the legal requirements of the contract.

**5-1.114 VALUE ANALYSIS**

The Contractor may submit to the Engineer, in writing, a request for a "Value Analysis" workshop. The purpose for having a workshop is to identify value enhancing opportunities and to consider modifications to the plans and specifications that will reduce either the total cost, time of construction or traffic congestion, without impairing, in any manner, the essential functions or characteristics of the project including, but not limited to, service life, economy of operation, ease of maintenance, benefits to the travelling public, desired appearance, or design and safety standards.

To maximize the potential benefits of a workshop, the request should be submitted to the Engineer early in the project after approval of the contract. If the Contractor's request for a "Value Analysis" workshop is approved by the Engineer, scheduling of a workshop, selecting the facilitator and workshop site, and other administrative details shall be determined cooperatively by the Contractor and the Engineer.

The workshop shall be conducted in conformance with the methodology described in the Department's "Value Analysis Team Guide" available at the Department's web site at:

http://www.dot.ca.gov/hq/oppd/value/

The facilitator shall be a Certified Value Specialist (CVS) as recognized by the Society of American Value Engineers (SAVE) International, which may be contacted as follows:

SAVE International, 60 Revere Drive, Northbrook, IL 60062
Telephone 1-847-480-1730, FAX 1-847-480-9282

The Contractor may submit recommendations resulting from a "Value Analysis" workshop for approval by the Engineer as cost reduction incentive proposals in conformance with the provisions in Section 5-1.14, "Cost Reduction Incentive," of the Standard Specifications.

The costs involved in providing the "Value Analysis" facilitator and workshop site will be borne equally by the State and the Contractor. The division of cost will be made by determining the cost in providing the "Value Analysis" facilitator and workshop site in conformance with the provisions in Section 9-1.03B, "Work Performed by Special Forces or Other Special Services," of the Standard Specifications, and paying to the Contractor one-half of that cost, except no markups will be allowed.

All other costs associated with the "Value Analysis" workshop will be borne separately by the party incurring the costs, such as wages and travel expenses, and no additional compensation will be allowed therefor.

## 5-1.12 DISPUTE REVIEW BOARD

### GENERAL

To assist in the resolution of disputes or potential claims arising out of the work of this project, a Dispute Review Board, hereinafter referred to as the "DRB," shall be established by the Engineer and Contractor cooperatively upon approval of the contract. The DRB is intended to assist the contract administrative claims resolution process as specified in the provisions in Section 9-1.04, "Notice of Potential Claim," and Section 9-1.07B, "Final Payment and Claims," of the Standard Specifications and these special provisions. The DRB shall not serve as a substitute for provisions in the specifications in regard to filing potential claims. The requirements and procedures established in this section shall be a prerequisite to filing a claim, filing for arbitration, or filing for litigation prior or subsequent to project completion.

The DRB shall be utilized when dispute or potential claim resolution at the project level is unsuccessful. The DRB shall function as specified herein until the day of acceptance of the contract, at which time the work of the DRB will cease except for completion of unfinished reports. No DRB dispute meetings shall take place later than 30 days prior to acceptance of contract. After acceptance of contract, disputes or potential claims which have followed the dispute resolution processes of the Standard Specifications and these special provisions, but have not been resolved, shall be stated or restated by the Contractor, in response to the Proposed Final Estimate within the time limits provided in Section 9-1.07B, "Final Payment and Claims," of the Standard Specifications. The State will review those claims in conformance with the provisions in Section 9-1.07B of the Standard Specifications. Following the adherence to and completion of the contractual administrative claims procedure, the Contractor may file for arbitration in conformance with the provisions in Section 9-1.10, "Arbitration," of the Standard Specifications and these special provisions.

Disputes, as used in this section, shall include differences of opinion, properly noticed as provided hereinafter, between the State and Contractor on matters related to the work and other subjects considered by the State or Contractor, or by both, to be of concern to the DRB on this project, except matters relating to Contractor, subcontractor or supplier potential claims not actionable against the Department as specified in these special provisions or quantification of disputes for overhead type expenses or costs. Disputes for overhead type expenses or costs shall conform to the requirements of Section 9-1.07B, "Final Payment and Claims," of the Standard Specifications. Whenever the term "dispute" or "disputes" is used herein, it shall be deemed to include potential claims as well as disputes.

The DRB shall serve as an advisory body to assist in the resolution of disputes between the State and the Contractor, hereinafter referred to as the "parties." The DRB shall consider disputes referred to it, and furnish written reports containing findings and recommendations pertaining to those disputes, to the parties to aid in resolution of the differences between them. DRB findings and recommendations are not binding on the parties.

### SELECTION PROCESS, DISCLOSURE AND APPOINTMENTS

The DRB shall consist of one member selected by the State and approved by the Contractor, one member selected by the Contractor and approved by the State, and a third member selected by the first 2 members and approved by both the State and the Contractor. The third member shall act as the DRB Chairperson.

DRB members shall be especially knowledgeable in the type of construction and contract documents potentially anticipated by the contract. DRB members shall discharge their responsibilities impartially as an independent body, considering the facts and circumstances related to the matters under consideration, pertinent provisions of the contract and applicable laws and regulations.

The State and the Contractor shall nominate and approve DRB members in conformance with the terms and conditions of the Dispute Review Board Agreement and these special provisions, within 45 days of the approval of the contract. Each party shall provide written notification to the other of the name of their selected DRB nominee along with the prospective member's complete written disclosure statement.

Disclosure statements shall include a resume of the prospective member's experience and a declaration statement describing past, present, anticipated, and planned relationships, including indirect relationships through the prospective member's primary or full-time employer, to this project and with the parties involved in this construction contract, including but not limited to, relevant subcontractors or suppliers to the parties, parties' principals, or parties' counsel. DRB members shall also include a full disclosure of close professional or personal relationships with all key members of the contract. Objections to nominees must be based on a specific breech or violation of nominee responsibilities or on nominee qualifications under these provisions unless otherwise specified. The Contractor or the State may, on a one-time basis, object to the other's nominee without specifying a reason and this person will not be selected for the DRB. Another person shall then be nominated within 15 days.

The first duty of the State and Contractor selected members of the DRB shall be to select and recommend a prospective third DRB member to the parties for final selection and approval. The first 2 DRB members shall proceed with the selection of the third DRB member immediately upon receiving written notification from the State of their selection, and shall provide their recommendation simultaneously to the parties within 15 days of the notification.

The first 2 DRB members shall select a third DRB member subject to mutual approval of the parties or may mutually concur on a list of potentially acceptable third DRB members and submit the list to the parties for final selection and approval of the third member. The goal in the selection of the third member is to complement the professional experience of the first 2 members and to provide leadership for the DRB's activities.

The third prospective DRB member shall supply a full disclosure statement to the first 2 DRB members and to the parties prior to appointment.

An impasse shall be considered to have been reached if the parties are unable to approve a third member within 15 days of receipt of the recommendation of the first 2 DRB members, or if the first 2 DRB members are unable to agree upon a recommendation within their 15 day time limit. In the event of an impasse in selection of third DRB member the State and the Contractor shall each propose 3 candidates for the third DRB member position. The parties shall select the candidates proposed under this paragraph from the current list of arbitrators certified by the Public Works Contract Arbitration Committee created by Article 7.2 (commencing with Section 10245) of the State Contract Act. The first 2 DRB members shall then select one of the 6 proposed candidates in a blind draw.

No DRB member shall have prior direct involvement in this contract. No member shall have a financial interest in this contract or the parties thereto, within a period of 6 months prior to award of this contract or during the contract, except as follows:

A. Compensation for services on this DRB.
B. Ownership interest in a party or parties, documented by the prospective DRB member, that has been reviewed and determined in writing by the State to be sufficiently insignificant to render the prospective member acceptable to the State.
C. Service as a member of other Dispute Review Boards on other contracts.
D. Retirement payments or pensions received from a party that are not tied to, dependent on or affected by the net worth of the party.
E. The above provisions apply to parties having a financial interest in this contract, including but not limited to contractors, subcontractors, suppliers, consultants, and legal and business services.

The Contractor or the State may reject any of the three DRB members who fail to fully comply at all times with all required employment and financial disclosure conditions of DRB membership as described in the Dispute Review Board Agreement and as specified herein. A copy of the Dispute Review Board Agreement is included in this section.

The Contractor, the State, and the 3 members of the DRB shall complete and adhere to the Dispute Review Board Agreement in administration of this DRB within 15 days of the parties' concurrence in the selection of the third member. No DRB meeting shall take place until the Dispute Review Board Agreement has been signed by all parties. The State authorizes the Engineer to execute and administer the terms of the Agreement. The person(s) designated by the Contractor as authorized to execute contract change orders shall be authorized to execute and administer the terms of this agreement, or to delegate the authority in writing. The operation of the DRB shall be in conformance with the terms of the Dispute Review Board Agreement.

**COMPENSATION**

The State and the Contractor shall bear the costs and expenses of the DRB equally. Each DRB member shall be compensated at an agreed rate of $1,200 per day if time spent per meeting, including on-site time plus one hour of travel time, is greater than 4 hours. Each DRB member shall be compensated at an agreed rate of $700 per day if time spent per meeting, including on-site time plus one hour of travel time, is less than or equal to 4 hours. The agreed rates shall be considered full compensation for on-site time, travel expenses, transportation, lodging, time for travel and incidentals for each day, or portion thereof, that the DRB member is at an authorized DRB meeting. No additional compensation will be made for time spent by DRB members in review and research activities outside the official DRB meetings unless that time, (such as time spent evaluating and preparing recommendations on specific issues presented to the DRB), has been specifically agreed to in advance by the State and Contractor. Time away from the project, which has been specifically agreed to in advance by the parties, will be compensated at an agreed rate of $125 per hour. The agreed amount of $125 per hour shall include all incidentals including expenses for telephone, fax, and computer services. Members serving on more than one DRB involving the Department, regardless of the number of meetings per day, shall not be paid more than the all inclusive rate per day or rate per hour for an individual project. The State will provide, at no cost to the Contractor, administrative services such as conference facilities and secretarial services to the DRB. These special provisions and the Dispute Review Board Agreement state the provisions for compensation and expenses of the DRB. DRB members shall be compensated at the same daily and hourly rate. The Contractor shall make direct payments to each DRB member for their participation in authorized meetings and approved hourly rate charges from invoices submitted by each DRB member. The State will reimburse the Contractor for the State's share of the costs. There will be no markups applied to expenses

connected with the DRB, either by the DRB members or by the Contractor when requesting payment of the State's share of DRB expenses. Regardless of the DRB recommendation, neither party shall be entitled to reimbursement of DRB costs from the other party.

**REPLACEMENT OF DRB MEMBERS**

Service of a DRB member may be terminated at any time with not less than 15 days notice as follows:

A. The State may terminate service of the State appointed member.
B. The Contractor may terminate service of the Contractor appointed member.
C. Upon the written recommendation of the State and Contractor appointed members for the removal of the third member.
D. Upon resignation of a member.
E. The State or Contractor may terminate the service of any member who fails to fully comply with all required employment and financial disclosure conditions of DRB membership

When a member of the DRB is replaced, the replacement member shall be appointed in the same manner as the replaced member was appointed. The appointment of a replacement DRB member will begin promptly upon determination of the need for replacement and shall be completed within 15 days. Changes in either of the DRB members chosen by the two parties will not require re-selection of the third member, unless both parties agree to such re-selection in writing. The Dispute Review Board Agreement shall be amended to reflect the change of a DRB member.

**OPERATION**

The following procedure shall be used for dispute resolution:

A. If the Contractor objects to any decision, act or order of the Engineer, the Contractor shall give written notice of potential claim in conformance with the provisions in Section 9-1.04, "Notice of Potential Claim," of the Standard Specifications and these special provisions, including the provision of applicable cost documentation; or file written protests or notices in conformance with the provisions in the Standard Specifications and these special provisions.
B. The Engineer will respond, in writing, to the Contractor's written supplemental notice of potential claim within 20 days of receipt of the notice.
C. Within 15 days after receipt of the Engineer's written response, the Contractor shall, if the Contractor still objects, file a written reply with the Engineer, stating clearly and in detail the basis of the objection.
D. Following an objection to the Engineer's written response, the Contractor shall refer the dispute to the DRB if the Contractor wishes to further pursue the objection to the Engineer's decision. The Contractor shall make the referral in writing to the DRB, simultaneously copied to the State, within 21 days after receipt of the written response from the Engineer. The written dispute referral shall describe the disputed matter in individual discrete segments so that it will be clear to both parties and the DRB what discrete elements of the dispute have been resolved, and which remain unresolved, and shall include an estimate of the cost of the affected work and impacts, if any, on project completion.
E. By failing to submit the written notice of referral to the DRB, within 21 days after receipt of the Engineer's written response to the supplemental notice of potential claim, the Contractor waives future claims and arbitration on the matter in contention.
F. The Contractor and the State shall each be afforded an opportunity to be present and to be heard by the DRB, and to offer evidence. Either party furnishing written evidence or documentation to the DRB must furnish copies of such information to the other party a minimum of 15 days prior to the date the DRB is scheduled to convene the meeting for the dispute. Either party shall produce such additional evidence as the DRB may deem necessary to reach an understanding and a determination of the dispute. The party furnishing additional evidence shall furnish copies of such additional evidence to the other party at the same time the evidence is provided to the DRB. The DRB shall not consider evidence not furnished in conformance with the terms specified herein.
G. Upon receipt by the DRB of a written referral of a dispute, the DRB shall convene to review and consider the dispute. The dispute meeting shall be held no earlier than 30 days and no later than 60 days after receipt of the written referral unless otherwise agreed to by all parties. The DRB shall determine the time and location of the DRB dispute meeting, with due consideration for the needs and preferences of the parties while recognizing the paramount importance of a timely hearing of the dispute.
H. There shall be no participation of either party's attorneys at DRB dispute meetings.

I. There shall be no participation of persons who are not directly involved in the contract or who do not have direct knowledge of the dispute, including but not limited to consultants, except for expert testimony allowed at the discretion of the DRB and with approval prior to the dispute meeting by both parties.
J. The DRB shall furnish a report, containing findings and recommendations as described in the Dispute Review Board Agreement, in writing to both the State and the Contractor. The DRB may request clarifying information of either party within 10 days after the DRB dispute meeting. Requested information shall be submitted to the DRB within 10 days of the DRB request. The DRB shall complete its report, including minority opinion, if any, and submit it to the parties within 30 days of the DRB dispute meeting, except that time extensions may be granted at the request of the DRB with the written concurrence of both parties. The report shall include the facts and circumstances related to the matters under consideration, pertinent provisions of the contract, applicable laws and regulations, and actual costs and time incurred as shown on the Contractor's cost accounting records. The DRB shall make recommendations on the merit of the dispute and, if appropriate, recommend guidelines for determining compensation.
K. Within 30 days after receiving the DRB's report, both the State and the Contractor shall respond to the DRB in writing signifying that the dispute is either resolved or remains unresolved. Failure to provide the written response within the time specified, or a written rejection of the DRB's recommendation or response to a request for reconsideration presented in the report by either party, shall conclusively indicate that the party(s) failing to respond accepts the DRB recommendation. Immediately after responses have been received from both parties, the DRB shall provide copies of both responses to the parties simultaneously. Either party may request clarification of elements of the DRB's report from the DRB prior to responding to the report. The DRB shall consider any clarification request only if submitted within 10 days of receipt of the DRB's report, and if submitted simultaneously in writing to both the DRB and the other party. Each party may submit only one request for clarification for any individual DRB report. The DRB shall respond, in writing, to requests for clarification within 10 days of receipt of such requests.
L. The DRB's recommendations, stated in the DRB's reports, are not binding on either party. Either party may seek a reconsideration of a recommendation of the DRB. The DRB shall only grant a reconsideration based upon submission of new evidence and if the request is submitted within the 30-day time limit specified for response to the DRB's written report. Each party may submit only one request for reconsideration regarding an individual DRB recommendation.
M. If the State and the Contractor are able to resolve their dispute with the aid of the DRB's report, the State and Contractor shall promptly accept and implement the recommendations of the DRB. If the parties cannot agree on compensation within 60 days of the acceptance by both parties of the DRB's recommendation, either party may request the DRB to make a recommendation regarding compensation.
N. The State or the Contractor shall not call DRB members who served on the DRB for this contract as witnesses in arbitration proceedings which may arise from this contract, and all documents created by the DRB shall be inadmissible as evidence in subsequent arbitration proceedings, except the DRB's final written reports on each issue brought before it.
O. The State and Contractor shall jointly indemnify and hold harmless the DRB members from and against all claims, damages, losses, and expenses, including but not limited to attorney's fees, arising out of and resulting from the findings and recommendations of the DRB.
P. The DRB members shall have no claim against the State or the Contractor, or both, from claimed harm arising out of the parties' evaluations of the DRB's report.

**DISPUTES INVOLVING SUBCONTRACTOR POTENTIAL CLAIMS**

For purposes of this section, a "subcontractor potential claim" shall include any potential claim by a subcontractor (including also any pass through potential claims by a lower tier subcontractor or supplier) against the Contractor that is actionable by the Contractor against the Department which arises from the work, services, or materials provided or to be provided in connection with the contract. If the Contractor determines to pursue a dispute against the Department that includes a subcontractor potential claim, the dispute shall be processed and resolved in conformance with these special provisions and in conformance with the following:

A. The Contractor shall identify clearly in submissions pursuant to this section, that portion of the dispute that involves a subcontractor potential claim or potential claims.
B. The Contractor shall include, as part of its submission pursuant to Step D above, a certification (False Claims Act Certification) by the subcontractor's or supplier's officer, partner, or authorized representative with authority to bind the subcontractor and with direct knowledge of the facts underlying the subcontractor potential claim. The

Contractor shall submit a certification that the subcontractor potential claim is acknowledged and forwarded by the Contractor. The form for these certifications is available from the Engineer.

C. At DRB dispute meetings involving one or more subcontractor potential claims, the Contractor shall require that each subcontractor involved in the dispute have present an authorized representative with actual knowledge of the facts underlying the subcontractor potential claim to assist in presenting the subcontractor potential claim and to answer questions raised by the DRB members or the Department's representatives.

D. Failure by the Contractor to declare a subcontractor potential claim on behalf of its subcontractor (including lower tier subcontractors' and suppliers' pass through potential claims) at the time of submission of the Contractor's potential claims, as provided hereunder, shall constitute a release of the State by the Contractor of such subcontractor potential claim.

E. The Contractor shall include in all subcontracts under this contract that subcontractors and suppliers of any tier (a) agree to submit subcontractor potential claims to the Contractor in a proper form and in sufficient time to allow processing by the Contractor in conformance with the Dispute Review Board resolution specifications; (b) agree to be bound by the terms of the Dispute Review Board provisions to the extent applicable to subcontractor potential claims; (c) agree that, to the extent a subcontractor potential claim is involved, completion of all steps required under these Dispute Review Board special provisions shall be a condition precedent to pursuit by the subcontractor of other remedies permitted by law, including without limitation of a lawsuit against the Contractor; and (d) agree that the existence of a dispute resolution process for disputes involving subcontractor potential claims shall not be deemed to create any claim, right, or cause of action by any subcontractor or supplier against the Department.

Notwithstanding the foregoing, this Dispute Review Board special provision shall not apply to, and the DRB shall not have the authority to consider, subcontractor potential claims between the subcontractor(s) or supplier(s) and the Contractor that are not actionable by the Contractor against the Department.

**RETENTION**

Failure of the Contractor to nominate and approve DRB members in conformance with the terms and conditions of the Dispute Review Board Agreement and these special provisions shall result in the retention of 25 percent of the estimated value of all work performed during each estimate period in which the Contractor fails to comply with the requirements of this section as determined by the Engineer. DRB retentions will be released for payment on the next monthly estimate for partial payment following the date that the Contractor has nominated and approved DRB members and no interest will be due the Contractor.

**DISPUTE REVIEW BOARD AGREEMENT**

A copy of the "Dispute Review Board Agreement" to be executed by the Contractor, State and the 3 DRB members after approval of the contract follows:

Form 6202 Rev (09/01/02)

**DISPUTE REVIEW BOARD AGREEMENT**

_____
(Contract Identification)

Contract No. _____

**THIS DISPUTE REVIEW BOARD AGREEMENT, hereinafter called "AGREEMENT"**, made and entered into this _____ day of _____, _____, between the State of California, acting through the California Department of Transportation and the Director of Transportation, hereinafter called the "STATE," _____ _____ hereinafter called the "CONTRACTOR," and the Dispute Review Board, hereinafter called the "DRB" consisting of the following members:

_____ ,
(Contractor Appointee)

_____ ,
(State Appointee)

and _____
(Third Person)

WITNESSETH, that

WHEREAS, the STATE and the CONTRACTOR, hereinafter called the "parties," are now engaged in the construction on the State Highway project referenced above; and

WHEREAS, the special provisions for the above referenced contract provides for the establishment and operation of the DRB to assist in resolving disputes; and

WHEREAS, the DRB is composed of three members, one selected by the STATE, one selected by the CONTRACTOR, and the third member selected by the other two members and approved by the parties;

NOW THEREFORE, in consideration of the terms, conditions, covenants, and performance contained herein, or attached and incorporated and made a part hereof, the STATE, the CONTRACTOR, and the DRB members hereto agree as follows:

**SECTION I DESCRIPTION OF WORK**

To assist in the resolution of disputes between the parties, the contract provides for the establishment and the operation of the DRB. The intent of the DRB is to fairly and impartially consider disputes placed before it and provide written recommendations for resolution of these disputes to both parties. The members of this DRB shall perform the services necessary to participate in the DRB's actions as designated in Section II, Scope of Work.

**SECTION II SCOPE OF WORK**

The scope of work of the DRB includes, but is not limited to, the following:

**A. OBJECTIVE**

The principal objective of the DRB is to assist in the timely resolution of disputes between the parties arising from performance of this contract. It is not intended for either party to default on their normal responsibility to amicably and fairly settle their differences by indiscriminately assigning them to the DRB. It is intended that the mere existence of the DRB will encourage the parties to resolve disputes without resorting to this review procedure. But when a dispute that is serious enough to warrant the DRB's review does develop, the process for prompt and efficient action will be in place.

**B. PROCEDURES**

The DRB shall render written reports on disputes between the parties arising from the construction contract. Prior to consideration of a dispute, the DRB shall establish rules and regulations that will govern the conduct of its business and reporting procedures in conformance with the requirements of the contract and the terms of this AGREEMENT. DRB recommendations, resulting from its consideration of a dispute, shall be furnished in writing to both parties. The recommendations shall be based on facts and circumstances involved in the dispute, pertinent contract provisions, applicable laws and regulations. The recommendations shall find one responsible party in a dispute; shared or "jury" determinations shall not be rendered. The DRB shall make recommendations on the merit of the dispute, and if appropriate, recommend guidelines for determining compensation. If the parties cannot agree on compensation within 60 days of the acceptance by both parties of the DRB's recommendation, either party may request the DRB to make a recommendation regarding compensation.

The DRB shall refrain from officially giving advice or consulting services to anyone involved in the contract. The individual members shall act in a completely independent manner and while serving as members of the DRB shall have no consulting business connections with either party or its principals or attorneys or other affiliates (subcontractors, suppliers, etc.) who have a beneficial interest in the contract.

During scheduled meetings of the DRB as well as during dispute meetings, DRB members shall refrain from expressing opinions on the merits of statements on matters under dispute or potential dispute. Opinions of DRB members expressed in private sessions shall be kept strictly confidential. Individual DRB members shall not meet with, or discuss contract issues with individual parties, except as directed by the DRB Chairperson. Such discussions or meetings shall be disclosed to both parties. Other discussions regarding the project between the DRB members and the parties shall be in the presence of all three members and both parties. Individual DRB members shall not undertake independent investigations of any kind pertaining to disputes or potential disputes, except with the knowledge of both parties and as expressly directed by the DRB Chairperson.

**C. CONSTRUCTION SITE VISITS, PROGRESS MEETINGS AND FIELD INSPECTIONS**

The DRB members shall visit the project site and meet with representatives of the parties to keep abreast of construction activities and to develop familiarity with the work in progress. Scheduled progress meetings shall be held at or near the project site. The DRB shall meet at least once at the start of the project, and at least once every 4 months thereafter. The frequency, exact time, and duration of additional site visits and progress meetings shall be as recommended by the DRB and approved by the parties consistent with the construction activities or matters under consideration and dispute. Each meeting shall consist of a round table discussion and a field inspection of the work being performed on the contract, if necessary. Each meeting shall be attended by representatives of both parties. The agenda shall generally be as follows:

1. Meeting opened by the DRB Chairperson.
2. Remarks by the STATE's representative.
3. A description by the CONTRACTOR's representative of work accomplished since the last meeting; the current schedule status of the work; and a forecast for the coming period.
4. An outline by the CONTRACTOR's representative of potential problems and a description of proposed solutions.
5. An outline by the STATE's representative of the status of the work as the STATE views it.
6. A brief description by the CONTRACTOR's or STATE's representative of potential claims or disputes which have surfaced since the last meeting.
7. A summary by the STATE's representative, the CONTRACTOR's representative, or the DRB of the status of past disputes and potential claims.

The STATE's representative will prepare minutes of all progress meetings and circulate them for revision and approval by all concerned within 10 days of the meeting.

The field inspection shall cover all active segments of the work, the DRB being accompanied by both parties' representatives. The field inspection may be waived upon mutual agreement of the parties.

**D. DRB CONSIDERATION AND HANDLING OF DISPUTES**

Upon receipt by the DRB of a written referral of a dispute, the DRB shall convene to review and consider the dispute. The dispute meeting shall be held no earlier than 30 days and no later than 60 days after receipt of the written referral, unless otherwise agreed to by all parties. The DRB shall determine the time and location of DRB dispute meetings, with due consideration for the needs and preferences of the parties while recognizing the paramount importance of speedy resolution of issues. No dispute meetings shall take place later than 30 days prior to acceptance of contract.

Normally, dispute meetings shall be conducted at or near the project site. However, any location that would be more convenient and still provide required facilities and access to necessary documentation shall be satisfactory.

Both parties shall be given the opportunity to present their evidence at these dispute meetings. It is expressly understood that the DRB members are to act impartially and independently in the consideration of the contract provisions, applicable laws and regulations, and the facts and conditions surrounding any dispute presented by either party, and that the recommendations concerning any such dispute are advisory and nonbinding on the parties.

The DRB may request that written documentation and arguments from both parties be sent to each DRB member, through the DRB Chairperson, for review before the dispute meeting begins. A party furnishing written documentation to the DRB shall furnish copies of such information to the other party at the same time that such information is supplied to the DRB.

DRB dispute meetings shall be informal. There shall be no testimony under oath or cross-examination. There shall be no reporting of the procedures by a shorthand reporter or by electronic means. Documents and verbal statements shall be received by the DRB in conformance with acceptance standards established by the DRB. These standards need not comply with prescribed legal laws of evidence.

The third DRB member shall act as Chairperson for dispute meetings and all other DRB activities. The parties shall have a representative at all dispute meetings. Failure to attend a duly noticed dispute meeting by either of the parties shall be conclusively considered by the DRB as indication that the non-attending party considers written submittals as their entire and complete argument. The claimant shall discuss the dispute, followed by the other party. Each party shall then be allowed one or more rebuttals until all aspects of the dispute are thoroughly covered. DRB members shall ask questions, seek clarification, and request further data from either of the parties as may be necessary to assist in making a fully informed recommendation. The DRB may request from either party documents or information that would assist the DRB in making its findings and recommendations including, but not limited to, documents used by the CONTRACTOR in preparing the bid for the project. A refusal by a party to provide information requested by the DRB may be considered by the DRB as an indication that the requested material would tend to disprove that party's position. In large or complex cases, additional dispute meetings may be necessary in order to consider all the evidence presented by both parties. All involved parties shall maintain the confidentiality of all documents and information, as provided in this AGREEMENT.

During dispute meetings, no DRB member shall express an opinion concerning the merit of any facet of the case. DRB deliberations shall be conducted in private, with interim individual views kept strictly confidential.

After dispute meetings are concluded, the DRB shall meet in private and reach a conclusion supported by 2 or more members. Private sessions of the DRB may be held at a location other than the job site or by electronic conferencing as deemed appropriate, in order to expedite the process.

The DRB's findings and recommendations, along with discussion of reasons therefor, shall then be submitted as a written report to both parties. Recommendations shall be based on the pertinent contract provisions, applicable laws and regulations, and facts and circumstances related to the dispute. The report shall be thorough in discussing the facts considered, the contract language, law or regulation viewed by the DRB as pertinent to the issues, and the DRB's interpretation and philosophy in arriving at its conclusions and recommendations. The DRB's report shall stand on its own, without attachments or appendices. The DRB Chairperson shall furnish a copy of the written recommendation report to the DRB Coordinator, Division of Construction, MS 44, P.O. Box 942874, Sacramento, CA 94274.

With prior written approval of both parties, the DRB may obtain technical services necessary to adequately review the disputes presented, including audit, geotechnical, schedule analysis and other services. The parties' technical staff may supply those services as appropriate. The cost of technical services, as agreed to by the parties, shall be borne equally by the 2 parties as specified in an approved contract change order. The CONTRACTOR will not be entitled to markups for the payments made for these services.

The DRB shall resist submittal of incremental portions of information by either party, in the interest of making a fully informed decision and recommendation.

The DRB shall make every effort to reach a unanimous decision. If this proves impossible, the dissenting member shall prepare a minority opinion, which shall be included in the DRB's report.

Although both parties should place weight upon the DRB's recommendations, they are not binding. Either party may appeal a recommendation to the DRB for reconsideration. However, reconsideration shall only be allowed when there is new evidence to present, and the DRB shall accept only one appeal from each party pertaining to an individual DRB recommendation. The DRB shall hear appeals in conformance with the terms described in the Section entitled "Dispute Review Board" in the special provisions.

**E. DRB MEMBER REPLACEMENT**

Should the need arise to appoint a replacement DRB member, the replacement DRB member shall be appointed in the same manner as the original DRB members were appointed. The selection of a replacement DRB member shall begin promptly upon notification of the necessity for a replacement and shall be completed within 15 days. This AGREEMENT shall be amended to indicate change in DRB membership.

**SECTION III CONTRACTOR RESPONSIBILITIES**

The CONTRACTOR shall furnish to each DRB member one copy of pertinent documents that are or may become necessary for the DRB to perform their function. Pertinent documents are written notices of potential claim, responses to those notices, drawings or sketches, calculations, procedures, schedules, estimates, or other documents which are used in the performance of the work or in justifying or substantiating the CONTRACTOR's position. The CONTRACTOR shall also furnish a copy of such pertinent documents to the STATE, in conformance with the terms outlined in the special provisions.

**SECTION IV STATE RESPONSIBILITIES**

The STATE will furnish the following services and items:

**A. CONTRACT RELATED DOCUMENTS**

The STATE will furnish to each DRB member one copy of Notice to Contractors and Special Provisions, Proposal and Contract, Plans, Standard Specifications, and Standard Plans, change orders, written instructions issued by the STATE to the CONTRACTOR, or other documents pertinent to any dispute that has been referred to the DRB and necessary for the DRB to perform its function.

**B. COORDINATION AND SERVICES**

The STATE, through the Engineer, will, in cooperation with the CONTRACTOR, coordinate the operations of the DRB. The Engineer will arrange or provide conference facilities at or near the project site and provide secretarial and copying services to the DRB without charge to the CONTRACTOR.

**SECTION V TIME FOR BEGINNING AND COMPLETION**

Once established, the DRB shall be in operation until the day of acceptance of the contract. The DRB members shall not begin work under the terms of this AGREEMENT until authorized in writing by the STATE.

**SECTION VI PAYMENT**

**A. ALL INCLUSIVE RATE PAYMENT**

The STATE and the CONTRACTOR shall bear the costs and expenses of the DRB equally. Each DRB member shall be compensated at an agreed rate of $1,200 per day if time spent per meeting, including on-site time plus one hour of travel time, is greater than 4 hours. Each DRB member shall be compensated at an agreed rate of $700 per day if time spent per meeting, including on-site time plus one hour of travel time, is less than or equal to 4 hours. The agreed rates shall be considered full compensation for on-site time, travel expenses, transportation, lodging, time for travel and incidentals for each day, or portion thereof, that the DRB member is at an authorized DRB meeting. No additional compensation will be made for time spent by DRB members in review and research activities outside the official DRB meetings unless that time has been specifically agreed to in advance by the STATE and CONTRACTOR. Time away from the project that has been specifically agreed to in advance by the parties will be compensated at an agreed rate of $125 per hour. The agreed amount of $125 per hour shall include all incidentals including expenses for telephone, fax, and computer services. Members serving on more than one DRB involving the State, regardless of the number of meetings per day, shall not be paid more than the all inclusive rate per day or rate per hour for an individual project. The STATE will provide, at no cost to the CONTRACTOR, administrative services such as conference facilities and secretarial services to the DRB.

**B. PAYMENTS**

DRB members shall be compensated at the same rate. The CONTRACTOR shall make direct payments to each DRB member for their participation in authorized meetings and approved hourly rate charges from invoices submitted by each DRB member. The STATE will reimburse the CONTRACTOR for its share of the costs of the DRB.

The DRB members may submit invoices to the CONTRACTOR for partial payment for work performed and services rendered for their participation in authorized meetings not more often than once per month during the progress of the work. The invoices shall be in a format approved by the parties and accompanied by a general description of activities performed during that billing period. Payment for hourly fees, at the agreed rate, shall not be paid to a DRB member until the amount and extent of those fees are approved by the STATE and CONTRACTOR.

Invoices shall be accompanied by original supporting documents, which the CONTRACTOR shall include with the extra work billing when submitting for reimbursement of the STATE's share of cost from the STATE. The CONTRACTOR will be reimbursed for one-half of approved costs of the DRB. No markups will be added to the CONTRACTOR's payment.

**C. INSPECTION OF COSTS RECORDS**

The DRB members and the CONTRACTOR shall keep available for inspection by representatives of the STATE and the United States, for a period of 3 years after final payment, the cost records and accounts pertaining to this AGREEMENT. If any litigation, claim, or audit arising out of, in connection with, or related to this contract is initiated before the expiration of the 3-year period, the cost records and accounts shall be retained until such litigation, claim, or audit involving the records is completed.

**SECTION VII ASSIGNMENT OF TASKS OF WORK**

The DRB members shall not assign the work of this AGREEMENT.

**SECTION VIII TERMINATION OF DRB MEMBERS**

DRB members may resign from the DRB by providing not less than 15 days written notice of the resignation to the STATE and CONTRACTOR. DRB members may be terminated by their original appointing power or by either party, for failing to fully comply at all times with all required employment and financial disclosure conditions of DRB membership in conformance with the terms of the contract.

**SECTION IX LEGAL RELATIONS**

The parties hereto mutually understand and agree that the DRB member in the performance of duties on the DRB, is acting in the capacity of an independent agent and not as an employee of either party.

No party to this AGREEMENT shall bear a greater responsibility for damages or personal injury than is normally provided by Federal or State of California Law.

Notwithstanding the provisions of this contract that require the CONTRACTOR to indemnify and hold harmless the STATE, the parties shall jointly indemnify and hold harmless the DRB members from and against all claims, damages, losses, and expenses, including but not limited to attorney's fees, arising out of and resulting from the findings and recommendations of the DRB.

**SECTION X CONFIDENTIALITY**

The parties hereto mutually understand and agree that all documents and records provided by the parties in reference to issues brought before the DRB, which documents and records are marked "Confidential - for use by the DRB only," shall be kept in confidence and used only for the purpose of resolution of subject disputes, and for assisting in development of DRB findings and recommendations; that such documents and records will not be utilized or revealed to others, except to officials of the parties who are authorized to act on the subject disputes, for any purposes, during the life of the DRB. Upon termination of this AGREEMENT, said confidential documents and records, and all copies thereof, shall be returned to the parties who furnished them to the DRB. However, the parties understand that such documents shall be subsequently discoverable and admissible in court or arbitration proceedings unless a protective order has been obtained by the party seeking further confidentiality.

**SECTION XI DISPUTES**

Disputes between the parties hereto, including disputes between the DRB members and either party or both parties, arising out of the work or other terms of this AGREEMENT, which cannot be resolved by negotiation and mutual concurrence between the parties, or through the administrative process provided in the contract, shall be resolved by arbitration as provided in Section 9-1.10, "Arbitration," of the Standard Specifications.

**SECTION XII VENUE, APPLICABLE LAW, AND PERSONAL JURISDICTION**

In the event that any party, including an individual member of the DRB, deems it necessary to institute arbitration proceedings to enforce any right or obligation under this AGREEMENT, the parties hereto agree that such action shall be initiated in the Office of Administrative Hearings of the State of California. The parties hereto agree that all questions shall be resolved by arbitration by application of California law and that the parties to such arbitration shall have the right of appeal from such decisions to the Superior Court in conformance with the laws of the State of California. Venue for the arbitration shall be Sacramento or any other location as agreed to by the parties.

**SECTION XIII FEDERAL REVIEW AND REQUIREMENTS**

On Federal-Aid contracts, the Federal Highway Administration shall have the right to review the work of the DRB in progress, except for private meetings or deliberations of the DRB.

Other Federal requirements in this agreement shall only apply to Federal-Aid contracts.

**SECTION XIV CERTIFICATION OF THE CONTRACTOR, THE DRB MEMBERS, AND THE STATE**

IN WITNESS WHEREOF, the parties hereto have executed this AGREEMENT as of the day and year first above written.

DRB MEMBER

By: _____

Title: _____

DRB MEMBER

By: _____

Title : _____

DRB MEMBER

By : _____

Title : _____

CONTRACTOR

By: _____

Title: _____

CALIFORNIA STATE DEPARTMENT OF TRANSPORTATION

By: _____

Title: _____

**5-1.13 FORCE ACCOUNT PAYMENT**

The second, third and fourth paragraphs of Section 9-1.03A, "Work Performed by Contractor," in the Standard Specifications, shall not apply.

Attention is directed to "Time-Related Overhead" of these special provisions.

To the total of the direct costs for work performed on a force account basis, computed as provided in Sections 9-1.03A(1), "Labor," 9-1.03A(2), "Materials," and 9-1.03A(3), "Equipment Rental," of the Standard Specifications, there will be added the following markups:

| Cost | Percent Markup |
|---|---|
| Labor | 28 |
| Materials | 10 |
| Equipment Rental | 10 |

The above markups shall be applied to work performed on a force account basis, regardless of whether the work revises the current contract completion date.

The above markups, together with payments made for time-related overhead pursuant to "Time-Related Overhead" of these special provisions, shall constitute full compensation for all overhead costs for work performed on a force account basis. These overhead costs shall be deemed to include all items of expense not specifically designated as cost or equipment rental in conformance with the provisions in Sections 9-1.03A(1), "Labor," 9-1.03A(2), "Materials," and 9-1.03A(3), "Equipment Rental," of the Standard Specifications. The total payment made as provided above and in the first paragraph of Section 9-1.03A, "Work Performed by Contractor," of the Standard Specifications shall be deemed to be the actual cost of the work performed on a force account basis, and shall constitute full compensation therefor.

Full compensation for overhead costs for work performed on a force account basis, and for which no adjustment is made to the quantity for time-related overhead conforming to the provisions in "Time-Related Overhead" of these special provisions, shall be considered as included in the markups specified above, and no additional compensation will be allowed therefor.

When extra work to be paid for on a force account basis is performed by a subcontractor, approved in conformance with the provisions in Section 8-1.01, "Subcontracting," of the Standard Specifications, an additional markup of 7 percent will be added to the total cost of that extra work including all markups specified in this section "Force Account Payment". The additional 7 percent markup shall reimburse the Contractor for additional administrative costs, and no other additional payment will be made by reason of performance of the extra work by a subcontractor.

## 5-1.14 COMPENSATION ADJUSTMENTS FOR PRICE INDEX FLUCTUATIONS

The provisions of this section shall apply only to the following contract items:

| ITEM CODE | ITEM |
|---|---|
| 390160 | ASPHALT CONCRETE (TYPE B) |
| 390206 | RUBBERIZED ASPHALT CONCRETE (TYPE G) |

The compensation payable for asphalt concrete and asphalt treated permeable base will be increased or decreased in conformance with the provisions of this section for paving asphalt price fluctuations exceeding 10 percent (Iu/Ib is greater than 1.10 or less than 0.90) which occur during performance of the work.

The adjustment in compensation will be determined in conformance with the following formulae when the item of asphalt concrete or asphalt treated permeable base (or both) is included in a monthly estimate:

A. Total monthly adjustment = AQ

B. For an increase in paving asphalt price index exceeding 10 percent:

$$A = 0.90\ (1.1023)\ (Iu/Ib - 1.10)\ Ib$$

C. For a decrease in paving asphalt price index exceeding 10 percent:

$$A = 0.90\ (1.1023)\ (Iu/Ib - 0.90)\ Ib$$

D. Where:

A = Adjustment in dollars per tonne of paving asphalt used to produce asphalt concrete and asphalt treated permeable base rounded to the nearest $0.01.

Iu = The California Statewide Paving Asphalt Price Index which is in effect on the first business day of the month within the pay period in which the quantity subject to adjustment was included in the estimate.

Ib = The California Statewide Paving Asphalt Price Index for the month in which the bid opening for the project occurred.

Q = Quantity in tonnes of paving asphalt that was used in producing the quantity of asphalt concrete shown under "This Estimate" on the monthly estimate using the amount of asphalt determined by the Engineer plus the quantity in tonnes of paving asphalt that would have been used in producing the quantity of asphalt treated permeable base shown under "This Estimate" on the monthly estimate using the amount of asphalt specified in the specifications.

The adjustment in compensation will also be subject to the following:

A. The compensation adjustments provided herein will be shown separately on payment estimates. The Contractor shall be liable to the State for decreased compensation adjustments and the Department may deduct the amount thereof from any moneys due or that may become due the Contractor.

B. Compensation adjustments made under this section will be taken into account in making adjustments in conformance with the provisions in Section 4-1.03B, "Increased or Decreased Quantities," of the Standard Specifications.

C. In the event of an overrun of contract time, adjustment in compensation for paving asphalt included in estimates during the overrun period will be determined using the California Statewide Paving Asphalt Price Index in effect on the first business day of the month within the pay period in which the overrun began.

The California Statewide Paving Asphalt Price Index is determined each month on the first business day of the month by the Department using the median of posted prices in effect as posted by Chevron, Mobil, and Unocal for the Buena Vista, Huntington Beach, Kern River, Long Beach, Midway Sunset, and Wilmington fields.

In the event that the companies discontinue posting their prices for a field, the Department will determine an index from the remaining posted prices. The Department reserves the right to include in the index determination the posted prices of additional fields.

## 5-1.15 AREAS FOR CONTRACTOR'S USE

Attention is directed to the provisions in Section 7-1.19, "Rights in Land and Improvements," of the Standard Specifications and these special provisions.

The highway right of way shall be used only for purposes that are necessary to perform the required work. The Contractor shall not occupy the right of way, or allow others to occupy the right of way, for purposes which are not necessary to perform the required work.

No State-owned parcels adjacent to the right of way are available for the exclusive use of the Contractor within the contract limits. The Contractor shall secure, at the Contractor's own expense, areas required for plant sites, storage of equipment or materials, or for other purposes.

No area is available within the contract limits for the exclusive use of the Contractor. However, temporary storage of equipment and materials on State property may be arranged with the Engineer, subject to the prior demands of State maintenance forces and to other contract requirements. Use of the Contractor's work areas and other State-owned property shall be at the Contractor's own risk, and the State shall not be held liable for damage to or loss of materials or equipment located within such areas.

## 5-1.16 PAYMENTS

Attention is directed to Sections 9-1.06, "Partial Payments," and 9-1.07, "Payment After Acceptance," of the Standard Specifications and these special provisions.

For the purpose of making partial payments pursuant to Section 9-1.06, "Partial Payments," of the Standard Specifications, the amount set forth for the contract items of work hereinafter listed shall be deemed to be the maximum value of the contract item of work which will be recognized for progress payment purposes:

A. Clearing and Grubbing $100,000
B. Progress Schedule (Critical Path Method) $5,000

After acceptance of the contract pursuant to the provisions in Section 7-1.17, "Acceptance of Contract," of the Standard Specifications, the amount, if any, payable for a contract item of work in excess of the maximum value for progress payment purposes hereinabove listed for the item, will be included for payment in the first estimate made after acceptance of the contract.

In determining the partial payments to be made to the Contractor, only the following listed materials will be considered for inclusion in the payment as materials furnished but not incorporated in the work:

A. 200 mm CHDPE Conduit
B. Prestressing Steel for CIP members (sealed packages only)
C. Tieback Anchors
D. PTFE bearings
E. Sound Wall Masonry Block
F. Joint Seal Assemblies
G. Bar Reinforcing Steel
H. Metal Sign Structures
I. Reinforced Concrete Pipe
J. Edge Drain Pipe
K. Sewer Pipe and Appurtenances
L. Miscellaneous Iron and Steel
M. Crash Cushions
N. Fences and Gates
O. Railings
P. Pavement Markers
Q. Isolation Casing
R. Miscellaneous Metal
S. Camera Poles
T. Fiber Optic Cables
U. Twisted Pair Cables
V. Splice Vaults
W. Innnerducts
X. Signal and Lighting Standards
Y. Sign Illumination Equipment

Z. Luminaires
AA. Signal Heads and Mounting Brackets

**5-1.17 SOUND CONTROL REQUIREMENTS**

Sound control shall conform to the provisions in Section 7-1.01I, "Sound Control Requirements," of the Standard Specifications and these special provisions.

The noise level from the Contractor's operations, between the hours of 9:00 p.m. and 7:00 a.m., shall not exceed 86 dBa at a distance of 15 m. This requirement shall not relieve the Contractor from responsibility for complying with local ordinances regulating noise level.

The noise level requirement shall apply to the equipment on the job or related to the job, including but not limited to trucks, transit mixers or transient equipment that may or may not be owned by the Contractor. The use of loud sound signals shall be avoided in favor of light warnings except those required by safety laws for the protection of personnel.

Full compensation for conforming to the requirements of this section shall be considered as included in the prices paid for the various contract items of work involved and no additional compensation will be allowed therefor.

**5-1.18 AERIALLY DEPOSITED LEAD**

Aerially deposited lead is present within the project limits. Aerially deposited lead is lead deposited within unpaved areas or formerly unpaved areas, primarily due to vehicle emissions.

Attention is directed to "Material Containing Aerially Deposited Lead" of these special provisions.

The complete report, entitled "Site Investigation Data (Fieldwork and Lab Analysis only), Rte 60 Eastbound Direct HOV Connector to Rte 57 Southbound Project, City of Diamond Bar, Los Angeles County, California, Contract No. 43A0078, Task Order Number 07-125701-PI, EA 125701, Prepared by Professional Services Industries (PSI), Dated March 2002," is available for inspection at the Department of Transportation, Division of Construction, CCO Unit, 801 South Grand Avenue, Ste 400, Los Angeles, CA, 90017, (213) 897-0054.

The Department has received from the California Department of Toxic Substances Control (DTSC) a Variance regarding the use of material containing aerially deposited lead. This project is subject to the conditions of the Variance, as amended. The Variance is available for inspection at the Department of Transportation, Construction Office, Change Order Desk, located in a secure building at 801 South Grand Avenue, Los Angeles, California. The Contractor shall telephone 213-897-0054 in advance to make arrangements for entering the building.

Once the Contractor has completed the placement of material containing aerially deposited lead in conformance with these special provisions and as directed by the Engineer, the Contractor shall have no responsibility for such materials in place. The Department will not consider the Contractor a generator of such contaminated materials. Further cleanup, removal or remedial actions for such materials will not be required if handled or disposed of as specified herein.

Excavation, reuse, and disposal of material with aerially deposited lead shall be in conformance with all rules and regulations including, but not limited to, those of the following agencies:

United States Department of Transportation (USDOT)
United States Environmental Protection Agency (USEPA)
California Environmental Protection Agency (Cal-EPA)
California Department of Health Services
Department of Toxic Substances Control (DTSC), Los Angeles Region
California Division of Occupational Safety and Health Administration (Cal-OSHA)
Integrated Waste Management Board
Regional Water Quality Control Board (RWQCB), Region 4
State Air Resources Control Board
South Coast Air Quality Management District (SCAQMD)

Materials containing hazardous levels of lead shall be transported and disposed of in conformance with Federal and State laws and regulations, as amended, and county and municipal ordinances and regulations, as amended. Laws and regulations that govern this work include, but are not limited to:

Health and Safety Code, Division 20, Chapter 6.5 (California Hazardous Waste Control Act)
Title 22, California Code of Regulations, Division 4.5 (Environmental Health Standards for the Management of Hazardous Waste)
Title 8, California Code of Regulations

### 5-1.19 CULTURAL RESOURCE MONITORING

Monitoring for remains of an archaeological nature shall be required during excavation for the collector road to westbound Route 60. These excavation areas shall be considered "Areas of Potential Effect".

Monitoring shall be performed by a Native American Monitor obtained from a list of qualified individuals from the Native American Heritage Commission. This list may be obtained from the Department of Transportation, at 120 South Spring Street, Office of Environmental Planning, Los Angeles, CA 90012. The monitor shall be present during excavation operations. The Native American Monitor shall be obtained by the Contractor. No work in the areas of potential effect shall begin prior to a preconstruction meeting between the Engineer, the Contractor, and the Native American Monitor to discuss construction strategies and the requirements necessary to ensure compliance with these special provisions.

If remains of an archaeological nature are discovered in the "Areas of Potential Effect" during construction, the Contractor shall cease work in the immediate area and the Engineer shall be notified. Work shall resume with approval from the Engineer.

If the Contractor changes construction strategies or the location of construction is altered, the changes will be reviewed by the Engineer for potential impacts to cultural resources before construction can resume.

If, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with due to native American monitoring, the delay will be considered a right of way delay in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

Full compensation for cultural resource monitoring, including obtaining and providing the Native American Monitor for all the work described herein, shall be considered as included in the contract prices paid for the various types of excavation involved, and no separate payment will be made therefor.

### 5-1.20 RELATIONS WITH CITY OF DIAMOND BAR

This project is located within the jurisdiction of the City of Diamond Bar. A permit regarding this project has been secured by the State from the City of Diamond Bar. The Contractor shall be fully informed of the requirements of this permit as well as rules, regulations, and conditions that may govern the Contractor's operations in these areas and shall conduct the work accordingly.

Copies of the agreement may be obtained at the Department of Transportation, Plans and Bid Documents Section, MS 26, 1120 N Street, Room 200, Sacramento, CA 95814, Telephone 916-654-4490, and are available for inspection at the office of the District Director of Transportation at Construction Office, Change Order Desk, located in a secure building at 801 South Grand Avenue, Los Angeles, California. The Contractor shall telephone 213-897-0054 in advance to make arrangements for entering the building.

Attention is directed to Section 7-1.12, "Indemnification and Insurance," of the Standard Specifications.

Should the Contractor fail to conform to the regulations and requirements of the City of Diamond Bar, the State reserves the right to perform the work necessary to conform to the provisions and the cost of such work will be deducted from any moneys due or to become due the Contractor.

Any change in the above listed conditions proposed by the Contractor shall be submitted to the Engineer for transmittal to the City of Diamond Bar for their approval. Changes shall not be implemented until approved in writing by the City of Diamond Bar. Any executed change shall be made a part of every subcontract executed pursuant to this contract.

Full compensation for conforming to the requirements of this section shall be considered as included in the contract prices paid for the various contract items of work and no additional compensation will be allowed therefor.

The provisions of this section shall be made a part of every subcontract executed pursuant to this contract.

## SECTION 6. (BLANK)

## SECTION 7. (BLANK)

## SECTION 8. MATERIALS

## SECTION 8-1. MISCELLANEOUS

### 8-1.01 SUBSTITUTION OF NON-METRIC MATERIALS AND PRODUCTS

Only materials and products conforming to the requirements of the specifications shall be incorporated in the work. When metric materials and products are not available, and when approved by the Engineer, and at no cost to the State, materials and products in the United States Standard Measures which are of equal quality and of the required properties and characteristics for the purpose intended, may be substituted for the equivalent metric materials and products, subject to the following provisions:

A. Materials and products shown on the plans or in the special provisions as being equivalent may be substituted for the metric materials and products specified or detailed on the plans.
B. Before other non-metric materials and products will be considered for use, the Contractor shall furnish, at the Contractor's expense, evidence satisfactory to the Engineer that the materials and products proposed for use are equal to or better than the materials and products specified or detailed on the plans. The burden of proof as to the quality and suitability of substitutions shall be upon the Contractor and the Contractor shall furnish necessary information as required by the Engineer. The Engineer will be the sole judge as to the quality and suitability of the substituted materials and products and the Engineer's decision will be final.
C. When the Contractor elects to substitute non-metric materials and products, including materials and products shown on the plans or in the special provisions as being equivalent, the list of sources of material specified in Section 6-1.01, "Source of Supply and Quality of Materials," of the Standard Specification shall include a list of substitutions to be made and contract items involved. In addition, for a change in design or details, the Contractor shall submit plans and working drawings in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. The plans and working drawings shall be submitted at least 7 days before the Contractor intends to begin the work involved.

Unless otherwise specified, the following substitutions of materials and products will be allowed:

SUBSTITUTION TABLE FOR SIZES OF HIGH STRENGTH STEEL FASTENERS
ASTM Designation: A 325M

| METRIC SIZE SHOWN ON THE PLANS mm x thread pitch | SIZE TO BE SUBSTITUTED inch |
|---|---|
| M16 x 2 | 5/8 |
| M20 x 2.5 | 3/4 |
| M22 x 2.5 | 7/8 |
| M24 x 3 | 1 |
| M27 x 3 | 1-1/8 |
| M30 x 3.5 | 1-1/4 |
| M36 x 4 | 1-1/2 |

SUBSTITUTION TABLE FOR PLAIN WIRE REINFORCEMENT
ASTM Designation: A 82

| METRIC SIZE SHOWN ON THE PLANS $mm^2$ | SIZE TO BE SUBSTITUTED $inch^2$ x 100 |
|---|---|
| MW9 | W1.4 |
| MW10 | W1.6 |
| MW13 | W2.0 |
| MW15 | W2.3 |
| MW19 | W2.9 |
| MW20 | W3.1 |
| MW22 | W3.5 |
| MW25 | W3.9, except W3.5 in piles only |
| MW26 | W4.0 |
| MW30 | W4.7 |
| MW32 | W5.0 |
| MW35 | W5.4 |
| MW40 | W6.2 |
| MW45 | W6.5 |
| MW50 | W7.8 |
| MW55 | W8.5, except W8.0 in piles only |
| MW60 | W9.3 |
| MW70 | W10.9, except W11.0 in piles only |
| MW80 | W12.4 |
| MW90 | W14.0 |
| MW100 | W15.5 |

SUBSTITUTION TABLE FOR BAR REINFORCEMENT

| METRIC BAR DESIGNATION NUMBER[1] SHOWN ON THE PLANS | BAR DESIGNATION NUMBER[2] TO BE SUBSTITUTED |
|---|---|
| 10 | 3 |
| 13 | 4 |
| 16 | 5 |
| 19 | 6 |
| 22 | 7 |
| 25 | 8 |
| 29 | 9 |
| 32 | 10 |
| 36 | 11 |
| 43 | 14 |
| 57 | 18 |

[1]Bar designation numbers approximate the number of millimeters of the nominal diameter of the bars.
[2]Bar numbers are based on the number of eighths of an inch included in the nominal diameter of the bars.
No adjustment will be required in spacing or total number of reinforcing bars due to a difference in minimum yield strength between metric and non-metric bars.

SUBSTITUTION TABLE FOR SIZES OF:

(1) STEEL FASTENERS FOR GENERAL APPLICATIONS (ASTM Designation: A 307 or AASHTO Designation: M 314, Grade 36 or 55), and

(2) HIGH STRENGTH STEEL FASTENERS (ASTM Designation: A 325 or A 449)

| METRIC SIZE SHOWN ON THE PLANS<br>mm | SIZE TO BE SUBSTITUTED<br>inch |
|---|---|
| 6 or 6.35 | 1/4 |
| 8 or 7.94 | 5/16 |
| 10 or 9.52 | 3/8 |
| 11 or 11.11 | 7/16 |
| 13 or 12.70 | 1/2 |
| 14 or 14.29 | 9/16 |
| 16 or 15.88 | 5/8 |
| 19 or 19.05 | 3/4 |
| 22 or 22.22 | 7/8 |
| 24, 25, or 25.40 | 1 |
| 29 or 28.58 | 1-1/8 |
| 32 or 31.75 | 1-1/4 |
| 35 or 34.93 | 1-3/8 |
| 38 or 38.10 | 1-1/2 |
| 44 or 44.45 | 1-3/4 |
| 51 or 50.80 | 2 |
| 57 or 57.15 | 2-1/4 |
| 64 or 63.50 | 2-1/2 |
| 70 or 69.85 | 2-3/4 |
| 76 or 76.20 | 3 |
| 83 or 82.55 | 3-1/4 |
| 89 or 88.90 | 3-1/2 |
| 95 or 95.25 | 3-3/4 |
| 102 or 101.60 | 4 |

SUBSTITUTION TABLE FOR NOMINAL THICKNESS OF SHEET METAL

| UNCOATED HOT AND COLD ROLLED SHEETS | | HOT-DIPPED ZINC COATED SHEETS (GALVANIZED) | |
|---|---|---|---|
| METRIC THICKNESS SHOWN ON THE PLANS mm | GAGE TO BE SUBSTITUTED inch | METRIC THICKNESS SHOWN ON THE PLANS mm | GAGE TO BE SUBSTITUTED inch |
| 7.94 | 0.3125 | 4.270 | 0.1681 |
| 6.07 | 0.2391 | 3.891 | 0.1532 |
| 5.69 | 0.2242 | 3.510 | 0.1382 |
| 5.31 | 0.2092 | 3.132 | 0.1233 |
| 4.94 | 0.1943 | 2.753 | 0.1084 |
| 4.55 | 0.1793 | 2.372 | 0.0934 |
| 4.18 | 0.1644 | 1.994 | 0.0785 |
| 3.80 | 0.1495 | 1.803 | 0.0710 |
| 3.42 | 0.1345 | 1.613 | 0.0635 |
| 3.04 | 0.1196 | 1.461 | 0.0575 |
| 2.66 | 0.1046 | 1.311 | 0.0516 |
| 2.28 | 0.0897 | 1.158 | 0.0456 |
| 1.90 | 0.0747 | 1.006 or 1.016 | 0.0396 |
| 1.71 | 0.0673 | 0.930 | 0.0366 |
| 1.52 | 0.0598 | 0.853 | 0.0336 |
| 1.37 | 0.0538 | 0.777 | 0.0306 |
| 1.21 | 0.0478 | 0.701 | 0.0276 |
| 1.06 | 0.0418 | 0.627 | 0.0247 |
| 0.91 | 0.0359 | 0.551 | 0.0217 |
| 0.84 | 0.0329 | 0.513 | 0.0202 |
| 0.76 | 0.0299 | 0.475 | 0.0187 |
| 0.68 | 0.0269 | -------- | -------- |
| 0.61 | 0.0239 | -------- | -------- |
| 0.53 | 0.0209 | -------- | -------- |
| 0.45 | 0.0179 | -------- | -------- |
| 0.42 | 0.0164 | -------- | -------- |
| 0.38 | 0.0149 | -------- | -------- |

SUBSTITUTION TABLE FOR WIRE

| METRIC THICKNESS SHOWN ON THE PLANS mm | WIRE THICKNESS TO BE SUBSTITUTED inch | GAGE NO. |
|---|---|---|
| 6.20 | 0.244 | 3 |
| 5.72 | 0.225 | 4 |
| 5.26 | 0.207 | 5 |
| 4.88 | 0.192 | 6 |
| 4.50 | 0.177 | 7 |
| 4.11 | 0.162 | 8 |
| 3.76 | 0.148 | 9 |
| 3.43 | 0.135 | 10 |
| 3.05 | 0.120 | 11 |
| 2.69 | 0.106 | 12 |
| 2.34 | 0.092 | 13 |
| 2.03 | 0.080 | 14 |
| 1.83 | 0.072 | 15 |
| 1.57 | 0.062 | 16 |
| 1.37 | 0.054 | 17 |
| 1.22 | 0.048 | 18 |
| 1.04 | 0.041 | 19 |
| 0.89 | 0.035 | 20 |

SUBSTITUTION TABLE FOR PIPE PILES

| METRIC SIZE SHOWN ON THE PLANS mm x mm | SIZE TO BE SUBSTITUTED inch x inch |
|---|---|
| PP 360 x 4.55 | NPS 14 x 0.179 |
| PP 360 x 6.35 | NPS 14 x 0.250 |
| PP 360 x 9.53 | NPS 14 x 0.375 |
| PP 360 x 11.12 | NPS 14 x 0.438 |
| PP 406 x 12.70 | NPS 16 x 0.500 |
| PP 460 x T | NPS 18 x T" |
| PP 508 x T | NPS 20 x T" |
| PP 559 x T | NPS 22 x T" |
| PP 610 x T | NPS 24 x T" |
| PP 660 x T | NPS 26 x T" |
| PP 711 x T | NPS 28 x T" |
| PP 762 x T | NPS 30 x T" |
| PP 813 x T | NPS 32 x T" |
| PP 864 x T | NPS 34 x T" |
| PP 914 x T | NPS 36 x T" |
| PP 965 x T | NPS 38 x T" |
| PP 1016 x T | NPS 40 x T" |
| PP 1067 x T | NPS 42 x T" |
| PP 1118 x T | NPS 44 x T" |
| PP 1219 x T | NPS 48 x T" |
| PP 1524 x T | NPS 60 x T" |

The thickness in millimeters (T) represents an exact conversion of the thickness in inches (T").

SUBSTITUTION TABLE FOR STRUCTURAL TIMBER AND LUMBER

| METRIC MINIMUM DRESSED DRY, SHOWN ON THE PLANS mm x mm | METRIC MINIMUM DRESSED GREEN, SHOWN ON THE PLANS mm x mm | NOMINAL SIZE TO BE SUBSTITUTED inch x inch |
|---|---|---|
| 19x89 | 20x90 | 1x4 |
| 38x89 | 40x90 | 2x4 |
| 64x89 | 65x90 | 3x4 |
| 89x89 | 90x90 | 4x4 |
| 140x140 | 143x143 | 6x6 |
| 140x184 | 143x190 | 6x8 |
| 184x184 | 190x190 | 8x8 |
| 235x235 | 241x241 | 10x10 |
| 286x286 | 292x292 | 12x12 |

SUBSTITUTION TABLE FOR NAILS AND SPIKES

| METRIC COMMON NAIL, SHOWN ON THE PLANS<br><br>Length, mm<br>Diameter, mm | METRIC BOX NAIL, SHOWN ON THE PLANS<br><br>Length, mm<br>Diameter, mm | METRIC SPIKE, SHOWN ON THE PLANS<br>Length, mm<br>Diameter, mm | SIZE TO BE SUBSTITUTED<br>Penny-weight |
|---|---|---|---|
| 50.80<br>2.87 | 50.80<br>2.51 | _____ | 6d |
| 63.50<br>3.33 | 63.50<br>2.87 | _____ | 8d |
| 76.20<br>3.76 | 76.20<br>3.25 | 76.20<br>4.88 | 10d |
| 82.55<br>3.76 | 82.55<br>3.25 | 82.55<br>4.88 | 12d |
| 88.90<br>4.11 | 88.90<br>3.43 | 88.90<br>5.26 | 16d |
| 101.60<br>4.88 | 101.60<br>3.76 | 101.60<br>5.72 | 20d |
| 114.30<br>5.26 | 114.30<br>3.76 | 114.30<br>6.20 | 30d |
| 127.00<br>5.72 | 127.00<br>4.11 | 127.00<br>6.68 | 40d |
| _____ | _____ | 139.70<br>7.19 | 50d |
| _____ | _____ | 152.40<br>7.19 | 60d |

SUBSTITUTION TABLE FOR IRRIGATION COMPONENTS

| METRIC WATER METERS, TRUCK LOADING STANDPIPES, VALVES, BACKFLOW PREVENTERS, FLOW SENSORS, WYE STRAINERS, FILTER ASSEMBLY UNITS, PIPE SUPPLY LINES, AND PIPE IRRIGATION SUPPLY LINES SHOWN ON THE PLANS DIAMETER NOMINAL (DN) mm | NOMINAL SIZE TO BE SUBSTITUTED inch |
|---|---|
| 15 | 1/2 |
| 20 | 3/4 |
| 25 | 1 |
| 32 | 1-1/4 |
| 40 | 1-1/2 |
| 50 | 2 |
| 65 | 2-1/2 |
| 75 | 3 |
| 100 | 4 |
| 150 | 6 |
| 200 | 8 |
| 250 | 10 |
| 300 | 12 |
| 350 | 14 |
| 400 | 16 |

Unless otherwise specified, substitutions of United States Standard Measures standard structural shapes corresponding to the metric designations shown on the plans and in conformance with the requirements in ASTM Designation: A 6/A 6M, Annex 2, will be allowed.

**8-1.02 PREQUALIFIED AND TESTED SIGNING AND DELINEATION MATERIALS**

The Department maintains the following list of Prequalified and Tested Signing and Delineation Materials. The Engineer shall not be precluded from sampling and testing products on the list of Prequalified and Tested Signing and Delineation Materials.

The manufacturer of products on the list of Prequalified and Tested Signing and Delineation Materials shall furnish the Engineer a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for each type of traffic product supplied.

For those categories of materials included in the list of Prequalified and Tested Signing and Delineation Materials, only those products shown within the listing may be used in the work. Other categories of products, not included in the list of Prequalified and Tested Signing and Delineation Materials, may be used in the work provided they conform to the requirements of the Standard Specifications.

Materials and products may be added to the list of Prequalified and Tested Signing and Delineation Materials if the manufacturer submits a New Product Information Form to the New Product Coordinator at the Transportation Laboratory. Upon a Departmental request for samples, sufficient samples shall be submitted to permit performance of required tests. Approval of materials or products will depend upon compliance with the specifications and tests the Department may elect to perform.

**PAVEMENT MARKERS, PERMANENT TYPE**

**Retroreflective With Abrasion Resistant Surface (ARS)**

A. Apex, Model 921AR (100 mm x 100 mm)
B. Avery Dennison (formerly Stimsonite), Models C88 (100 mm x 100 mm), 911 (100 mm x 100 mm) and 953 (70 mm x 114 mm)
C. Ray-O-Lite, Model "AA" ARS (100 mm x 100 mm)
D. 3M Series 290 (89 mm x 100 mm)
E. 3M Series 290 PSA, with pressure sensitive adhesive pad (89 mm x 100 mm)

**Retroreflective With Abrasion Resistant Surface (ARS)**

(for recessed applications only)

A. Avery Dennison (formerly Stimsonite), Model 948 (58 mm x 119 mm)
B. Avery Dennison (formerly Stimsonite), Model 944SB (51 mm x 100 mm)*
C. Ray-O-Lite, Model 2002 (58 mm x 117 mm)
D. Ray-O-Lite, Model 2004 ARS (51 mm x 100 mm)*

*For use only in 114 mm wide (older) recessed slots

**Non-Reflective For Use With Epoxy Adhesive, 100 mm Round**

A. Apex Universal (Ceramic)
B. Novabrite Models Cdot (White) Cdot-y (Yellow)
C. Novabrite Models Pdot-w (White) Pdot-y (Yellow), Polypropylene

**Non-Reflective For Use With Bitumen Adhesive, 100 mm Round**

A. Alpine Products, "D-Dot" and "ANR" (ABS)
B. Apex Universal (Ceramic)
C. Apex Universal, Models 929 (ABS) and 929PP (Polypropylene)
D. Elgin Molded Plastics, "Empco-Lite" Model 900 (ABS)
E. Hi-Way Safety, Inc., Models P20-2000W and 2001Y (ABS)
F. Interstate Sales, "Diamond Back" (ABS) and (Polypropylene)
G. Novabrite Models Adot-w (White) Adot-y (Yellow), (ABS)
H. Road Creations, Model RCB4NR (Acrylic)
I. Three D Traffic Works TD10000 (ABS), TD10500 (Polypropylene)
J. Zumar Industries, "Titan TM40A" (ABS)

**PAVEMENT MARKERS, TEMPORARY TYPE**

**Temporary Markers For Long Term Day/Night Use (6 months or less)**

A. Apex Universal, Model 924 (100 mm x 100 mm)
B. Elgin Molded Plastics, "Empco-Lite" Model 901 (100 mm x 100 mm)
C. Road Creations, Model R41C (100 mm x 100 mm)
D. Vega Molded Products "Temporary Road Marker" (75 mm x 100 mm)

**Temporary Markers For Short Term Day/Night Use (14 days or less)**

(For seal coat or chip seal applications, clear protective covers are required)

A. Apex Universal, Model 932
B. Bunzl Extrusion, Models T.O.M., T.R.P.M., and "HH" (High Heat)
C. Hi-Way Safety, Inc., Model 1280/1281

**STRIPING AND PAVEMENT MARKING MATERIAL**

**Permanent Traffic Striping and Pavement Marking Tape**

A. Advanced Traffic Marking, Series 300 and 400
B. Brite-Line, Series 1000
C. Brite-Line, "DeltaLine XRP"
D. Swarco Industries, "Director 35" (For transverse application only)
E. Swarco Industries, "Director 60"
F. 3M, "Stamark" Series 380 and 5730
G. 3M, "Stamark" Series 420 (For transverse application only)

**Temporary (Removable) Striping and Pavement Marking Tape (6 months or less)**

A. Advanced Traffic Marking, Series 200
B. Brite-Line, Series 100
C. Garlock Rubber Technologies, Series 2000
D. P.B. Laminations, Aztec, Grade 102
E. Swarco Industries, "Director-2"
F. Trelleborg Industri, R140 Series
G. 3M, Series 620 "CR", and Series A750
H. 3M, Series A145, Removable Black Line Mask
(Black Tape: for use only on Asphalt Concrete Surfaces)
I. Advanced Traffic Marking Black "Hide-A-Line"
(Black Tape: for use only on Asphalt Concrete Surfaces)
J. Brite-Line "BTR" Black Removable Tape
(Black Tape: for use only on Asphalt Concrete Surfaces)
K. Trelleborg Industri, RB-140
(Black Tape: for use only on Asphalt Concrete Surfaces)

**Preformed Thermoplastic (Heated in place)**

A. Avery Dennison, "Hotape"
B. Flint Trading, "Premark," "Premark 20/20 Flex," and "Premark 20/20 Flex Plus"

**Ceramic Surfacing Laminate, 150 mm x 150 mm**

A. Safeline Industries/Highway Ceramics, Inc.

**CLASS 1 DELINEATORS**

**One Piece Driveable Flexible Type, 1700 mm**

A. Bunzl Extrusion, "Flexi-Guide Models 400 and 566"
B. Carsonite, Curve-Flex CFRM-400
C. Carsonite, Roadmarker CRM-375
D. FlexStake, Model 654 TM
E. GreenLine Models HWD1-66 and CGD1-66
F. J. Miller Industries, Model JMI-375 (with soil anchor)

**Special Use Type, 1700 mm**

A. Bunzl Extrusion, Model FG 560 (with 450 mm U-Channel base)
B. Carsonite, "Survivor" (with 450 mm U-Channel base)
C. Carsonite, Roadmarker CRM-375 (with 450 mm U-Channel base)
D. FlexStake, Model 604
E. GreenLine Models HWDU and CGD (with 450 mm U-Channel base)
F. Impact Recovery Model D36, with #105 Driveable Base
G. Safe-Hit with 200 mm pavement anchor (SH248-GP1)
H. Safe-Hit with 380 mm soil anchor (SH248-GP2) and with 450 mm soil anchor (SH248-GP3)

**Surface Mount Type, 1200 mm**

A. Bent Manufacturing Company, Masterflex Model MF-180EX-48
B. Carsonite, "Super Duck II"
C. FlexStake, Surface Mount, Models 704 and 754 TM
D. Impact Recovery Model D48, with #101 Fixed (Surface-Mount) Base

**CHANNELIZERS**

**Surface Mount Type, 900 mm**

A. Bent Manufacturing Company, Masterflex Models MF-360-36 (Round) and MF-180-36 (Flat)
B. Bunzl Extrusion, Flexi-Guide Models FG300LD and FG300UR
C. Carsonite, "Super Duck" (Flat SDF-436, Round SDR-336)
D. Carsonite, "Super Duck II" Model SDCF203601MB "The Channelizer"
E. FlexStake, Surface Mount, Models 703 and 753 TM
F. GreenLine, Model SMD-36
G. Hi-Way Safety, Inc. "Channel Guide Channelizer" Model CGC36
H. Impact Recovery Model D36, with #101 Fixed (Surface-Mount) Base
I. Repo, Models 300 and 400
J. Safe-Hit, Guide Post, Model SH236SMA
K. The Line Connection, "Dura-Post" Model DP36-3 (Permanent)
L. The Line Connection, "Dura-Post" Model DP36-3C (Temporary)

**Lane Separation System**

A. Bunzl "Flexi_Guide (FG) 300 Curb System
B. Qwick Kurb, "Klemmfix Guide System"
C. Recycled Technology, Inc. "Safe-Lane System"

**CONICAL DELINEATORS, 1070 mm**

(For 700 mm Traffic Cones, see Standard Specifications)

A. Bent Manufacturing Company "T-Top"
B. Plastic Safety Systems "Navigator-42"
C. Radiator Specialty Company "Enforcer"
D. Roadmaker Company "Stacker"
E. TrafFix Devices "Grabber"

**OBJECT MARKERS**

**Type "K", 450 mm**

A. Bunzl, Model FG318PE
B. Carsonite, Model SMD 615
C. FlexStake, Model 701 KM
D. Repo, Models 300 and 400
E. Safe-Hit, Model SH718SMA
F. The Line Connection, Model DP21-4K

**Type "K-4" / "Q" Object Markers, 600 mm**

A. Bent Manufacturing "Masterflex" Model MF-360-24
B. Bunzl Extrusion, Model FG324PE
C. Carsonite, Super Duck II
D. FlexStake, Model 701KM
E. Repo, Models 300 and 400
F. Safe-Hit, Models SH8 24SMA_WA and SH8 24GP3_WA
G. The Line Connection, Model DP21-4Q

**CONCRETE BARRIER MARKERS AND**
**TEMPORARY RAILING (TYPE K) REFLECTORS**

**Impactable Type**

A. ARTUK, "FB"
B. Bunzl Extrusion, Models PCBM-12 and PCBM-T12
C. Duraflex Corp., "Flexx 2020" and "Electriflexx"
D. Hi-Way Safety, Inc., Model GMKRM100
E. Sun-Lab Technology, "Safety Guide Light Model TM-5"

**Non-Impactable Type**

A. ARTUK, JD Series
B. Plastic Safety Systems "BAM" Concrete Barrier Marker
C. Vega Molded Products, Models GBM and JD

**THRIE BEAM BARRIER MARKERS**
(For use to the left of traffic)
A. Bunzl Extrusion, "Mini" (75 mm x 254 mm)
B. Duraflex Corp., "Railrider"

**CONCRETE BARRIER DELINEATORS, 400 mm**
(For use to the right of traffic)
A. Bunzl Extrusion, Model PCBM T-16
B. Safe-Hit, Model SH216RBM
C. Sun-Lab Technology, "Safety Guide Light, Model TM16," (75 mm x 300 mm)

**CONCRETE BARRIER-MOUNTED MINI-DRUM (260 mm x 360 mm x 570 mm)**
A. Stinson Equipment Company "SaddleMarker"

**SOUND WALL DELINEATOR**
(Applied vertically. Place top of 75 mm x 300 mm reflective element at 1200 mm above roadway)
A. Bunzl Extrusion, PCBM S-36
B. Sun-Lab Technology, "Safety Guide Light, Model SM12," (75 mm x 300 mm)

**GUARD RAILING DELINEATOR**
(Place top of reflective element at 1200 mm above plane of roadway)

**Wood Post Type, 686 mm**

A. Bunzl Extrusion, FG 427 and FG 527
B. Carsonite, Model 427
C. FlexStake, Model 102 GR
D. GreenLine GRD 27
E. J. Miller Model JMI-375G
F. Safe-Hit, Model SH227GRD

**Steel Post Type**

A. Carsonite, Model CFGR-327 with CFGRBK300 Mounting Bracket

**RETROREFLECTIVE SHEETING**

**Channelizers, Barrier Markers, and Delineators**

A. Avery Dennison T-6500 Series (Formerly Stimsonite, Series 6200) (For rigid substrate devices only)
B. Avery Dennison WR-6100 Series
C. Nippon Carbide, Flexible Ultralite Grade (ULG) II
D. Reflexite, PC-1000 Metalized Polycarbonate
E. Reflexite, AC-1000 Acrylic
F. Reflexite, AP-1000 Metalized Polyester
G. Reflexite, Conformalight, AR-1000 Abrasion Resistant Coating
H. 3M, High Intensity

**Traffic Cones, 330 mm Sleeves**

A. Reflexite SB (Polyester), Vinyl or "TR" (Semi-transparent)

**Traffic Cones, 100 mm and 150 mm Sleeves**

A. Nippon Carbide, Flexible Ultralite Grade (ULG) II
B. Reflexite, Vinyl, "TR" (Semi-transparent) or "Conformalight"
C. 3M Series 3840

**Barrels and Drums**

A. Avery Dennison WR-6100
B. Nippon Carbide, Flexible Ultralite Grade (ULG) II
C. Reflexite, “Conformalight”, "Super High Intensity" or "High Impact Drum Sheeting"
D. 3M Series 3810

**Barricades: Type I, Medium-Intensity (Typically Enclosed Lens, Glass-Bead Element)**

A. American Decal, Adcolite
B. Avery Dennison, T-1500 and T-1600 series
C. 3M Engineer Grade, Series 3170

**Barricades: Type II, Medium-High-Intensity (Typically Enclosed Lens, Glass-Bead Element)**

A. Avery Dennison, T-2500 Series
B. Kiwalite Type II
C. Nikkalite 1800 Series

**Signs: Type II, Medium-High-Intensity (Typically Enclosed Lens, Glass-Bead Element)**

A. Avery Dennison, T-2500 Series
B. Kiwalite, Type II
C. Nikkalite 1800 Series

**Signs: Type III, High-Intensity (Typically Encapsulated Glass-Bead Element)**

A. Avery Dennison, T-5500 Series
B. Nippon Carbide, Nikkalite Brand Ultralite Grade II
C. 3M Series 3870

**Signs: Type IV, High-Intensity (Typically Unmetallized Microprismatic Element)**

A. Avery Dennison, T-6500 Series (Formerly Stimsonite Series 6200)
B. Nippon Carbide, Crystal Grade, 94000 Series

**Signs: Type VI, Elastomeric (Roll-Up) High-Intensity, without Adhesive**

A. Avery Dennison, WU-6014 (Fluorescent orange)
B. Reflexite "Vinyl" (Orange)
C. Reflexite "SuperBright" (Fluorescent orange)
D. Reflexite "Marathon" (Fluorescent orange)
E. 3M Series RS34 (Orange) and RS20 (Fluorescent orange)

**Signs: Type VII, Super-High-Intensity (Typically Unmetallized Microprismatic Element)**

A. 3M LDP Series 3970

**Signs: Type VIII, Super-High-Intensity (Typically Unmetallized Microprismatic Element)**

A. Avery Dennison, T-7500 Series

**Signs: Type IX, Very-High-Intensity (Typically Unmetallized Microprismatic Element)**

A. 3M VIP Series 3990 Diamond Grade

**SPECIALTY SIGNS**

A. All Sign Products, STOP Sign (All Plastic), 750 mm
B. Relexite "Endurance" Work Zone Sign (with Semi-Rigid Plastic Substrate)

**SIGN SUBSTRATE**

**Fiberglass Reinforced Plastic (FRP)**

A. Fiber-Brite
B. Sequentia, "Polyplate"
C. Inteplast Group "InteCel" (13 mm for Post-Mounted CZ Signs, 1200 mm or less)

### 8-1.03 STATE-FURNISHED MATERIALS

Attention is directed to Section 6-1.02, "State-Furnished Materials," of the Standard Specifications and these special provisions.

The following materials will be furnished to the Contractor:

A. Sign panels for roadside signs, overhead sign structures, and flashing beacon unit.
B. Sign overlay panels for roadside signs and overhead sign structures.
C. Mast arm sign hanger assemblies.
D. Laminated wood box posts with metal caps for roadside signs.
E. Hardware for mounting sign panels as follows:

   1. Blind rivets for mounting overlapping legend at sign panel joints.
   2. Closure inserts.
   3. Aluminum bolts and nuts and steel beveled washers for mounting laminated sign panels on overhead sign structures.
   4. Aluminum bolts, nuts, and washers for mounting overhead formed panels.

F. Target plates for median mileage panels.
G. Lamps for ramp metering signal heads and flashing beacon unit.
H. Model 170 controller assemblies, including controller unit, completely wired controller cabinet, and inductive loop detector sensor units.
I. Reflective numbers and edge sealer for numbering electrical equipment.

Completely wired Model 334 controller cabinets, with auxiliary equipment including controller units, loop detector sensor units and reflective numbers and edge sealer for numbering electrical equipment will be furnished to the Contractor at the following address:

Department of Transportation
District Maintenance Yard
7310 East Bandini Boulevard
Commerce, CA 90040
Telephone (213) 620-2185

The Contractor shall notify the Engineer not less than fifteen working days before State-furnished material is to be picked up by the Contractor. A full description of the material and the time the material will be picked up shall be provided.

A listing of field conductor terminations for each State-furnished controller cabinet will be furnished free of charge to the Contractor at the site of the work.

The Contractor shall notify the Engineer and the Department of Transportation, Office Electrical Traffic Design at 120 S. Spring St., Los Angeles, telephone (213) 897-4656, at least 10 working days prior to picking up the controller assemblies.

### 8-1.04 SLAG AGGREGATE

Aggregate produced from slag resulting from any steel-making process or from air-cooled iron blast furnace slag shall not be used on this project.

### 8-1.05 ENGINEERING FABRICS

Engineering fabrics shall conform to the provisions in Section 88, "Engineering Fabrics," of the Standard Specifications and these special provisions.

Filter fabric for this project shall be ultraviolet (UV) ray protected.

## SECTION 8-2. CONCRETE

### 8-2.01 PORTLAND CEMENT CONCRETE

Portland cement concrete shall conform to the provisions in Section 90, "Portland Cement Concrete," of the Standard Specifications and these special provisions.

References to Section 90-2.01, "Portland Cement," of the Standard Specifications shall mean Section 90-2.01, "Cement," of the Standard Specifications.

Mineral admixture shall be combined with cement in conformance with the provisions in Section 90-4.08, "Required Use of Mineral Admixtures," of the Standard Specifications for the concrete materials specified in Section 56-2, "Roadside Signs," of the Standard Specifications.

The requirements of Section 90-4.08, "Required Use of Mineral Admixture," of the Standard Specifications shall not apply to Section 19-3.025C, "Soil Cement Bedding," of the Standard Specifications.

The Department maintains a list of sources of fine and coarse aggregate that have been approved for use with a reduced amount of mineral admixture in the total amount of cementitious material to be used. A source of aggregate will be considered for addition to the approved list if the producer of the aggregate submits to the Transportation Laboratory certified test results from a qualified testing laboratory that verify the aggregate complies with the requirements. Prior to starting the testing, the aggregate test shall be registered with the Department. A registration number can be obtained by calling (916) 227-7228. The registration number shall be used as the identification for the aggregate sample in correspondence with the Department. Upon request, a split of the tested sample shall be provided to the Department. Approval of aggregate will depend upon compliance with the specifications, based on the certified test results submitted, together with any replicate testing the Department may elect to perform. Approval will expire 3 years from the date the most recent registered and evaluated sample was collected from the aggregate source.

Qualified testing laboratories shall conform to the following requirements:

A. Laboratories performing ASTM Designation: C 1293 shall participate in the Cement and Concrete Reference Laboratory (CCRL) Concrete Proficiency Sample Program and shall have received a score of 3 or better on all tests of the previous 2 sets of concrete samples.
B. Laboratories performing ASTM Designation: C 1260 shall participate in the Cement and Concrete Reference Laboratory (CCRL) Pozzolan Proficiency Sample Program and shall have received a score of 3 or better on the shrinkage and soundness tests of the previous 2 sets of pozzolan samples.

Aggregates on the list shall conform to one of the following requirements:

A. When the aggregate is tested in conformance with the requirements in California Test 554 and ASTM Designation: C 1293, the average expansion at one year shall be less than or equal to 0.040 percent; or
B. When the aggregate is tested in conformance with the requirements in California Test 554 and ASTM Designation: C 1260, the average of the expansion at 16 days shall be less than or equal to 0.15 percent.

The amounts of cement and mineral admixture used in cementitious material shall be sufficient to satisfy the minimum cementitious material content requirements specified in Section 90-1.01, "Description," or Section 90-4.05, "Optional Use of Chemical Admixtures," of the Standard Specifications and shall conform to the following:

A. The minimum amount of cement shall not be less than 75 percent by mass of the specified minimum cementitious material content.
B. The minimum amount of mineral admixture to be combined with cement shall be determined using one of the following criteria:

    1. When the calcium oxide content of a mineral admixture is equal to or less than 2 percent by mass, the amount of mineral admixture shall not be less than 15 percent by mass of the total amount of cementitious material to be used in the mix.
    2. When the calcium oxide content of a mineral admixture is greater than 2 percent by mass, and any of the aggregates used are not listed on the approved list as specified in these special provisions, then the amount of mineral admixture shall not be less than 25 percent by mass of the total amount of cementitious material to be used in the mix.
    3. When the calcium oxide content of a mineral admixture is greater than 2 percent by mass and the fine and coarse aggregates are listed on the approved list as specified in these special provisions, then the amount of mineral admixture shall not be less than 15 percent by mass of the total amount of cementitious material to be used in the mix.
    4. When a mineral admixture that conforms to the provisions for silica fume in Section 90-2.04, "Admixture Materials," of the Standard Specifications is used, the amount of mineral admixture shall not be less than 10 percent by mass of the total amount of cementitious material to be used in the mix.
    5. When a mineral admixture that conforms to the provisions for silica fume in Section 90-2.04, "Admixture Materials," of the Standard Specifications is used and the fine and coarse aggregates are listed on the approved

list as specified in these special provisions, then the amount of mineral admixture shall not be less than 7 percent by mass of the total amount of cementitious material to be used in the mix.

C. The total amount of mineral admixture shall not exceed 35 percent by mass of the total amount of cementitious material to be used in the mix. Where Section 90-1.01, "Description," of the Standard Specifications specifies a maximum cementitious content in kilograms per cubic meter, the total mass of cement and mineral admixture per cubic meter shall not exceed the specified maximum cementitious material content.

The Contractor will be permitted to use Type III portland cement for concrete used in the manufacture of precast concrete members.

## SECTION 8-3. WELDING

### 8-3.01 WELDING

**GENERAL**

Flux core welding electrodes conforming to the requirements of AWS A5.20 E6XT-4 or E7XT-4 shall not be used to perform welding for this project.

Wherever reference is made to the following AWS welding codes in the Standard Specifications, on the plans, or in these special provisions, the year of adoption for these codes shall be as listed:

| AWS Code | Year of Adoption |
|---|---|
| D1.1 | 2000 |
| D1.4 | 1998 |
| D1.5 | 1995 |
| D1.5 (metric only) | 1996 |

Requirements of the AWS welding codes shall apply unless specified otherwise in the Standard Specifications, on the plans, or in these special provisions. Wherever the abbreviation AWS is used, it shall be equivalent to the abbreviations ANSI/AWS or ANSI/AASHTO/AWS.

Sections 6.1.2 through 6.1.4.3 of AWS D 1.1, Sections 7.1.1 and 7.1.2 of AWS D 1.4, and Sections 6.1.1.1 through 6.1.3.3 of AWS D 1.5 are replaced with the following:

Quality Control (QC) shall be the responsibility of the Contractor. As a minimum, the Contractor shall perform inspection and testing of each weld joint prior to welding, during welding, and after welding as specified in this section and as necessary to ensure that materials and workmanship conform to the requirements of the contract documents.

The QC Inspector shall be the duly designated person who acts for and on behalf of the Contractor for inspection, testing, and quality related matters for all welding.

Quality Assurance (QA) is the prerogative of the Engineer. The QA Inspector is the duly designated person who acts for and on behalf of the Engineer.

The QC Inspector shall be responsible for quality control acceptance or rejection of materials and workmanship, and shall be currently certified as an AWS Certified Welding Inspector (CWI) in conformance with the requirements in AWS QC1, "Standard and Guide for Qualification of Welding Inspectors."

The QC Inspector may be assisted by an Assistant QC Inspector provided that this individual is currently certified as an AWS Certified Associate Welding Inspector (CAWI) in conformance with the requirements in AWS QC1, "Standard and Guide for Qualification of Welding Inspectors," or has equivalent qualifications. The QC Inspector shall monitor the Assistant QC Inspector's work, and shall be responsible for signing all reports.

When the term "Inspector" is used without further qualification, it shall refer to the QC Inspector.

Section 6.14.6, "Personnel Qualification," of AWS D 1.1, Section 7.7.6, "Personnel Qualification," of AWS D 1.4, and Section 6.1.3.4, "Personnel Qualification," of AWS D 1.5 are replaced with the following:

Personnel performing nondestructive testing (NDT) shall be qualified and certified in conformance with the requirements of the American Society for Nondestructive Testing (ASNT) Recommended Practice No. SNT-TC-1A and the Written Practice of the NDT firm. The Written Practice of the NDT firm shall meet or exceed the guidelines of the ASNT Recommended Practice No. SNT-TC-1A. Only individuals who are 1) certified as an NDT Level II, or 2) Level III

technicians who hold a current ASNT Level III certificate in that discipline and are authorized and certified to perform the work of Level II technicians, shall perform NDT, review the results, and prepare the written reports.

Section 6.5.4, "Scope of Examination," of AWS D 1.1 and Section 7.5.4 of AWS D 1.4 are replaced with the following:

The QC Inspector shall inspect and approve each joint preparation, assembly practice, welding technique, and the performance of each welder, welding operator, and tack welder to make certain that the applicable requirements of this code and the approved welding procedure specification (WPS) are met.

Section 6.5.4 of AWS D 1.5 is replaced with the following:

The QC Inspector shall inspect and approve each joint preparation, assembly practice, welding technique, and the performance of each welder, welding operator, and tack welder to make certain that the applicable requirements of this code and the approved WPS are met. The QC Inspector shall examine the work to make certain that it meets the requirements of Sections 3 and 9.21. The size and contour of all welds shall be measured using suitable gages. Visual inspection for cracks in welds and base metal, and for other discontinuities should be aided by strong light magnifiers, or such other devices as may be helpful. Acceptance criteria different from those specified in this code may be used when approved by the Engineer.

Section 6.6.5, "Nonspecified Nondestructive Testing Other Than Visual," of AWS D 1.1, Section 6.6.5 of AWS D 1.4 and Section 6.6.5 of AWS D 1.5 shall not apply.

For any welding, the Engineer may direct the Contractor to perform NDT that is in addition to the visual inspection or NDT specified in the AWS welding codes, in the Standard Specifications, or in these special provisions. Additional NDT required by the Engineer, will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications. Should any welding deficiencies be discovered by this additional NDT, the cost of the testing will not be paid for as extra work but shall be at the Contractor's expense.

Required repair work to correct welding deficiencies, whether discovered by the required visual inspection or NDT, or by additional NDT directed by the Engineer, and any associated delays or expenses caused to the Contractor by performing these repairs, shall be at the Contractor's expense.

The Engineer shall have the authority to verify the qualifications or certifications of any welder, QC Inspector, or NDT personnel to specified levels by retests or other means.

A sufficient number of QC Inspectors shall be provided to ensure continuous inspection when any welding is being performed. Continuous inspection, as a minimum, shall include (1) having QC Inspectors continually present on the shop floor or project site when any welding operation is being performed, and (2) having a QC Inspector within such close proximity of all welding operations so that inspections by the QC Inspector of each operation, at each welding location, shall not lapse for a period exceeding 30 minutes.

Inspection and approval of all joint preparations, assembly practices, welding techniques, and the performance of each welder, welding operator, and tack welder shall be documented by the QC Inspector on a daily basis for each day that welding is performed. The QC Inspector shall confirm and document compliance with the requirements of the AWS code criteria and the requirements of these special provisions on all weld joints before welding, during welding, and after the completion of each weld.

When joint details that are not prequalified by the applicable AWS codes are proposed for use in the work, welders using these details shall perform a qualification test plate using the approved WPS variables and the joint detail to be used in production. The test plate shall be the maximum thickness to be used in production. The test plate shall be mechanically or radiographically tested as directed by the Engineer. Mechanical and radiographic testing and acceptance criteria shall be as specified in the applicable AWS codes.

The period of effectiveness for a welder's or welding operator's qualification shall be a maximum of 3 years for the same weld process, welding position, and weld type. A valid qualification at the beginning of work on a contract will be acceptable for the entire period of the contract, as long as the welder's work remains satisfactory.

**WELDING QUALITY CONTROL**

Welding quality control shall conform to the requirements in the AWS welding codes, the Standard Specifications, and these special provisions.

Unless otherwise specified, welding quality control shall apply when any work is welded in conformance with the provisions in Section 49, "Piling," Section 52, "Reinforcement," Section 55, "Steel Structures," Section 56-1, "Overhead Sign Structures," Section 75-1.035, "Bridge Joint Restrainer Units," or Section 86-2.04, "Standards, Steel Pedestals and Posts," of the Standard Specifications.

The welding of fracture critical members (FCMs) shall conform to the provisions specified in the Fracture Control Plan (FCP) and herein.

The Contractor shall designate in writing a welding Quality Control Manager (QCM). The QCM shall be responsible directly to the Contractor for the quality of welding, including materials and workmanship, performed by the Contractor and subcontractors.

The QCM shall be the sole individual responsible to the Contractor for submitting, receiving, and approving all correspondence, required submittals, and reports to and from the Engineer.

The QCM shall not be employed or compensated by any subcontractor, or by other persons or entities hired by subcontractors, who will provide other services or materials for the project. The QCM may be an employee of the Contractor.

Welding inspection personnel or NDT firms to be used in the work shall not be employed or compensated by any subcontractor, or by other persons or entities hired by subcontractors, who will provide other services or materials for the project, except for the following conditions:

A. The welding is performed at a permanent fabrication or manufacturing facility which is certified under the AISC Quality Certification Program, Category Cbr, Major Steel Bridges.
B. The welding is performed at a permanent fabrication or manufacturing facility which is certified under the AISC Quality Certification Program, Category Sbd, Conventional Steel Building Structures. This condition shall apply only for work welded in conformance with the provisions in Section 56-1, "Overhead Sign Structures" or Section 86-2.04, "Standards, Steel Pedestals and Posts," of the Standard Specifications.
C. The welding is performed on pipe pile material at a permanent pipe manufacturing facility where an automatic welding process or seamless pipe operation is used in conformance with the requirements in the applicable welding code as specified elsewhere in these special provisions.

For welding performed at such facilities, the inspection personnel or NDT firms may be employed or compensated by the facility performing the welding.

Prior to submitting the Welding Quality Control Plan (WQCP) required herein, a pre-welding meeting between the Engineer, Contractor, and any entity performing welding for this project, shall be held to discuss the requirements for the WQCP.

The Contractor shall submit to the Engineer, in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications, 3 copies of a separate WQCP for each item of work for which welding is to be performed.

The Contractor shall allow the Engineer 2 weeks to review the WQCP submittal after a complete plan has been received. Except for work that is welded in conformance with Section 86-2.04, "Standards, Steel Pedestals and Posts," of the Standard Specifications, and for pipe piling produced at a permanent manufacturing facility as specified above, no welding shall be performed until the WQCP is approved in writing by the Engineer. Materials welded in conformance with Section 86-2.04, "Standards, Steel Pedestals and Posts," of the Standard Specifications, and pipe piling produced at such permanent manufacturing facilities, shall not be incorporated into the work until the WQCP is approved in writing by the Engineer. In the event the Engineer fails to complete the review within the time allowed, and if, in the opinion of the Engineer, completion of the work is delayed or interfered with by reason of the Engineer's delay in completing the review, the Contractor will be compensated for any resulting loss, and an extension of time will be granted, in the same manner as provided for in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

An amended WQCP or any addendum to the approved WQCP shall be submitted to, and approved in writing by the Engineer, for proposed revisions to the approved WQCP. An amended WQCP or addendum will be required for revisions to the WQCP, including but not limited to a revised WPS, additional welders, changes in NDT firms or procedures, QC, or NDT personnel, or updated systems for tracking and identifying welds. The Engineer shall have 3 working days to complete the review of the amended WQCP or addendum. Work affected by the proposed revisions shall not be performed until the amended WQCP or addendum has been approved. In the event the Engineer fails to complete the review within the time allowed, and if, in the opinion of the Engineer, completion of the work is delayed or interfered with by reason of the Engineer's delay in completing the review, the Contractor will be compensated for any resulting loss, and an extension of time will be granted, in the same manner as provided for in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

Each WQCP shall include the applicable portions of the following, as determined by the Engineer:

A. The name of the welding firm and any required NDT inspection personnel or firms.
B. A manual prepared by the NDT inspection personnel or firm that shall include equipment, testing procedures, code of safe practices, the Written Practice of the NDT inspection personnel or firm, and the names, qualifications, and documentation of certifications for all personnel to be used.

C. The name of the QCM and the names, qualifications, and documentation of certifications for all QC Inspectors and Assistant QC Inspectors to be used.
D. An organizational chart showing all QC personnel and their assigned QC responsibilities.
E. The methods and frequencies for performing all required quality control procedures, including QC inspection forms to be used, as required by the specifications including:

    1. all visual inspections.
    2. all NDT including radiographic geometry, penetrameter and shim selection, film quality, film processing, radiograph identification and marking system, and film interpretation and reports.
    3. calibration procedures and calibration frequency for all NDT equipment.

F. A system for the identification and tracking of all welds, NDT, and any required repairs, and a procedure for the reinspection of repaired welds. The system shall have provisions for 1) permanently identifying each weld and the person who performed the weld, 2) placing all identification and tracking information on each radiograph, 3) a method of reporting nonconforming welds to the Engineer, and 4) a method of documentation of repairs and reinspection of nonconforming welds.
G. Standard procedures for performing noncritical repair welds. Noncritical repair welds are defined as welds to deposit additional weld beads or layers to compensate for insufficient weld size and to fill limited excavations that were performed to remove unacceptable edge or surface discontinuities, rollover or undercut. The depth of these excavations shall not exceed 65 percent of the specified weld size.
H. The WPS, including documentation of all supporting Procedure Qualification Record (PQR) tests performed, and the name of the testing laboratory who performed the tests, to verify the acceptability of the WPS. The submitted WPS shall be within the allowable period of effectiveness.
I. Documentation of all certifications for welders for each weld process and position that will be used. Certifications shall list the electrodes used, test position, base metal and thickness, tests performed, and the witnessing authority. All certifications shall be within the allowable period of effectiveness.
J. One authorized copy or original code book for each of all AWS welding codes and the FCP which are applicable to the welding to be performed. These codes and the FCP shall become the permanent property of the Department.
K. Forms to be used for Certificates of Compliance, daily production logs, and daily reports.

After final approval of the WQCP, amended WQCP, or addendum, the Contractor shall submit 7 copies to the Engineer of the approved documents.

It is expressly understood that the Engineer's approval of the Contractor's WQCP shall not relieve the Contractor of any responsibility under the contract for the successful completion of the work in conformance with the requirements of the plans and specifications. The Engineer's approval shall not constitute a waiver of any requirement of the plans and specifications nor relieve the Contractor of any obligation thereunder; and defective work, materials, and equipment may be rejected notwithstanding approval of the WQCP.

A daily production log for welding shall be kept by the QCM for each day that welding is performed. The log shall clearly indicate the locations of all welding, except partial penetration longitudinal seam welds performed in conformance with Section 86-2.04, "Standards, Steel Pedestals and Posts," of the Standard Specifications. The log shall include the welders' names, amount of welding performed, any problems or deficiencies discovered, and any testing or repair work performed, at each location. The daily report from each QC Inspector shall also be included in the log.

The following items shall be included in a Welding Report that is to be submitted to the Engineer within 7 days following the performance of any welding. For work welded in conformance with Section 86-2.04, "Standards, Steel Pedestals and Posts," of the Standard Specifications, and for piling produced at a permanent manufacturing facility, the following items shall be included in a Welding Report that is to be submitted to the Engineer 48 hours prior to furnishing a Certificate of Compliance for the material:

A. Reports of all visual weld inspections and NDT.
B. Radiographs and radiographic reports, and other required NDT reports.
C. Documentation that the Contractor has evaluated all radiographs and other nondestructive tests and corrected all rejectable deficiencies, and all repaired welds have been reexamined by the required NDT and found acceptable.
D. Daily production log.

Radiographic envelopes shall have clearly written on the outside of the envelope the following information: name of the QCM, name of the nondestructive testing firm, name of the radiographer, date, contract number, complete part description, and all included weld numbers or a report number, as detailed in the WQCP. In addition, all innerleaves shall have clearly written on them the part description and all included weld numbers, as detailed in the WQCP.

Reports regarding NDT, including radiographs, shall be signed by both the NDT technician and the person that performed the review, and then submitted directly to the QCM for review and signature prior to submittal to the Engineer. Corresponding names shall be clearly printed or typewritten next to all signatures.

The Engineer will review the Welding Report to determine if the Contractor is in conformance with the WQCP. Unless otherwise specified, the Engineer shall be allowed 7 working days to review the report and respond in writing after a complete Welding Report has been received. Prior to receiving notification from the Engineer of the Contractor's conformance with the WQCP, the Contractor may encase in concrete or cover welds for which a Welding Report has been submitted. However, should the Contractor elect to encase or cover those welds prior to receiving notification from the Engineer, it is expressly understood that the Contractor shall not be relieved of the responsibility for incorporating material in the work that conforms to the requirements of the plans and specifications. Material not conforming to these requirements will be subject to rejection. Should the Contractor elect to wait to encase or cover welds pending notification by the Engineer, and in the event the Engineer fails to complete the review within the time allowed, and if, in the opinion of the Engineer, completion of the work is delayed or interfered with by reason of the Engineer's delay in completing the review, the Contractor will be compensated for any resulting loss, and an extension of time will be granted, in the same manner as provided for in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

The QC Inspector shall provide reports to the QCM on a daily basis for each day that welding is performed.

Except for noncritical weld repairs, the Engineer shall be notified immediately in writing when welding problems, deficiencies, base metal repairs, or any other type of repairs not submitted in the WQCP are discovered and also of the proposed repair procedures to correct them. The Contractor shall allow the Engineer one week to review these procedures. No remedial work shall begin until the repair procedures are approved in writing by the Engineer. In the event the Engineer fails to complete the review within the time allowed, and if, in the opinion of the Engineer, completion of the work is delayed or interfered with by reason of the Engineer's delay in completing the review, the Contractor will be compensated for any resulting loss, and an extension of time will be granted, in the same manner as provided for in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

The QCM shall sign and furnish to the Engineer, a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for each item of work for which welding was performed. The certificate shall state that all of the materials and workmanship incorporated in the work, and all required tests and inspections of this work, have been performed in conformance with the details shown on the plans, the Standard Specifications, and these special provisions.

**PAYMENT**

Full compensation for conforming to the requirements of this section shall be considered as included in the contract prices paid for the various items of work involved and no additional compensation will be allowed therefor.

## SECTION 9. DESCRIPTION OF BRIDGE WORK

The bridge work to be done consists, in general, of constructing two bridge structures, replacing approach slabs, installing fiber optic communication system and six retaining walls of various types as shown in the plans and briefly described as follows:

BREA CANYON ROAD UNDERCROSSING ON RAMP
(Bridge Number 53-2917)

A 10-span, 2 frame, cast-in-place prestressed concrete box girder bridge approximately 456 meters in length and 14 meters in width on CIDH concrete piling foundation.

ROUTE 57/60 HOV CONNECTOR
(Bridge Number 53-2918)

A 19 span, 5 frame, cast-in-place prestressed concrete box girder bridge approximately 955 meters in length and 17 meters in width on CIDH concrete piling foundation.

LEMON AVENUE UNDERCROSSING
(Bridge Number 53-1787)

Replace existing concrete approach slab with type R(9D) and corresponding type 50A concrete barrier railing.

GOLDEN SPRINGS DRIVE UNDERCROSSING
(Bridge Number 53-2149R)

Install fiber optic communication system to outer bay of 2 span cast-in-place prestressed box girder bridge approximately 116 meters long and into the concrete approach slabs.

RETAINING WALL 2963M
(Location A)

Two MSE walls approximately 118 meters and 129 meters in length with soil cement mixing and prefabricated vertical drains as foundation modifications.

RETAINING WALL 367

A cast-in-place concrete retaining wall with soundwall on barrier approximately 436 meters in length on spread and pile footing.

RETAINING WALL 377
(Location B)

1264 meter long wall that comprises of approximately 809 meters of MSE wall and 387 meters of a cast-in-place concrete retaining wall. Portions of wall have soundwalls on barrier and prefabricated vertical drains in the substructure.

RETAINING WALL 379
(Location C)

410 meter long wall that comprises of approximately 220 meters of MSE wall and 190 meters of a cast-in-place concrete retaining wall. Portions of wall have prefabricated vertical drains in the substructure.

RETAINING WALL 393

70 meter long wall that comprises of approximately 43 meters of tieback wall and 27 meters of a soil nail wall

RETAINING WALL 394

220 meter long wall that comprises of approximately 39 meters of tieback wall and 181 meters of a soil nail wall

## SECTION 10. CONSTRUCTION DETAILS

## SECTION 10-1. GENERAL

### 10-1.00 CONSTRUCTION PROJECT INFORMATION SIGNS

Before any major physical construction work readily visible to highway users is started on this contract, the Contractor shall furnish and erect 4 Type 2 Construction Project Information signs at the locations designated by the Engineer.

The signs and overlays shall be of a type and material consistent with the estimated time of completion of the project and shall conform to the details shown on the plans.

The sign letters, border and the Department's construction logos shall conform to the colors (non-reflective) and details shown on the plans, and shall be on a white background (non-reflective). The colors blue and orange shall conform to PR Color Number 3 and Number 6, respectively, as specified in the Federal Highway Administration's Color Tolerance Chart.

The sign message to be used for fund types shall consist of the following, in the order shown:

| |
|---|
| FEDERAL HIGHWAY TRUST FUNDS |
| STATE HIGHWAY FUNDS |

The sign message to be used for type of work shall consist of the following:

| |
|---|
| HIGHWAY CONSTRUCTION |

The sign message to be used for the Year of Completion of Project Construction will be furnished by the Engineer. The Contractor shall furnish and install the "Year" sign overlay within 10 working days of notification of the year date to be used.

The letter sizes to be used shall be as shown on the plans. The information shown on the signs shall be limited to that shown on the plans.

The signs shall be kept clean and in good repair by the Contractor.

Upon completion of the work, the signs shall be removed and disposed of outside the highway right of way in conformance with the provisions in Section 7-1.13 of the Standard Specifications.

Full compensation for furnishing, erecting, maintaining, and removing and disposing of the construction project information signs shall be considered as included in the contract lump sum price paid for construction area signs and no additional compensation will be allowed therefor.

**10-1.01 ORDER OF WORK**

Order of work shall conform to the provisions in Section 5-1.05, "Order of Work," of the Standard Specifications and these special provisions.

A first order of work shall be to construct retaining wall 2963M. After the completion of retaining wall 2963M, a 6 month waiting period shall elapse before construction may begin at abutment 20 of Route 57/60 HOV connector.

Attention is directed to "Concrete Pavement (with Doweled Transverse Weakened Plane Joints)" of these special provisions regarding prepaving conference and constructing a 200 m to 300 m concrete pavement test strip prior to performing concrete paving.

Attention is directed to "Slope Paving" of these special provisions regarding constructing a 1.2 m by 1.8 m test panel prior to placing the permanent slope paving.

Attention is directed to "Miscellaneous Concrete Construction" of these special provisions regarding constructing a 600 mm by 600 mm test panel prior to constructing curb ramps with detectable warning surfaces.

Temporary railing (Type K) and temporary crash cushions shall be secured in place prior to commencing work for which the temporary railing and crash cushions are required.

Attention is directed to "Replace Concrete Pavement (Rapid Strength Concrete)" of these special provisions in regards to providing Pre-Operation Conference and the Just-In-Time Training prior to commencing pavement replacement operations.

Attention is directed to "Water Pollution Control" of these special provisions regarding the submittal and approval of the Storm Water Pollution Prevention Plan prior to performing work having potential to cause water pollution.

The first order of work shall be to place the order for the traffic signal, lighting, communication equipment, communication system routing and electrical equipment and to perform the jointly conducted pre-construction check with the Engineer according to the provisions under "Maintaining Existing and Temporary Electrical Systems," as described under "Service," elsewhere in these special provisions.

Prior to commencement of the traffic signal functional test at any location, all items of work related to signal control shall be completed and all roadside signs, pavement delineation, and pavement markings shall be in place at that location.

The Contractor shall submit to the Engineer a plan to meet the requirements of Traffic Signal and Lighting System restrictions as defined under "Maintaining Existing and Temporary Electrical Systems," elsewhere in these special provisions no less than 30 days prior to commencing work. The Engineer will have 10 days to review the plan. Should the Engineer fail to complete the review within 10 days, and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in reviewing the plan, the delay will be considered a right of way delay in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

Attention is directed to "Maintaining Traffic" and "Temporary Pavement Delineation" of these special provisions and to the stage construction sheets of the plans.

Attention is directed to "Progress Schedule (Critical Path Method)" of these special provisions regarding the submittal of a general time-scaled logic diagram within 10 days after approval of the contract. The diagram shall be submitted prior to performing any work that may be affected by any proposed deviations to the construction staging of the project.

The work shall be performed in conformance with the stages of construction shown on the plans. Nonconflicting work in subsequent stages may proceed concurrently with work in preceding stages, provided satisfactory progress is maintained in the preceding stages of construction.

In each stage, after completion of the preceding stage, the first order of work shall be the removal of existing pavement delineation as directed by the Engineer. Pavement delineation removal shall be coordinated with new delineation so that lane lines are provided at all times on traveled ways open to public traffic.

Before obliterating any pavement delineation (traffic stripes, pavement markings, and pavement markers) that is to be replaced on the same alignment and location, as determined by the Engineer, the pavement delineation shall be referenced by the Contractor, with a sufficient number of control points to reestablish the alignment and location of the new pavement delineation. The references shall include the limits or changes in striping pattern, including one- and 2-way barrier lines, limit lines, crosswalks and other pavement markings. Full compensation for referencing existing pavement delineation shall be considered as included in the contract prices paid for new pavement delineation and no additional compensation will be allowed therefor.

Prior to applying asphalt concrete (Type B) and rubberized asphalt concrete (Type G), the Contractor shall cover all manholes, valve and monument covers, grates, or other exposed facilities located within the area of application, using a plastic or oil resistant construction paper secured to the facility being covered by tape or adhesive. The covered facilities shall be referenced by the Contractor, with a sufficient number of control points to relocate the facilities after the asphalt concrete (Type B) and rubberized asphalt concrete (Type G) has been placed. After completion of the asphalt concrete

(Type B) and rubberized asphalt concrete (Type G) operations, all covers shall be removed and disposed of in a manner satisfactory to the Engineer. Full compensation for covering manholes, valve and monument covers, grates, or other exposed facilities, referencing, and removing temporary cover shall be considered as included in the contract price paid per tonne for asphalt concrete (Type B) and rubberized asphalt concrete (Type G), and no additional compensation will be allowed therefor.

At those locations exposed to public traffic where guard railings or barriers are to be constructed, reconstructed, or removed and replaced, the Contractor shall schedule operations so that at the end of each working day there shall be no post holes open nor shall there be any railing or barrier posts installed without the blocks and rail elements assembled and mounted thereon.

Not less than 60 days prior to planting the plants, the Contractor shall furnish the Engineer a statement from the vendor that the order for the plants required for this contract, including inspection plants, has been received and accepted by the vendor. The statement from the vendor shall include the names, sizes, and quantities of plants ordered and the anticipated date of delivery.

The Contractor shall place orders for replacement plants with the vendor at the appropriate time so that the roots of the replacement plants are not in a root-bound condition.

Not less than 60 days prior to applying seeds, the Contractor shall furnish the Engineer a statement from the vendor that the order for the seed required for this contract has been received and accepted by the vendor. The statement from the vendor shall include the names and quantity of seed ordered and the anticipated date of delivery.

Attention is directed to "Duff" of these special provisions regarding excavation and stockpiling.

Attention is directed to "Irrigation Systems Functional Test" of these special provisions, regarding restrictions for planting operations.

Attention is directed to "Locate Existing Crossovers and Conduits" of these special provisions regarding locating existing irrigation water line crossovers and conduits shown on the plans to be incorporated in the new work. Existing irrigation water line crossovers and conduits shall be located prior to performing work on the irrigation system.

Unless otherwise shown on the plans or specified in these special provisions, conduits to be jacked or drilled or installed by the open trench method for water line crossovers and sprinkler control crossovers shall be installed prior to the installation of other pipe supply lines.

Attention is directed to "Existing Highway Irrigation Facilities" of these special provisions regarding the checking of existing irrigation facilities that are to remain in place, prior to the start of any irrigation work.

Clearing, grubbing, and earthwork operations shall not be performed in areas where existing irrigation facilities are to remain in place until existing irrigation facilities have been checked for proper operation in conformance with the provisions in "Existing Highway Irrigation Facilities" of these special provisions.

Existing conduits to be extended shall be located in conformance with the provisions in "Extend Irrigation Crossovers" of these special provisions prior to the start of other work in these areas.

Attention is directed to Section 20-5.027B, "Wiring Plans and Diagrams," of the Standard Specifications regarding submittal of working drawings.

### 10-1.02 WATER POLLUTION CONTROL

Water pollution control work shall conform to the provisions in Section 7-1.01G, "Water Pollution," of the Standard Specifications and these special provisions.

This project lies within the boundaries of the Los Angeles Regional Water Quality Control Board (RWQCB) (Region 4).

The State Water Resources Control Board (SWRCB) has issued a permit to the Department which governs storm water and non-storm water discharges from its properties, facilities and activities. The Department's Permit is entitled: "Order No. 99-06-DWQ, NPDES No. CAS000003, National Pollutant Discharge Elimination System (NPDES) Permit, Storm Water Permit and Waste Discharge Requirements (WDRs) for the State of California, Department of Transportation Properties, Facilities, and Activities." Copies of the Department's Permit are available for review from the SWRCB, Storm Water Permit Unit, 1001 "I" Street, P.O. Box 1977, Sacramento, California 95812-1977, Telephone: (916) 341-5254, and may also be obtained from the SWRCB Internet website at: http://www.swrcb.ca.gov/stormwtr/caltrans.html.

The Department's Permit references and incorporates by reference the current Statewide General Permit issued by the SWRCB entitled "Order No. 99-08-DWQ, National Pollutant Discharge Elimination System (NPDES) General Permit No. CAS000002, Waste Discharge Requirements (WDRs) for Discharges of Storm Water Associated with Construction Activity," which regulates discharges of storm water and non-storm water from construction activities disturbing 2 or more hectares of soil in a common plan of development. Sampling and analysis requirements as specified in SWRCB Resolution No. 2001-46 are added to the Statewide General Permit. Copies of the Statewide General Permit and modifications thereto are available for review from the SWRCB, Storm Water Permit Unit, 1001 "I" Street, P.O. Box 1977, Sacramento, California 95812-1977, Telephone: (916) 341-5254 and may also be obtained from the SWRCB Internet website at: http://www.swrcb.ca.gov/stormwtr/construction.html.

The NPDES permit that regulate this project, as referenced above, are hereafter collectively referred to as the "Permits."

This project shall conform to the Permits and modifications thereto. The Contractor shall maintain copies of the Permits at the project site and shall make the Permits available during construction.

The Permits require the preparation of a Storm Water Pollution Prevention Plan (SWPPP). The SWPPP shall be prepared in conformance with the requirements of the Permits, the Department's "Storm Water Pollution Prevention Plan (SWPPP) and Water Pollution Control Program (WPCP) Preparation Manual," and the Department's "Construction Site Best Management Practices (BMPs) Manual," including addenda issued up to and including the date of advertisement of the project. These manuals are hereinafter referred to, respectively, as the "Preparation Manual" and the "Construction Site BMPs Manual," and collectively, as the "Manuals." Copies of the Manuals may be obtained from the Department of Transportation, Material Operations Branch, Publication Distribution Unit, 1900 Royal Oaks Drive, Sacramento, California 95815, Telephone: (916) 445-3520, and may also be obtained from the Department's Internet website at: http://www.dot.ca.gov/hq/construc/stormwater.html.

The Contractor shall know and fully comply with applicable provisions of the Permits and all modifications thereto, the Manuals, and Federal, State, and local regulations and requirements that govern the Contractor's operations and storm water and non-storm water discharges from both the project site and areas of disturbance outside the project limits during construction. Attention is directed to Sections 7-1.01, "Laws to be Observed," and 7-1.12, "Indemnification and Insurance," of the Standard Specifications.

The Permits shall apply to storm water and certain permitted non-storm water discharges from areas outside the project site which are directly related to construction activities for this contract including, but not limited to, asphalt batch plants, material borrow areas, concrete plants, staging areas, storage yards and access roads. The Contractor shall comply with the Permits and the Manuals for those areas and shall implement, inspect and maintain the required water pollution control practices. Installing, inspecting and maintaining water pollution control practices on areas outside the highway right of way not specifically arranged and provided for by the Department for the execution of this contract, will not be paid for.

The Contractor shall be responsible for penalties assessed or levied on the Contractor or the Department as a result of the Contractor's failure to comply with the provisions in this section "Water Pollution Control" including, but not limited to, compliance with the applicable provisions of the Permits, the Manuals, and Federal, State and local regulations and requirements as set forth therein.

Penalties as used in this section, "Water Pollution Control," shall include fines, penalties and damages, whether proposed, assessed, or levied against the Department or the Contractor, including those levied under the Federal Clean Water Act and the State Porter-Cologne Water Quality Control Act, by governmental agencies or as a result of citizen suits. Penalties shall also include payments made or costs incurred in settlement for alleged violations of the Permits, the Manuals, or applicable laws, regulations, or requirements. Costs incurred could include sums spent instead of penalties, in mitigation or to remediate or correct violations.

**RETENTION OF FUNDS**

Notwithstanding any other remedies authorized by law, the Department may retain money due the Contractor under the contract, in an amount determined by the Department, up to and including the entire amount of Penalties proposed, assessed, or levied as a result of the Contractor's violation of the Permits, the Manuals, or Federal or State law, regulations or requirements. Funds may be retained by the Department until final disposition has been made as to the Penalties. The Contractor shall remain liable for the full amount of Penalties until such time as they are finally resolved with the entity seeking the Penalties.

Retention of funds for failure to conform to the provisions in this section, "Water Pollution Control," shall be in addition to the other retention amounts required by the contract. The amounts retained for the Contractor's failure to conform to provisions in this section will be released for payment on the next monthly estimate for partial payment following the date when an approved SWPPP has been implemented and maintained, and when water pollution has been adequately controlled, as determined by the Engineer.

When a regulatory agency identifies a failure to comply with the Permits and modifications thereto, the Manuals, or other Federal, State or local requirements, the Department may retain money due the Contractor, subject to the following:

A. The Department will give the Contractor 30 days notice of the Department's intention to retain funds from partial payments which may become due to the Contractor prior to acceptance of the contract. Retention of funds from payments made after acceptance of the contract may be made without prior notice to the Contractor.
B. No retention of additional amounts out of partial payments will be made if the amount to be retained does not exceed the amount being withheld from partial payments pursuant to Section 9-1.06, "Partial Payments," of the Standard Specifications.
C. If the Department has retained funds, and it is subsequently determined that the State is not subject to the entire amount of the Costs and Liabilities assessed or proposed in connection with the matter for which the retention was

made, the Department shall be liable for interest on the amount retained for the period of the retention. The interest rate payable shall be 6 percent per annum.

During the first estimate period that the Contractor fails to conform to the provisions in this section, "Water Pollution Control," the Department may retain an amount equal to 25 percent of the estimated value of the contract work performed.

The Contractor shall notify the Engineer immediately upon request from the regulatory agencies to enter, inspect, sample, monitor, or otherwise access the project site or the Contractor's records pertaining to water pollution control work. The Contractor and the Department shall provide copies of correspondence, notices of violation, enforcement actions or proposed fines by regulatory agencies to the requesting regulatory agency.

**STORM WATER POLLUTION PREVENTION PLAN PREPARATION, APPROVAL AND AMENDMENTS**

As part of the water pollution control work, a Storm Water Pollution Prevention Plan (SWPPP) is required for this contract. The SWPPP shall conform to the provisions in Section 7-1.01G, "Water Pollution," of the Standard Specifications, the requirements in the Manuals, the requirements of the Permits, and these special provisions. Upon the Engineer's approval of the SWPPP, the SWPPP shall be considered to fulfill the provisions in Section 7-1.01G, "Water Pollution," of the Standard Specifications for development and submittal of a Water Pollution Control Program.

No work having potential to cause water pollution, shall be performed until the SWPPP has been approved by the Engineer. Approval shall not constitute a finding that the SWPPP complies with applicable requirements of the Permits, the Manuals and applicable Federal, State and local laws, regulations, and requirements.

The Contractor shall designate a Water Pollution Control Manager. The Water Pollution Control Manager shall be responsible for the preparation of the SWPPP and required modifications or amendments, and shall be responsible for the implementation and adequate functioning of the various water pollution control practices employed. The Contractor may designate different Water Pollution Control Managers to prepare the SWPPP and to implement the water pollution control practices. The Water Pollution Control Managers shall serve as the primary contact for issues related to the SWPPP or its implementation. The Contractor shall submit to the Engineer a statement of qualifications, describing the training, previous work history and expertise of the individual selected by the Contractor to serve as Water Pollution Control Manager. The Water Pollution Control Manager shall have a minimum of 24 hours of formal storm water management training or certification as a Certified Professional in Erosion and Sediment Control (CPESC). The Engineer will reject the Contractor's submission of a Water Pollution Control Manager if the submitted qualifications are deemed to be inadequate.

Within 20 working days after the approval of the contract, the Contractor shall submit 3 copies of the draft SWPPP to the Engineer. The Engineer will have 10 working days to review the SWPPP. If revisions are required, as determined by the Engineer, the Contractor shall revise and resubmit the SWPPP within 10 working days of receipt of the Engineer's comments. The Engineer will have 5 working days to review the revisions. Upon the Engineer's approval of the SWPPP, 4 approved copies of the SWPPP, incorporating the required changes, shall be submitted to the Engineer. In order to allow construction activities to proceed, the Engineer may conditionally approve the SWPPP while minor revisions are being completed. In the event the Engineer fails to complete the review within the time allowed, and if, in the opinion of the Engineer, completion of the work is delayed or interfered with by reason of the Engineer's delay in completing the review, the Contractor will be compensated for resulting losses, and an extension of time will be granted, in the same manner as provided for in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

The SWPPP shall apply to the areas within or outside of the highway right of way that are directly related to construction including, but not limited to, asphalt batch plants, material borrow areas, concrete plants, staging areas, storage yards, and access roads.

The SWPPP shall incorporate water pollution control practices in the following categories:

A. Soil stabilization.
B. Sediment control.
C. Wind erosion control.
D. Tracking control.
E. Non-storm water management.
F. Waste management and materials pollution control.

The Contractor shall develop a Water Pollution Control Schedule that describes the timing of grading or other work activities that could affect water pollution. The Water Pollution Control Schedule shall be updated by the Contractor to reflect changes in the Contractor's operations that would affect the necessary implementation of water pollution control practices.

The Contractor shall complete the "Construction Site BMPs Consideration Checklist" presented in the Preparation Manual and shall incorporate water pollution control practices into the SWPPP. Water pollution control practices include the

"Minimum Requirements" and other Contractor-selected water pollution control practices from the "Construction Site BMPs Consideration Checklist" and the "Project-Specific Minimum Requirements" identified in the Water Pollution Control Cost Break-Down of this section.

The SWPPP shall include, but not be limited to, the items described in the Manuals, Permits and related information contained in the contract documents.

The Contractor shall prepare an amendment to the SWPPP when there is a change in construction activities or operations which may affect the discharge of pollutants to surface waters, ground waters, municipal storm drain systems, or when the Contractor's activities or operations violate a condition of the Permits, or when directed by the Engineer. Amendments shall identify additional water pollution control practices or revised operations, including those areas or operations not identified in the initially approved SWPPP. Amendments to the SWPPP shall be prepared and submitted for review and approval within a time approved by the Engineer, but in no case longer than the time specified for the initial submittal and review of the SWPPP. At a minimum, the SWPPP shall be amended annually and submitted to the Engineer 25 days prior to the defined rainy season.

The Contractor shall keep one copy of the approved SWPPP and approved amendments at the project site. The SWPPP shall be made available upon request by a representative of the Regional Water Quality Control Board, State Water Resources Control Board, United States Environmental Protection Agency, or the local storm water management agency. Requests by the public shall be directed to the Engineer.

**COST BREAK-DOWN**

The Contractor shall include a Water Pollution Control Cost Break-Down in the SWPPP which itemizes the contract lump sum for water pollution control work. The Contractor shall use the Water Pollution Control Cost Break-Down provided in this section as the basis for the cost break-down submitted with the SWPPP. The Contractor shall use the Water Pollution Control Cost Break-Down to identify items, quantities and values for water pollution control work, excluding Temporary Water Pollution Control Practices for which there are separate bid items. The Contractor shall be responsible for the accuracy of the quantities and values used in the cost break-down submitted with the SWPPP. Partial payment for the item of water pollution control will not be made until the Water Pollution Control Cost Break-Down is approved by the Engineer.

Attention is directed to "Time-Related Overhead" of these special provisions regarding compensation for time-related overhead.

Line items indicated in the Water Pollution Control Cost Break-Down in this section with a specified Estimated Quantity shall be considered "Project-Specific Minimum Requirements." The Contractor shall incorporate Project-Specific Minimum Requirements with Contractor-designated quantities and values into the Water Pollution Control Cost Break-Down submitted with the SWPPP.

Line items indicated in the Water Pollution Control Cost Break-Down in this section without a specified Estimated Quantity shall be considered by the Contractor for selection to meet the applicable "Minimum Requirements" as defined in the Manuals, or for other water pollution control work as identified in the "Construction Site BMPs Consideration Checklist" presented in the Preparation Manual. In the Water Pollution Control Cost Break-Down submitted with the SWPPP, the Contractor shall list only those water pollution control practices selected for the project, including quantities and values required to complete the work for those items.

The sum of the amounts for the items of work listed in the Water Pollution Control Cost Break-Down shall be equal to the contract lump sum price bid for water pollution control. Overhead and profit, except for time-related overhead, shall be included in the individual items listed in the cost break-down.

**WATER POLLUTION CONTROL COST BREAK-DOWN**

**Contract No. 07-1257U4**

| ITEM | ITEM DESCRIPTION | UNIT | ESTIMATED QUANTITY | VALUE | AMOUNT |
|---|---|---|---|---|---|
| SS-3 | Hydraulic Mulch | M2 | 53,600 | | |
| SS-4 | Hydroseeding | M2 | 53,600 | | |
| SS-5 | Soil Binders | M2 | 53,600 | | |
| SS-6 | Straw Mulch | M2 | 53,600 | | |
| SS-7 | Geotextiles, Plastic Covers & Erosion Control Blankets/Mats | M2 | 53,600 | | |
| SS-8 | Wood Mulching | M2 | | | |
| SS-9 | Earth Dikes/Drainage Swales & Lined Ditches | M | | | |
| SS-10 | Outlet Protection/Velocity Dissipation Devices | EA | | | |
| SS-11 | Slope Drains | EA | 3 | | |
| SC-1 | Silt Fence | M | 6130 | | |
| SC-2 | Desilting Basin | EA | | | |
| SC-3 | Sediment Trap | EA | | | |
| SC-4 | Check Dam | EA | | | |
| SC-5 | Fiber Rolls | M | | | |
| SC-6 | Gravel Bag Berm | M | | | |
| SC-7 | Street Sweeping and Vacuuming | LS | LS | | |
| SC-8 | Sandbag Barrier | M | | | |
| SC-9 | Straw Bale Barrier | M | | | |
| SC-10 | Storm Drain Inlet Protection | EA | 90 | | |
| WE-1 | Wind Erosion Control | LS | LS | | |
| TC-1 | Stabilized Construction Entrance/Exit | EA | | | |
| TC-2 | Stabilized Construction Roadway | EA | | | |
| TC-3 | Entrance/Outlet Tire Wash | EA | | | |
| NS-1 | Water Conservation Practices | LS | | | |
| NS-2 | Dewatering Operations | EA | | | |
| NS-3 | Paving and Grinding Operations | LS | LS | | |
| NS-4 | Temporary Stream Crossing | EA | | | |
| NS-5 | Clear Water Diversion | EA | | | |
| NS-6 | Illicit Connection/Illegal Discharge Detection and Reporting | LS | LS | | |

| ITEM | ITEM DESCRIPTION | UNIT | ESTIMATED QUANTITY | VALUE | AMOUNT |
|---|---|---|---|---|---|
| NS-7 | Potable Water/Irrigation | LS | | | |
| NS-8 | Vehicle and Equipment Cleaning | LS | LS | | |
| NS-9 | Vehicle and Equipment Fueling | LS | LS | | |
| NS-10 | Vehicle and Equipment Maintenance | LS | LS | | |
| WM-1 | Material Delivery and Storage | LS | LS | | |
| WM-2 | Material Use | LS | LS | | |
| WM-3 | Stockpile Management | LS | | | |
| WM-4 | Spill Prevention and Control | LS | LS | | |
| WM-5 | Solid Waste Management | LS | LS | | |
| WM-6 | Hazardous Waste Management | LS | | | |
| WM-7 | Contaminated Soil Management | LS | | | |
| WM-8 | Concrete Waste Management | LS | | | |
| WM-9 | Sanitary/Septic Waste Management | LS | | | |
| WM-10 | Liquid Waste Management | LS | | | |

**TOTAL** _____

Adjustments in the items of work and quantities listed in the approved cost break-down shall be made when required to address amendments to the SWPPP, except when the adjusted items are paid for as extra work.

No adjustment in compensation will be made to the contract lump sum price paid for water pollution control due to differences between the quantities shown in the approved cost break-down and the quantities required to complete the work as shown on the approved SWPPP. No adjustment in compensation will be made for ordered changes to correct SWPPP work resulting from the Contractor's own operations or from the Contractor's negligence.

The approved cost break-down will be used to determine partial payments during the progress of the work and as the basis for calculating the adjustment in compensation for the item of water pollution control due to increases or decreases of quantities ordered by the Engineer. When an ordered change increases or decreases the quantities of an approved cost break-down item, the adjustment in compensation will be determined in the same manner specified for increases and decreases in the quantity of a contract item of work in conformance with the provisions in Section 4-1.03B, "Increased or Decreased Quantities," of the Standard Specifications. If an ordered change requires a new item which is not on the approved cost break-down, the adjustment in compensation will be determined in the same manner specified for extra work in conformance with Section 4-1.03D, "Extra Work," of the Standard Specifications.

If requested by the Contractor and approved by the Engineer, changes to the water pollution control practices listed in the approved cost break-down, including addition of new water pollution control practices, will be allowed. Changes shall be included in the approved amendment of the SWPPP. If the requested changes result in a net cost increase to the lump sum price for water pollution control, an adjustment in compensation will be made without change to the water pollution control item. The net cost increase to the water pollution control item will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications.

**SWPPP IMPLEMENTATION**

Unless otherwise specified, upon approval of the SWPPP, the Contractor shall be responsible throughout the duration of the project for installing, constructing, inspecting, maintaining, removing, and disposing of the water pollution control practices specified in the SWPPP and in the amendments. Unless otherwise directed by the Engineer, the Contractor's responsibility for SWPPP implementation shall continue throughout temporary suspensions of work ordered in conformance with the provisions in Section 8-1.05, "Temporary Suspension of Work," of the Standard Specifications. Requirements for installation, construction, inspection, maintenance, removal, and disposal of water pollution control practices shall conform to the requirements in the Manuals and these special provisions.

If the Contractor or the Engineer identifies a deficiency in the implementation of the approved SWPPP or amendments, the deficiency shall be corrected immediately unless requested by the Contractor and approved by the Engineer in writing, but shall be corrected prior to the onset of precipitation. If the Contractor fails to correct the identified deficiency by the date agreed or prior to the onset of precipitation, the project shall be in nonconformance with this section, "Water Pollution Control." Attention is directed to Section 5-1.01, "Authority of Engineer," of the Standard Specifications, and to "Retention of Funds" of this section for possible nonconformance penalties.

If the Contractor fails to conform to the provisions of this section, "Water Pollution Control," the Engineer may order the suspension of construction operations until the project complies with the requirements of this section.

Implementation of water pollution control practices may vary by season. The Construction Site BMPs Manual and these special provisions shall be followed for control practice selection of year-round, rainy season and non-rainy season water pollution control practices.

**Year-Round Implementation Requirements**

The Contractor shall have a year-round program for implementing, inspecting and maintaining water pollution control practices for wind erosion control, tracking control, non-storm water management, and waste management and materials pollution control.

The National Weather Service weather forecast shall be monitored and used by the Contractor on a daily basis. An alternative weather forecast proposed by the Contractor may be used if approved by the Engineer. If precipitation is predicted, the necessary water pollution control practices shall be deployed prior to the onset of the precipitation.

Disturbed soil areas shall be considered active whenever the soil disturbing activities have occurred, continue to occur or will occur during the ensuing 21 days. Non-active areas shall be protected as prescribed in the Construction Site BMPs Manual within 14 days of cessation of soil disturbing activities or prior to the onset of precipitation, whichever occurs first.

In order to provide effective erosion control, the Contractor may be directed by the Engineer to apply permanent erosion control in small or multiple units. The Contractor’s attention is directed to "Erosion Control (Type D)" and "Move-In/Move-Out (Erosion Control)" of these special provisions.

**Rainy Season Implementation Requirements**

Soil stabilization and sediment control practices conforming to the requirements of these special provisions shall be provided throughout the rainy season, defined as between October 1 and May 1.

An implementation schedule of required soil stabilization and sediment control practices for disturbed soil areas shall be completed no later than 20 days prior to the beginning of each rainy season. The implementation schedule shall identify the soil stabilization and sediment control practices and the dates when the implementation will be 25 percent, 50 percent and 100 percent complete, respectively. For construction activities beginning during the rainy season, the Contractor shall implement applicable soil stabilization and sediment control practices.

Throughout the defined rainy season, the active disturbed soil area of the project site shall be not more than 2 hectares. The Engineer may approve, on a case-by-case basis, expansions of the active disturbed soil area limit. Soil stabilization and sediment control materials shall be maintained on site sufficient to protect disturbed soil areas. A detailed plan for the mobilization of sufficient labor and equipment shall be maintained to deploy the water pollution control practices required to protect disturbed soil areas prior to the onset of precipitation.

**Non-Rainy Season Implementation Requirements**

The non-rainy season shall be defined as days outside the defined rainy season. The Contractor's attention is directed to the Construction Site BMPs Manual for soil stabilization and sediment control implementation requirements on disturbed soil areas during the non-rainy season. Disturbed soil areas within the project shall be protected in conformance with the requirements in the Construction Site BMPs Manual with an effective combination of soil stabilization and sediment control.

**MAINTENANCE**

To ensure the proper implementation and functioning of water pollution control practices, the Contractor shall regularly inspect and maintain the construction site for the water pollution control practices identified in the SWPPP. The construction site shall be inspected by the Contractor as follows:

A. Prior to a forecast storm.
B. After a precipitation event which causes site runoff.
C. At 24 hour intervals during extended precipitation events.
D. Routinely, a minimum of once every two weeks outside of the defined rainy season.
E. Routinely, a minimum of once every week during the defined rainy season.

The Contractor shall use the Storm Water Quality Construction Site Inspection Checklist provided in the "Preparation Manual" or an alternative inspection checklist provided by the Engineer. One copy of each site inspection record shall be submitted to the Engineer within 24 hours of completing the inspection.

**REPORTING REQUIREMENTS**

**Report of Discharges, Notices or Orders**

If the Contractor identifies discharges into surface waters or drainage systems in a manner causing, or potentially causing, a condition of pollution, or if the project receives a written notice or order from a regulatory agency, the Contractor shall immediately inform the Engineer. The Contractor shall submit a written report to the Engineer within ___ days of the discharge event, notice or order. The report shall include the following information:

A. The date, time, location, nature of the operation, and type of discharge, including the cause or nature of the notice or order.
B. The water pollution control practices deployed before the discharge event, or prior to receiving the notice or order.
C. The date of deployment and type of water pollution control practices deployed after the discharge event, or after receiving the notice or order, including additional measures installed or planned to reduce or prevent reoccurrence.
D. An implementation and maintenance schedule for affected water pollution control practices.

**Report of First-Time Non-Storm Water Discharge**

The Contractor shall notify the Engineer at least 3 days in advance of first-time non-storm water discharge events, excluding exempted discharges. The Contractor shall notify the Engineer of the operations causing non-storm water discharges and shall obtain field approval for first-time non-storm water discharges. Non-storm water discharges shall be monitored at first-time occurrences and routinely thereafter.

**Annual Certifications**

By June 15 of each year, the Contractor shall complete and submit an Annual Certification of Compliance, as contained in the Preparation Manual, to the Engineer.

**SAMPLING AND ANALYTICAL REQUIREMENTS**

The Contractor is required to implement specific sampling and analytical procedures to determine whether BMPs implemented on the construction site are:

A. preventing pollutants that are known or should be known by permittees to occur on construction sites that are not visually detectable in storm water discharges, to cause or contribute to exceedances of water quality objectives

**Non-Visible Pollutants**

The project has the potential to discharge non-visible pollutants in storm water from the construction site. The project SWPPP shall contain a Sampling and Analysis Plan (SAP) that describes the sampling and analysis strategy and schedule to be implemented on the project for monitoring non-visible pollutants in conformance with this section.

The SAP shall identify potential non-visible pollutants that are known or should be known to occur on the construction site associated with the following: (1) construction materials, wastes or operations; (2) known existing contamination due to historical site usage; or (3) application of soil amendments, including soil stabilization products, with the potential to alter pH or contribute toxic pollutants to storm water. Planned material and waste storage areas, locations of known existing contamination, and areas planned for application of soil amendments shall be shown on the SWPPP Water Pollution Control Drawings.

The SAP shall identify a sampling schedule for collecting a sample down gradient from the applicable non-visible pollutant source and a sufficiently large uncontaminated control sample during the first two hours of discharge from rain events during daylight hours which result in a sufficient discharge for sample collection. If run-on occurs onto the non-visible pollutant source, a run-on sample that is immediately down gradient of the run-on to the Department's right of way shall be collected. A minimum of 72 hours of dry weather shall occur between rain events to distinguish separate rain events.

The SAP shall state that water quality sampling will be triggered when any of the following conditions are observed during the required storm water inspections conducted before or during a rain event:

A. Materials or wastes containing potential non-visible pollutants are not stored under watertight conditions.
B. Materials or wastes containing potential non-visible pollutants are stored under watertight conditions, but (1) a breach, leakage, malfunction, or spill is observed; and (2) the leak or spill has not been cleaned up prior to the rain event; and (3) there is the potential for discharge of non-visible pollutants to surface waters or drainage system.
C. Construction activities, such as application of fertilizer, pesticide, herbicide, methyl methacrylate concrete sealant, or non-pigmented curing compound have occurred during a rain event or within 24 hours preceding a rain event, and there is the potential for discharge of pollutants to surface waters or drainage system.
D. Soil amendments, including soil stabilization products, with the potential to alter pH levels or contribute toxic pollutants to storm water runoff have been applied, and there is the potential for discharge of pollutants to surface waters or drainage system (unless independent test data are available that demonstrate acceptable concentration levels of non-visible pollutants in the soil amendment).
E. Storm water runoff from an area contaminated by historical usage of the site is observed to combine with storm water, and there is the potential for discharge of pollutants to surface waters or drainage system.

The SAP shall identify sampling locations for collecting down gradient and control samples, and the rationale for their selection. The control sampling location shall be selected where the sample does not come into contact with materials, wastes or areas associated with potential non-visible pollutants or disturbed soil areas. Sampling locations shall be shown on the SWPPP Water Pollution Control Drawings. Only trained personnel shall collect water quality samples and be identified in the SAP. Qualifications of designated sampling personnel shall describe training and experience, and shall be included in the SWPPP. The SAP shall state monitoring preparation, sample collection procedures, quality assurance/quality control, sample labeling procedures, sample collection documentation, sample shipping and chain of custody procedures, sample numbering system, and reference the construction site health and safety plan.

The SAP shall identify the analytical method to be used for analyzing down gradient and control samples for potential non-visible pollutants on the project. For samples analyzed in the field by sampling personnel, collection, analysis, and equipment calibration shall be in conformance with the Manufacturer's specifications. For samples that will be analyzed by a laboratory, sampling, preservation, and analysis shall be performed by a State-certified laboratory in conformance with 40

CFR 136. The SAP shall identify the specific State-certified laboratory, sample containers, preservation requirements, holding times, and analysis method to be used. A list of State-certified laboratories that are approved by the Department is available at the following internet site: http://www.dhs.ca.gov/ps/ls/elap/html/lablist_county.htm.

**Analytical Results and Evaluation**

The Contractor shall submit a hard copy and electronic copy of water quality analytical results and quality assurance/quality control data to the Engineer within 5 days of sampling for field analyses and within 30 days for laboratory analyses. Analytical results shall be accompanied by an evaluation from the Contractor to determine if down gradient samples show elevated levels of the tested parameter relative to levels in the control sample. If down gradient or downstream samples, as applicable, show increased levels, the Contractor will assess the BMPs, site conditions, and surrounding influences to determine the probable cause for the increase. As determined by the assessment, the Contractor will repair or modify BMPs to address increases and amend the SWPPP as necessary. Electronic results (in one of the following file formats: .xls, .txt, .csv, .dbs, or .mdb) shall have at a minimum the following information: sample identification number, contract number, constituent, reported value, method reference, method detection limit, and reported detection limit. The Contractor shall document sample collection during rain events.

Water quality sampling documentation and analytical results shall be maintained with the SWPPP on the project site until a Notice of Completion has been submitted and approved.

If construction activities or knowledge of site conditions change, such that discharges or sampling locations change, the Contractor shall amend the SAP in conformance with this section, "Water Pollution Control."

**PAYMENT**

The contract lump sum price paid for prepare storm water pollution prevention plan shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals for doing all the work involved in developing, preparing, obtaining approval of, revising, and amending the SWPPP, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Attention is directed to Section 9-1.06, "Partial Payments," and Section 9-1.07, "Payment After Acceptance," of the Standard Specifications. Payments for prepare storm water pollution prevention plan will be made as follows:

A. After the SWPPP has been approved by the Engineer, 75 percent of the contract item price for prepare storm water pollution prevention plan will be included in the monthly partial payment estimate.
B. After acceptance of the contract in conformance with the provisions in Section 7-1.17, "Acceptance of Contract," of the Standard Specifications, payment for the remaining 25 percent of the contract item price for prepare storm water pollution prevention plan will be made in conformance with the provisions in Section 9-1.07.

The contract lump sum price paid for water pollution control shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in installing, constructing, removing, and disposing of water pollution control practices, including non-storm water management, and waste management and materials pollution water pollution control practices, except those for which there is a contract item of work as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Storm water sampling and analysis will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications. No payment will be made for the preparation, collection, analysis, and reporting of storm water samples required where appropriate BMPs are not implemented prior to a rain event, or if a failure of a BMP is not corrected prior to a rain event.

For items identified on the approved Water Pollution Control Cost Break-Down, the cost of maintaining the temporary water pollution control practices shall be divided equally by the State and the Contractor as follows:

**Soil Stabilization**

Temporary water pollution control practices except:
SS-1 Scheduling
SS-2 Preservation of Existing Vegetation

**Sediment Control**

Temporary water pollution control practices except:
SC-7 Street Sweeping and Vacuuming

**Wind Erosion Control**

No sharing of maintenance costs will be allowed.

**Tracking Control**

TC-1 Stabilized Construction Entrance/Exit.

**Non-Storm Water Management**

No sharing of maintenance costs will be allowed.

**Waste Management & Materials Pollution Control**

No sharing of maintenance costs will be allowed.

The division of cost will be made by determining the cost of maintaining water pollution control practices in conformance with the provisions in Section 9-1.03, "Force Account Payment," of the Standard Specifications and paying to the Contractor one-half of that cost. Cleanup, repair, removal, disposal, improper installation, and replacement of water pollution control practices damaged by the Contractor's negligence, shall not be considered as included in the cost for performing maintenance.

The provisions for sharing maintenance costs shall not relieve the Contractor from the responsibility for providing appropriate maintenance on items with no shared maintenance costs.

Full compensation for non-shared maintenance costs of water pollution control practices, as specified in this section, "Water Pollution Control," shall be considered as included in the contract lump sum price paid for water pollution control and no additional compensation will be allowed therefor.

Water pollution control practices for which there is a contract item of work, will be measured and paid for as that contract item of work.

## 10-1.03 PRESERVATION OF PROPERTY

Attention is directed to Section 7-1.11, "Preservation of Property," of the Standard Specifications and these special provisions.

Existing trees, shrubs and other plants, that are not to be removed as shown on the plans or specified in these special provisions, and are injured or damaged by reason of the Contractor's operations, shall be replaced by the Contractor. The minimum size of tree replacement shall be No. 15 container and the minimum size of shrub replacement shall be No. 15 container. Replacement planting shall conform to the requirements in Section 20-4.07, "Replacement," of the Standard Specifications. The Contractor shall water replacement plants in conformance with the provisions in Section 20-4.06, "Watering," of the Standard Specifications.

Damaged or injured plants shall be removed and disposed of outside the highway right of way in conformance with the provisions in Section 7-l.13 of the Standard Specifications. At the option of the Contractor, removed trees and shrubs may be reduced to chips. The chipped material shall be spread within the highway right of way at locations designated by the Engineer.

Replacement planting of injured or damaged trees, shrubs, and other plants shall be completed prior to the start of the plant establishment period. Replacement planting shall conform to the provisions in Section 20-4.05, "Planting," of the Standard Specifications.

## 10-1.04 RELIEF FROM MAINTENANCE AND RESPONSIBILITY

The Contractor may be relieved of the duty of maintenance and protection for those items not directly connected with plant establishment work, except highway planting and irrigation systems in conformance with the provisions in Section 7-1.15, "Relief From Maintenance and Responsibility," of the Standard Specifications.

## 10-1.05 PROGRESS SCHEDULE (CRITICAL PATH METHOD)

The Contractor shall submit to the Engineer practicable critical path method (CPM) progress schedules in conformance with these special provisions. Whenever the term "schedule" is used in this section it shall mean CPM progress schedule.

Attention is directed to "Payments" of Section 5 of these special provisions.

The provisions in Section 8-1.04, "Progress Schedule," of the Standard Specifications shall not apply.

**DEFINITIONS**

The following definitions shall apply to this section:

A. ACTIVITY.—A task, event or other project element on a schedule that contributes to completing the project. Activities have a description, start date, finish date, duration and one or more logic ties.
B. BASELINE SCHEDULE.—The initial schedule representing the Contractor's work plan on the first working day of the project.
C. CONTRACT COMPLETION DATE.—The current extended date for completion of the contract shown on the weekly statement of working days furnished by the Engineer in conformance with the provisions in Section 8-1.06, "Time of Completion," of the Standard Specifications.
D. CRITICAL PATH.—The longest continuous chain of activities for the project that has the least amount of total float of all chains. In general, a delay on the critical path will extend the scheduled completion date.
E. CRITICAL PATH METHOD (CPM).—A network based planning technique using activity durations and the relationships between activities to mathematically calculate a schedule for the entire project.
F. DATA DATE.—The day after the date through which a schedule is current. Everything occurring earlier than the data date is "as-built" and everything on or after the data date is "planned."
G. EARLY COMPLETION TIME.—The difference in time between an early scheduled completion date and the contract completion date.
H. FLOAT.—The difference between the earliest and latest allowable start or finish times for an activity.
I. MILESTONE.—An event activity that has zero duration and is typically used to represent the beginning or end of a certain stage of the project.
J. NARRATIVE REPORT.—A document submitted with each schedule that discusses topics related to project progress and scheduling.
K. NEAR CRITICAL PATH.—A chain of activities with total float exceeding that of the critical path but having no more than 10 working days of total float.
L. SCHEDULED COMPLETION DATE.—The planned project finish date shown on the current accepted schedule.
M. STATE OWNED FLOAT ACTIVITY.—The activity documenting time saved on the critical path by actions of the State. It is the last activity prior to the scheduled completion date.
N. TIME IMPACT ANALYSIS.—A schedule and narrative report developed specifically to demonstrate what effect a proposed change or delay has on the current scheduled completion date.
O. TOTAL FLOAT.—The amount of time that an activity or chain of activities can be delayed before extending the scheduled completion date.
P. UPDATE SCHEDULE.—A current schedule developed from the baseline or subsequent schedule through regular monthly review to incorporate as-built progress and any planned changes.

**GENERAL REQUIREMENTS**

The Contractor shall submit to the Engineer baseline, monthly update and final update schedules, each consistent in all respects with the time and order of work requirements of the contract. The project work shall be executed in the sequence indicated on the current accepted schedule.

Schedules shall show the order in which the Contractor proposes to carry out the work with logical links between time-scaled work activities, and calculations made using the critical path method to determine the controlling operation or operations. The Contractor is responsible for assuring that all activity sequences are logical and that each schedule shows a coordinated plan for complete performance of the work.

The Contractor shall produce schedules using computer software and shall furnish compatible software for the Engineer's exclusive possession and use. The Contractor shall furnish network diagrams, narrative reports, tabular reports and schedule data as parts of each schedule submittal.

Schedules shall include, but not be limited to, activities that show the following that are applicable to the project:

A. Project characteristics, salient features, or interfaces, including those with outside entities, that could affect time of completion.
B. Project start date, scheduled completion date and other milestones.
C. Work performed by the Contractor, subcontractors and suppliers.
D. Submittal development, delivery, review and approval, including those from the Contractor, subcontractors and suppliers.
E. Procurement, delivery, installation and testing of materials, plants and equipment.
F. Testing and settlement periods.
G. Utility notification and relocation.
H. Erection and removal of falsework and shoring.
I. Major traffic stage switches.

J. Finishing roadway and final cleanup.
K. State-owned float as the predecessor activity to the scheduled completion date.

Schedules shall have not less than 50 and not more than 500 activities, unless otherwise authorized by the Engineer. The number of activities shall be sufficient to assure adequate planning of the project, to permit monitoring and evaluation of progress, and to do an analysis of time impacts.

Schedule activities shall include the following:

A. A clear and legible description.
B. Start and finish dates.
C. A duration of not less than one working day, except for event activities, and not more than 20 working days, unless otherwise authorized by the Engineer.
D. At least one predecessor and one successor activity, except for project start and finish milestones.
E. Required constraints.
F. Codes for responsibility, stage, work shifts, location and contract pay item numbers.

The Contractor may show early completion time on any schedule provided that the requirements of the contract are met. Early completion time shall be considered a resource for the exclusive use of the Contractor. The Contractor may increase early completion time by improving production, reallocating resources to be more efficient, performing sequential activities concurrently or by completing activities earlier than planned. The Contractor may also submit for approval a cost reduction incentive proposal in conformance with the provisions in Section 5-1.14, "Cost Reduction Incentive," of the Standard Specifications that will reduce time of construction.

The Contractor may show a scheduled completion date that is later than the contract completion date on an update schedule, after the baseline schedule is accepted. The Contractor shall provide an explanation for a late scheduled completion date in the narrative report that is included with the schedule.

State-owned float shall be considered a resource for the exclusive use of the State. The Engineer may accrue State-owned float by the early completion of review of any type of required submittal when it saves time on the critical path. The Contractor shall prepare a time impact analysis, when requested by the Engineer, to determine the effect of the action in conformance with the provisions in "Time Impact Analysis" specified herein. The Engineer will document State-owned float by directing the Contractor to update the State-owned float activity on the next update schedule. The Contractor shall include a log of the action on the State-owned float activity and include a discussion of the action in the narrative report. The Engineer may use State-owned float to mitigate past, present or future State delays by offsetting potential time extensions for contract change orders.

The Engineer may adjust contract working days for ordered changes that affect the scheduled completion date, in conformance with the provisions in Section 4-1.03, "Changes," of the Standard Specifications. The Contractor shall prepare a time impact analysis to determine the effect of the change in conformance with the provisions in "Time Impact Analysis" specified herein, and shall include the impacts acceptable to the Engineer in the next update schedule. Changes that do not affect the controlling operation on the critical path will not be considered as the basis for a time adjustment. Changes that do affect the controlling operation on the critical path will be considered by the Engineer in decreasing time or granting an extension of time for completion of the contract. Time extensions will only be granted if the total float is absorbed and the scheduled completion date is delayed one or more working days because of the ordered change.

The Engineer's review and acceptance of schedules shall not waive any contract requirements and shall not relieve the Contractor of any obligation thereunder or responsibility for submitting complete and accurate information. Schedules that are rejected shall be corrected by the Contractor and resubmitted to the Engineer within 5 working days of notification by the Engineer, at which time a new review period of one week will begin.

Errors or omissions on schedules shall not relieve the Contractor from finishing all work within the time limit specified for completion of the contract. If, after a schedule has been accepted by the Engineer, either the Contractor or the Engineer discover that any aspect of the schedule has an error or omission, it shall be corrected by the Contractor on the next update schedule.

**COMPUTER SOFTWARE**

The Contractor shall submit to the Engineer for approval a description of proposed software before delivery. The software shall be the current version of Primavera SureTrak Project Manager for Windows, or equal, and shall be compatible with Windows NT (version 4.0) operating system. If software other than SureTrak is proposed, it shall be capable of generating files that can be imported into SureTrak.

The Contractor shall furnish schedule software and all original software instruction manuals to the Engineer with submittal of the baseline schedule. The furnished schedule software shall become the property of the State and will not be

returned to the Contractor. The State will compensate the Contractor in conformance with the provisions in Section 4-1.03, "Extra Work," of the Standard Specifications for replacement of software which is damaged, lost or stolen after delivery to the Engineer.

The Contractor shall instruct the Engineer in the use of the software and provide software support until the contract is accepted. Within 20 working days of contract approval, the Contractor shall provide a commercial 8-hour training session for 2 Department employees in the use of the software at a location acceptable to the Engineer. It is recommended that the Contractor also send at least 2 employees to the same training session to facilitate development of similar knowledge and skills in the use of the software. If software other than SureTrak is furnished, then the training session shall be a total of 16-hours for each Department employee.

**NETWORK DIAGRAMS, REPORTS AND DATA**

The Contractor shall include the following for each schedule submittal:

A. Two sets of originally plotted, time-scaled network diagrams.
B. Two copies of a narrative report.
C. Two copies of each of 3 sorts of the CPM software-generated tabular reports.
D. One 1.44-megabyte 90 mm (3.5 inch) floppy diskette containing the schedule data.

The time-scaled network diagrams shall conform to the following:

A. Show a continuous flow of information from left to right.
B. Be based on early start and early finish dates of activities.
C. Clearly show the primary paths of criticality using graphical presentation.
D. Be prepared on E-size sheets, 860 mm x 1120 mm (34 inch x 44 inch).
E. Include a title block and a timeline on each page.

The narrative report shall be organized in the following sequence with all applicable documents included:

A. Contractor's transmittal letter.
B. Work completed during the period.
C. Identification of unusual conditions or restrictions regarding labor, equipment or material; including multiple shifts, 6-day work weeks, specified overtime or work at times other than regular days or hours.
D. Description of the current critical path.
E. Changes to the critical path and scheduled completion date since the last schedule submittal.
F. Description of problem areas.
G. Current and anticipated delays:

    1. Cause of delay.
    2. Impact of delay on other activities, milestones and completion dates.
    3. Corrective action and schedule adjustments to correct the delay.

H. Pending items and status thereof:

    1. Permits
    2. Change orders
    3. Time adjustments
    4. Non-compliance notices

I. Reasons for an early or late scheduled completion date in comparison to the contract completion date.

Tabular reports shall be software-generated and provide information for each activity included in the project schedule. Three different reports shall be sorted by (1) activity number, (2) early start and (3) total float. Tabular reports shall be 215 mm x 280 mm (8 1/2 inch x 11 inch) in size and shall include, as a minimum, the following applicable information:

A. Data date
B. Activity number and description
C. Predecessor and successor activity numbers and descriptions

D. Activity codes
E. Scheduled, or actual and remaining durations (work days) for each activity
F. Earliest start (calendar) date
G. Earliest finish (calendar) date
H. Actual start (calendar) date
I. Actual finish (calendar) date
J. Latest start (calendar) date
K. Latest finish (calendar) date
L. Free float (work days)
M. Total float (work days)
N. Percentage of activity complete and remaining duration for incomplete activities.
O. Lags
P. Required constraints

Schedule submittals will only be considered complete when all documents and data have been provided as described above.

**PRE-CONSTRUCTION SCHEDULING CONFERENCE**

The Contractor shall schedule and the Engineer will conduct a pre-construction scheduling conference with the Contractor's project manager and construction scheduler within 10 working days of the approval of the contract. At this meeting the Engineer will review the requirements of this section of the special provisions with the Contractor.

The Contractor shall submit a general time-scaled logic diagram displaying the major activities and sequence of planned operations and shall be prepared to discuss the proposed work plan and schedule methodology that comply with the requirements of these special provisions. If the Contractor proposes deviations to the construction staging of the project, then the general time-scaled logic diagram shall also display the deviations and resulting time impacts. The Contractor shall be prepared to discuss the proposal.

At this meeting, the Contractor shall additionally submit the alphanumeric coding structure and the activity identification system for labeling the work activities. To easily identify relationships, each activity description shall indicate its associated scope or location of work by including such terms as quantity of material, type of work, bridge number, station to station location, side of highway (such as left, right, northbound, southbound), lane number, shoulder, ramp name, ramp line descriptor or mainline.

The Engineer will review the logic diagram, coding structure, and activity identification system, and provide any required baseline schedule changes to the Contractor for implementation.

**BASELINE SCHEDULE**

Beginning the week following the pre-construction scheduling conference, the Contractor shall meet with the Engineer weekly until the baseline schedule is accepted by the Engineer to discuss schedule development and resolve schedule issues.

The Contractor shall submit to the Engineer a baseline schedule within 20 working days of approval of the contract. The Contractor shall allow 3 weeks for the Engineer's review after the baseline schedule and all support data are submitted. In addition, the baseline schedule submittal will not be considered complete until the computer software is delivered and installed for use in review of the schedule.

The baseline schedule shall include the entire scope of work and how the Contractor plans to complete all work contemplated. The baseline schedule shall show the activities that define the critical path. Multiple critical paths and near-critical paths shall be kept to a minimum. A total of not more than 50 percent of the baseline schedule activities shall be critical or near critical, unless otherwise authorized by the Engineer.

The baseline schedule shall not extend beyond the number of working days specified in these special provisions. The baseline schedule shall have a data date of the first working day of the contract and not include any completed work to date. The baseline schedule shall not attribute negative float or negative lag to any activity.

If the Contractor submits an early completion baseline schedule that shows contract completion in less than 85 percent of the working days specified in these special provisions, the baseline schedule shall be supplemented with resource allocations for every task activity and include time-scaled resource histograms. The resource allocations shall be shown to a level of detail that facilitates report generation based on labor crafts and equipment classes for the Contractor and subcontractors. The Contractor shall use average composite crews to display the labor loading of on-site construction activities. The Contractor shall optimize and level labor to reflect a reasonable plan for accomplishing the work of the contract and to assure that resources are not duplicated in concurrent activities. The time-scaled resource histograms shall show labor crafts and equipment classes to be utilized on the contract. The Engineer may review the baseline schedule activity resource allocations using Means Productivity Standards or equivalent to determine if the schedule is practicable.

**UPDATE SCHEDULE**

The Contractor shall submit an update schedule and meet with the Engineer to review contract progress, on or before the first day of each month, beginning one month after the baseline schedule is accepted. The Contractor shall allow 2 weeks for the Engineer's review after the update schedule and all support data are submitted, except that the review period shall not start until the previous month's required schedule is accepted. Update schedules that are not accepted or rejected within the review period will be considered accepted by the Engineer.

The update schedule shall have a data date of the twenty-first day of the month or other date established by the Engineer. The update schedule shall show the status of work actually completed to date and the work yet to be performed as planned. Actual activity start dates, percent complete and finish dates shall be shown as applicable. Durations for work that has been completed shall be shown on the update schedule as the work actually occurred, including Engineer submittal review and Contractor resubmittal times.

The Contractor may include modifications such as adding or deleting activities or changing activity constraints, durations or logic that do not (1) alter the critical path(s) or near critical path(s) or (2) extend the scheduled completion date compared to that shown on the current accepted schedule. The Contractor shall state in writing the reasons for any changes to planned work. If any proposed changes in planned work will result in (1) or (2) above, then the Contractor shall submit a time impact analysis as described herein.

**TIME IMPACT ANALYSIS**

The Contractor shall submit a written time impact analysis (TIA) to the Engineer with each request for adjustment of contract time, or when the Contractor or Engineer consider that an approved or anticipated change may impact the critical path or contract progress.

The TIA shall illustrate the impacts of each change or delay on the current scheduled completion date or internal milestone, as appropriate. The analysis shall use the accepted schedule that has a data date closest to and prior to the event. If the Engineer determines that the accepted schedule used does not appropriately represent the conditions prior to the event, the accepted schedule shall be updated to the day before the event being analyzed. The TIA shall include an impact schedule developed from incorporating the event into the accepted schedule by adding or deleting activities, or by changing durations or logic of existing activities. If the impact schedule shows that incorporating the event modifies the critical path and scheduled completion date of the accepted schedule, the difference between scheduled completion dates of the two schedules shall be equal to the adjustment of contract time. The Engineer may construct and utilize an appropriate project schedule or other recognized method to determine adjustments in contract time until the Contractor provides the TIA.

The Contractor shall submit a TIA in duplicate within 15 working days of receiving a written request for a TIA from the Engineer. The Contractor shall allow the Engineer 2 weeks after receipt to approve or reject the submitted TIA. All approved TIA schedule changes shall be shown on the next update schedule.

If a TIA submitted by the Contractor is rejected by the Engineer, the Contractor shall meet with the Engineer to discuss and resolve issues related to the TIA. If agreement is not reached, the Contractor will be allowed 15 days from the meeting with the Engineer to give notice in conformance with the provisions in Section 9-1.04, "Notice of Potential Claim," of the Standard Specifications. The Contractor shall only show actual as-built work, not unapproved changes related to the TIA, in subsequent update schedules. If agreement is reached at a later date, approved TIA schedule changes shall be shown on the next update schedule. The Engineer will withhold remaining payment on the schedule contract item if a TIA is requested by the Engineer and not submitted by the Contractor within 15 working days. The schedule item payment will resume on the next estimate after the requested TIA is submitted. No other contract payment will be retained regarding TIA submittals.

**FINAL UPDATE SCHEDULE**

The Contractor shall submit a final update, as-built schedule with actual start and finish dates for the activities, within 30 days after completion of contract work. The Contractor shall provide a written certificate with this submittal signed by the Contractor's project manager and an officer of the company stating, "To my knowledge and belief, the enclosed final update schedule reflects the actual start and finish dates of the actual activities for the project contained herein." An officer of the company may delegate in writing the authority to sign the certificate to a responsible manager.

**RETENTION**

The Department will retain an amount equal to 25 percent of the estimated value of the work performed during each estimate period in which the Contractor fails to submit an acceptable schedule conforming to the requirements of these special provisions as determined by the Engineer. Schedule retentions will be released for payment on the next monthly estimate for partial payment following the date that acceptable schedules are submitted to the Engineer or as otherwise specified herein. Upon completion of all contract work and submittal of the final update schedule and certification, any

remaining retained funds associated with this section, "Progress Schedule (Critical Path Method)", will be released for payment. Retentions held in conformance with this section shall be in addition to other retentions provided for in the contract. No interest will be due the Contractor on retention amounts.

**PAYMENT**

Progress schedule (critical path method) will be paid for at a lump sum price. The contract lump sum price paid for progress schedule (critical path method) shall include full compensation for furnishing all labor, material, tools, equipment, and incidentals, including computer software, and for doing all the work involved in preparing, furnishing, and updating schedules, and instructing and assisting the Engineer in the use of computer software, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Payments for the progress schedule (critical path method) contract item will be made progressively as follows:

A. A total of 25 percent of the item amount or a total of 25 percent of the amount listed for progress schedule (critical path method) in "Payments" of Section 5 of these special provisions, whichever is less, will be paid upon achieving all of the following:

   1. Completion of 5 percent of all contract item work.
   2. Acceptance of all schedules and TIAs required to the time when 5 percent of all contract item work is complete.
   3. Delivery of schedule software to the Engineer.
   4. Completion of required schedule software training.

B. A total of 50 percent of the item amount or a total of 50 percent of the amount listed for progress schedule (critical path method) in "Payments" of Section 5 of these special provisions, whichever is less, will be paid upon completion of 25 percent of all contract item work and acceptance of all schedules and TIAs required to the time when 25 percent of all contract item work is complete.
C. A total of 75 percent of the item amount or a total of 75 percent of the amount listed for progress schedule (critical path method) in "Payments" of Section 5 of these special provisions, whichever is less, will be paid upon completion of 50 percent of all contract item work and acceptance of all schedules and TIAs required to the time when 50 percent of all contract item work is complete.
D. A total of 100 percent of the item amount or a total of 100 percent of the amount listed for progress schedule (critical path method) in "Payments" of Section 5 of these special provisions, whichever is less, will be paid upon completion of all contract item work, acceptance of all schedules and TIAs required to the time when all contract item work is complete, and submittal of the certified final update schedule.

If the Contractor fails to complete any of the work or provide any of the schedules required by this section, the Engineer shall make an adjustment in compensation in conformance with the provisions in Section 4-1.03C, "Changes in Character of Work," of the Standard Specifications for the work not performed. Adjustments in compensation for schedules will not be made for any increased or decreased work ordered by the Engineer in furnishing schedules.

**10-1.06 OVERHEAD**

Overhead shall conform to these special provisions. The Contractor will be compensated for time-related overhead in conformance with these special provisions.

Attention is directed to "Force Account Payment" and "Progress Schedule (Critical Path Method)" of these special provisions.

The provisions in Section 9-1.08, "Adjustment of Overhead Costs," of the Standard Specifications shall not apply.

Time-related overhead shall consist of those overhead costs, including field and home office overhead, that are in proportion to the time required to complete the work. Time-related overhead shall not include costs that are not related to time, including but not limited to, mobilization, licenses, permits, and any other charges incurred only once during the contract.

Field office overhead expenses include time-related costs associated with the normal and recurring operations of the construction project, and shall not include costs directly attributable to any of the work of the contract. Such time-related costs include, but are not limited to, the salaries and benefits of project managers, general superintendents, field office managers and other field office staff assigned to the project, and rent, utilities, maintenance, security, supplies and equipment costs of the project field office.

Home office overhead or general and administrative expenses refer to the fixed costs of operating the Contractor's business. These costs include, but are not limited to, general administration, insurance, personnel and subcontract administration, purchasing, accounting, and project engineering and estimating. The rate of home office overhead shall

exclude expenses specifically related to other contracts or other businesses of the Contractor, equipment coordination, material deliveries, and consultant and legal fees.

The quantity of time-related overhead to be paid will be measured by the working day, as specified in the Engineer's Estimate as WDAY. The estimated amount will be based on the number of working days, excluding any days for plant establishment, as specified in "Beginning of Work, Time of Completion and Liquidated Damages" of these special provisions. In the event an early completion progress schedule, as defined in "Progress Schedule (Critical Path Method)" of these special provisions, is submitted by the Contractor and approved by the Engineer, the quantity of time-related overhead eligible for payment will be based on the total number of working days as specified in "Beginning of Work, Time of Completion and Liquidated Damages" of these special provisions, rather than the Contractor's early completion progress schedule. The quantity of time-related overhead, as measured above, will be adjusted only as a result of suspensions and adjustments of time which revise the current contract completion date and which are also any of the following:

A. Suspensions of work ordered in conformance with the provisions in Section 8-1.05, "Temporary Suspension of Work," of the Standard Specifications, except:

    1. Suspensions ordered due to weather conditions being unfavorable for the suitable prosecution of the controlling operation or operations; or
    2. Suspensions ordered due to the failure on the part of the Contractor to carry out orders given, or to perform any provision of the contract; or
    3. Any other suspensions mutually agreed upon between the Engineer and the Contractor.

B. Extensions of time granted by the State in conformance with the provisions in the fifth paragraph in Section 8-1.07, "Liquidated Damages," of the Standard Specifications; or
C. Reductions in contract time set forth in approved contract change orders, in conformance with the provisions in Section 4-1.03, "Changes," of the Standard Specifications.

In the event a cost reduction proposal is submitted by the Contractor, and is subsequently approved by the Engineer, which provides for a reduction in contract time, the contract amount of time-related overhead associated with the reduction in contract time shall be considered as a net savings in the total cost of time-related overhead. The Contractor will be paid 50 percent of the estimated net savings of the time-related overhead, in conformance with the provisions in Section 5-1.14, "Cost Reduction Incentive," of the Standard Specifications.

If the quantity of time-related overhead, measured as specified in this special provision, exceeds 149 percent of the number of working days specified in the Engineer's Estimate, the Contractor shall, within 60 days of the Engineer's written request, submit to the Engineer an audit examination and report performed by an independent Certified Public Accountant of the Contractor's actual overhead costs. The independent Certified Public Accountant's audit examination shall be performed in conformance with the requirements of the American Institute of Certified Public Accountants Attestation Standards. The audit examination and report shall depict the Contractor's project and company-wide financial records and shall specify the actual overall average daily rates for both field and home office overhead for the entire duration of the project, and whether the costs have been properly allocated. The rates of field and home office overhead shall exclude all unallowable costs as determined in the Federal Acquisition Regulations, 48 CFR, Chapter 1, Part 31. The audit examination shall determine if the rates of field and home office overhead:

A. are allowable in conformance with the requirements of the Federal Acquisition Regulations, 48 CFR, Chapter 1, Part 31;
B. are adequately supported by reliable documentation; and
C. related solely to the project under examination.

Upon the Engineer's written request, the Contractor shall make its financial records available for audit by the State for the purpose of verifying the actual rate of time-related overhead specified in the audit submitted by the Contractor. The actual rate of time-related overhead specified in the audit, submitted by the Contractor, will be subject to approval by the Engineer.

If the Engineer elects, or if requested in writing by the Contractor, contract item payments for time-related overhead, in excess of 149 percent of the number of working days designated in the Engineer's Estimate, will be adjusted to reflect the actual rate.

The cost of performing an audit examination and submitting the report, requested by the Engineer, will be borne equally by the State and the Contractor. The division of the cost will be made by determining the cost of providing an audit examination in conformance with the provisions of Section 9-1.03B, "Work performed by Special Forces or Other Special Services" of the Standard Specifications, and paying to the Contractor one-half of that cost.

The contract price paid per working day for time-related overhead shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in time-related overhead, complete in place, including all field and home office overhead costs incurred by the Contractor and by any joint venture partner, subcontractor, supplier or other party associated with the Contractor, and the Contractor's share of costs of audits of overhead costs requested by the Engineer, as specified in these special provisions, and as directed by the Engineer. The provisions in Sections 4-1.03B, "Increased or Decreased Quantities," 4-1.03C, "Changes in Character of the Work," of the Standard Specifications shall not apply to time-related overhead.

Full compensation for additional overhead costs involved in the performance of extra work at force account shall be considered as included in the markups specified in "Force Account Payment," of these special provisions.

Full compensation for additional overhead cost involved in performing additional contract item work that is not a controlling operation and for all overhead, other than the time-related overhead measured and paid for as specified in this section "Overhead", shall be considered as included in the various items of work involved, and no additional compensation will be allowed therefor.

For the purpose of making partial payments pursuant to the provisions in Section 9-1.06, "Partial Payments," of the Standard Specifications, the number of working days to be paid for time-related overhead in each monthly partial payment will be the number of working days, specified above to be measured for payment, that occurred during that monthly estimate period. The amount earned per working day for time-related overhead shall be either the contract item price, or 20 percent of the original total contract amount divided by the number of working days specified in "Beginning of Work, Time of Completion and Liquidated Damages," of these special provisions, whichever is the lesser.

After all work has been completed, except plant establishment work, as provided in Section 20-4.08, "Plant Establishment Work," of the Standard Specifications, the amount, if any, of the total contract item price for time-related overhead not yet paid will be included for payment in the first estimate made after completion of all roadway construction work, in conformance with the provisions in Section 9-1.06, "Partial Payments," of the Standard Specifications.

**10-1.07 OBSTRUCTIONS**

Attention is directed to Section 8-1.10, "Utility and Non-Highway Facilities," and Section 15, "Existing Highway Facilities," of the Standard Specifications and these special provisions.

Attention is directed to the existence of certain underground facilities that may require special precautions be taken by the Contractor to protect the health, safety and welfare of workers and of the public. Facilities requiring special precautions include, but are not limited to: conductors of petroleum products, oxygen, chlorine, and toxic or flammable gases; natural gas in pipelines greater than 150 mm in diameter or pipelines operating at pressures greater than 415 kPa (gage); underground electric supply system conductors or cables, with potential to ground of more than 300 V, either directly buried or in a duct or conduit which do not have concentric grounded or other effectively grounded metal shields or sheaths.

If these facilities are not located on the plans in both alignment and elevation, no work shall be performed in the vicinity of the facilities, except as provided herein for conduit to be placed under pavement, until the owner, or the owner's representative, has located the facility by potholing, probing or other means that will locate and identify the facility. Conduit to be installed under pavement in the vicinity of these facilities shall be placed by the "Trenching in Pavement Method" in conformance with the provisions in "Conduit" of these special provisions. If, in the opinion of the Engineer, the Contractor's operations are delayed or interfered with by reason of the utility facilities not being located by the owner or the owner's representative, the State will compensate the Contractor for the delays to the extent provided in Section 8-1.09, "Right of Way Delays," of the Standard Specifications, and not otherwise, except as provided in Section 8-1.10, "Utility and Non-Highway Facilities," of the Standard Specifications.

All excavation required to install electrical conduits and pull boxes within 1.2 m in the areas with high risks utilities shall be performed by hand excavation without the use of power equipment except that power equipment may be used to cut and remove asphalt or Portland cement pavement.

The Contractor shall notify the Engineer and the appropriate regional notification center for operators of subsurface installations at least 2 working days, but not more than 14 calendar days, prior to performing any excavation or other work close to any underground pipeline, conduit, duct, wire or other structure. Regional notification centers include, but are not limited to, the following:

| Notification Center | Telephone Number |
|---|---|
| Underground Service Alert-Northern California (USA) | 1-800-642-2444<br>1-800-227-2600 |
| Underground Service Alert-Southern California (USA) | 1-800-422-4133<br>1-800-227-2600 |

The following utility facilities will be relocated during the progress of the contract. The Contractor shall notify the Engineer, in writing, prior to doing work in the vicinity of the facility. The utility facility will be relocated within the listed working days, as defined in Section 8-1.06, "Time of Completion," of the Standard Specifications, after the notification is received by the Engineer:

| Utility | Location | Working Days |
|---|---|---|
| Southern California Edison<br>Remove tower and wood pole, install two steel poles | Station 387+60 of Route 60 | 75 |

**10-1.08 DUST CONTROL**

Dust control shall conform to the provisions in Section 10, "Dust Control," of the Standard Specifications.

**10-1.09 MOBILIZATION**

Mobilization shall conform to the provisions in Section 11, "Mobilization," of the Standard Specifications.

**10-1.10 CONSTRUCTION AREA TRAFFIC CONTROL DEVICES**

Flagging, signs, and all other traffic control devices furnished, installed, maintained, and removed when no longer required shall conform to the provisions in Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications and these special provisions.

Category 1 traffic control devices are defined as those devices that are small and lightweight (less than 45 kg), and have been in common use for many years. The devices shall be known to be crashworthy by crash testing, crash testing of similar devices, or years of demonstrable safe performance. Category 1 traffic control devices include traffic cones, plastic drums, portable delineators, and channelizers.

If requested by the Engineer, the Contractor shall provide written self-certification for crashworthiness of Category 1 traffic control devices. Self-certification shall be provided by the manufacturer or Contractor and shall include the following: date, Federal Aid number (if applicable), expenditure authorization, district, county, route and kilometer post of project limits; company name of certifying vendor, street address, city, state and zip code; printed name, signature and title of certifying person; and an indication of which Category 1 traffic control devices will be used on the project. The Contractor may obtain a standard form for self-certification from the Engineer.

Category 2 traffic control devices are defined as those items that are small and lightweight (less than 45 kg), that are not expected to produce significant vehicular velocity change, but may otherwise be potentially hazardous. Category 2 traffic control devices include: barricades and portable sign supports.

Category 2 devices purchased on or after October 1, 2000 shall be on the Federal Highway Administration (FHWA) Acceptable Crashworthy Category 2 Hardware for Work Zones list. This list is maintained by FHWA and can be located at the following internet address: http://safety.fhwa.dot.gov/fourthlevel/hardware/listing.cfm?code=workzone. The Department maintains a secondary list at the following internet address: http://www.dot.ca.gov/hq/traffops/signtech/signdel/pdf.htm.

Category 2 devices that have not received FHWA acceptance, and were purchased before October 1, 2000, may continue to be used until they complete their useful service life or until January 1, 2003, whichever comes first. Category 2 devices in use that have received FHWA acceptance shall be labeled with the FHWA acceptance letter number and the name of the manufacturer by the start of the project. The label shall be readable. After January 1, 2003, all Category 2 devices without a label shall not be used on the project.

If requested by the Engineer, the Contractor shall provide a written list of Category 2 devices to be used on the project at least 5 days prior to beginning any work using the devices. For each type of device, the list shall indicate the FHWA acceptance letter number and the name of the manufacturer.

Full compensation for providing self-certification for crashworthiness of Category 1 traffic control devices and for providing a list of Category 2 devices used on the project and labeling Category 2 devices as specified shall be considered as included in the prices paid for the various contract items of work requiring the use of the Category 1 or Category 2 traffic control devices and no additional compensation will be allowed therefor.

**10-1.11 CONSTRUCTION AREA SIGNS**

Construction area signs shall be furnished, installed, maintained, and removed when no longer required in conformance with the provisions in Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications and these special provisions.

Attention is directed to the provisions in "Prequalified and Tested Signing and Delineation Materials" of these special provisions. Type II retroreflective sheeting shall not be used on construction area sign panels.

Attention is directed to "Construction Project Information Signs" of these special provisions regarding the number and type of construction project information signs to be furnished, erected, maintained, and removed and disposed of.

The Contractor shall notify the appropriate regional notification center for operators of subsurface installations at least 2 working days, but not more than 14 calendar days, prior to commencing excavation for construction area sign posts. The regional notification centers include, but are not limited to, the following:

| Notification Center | Telephone Number |
|---|---|
| Underground Service Alert-Northern California (USA) | 1-800-642-2444<br>1-800-227-2600 |
| Underground Service Alert-Southern California (USA) | 1-800-422-4133<br>1-800-227-2600 |

Excavations required to install construction area signs shall be performed by hand methods without the use of power equipment, except that power equipment may be used if it is determined there are no utility facilities in the area of the proposed post holes.

Sign substrates for stationary mounted construction area signs may be fabricated from fiberglass reinforced plastic as specified under "Prequalified and Tested Signing and Delineation Materials" of these special provisions.

The Contractor may be required to cover certain signs during the progress of the work. Signs that are no longer required or that convey inaccurate information to the public shall be immediately covered or removed, or the information shall be corrected. Covers for construction area signs shall be of sufficient size and density to completely block out the complete face of the signs. The retroreflective face of the covered signs shall not be visible either during the day or at night. Covers shall be fastened securely so that the signs remain covered during inclement weather. Covers shall be replaced when they no longer cover the signs properly.

The term "construction area signs" shall include temporary object markers required for the direction of public traffic through or around the work during construction. Object markers listed or designated on the plans as construction area signs shall be considered to be signs and shall be furnished, erected, maintained, and removed by the Contractor in the same manner specified for construction area signs.

Object markers shall be stationary mounted on wood or metal posts in conformance with the details shown on the plans and the provisions in Section 82, "Markers and Delineators," of the Standard Specifications.

Marker panels for Type N, Type P and Type R object markers shall conform to the provisions for sign panels for stationary mounted signs.

Target plates for Type K and Type L object markers and posts, reflectors and hardware shall conform to the provisions in Section 82, but need not be new.

**10-1.12 MAINTAINING TRAFFIC**

Attention is directed to Sections 7-1.08, "Public Convenience," 7-1.09, "Public Safety," and 12, "Construction Area Traffic Control Devices," of the Standard Specifications and to the provisions in "Public Safety", "Portable Changeable Message Sign", "Replace Concrete Pavement (Rapid Strength Concrete)", and "Structural Approach Slabs (Type R)" of these special provisions and these special provisions. Nothing in these special provisions shall be construed as relieving the Contractor from the responsibilities specified in Section 7-1.09.

Lane closures shall conform to the provisions in section "Traffic Control System for Lane Closure" of these special provisions.

In addition to the provisions set forth in "Public Safety" of these special provisions, whenever work to be performed on the freeway traveled way (except saw-cutting concrete slabs; saw cutting and installing loop detectors with a truck mounted attenuator (TMA) as a shadow vehicle and except the work of installing, maintaining and removing traffic control devices) is within 1.8 m of the adjacent traffic lane, the adjacent traffic lane shall be closed.

At locations where falsework pavement lighting through falsework are designated, falsework lighting shall be installed in conformance with the provisions in Section 86-6.11, "Falsework Lighting," of the Standard Specifications.

Openings shall be provided through bridge falsework for the use of public traffic at each location where falsework is constructed over the streets or routes listed in the following table. The type, minimum width, height, and number of openings at each location, and the location and maximum spacing of falsework lighting, if required for each opening, shall conform to the requirements in the table. The width of vehicular openings shall be the clear width between temporary railings or other protective work. The spacing shown for falsework pavement lighting is the maximum distance center to center in meters between fixtures.

Brea Canyon Road UC on ramp Br.No.53-2917

| | Number | Width | Height |
|---|---|---|---|
| Vehicle Openings<br>Brea Canyon Rd | 2 | 9.6 m | 4.6 m |
| Ramp "O" | 1 | 9.6 m | 4.6 m |

| | Location | Spacing |
|---|---|---|
| Falsework Pavement Lighting<br>Brea Canyon Rd | R and L | 7 |
| Ramp "O" | R and L | 9 staggered 1/2 space |

(Width and Height in meters)
(R = Right side of traffic. L = Left side of traffic)
(C = Centered overhead)

Route 57/60 HOV connector Br.No.53-2918

| | Number | Width | Height |
|---|---|---|---|
| Vehicle Openings<br>Rte 60 eastbound | 1 | 18.3 m | 4.6 m |
| Rte 60 westbound | 2 | 18.3 m | 6.6 m |
| Golden Springs Drive | 2 | 9.6 m | 4.57 m |

| | Location | Spacing |
|---|---|---|
| Falsework Pavement Lighting<br>Rte 60 eastbound | R and L | 7 |
| Rte 60 westbound | R and L | 9 staggered 1/2 space |
| Golden Springs Drive | R and L | 9 staggered 1/2 space |

(Width and Height in meters)
(R = Right side of traffic. L = Left side of traffic)
(C = Centered overhead)

The exact location of openings will be determined by the Engineer.

Personal vehicles of the Contractor's employees shall not be parked within the freeway right of way. The Contractor shall notify local authorities of the Contractor's intent to begin work at least 5 days before work is begun. The Contractor shall cooperate with local authorities relative to handling traffic through the area and shall make arrangements relative to keeping the working area clear of parked vehicles.

Whenever vehicles or equipment are parked on the freeway shoulder within 1.8 m of a traffic lane, the shoulder area shall be closed as shown on the plans.

Except as otherwise provided in these special provisions, Table Z (Lane Closure Restrictions for Designated Legal Holidays and Special Days) or as shown on the Traffic Handling Plans, freeway lanes, connectors, and ramps shall be closed only during the hours shown on Charts 1 through 5 and 14 through 29 included in this section "Maintaining Traffic." Except

work required under Sections 7-1.08 and 7-1.09, work that interferes with public traffic shall be performed only during the hours shown for lane closures.

Except as otherwise provided in these special provisions, at his option, the Contractor may work during the hours designated as "No lane closure permitted; no work permitted ... " shown on Charts 1 through 5, provided temporary traffic screens are installed on top of temporary railings (Type K), as shown on the plans. Temporary traffic screens shall be furnished, installed, maintained, and removed at the Contractor's expense. Temporary traffic screen panels shall be new or used CDX Grade, or better, plywood or weather resistant strandboard mounted and anchored on temporary railing (Type K). Wale boards shall be new or used Douglas fir, rough sawn, Construction Grade, or better. Pipe screen supports shall be new or used galvanized steel pipe Schedule 40. Nuts, bolts, and washers shall be cadmium plated. Screws shall be black or cadmium plated flat head, cross slotted screws with full thread length.

Except as otherwise shown on the Traffic Handling Plans the HOV lane may be closed anytime the adjacent freeway lane is permitted to be closed as shown on Charts 1, 3, 4, and 5. When the HOV lane is closed. the Contractor shall furnish and erect, at his expense, a " Lane Closed" (C30) sign at 300 meter intervals as directed by the Engineer.

The traffic lanes, which are outside of through traffic lanes, as described in the Charts 1, 3, and 4 may be closed anytime the adjacent connector, or ramp is permitted to be closed in accordance with Charts 14 through 29.

When removing and replacing approach and departure slabs, the Contractor shall schedule his operations in conformance with the hours and requirements shown on Tables A and B in place of Charts 3 and 5. The Contractor shall place a Special " WET CONCRETE" sign in front of newly poured concrete during the entire curing period. When a designated legal holiday falls between and including Thursday and the following Tuesday, no work will be permitted during the intervening weekend for concrete pavement and approach slab replacement. The Contractor shall work in one direction at a time unless otherwise permitted by the Engineer.

Except as otherwise provided in these special provisions, Routes 57 and 60 freeway may be closed to public traffic at one location in one direction at a time for the purpose of striping, falsework erection and removal, sign bridge installation and removal, and loop detector installation in conformance with the hours and requirements as shown on Charts 6 through 13.

When work requires a connector to be closed within the limits of a freeway lane closure, all work on the connector shall be completed first. Work on portions of the freeway mainline necessary to insure a safe passageway for public traffic between the connector and the open lanes of the freeway mainline shall also be completed. The connector shall then be opened to public traffic before commencing work on the remaining portions of the freeway mainline, unless otherwise permitted by the Engineer.

Except as otherwise provided in these special provisions no two consecutive on-ramps or consecutive off-ramps in the same direction of travel shall be closed at the same time unless otherwise permitted by the Engineer. If two or more consecutive on-ramps are permitted to be closed, the Contractor, at his expense, shall furnish and install special signs for entrance ramp closures (sign SP-4) as directed by the Engineer. When an off-ramp is closed, the Contractor shall furnish and erect, as directed by the Engineer, a special sign for exit ramp closures (sign SP-3 or SP-5) as shown on the plans.

Special advance notice publicity signs (sign SP-1), as shown on the plans shall be posted as directed by the Engineer, a minimum of 7 days prior to the actual ramp or connector closure. When work is not actively in progress, the SP-1 sign shall be removed or covered.

Full compensation for furnishing, erecting, maintaining, and removing special advance notice publicity signs (SP-1), special portable freeway detour signs (SP-2), special signs for exit ramp closures (SP-3 or SP-5), special signs for Route 57 and Route 60 alternate routes (Special Signs A, B, and 1 through 9), and special "WET CONCRETE" (2100 MM X 900 MM, series "D" letter and black on orange) signs as shown on the plans or in these special provisions shall be considered as included in the contract lump sum price paid for traffic control system and no additional payment will be made therefor.

All aforementioned special signs shall become the property of the Contractor at the conclusion of this project and shall be removed from the worksite.

No work that encroaches onto the traveled ways shall be allowed from 3 hours before to 2 hours following special events, or games listed below, unless otherwise permitted by the Engineer.

| Venue/Special Event | Affected Routes | Route Limits |
|---|---|---|
| Los Angeles County Fair | 57 | Route 60 to Route 10 |
| California Speedway | 57 | Orange County Line to Route 10 (Northbound only) |
| | 60 | Route 605 to Mills Ave (San Bernardino Co. Line) (Eastbound only) |

No work on city streets that interferes with traffic shall be performed between 5:00 a.m. and 9:00 a.m., nor between 3:00 p.m. and 7:00 p.m.

Designated legal holidays are: January 1st, the third Monday in February, the last Monday in May, July 4th, the first Monday in September, November 11th, Thanksgiving Day, and December 25th. When a designated legal holiday falls on a Sunday, the following Monday shall be a designated legal holiday. When November 11th falls on a Saturday, the preceding Friday shall be a designated legal holiday.

Special Days are Martin Luther King Day, Lincoln's Birthday, Cesar Chavez, and Columbus Day.

# Table Z

| Lane Closure Restrictions for Designated Legal Holidays and Special Days | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Each row represents an individual legal holiday or special day situation | **Thu** | **Fri** | **Sat** | **Sun** | **Mon** | **Tues** | **Wed** | **Thu** | **Fri** | **Sat** | **Sun** |
| | x | **H** xx | xx | xx | | | | | | | |
| | | **SD** xx | | | | | | | | | |
| | x | xx | **H** xx | xx | | | | | | | |
| | | | **SD** xx | | | | | | | | |
| | | x | xx | **H** xx | xx | | | | | | |
| | | | | **SD** xx | | | | | | | |
| | | x | xx | xx | **H** **SD** xx | | | | | | |
| | | x | xx | | | **H** xx | | | | | |
| | | | | | | **SD** xx | | | | | |
| | | | | | | x | **H** xx | | | | |
| | | | | | | | **SD** xx | | | | |
| | | | | | | | x | **H** xx | xx | | xx |
| | | | | | | | | **SD** xx | | | |

**H** = Designated Legal Holiday
**SD** = Special Day

| | |
|---|---|
| | Refer to lane closure charts |
| x | The full width of the traveled way shall be open for use by public traffic after 5 a.m. |
| xx | The full width of the traveled way shall be open for use by public traffic. |

Minor deviations from the requirements of this section concerning hours of work which do not significantly change the cost of the work may be permitted upon the written request of the Contractor, if in the opinion of the Engineer, public traffic will be better served and the work expedited. These deviations shall not be adopted by the Contractor until the Engineer has approved the deviations in writing. All other modifications will be made by contract change order.

**Chart No. 1**
**Lane Requirements and Hours of Work**

Location: Northbound Route 57 freeway; from Pathfinder Rd. to Eastbound Route 60 freeway junction

| | a.m. | | | | | | | | | | | | p.m. | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM HOUR TO HOUR | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Mondays through Thursdays | 1 | 1 | 1 | 1 | 1 | 2 | | | | | | | | | | X | X | X | X | | 3 | 3 | 3 | 2 | |
| Fridays | 1 | 1 | 1 | 1 | 1 | 2 | 3 | | | | | | | X | X | X | X | X | X | | 3 | 3 | 3 | 2 | |
| Saturdays | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | | | | | | | | | | 3 | 3 | 3 | 2 | |
| Sundays | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | | | | | | | | | 3 | 3 | 2 | 1 | |

Legend:

| | |
|---|---|
| 1 | Provide at least one through freeway lane open in direction of travel |
| 2 | Provide at least two through freeway lanes open in direction of travel |
| 3 | Provide at least three through freeway lanes open in direction of travel |
| | No lane closure permitted; work permitted anywhere that does not require freeway lane closure |
| X | No lane closure permitted; no work permitted on northbound roadway |

REMARKS: Number of Through Traffic Lanes - 3* & 4 (does not include HOV)
* - The traffic lanes which are outside of the through traffic lanes and are delineated with a double line of pavement markers as shown on "Pavement Markers and Traffic Lines Typical Details (Detail 37 series)," shall not be closed at the same time as through traffic lanes, except as otherwise provided in this section.

**Chart No. 2**
**Lane Requirements and Hours of Work**

Location: Southbound Route 57 freeway; from Westbound Route 60 freeway junction to Pathfinder Rd.

| | a.m. | | | | | | | | | | | | p.m. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM HOUR TO HOUR | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Mondays through Thursdays | 1 | 1 | 1 | 1 | 2 | | X | X | X | | | | | | | | | | | 4 | 3 | 3 | 2 | 2 | 1 |
| Fridays | 1 | 1 | 1 | 1 | 2 | | X | X | X | | | | | | | | | | | 4 | 3 | 3 | 2 | 2 | 2 |
| Saturdays | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 2 | 2 |
| Sundays | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 2 | 1 |

Legend:

| | |
|---|---|
| 1 | Provide at least one through freeway lane open in direction of travel |
| 2 | Provide at least two through freeway lanes open in direction of travel |
| 3 | Provide at least three through freeway lanes open in direction of travel |
| 4 | Provide at least four through freeway lanes open in direction of travel |
| | No lane closure permitted; work permitted anywhere that does not require freeway lane closure |
| X | No lane closure permitted; no work permitted on southbound roadway |

REMARKS: Number of Through Traffic Lanes - 3 & 5
The full width of the traveled way shall be open for use by public traffic when construction operations are not actively in progress.

**Chart No. 3**
**Lane Requirements and Hours of Work**

Location: Eastbound Route 60 freeway; from Lemon Ave. to Northbound Route 57 freeway off-connector

| | a.m. | | | | | | | | | | | | p.m. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM HOUR TO HOUR | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Mondays through Thursdays | 2 | 1 | 1 | 1 | 2 | 3 | 5 | | | | | | | | X | X | X | X | X | X | 5 | 5 | 4 | 3 | |
| Fridays | 2 | 1 | 1 | 1 | 2 | 3 | 5 | | | | | | | X | X | X | X | X | X | X | | | 5 | 4 | |
| Saturdays | 3 | 2 | 2 | 1 | 1 | 2 | 3 | 4 | 5 | 5 | | | | | | | | | | | 5 | 5 | 5 | 4 | |
| Sundays | 3 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 5 | 5 | | | | | | | 5 | 4 | 3 | 2 | |

Legend:

| | |
|---|---|
| 1 | Provide at least one through freeway lane open in direction of travel |
| 2 | Provide at least two through freeway lanes open in direction of travel |
| 3 | Provide at least three through freeway lanes open in direction of travel |
| | No lane closure permitted; work permitted anywhere that does not require freeway lane closure |

REMARKS: Number of Through Traffic Lanes - 4* and 6 (does not include HOV)
* - The traffic lane which is outside of the through traffic lanes and is delineated with a double line of pavement markers as shown on "Pavement Markers and Traffic Lines Typical Details (Detail 37 series)," shall not be closed at the same time as through traffic lanes, except as otherwise provided in this section.

**Chart No. 4**
**Lane Requirements and Hours of Work**

Location: Westbound Route 60 freeway; from Grand Ave. to southbound Route 57 freeway off-connector

| | a.m. | | | | | | | | | | | | p.m. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM HOUR TO HOUR | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Mondays through Thursdays | 2 | 1 | 1 | 2 | 5 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | 4 | 4 | 3 | 2 | |
| Fridays | 2 | 1 | 1 | 2 | 5 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | 5 | 4 | 4 | 3 | |
| Saturdays | 2 | 2 | 1 | 1 | 2 | 3 | 4 | 5 | | | X | X | X | X | X | X | X | X | X | | 5 | 5 | 4 | 3 | |
| Sundays | 3 | 2 | 1 | 1 | 1 | 2 | 2 | 3 | 4 | | | X | X | X | X | X | X | X | X | | 5 | 5 | 3 | 2 | |

Legend:

| | |
|---|---|
| 1 | Provide at least one through freeway lane open in direction of travel |
| 2 | Provide at least two through freeway lanes open in direction of travel |
| 3 | Provide at least three through freeway lanes open in direction of travel |
| 4 | Provide at least four through freeway lanes open in direction of travel |
| 5 | Provide at least five through freeway lanes open in direction of travel |
| | No lane closure permitted; work permitted anywhere that does not require freeway lane closure |
| X | No lane closure permitted; no work permitted on westbound roadway |

REMARKS: Number of Through Traffic Lanes - 4* 6 (does not include HOV)
* - The traffic lanes which are outside of the through traffic lanes and are delineated with a double line of pavement markers as shown on "Pavement Markers and Traffic Lines Typical Details (Detail 37 series)," shall not be closed at same time as through traffic lanes, except as otherwise provided in this section.

**Chart No. 5**
**Lane Requirements and Hours of Work**

Location: Westbound Route 60 freeway; from Southbound Route 57 freeway off-connector to Lemon Ave.

| | a.m. | | | | | | | | | | | | p.m. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM HOUR TO HOUR | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Mondays through Thursdays | 1 | 1 | 1 | 2 | 3 | | | | | | | | | | | | | | | | 3 | 3 | 2 | 2 | |
| Fridays | 1 | 1 | 1 | 2 | | | | | | | | | | | | | | | | | 3 | 3 | 3 | 2 | |
| Saturdays | 1 | 1 | 1 | 1 | 2 | 3 | 3 | 3 | | | | | | | | | | | | | 3 | 3 | 3 | 2 | |
| Sundays | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | | | | | | | | | | | | 3 | 3 | 3 | 2 | |

Legend:

| | |
|---|---|
| 1 | Provide at least one through freeway lane open in direction of travel |
| 2 | Provide at least two through freeway lanes open in direction of travel |
| 3 | Provide at least three through freeway lanes open in direction of travel |
| | No lane closure permitted; work permitted anywhere that does not require freeway lane closure |

REMARKS: Number of Through Traffic Lanes - 4 (does not include HOV)

**Chart No. 6**
**Complete Freeway Closure Hours**

Location: Northbound Route 57 freeway; from Pathfinder Rd. to Route 60 freeway

| | a.m. | | | | | | | | | | | | p.m. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM HOUR TO HOUR | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Mondays through Thursdays | C | C | C | C | C | | | | | | | | | | | | | | | | | | | | |
| Fridays | C | C | C | C | C | | | | | | | | | | | | | | | | | | | | |
| Saturdays | | C | C | C | C | C | | | | | | | | | | | | | | | | | | | |
| Sundays | | C | C | C | C | C | C | | | | | | | | | | | | | | | | | | |

Legend:

| | |
|---|---|
| C | Freeway may be closed completely |
| | No complete freeway closure is allowed |

REMARKS:
Detour northbound Route 57 traffic to exit at Pathfinder Rd. off-ramp; for westbound Route 60 freeway, west to Brea Canyon Rd.; north to the on-ramp to westbound Route 60 freeway; for eastbound Route 60 and northbound Route 57 freeways, east to Diamond Bar Blvd.; north to the on-ramps to eastbound Route 60 and northbound Route 57 freeways. Place a portable changeable message sign on the right shoulder of northbound Route 57 freeway, south of the Diamond Bar Blvd. off-ramp, with the message: "FREEWAY / CLOSED / AHEAD - PATHFNDR / TO / RTE 60".
A minimum of 8 special freeway detour signs shall be posted along the detour route as shown on the plans and as directed by the Engineer.
Close the Pathfinder Rd. on-ramp to northbound Route 57 freeway.

**Chart No. 7**
**Complete Freeway Closure Hours**

Location: Southbound Route 57 freeway; from Route 60 freeway to Pathfinder Rd.

| | a.m. | | | | | | | | | | | | p.m. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM HOUR TO HOUR | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Mondays through Thursdays | C | C | C | C | | | | | | | | | | | | | | | | | | | | | |
| Fridays | C | C | C | C | | | | | | | | | | | | | | | | | | | | | |
| Saturdays | C | C | C | C | C | | | | | | | | | | | | | | | | | | | | |
| Sundays | | C | C | C | C | C | C | | | | | | | | | | | | | | | | | | |

Legend:

| | |
|---|---|
| C | Freeway may be closed completely |
| | No complete freeway closure is allowed |

REMARKS:
Detour westbound Route 60 to southbound Route 57 traffic to exit at the Grand Ave. off-ramp; south to Diamond Bar Blvd.; southwest to Pathfinder Rd.; west to the on-ramp to southbound Route 57 freeway. Place a portable changeable message sign on the right shoulder of westbound Route 60 freeway, in the gore area of Route 57 on-connector, with the message: "SOUTH 57 / EXIT / CLOSED - DETOUR / USE / GRAND AV". Place a second portable changeable message sign on the right shoulder of westbound Route 60 freeway, upstream of the Diamond Bar Blvd. off-ramp, with the message: "SOUTH 57 / EXIT / CLOSED - DETOUR / USE / GRAND AV". Place a third portable changeable message sign on the right shoulder of southbound Route 57 freeway, upstream of the Sunset Crossing Rd. off-ramp, with the message: "SOUTH 57 / FREEWAY / CLOSED - ROUTE 60 / TO / PATHFNDR".
Close the Grand Ave. on-ramp.
A minimum of 12 special freeway detour signs shall be posted along the detour route as shown on the plans and as directed by the Engineer.
Close the eastbound Route 60 to southbound Route 57 connector and detour traffic per the requirements in Chart 17.

**Chart No. 8**
**Complete Freeway Closure Hours**

Location: Eastbound Route 60 freeway; from Fairway Dr. off-ramp to Brea Canyon Rd. on-ramp

| | a.m. | | | | | | | | | | | | p.m. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM HOUR TO HOUR | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Mondays through Thursdays | | C | C | C | | | | | | | | | | | | | | | | | | | | | |
| Fridays | | C | C | C | | | | | | | | | | | | | | | | | | | | | |
| Saturdays | | | C | C | C | | | | | | | | | | | | | | | | | | | | |
| Sundays | | | C | C | C | C | | | | | | | | | | | | | | | | | | | |

Legend:

| | |
|---|---|
| C | Freeway may be closed completely |
| | No complete freeway closure is allowed |

REMARKS:
Detour eastbound Route 60 traffic to exit at Fairway Dr.; south to Colima Rd.; east to the on-ramp to eastbound Route 60 freeway at Brea Canyon Rd. Place a portable changeable message sign on the right shoulder of eastbound Route 60 freeway, inside the gore area of the Fullerton Rd. on-ramp, with the message: "FREEWAY / CLOSED / AHEAD - FAIRWAY / TO / BREA CYN".
Close the southbound and northbound Fairway Dr. on-ramps to eastbound Route 60 freeway.
A minimum of 8 special freeway detour signs shall be posted along the detour route as shown on the plans and as directed by the Engineer.

**Chart No. 9**
**Complete Freeway Closure Hours**

Location: Eastbound Route 60 freeway; from Brea Canyon Rd. on-ramp to Grand Ave. on-ramp

| | a.m. | | | | | | | | | | | | p.m. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM HOUR TO HOUR | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Mondays through Thursdays | | C | C | C | | | | | | | | | | | | | | | | | | | | | |
| Fridays | | C | C | C | | | | | | | | | | | | | | | | | | | | | |
| Saturdays | | | C | C | C | | | | | | | | | | | | | | | | | | | | |
| Sundays | | C | C | C | C | C | C | | | | | | | | | | | | | | | | | | |

Legend:

| | |
|---|---|
| C | Freeway may be closed completely |
| | No complete freeway closure is allowed |

REMARKS:
Detour eastbound Route 60 traffic to exit at Brea Canyon Rd. off-ramp; east on Golden Springs Dr.; north on Grand Ave. to the on-ramp to eastbound Route 60 freeway; detour the connector traffic to southbound Route 57 freeway south on Brea Canyon Rd.; east on Pathfinder Rd. to the on-ramp to southbound Route 57 freeway.
Place a portable changeable message sign on the right shoulder of eastbound Route 60 freeway, inside the gore area of the Nogales St. on-ramp, with the message: "FREEWAY / CLOSED / AHEAD - BREA CYN / TO / GRAND AV".
A minimum of 8 special freeway detour signs shall be posted along the detour route as shown on the plans and as directed by the Engineer.
Close the Brea Canyon Rd. on-ramp to eastbound Route 60 freeway.

Close the northbound Route 57 to eastbound Route 60 connector and detour traffic per the requirements in Chart 14.

**Chart No. 10**
**Complete Freeway Closure Hours**

Location: Eastbound Route 60 freeway; from Grand Ave. off-ramp to Diamond Bar Blvd. on-ramp

| | a.m. | | | | | | | | | | | | p.m. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM HOUR TO HOUR | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Mondays through Thursdays | | C | C | C | C | | | | | | | | | | | | | | | | | | | | |
| Fridays | | C | C | C | C | | | | | | | | | | | | | | | | | | | | |
| Saturdays | | | C | C | C | C | | | | | | | | | | | | | | | | | | | |
| Sundays | | | C | C | C | C | C | | | | | | | | | | | | | | | | | | |

Legend:

| | |
|---|---|
| C | Freeway may be closed completely |
| | No complete freeway closure is allowed |

REMARKS:
Detour eastbound Route 60 traffic to exit at the Grand Ave. off-ramp; south to Golden Springs Dr.; east to Diamond Bar Blvd.; north to the on-ramps to eastbound Route 60 and northbound Route 57 freeways. Place a portable changeable message sign on the right shoulder of eastbound Route 60 freeway, upstream of the Brea Canyon Rd. off-ramp, with the message: "FREEWAY / CLOSED / AHEAD - DETOUR / USE / GRAND AV".
Close the Grand Ave. on-ramp.
A minimum of 7 special freeway detour signs shall be posted along the detour route as shown on the plans and as directed by the Engineer.
Close the northbound Route 57 to eastbound Route 60 freeway connector and detour traffic per the requirements in Chart 14.

**Chart No. 11**
**Complete Freeway Closure Hours**

Location: Westbound Route 60 freeway; from Diamond Bar Blvd. off-ramp to Grand Ave. on-ramp

| | a.m. | | | | | | | | | | | | p.m. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM HOUR TO HOUR | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Mondays through Thursdays | C | C | C | | | | | | | | | | | | | | | | | | | | | | |
| Fridays | C | C | C | | | | | | | | | | | | | | | | | | | | | | |
| Saturdays | | C | C | C | | | | | | | | | | | | | | | | | | | | | |
| Sundays | | C | C | C | C | | | | | | | | | | | | | | | | | | | | |

Legend:

| | |
|---|---|
| C | Freeway may be closed completely |
| | No complete freeway closure is allowed |

REMARKS:
Detour westbound Route 60 traffic to exit at the Diamond Bar Blvd. off-ramp; south to Golden Springs Dr.; west to Grand Ave.; north to the on-ramp to westbound Route 60 freeway. Place a portable changeable message sign on the right shoulder of westbound Route 60 freeway, upstream of the Diamond Bar Blvd. off-ramp, with the message: "FREEWAY / CLOSED - AT / DIAMOND / BAR BLVD".
Close the Diamond Bar Blvd. on-ramp to westbound Route 60 freeway.
A minimum of 13 special freeway detour signs shall be posted along the detour route as shown on the plans and as directed by the Engineer.
Close the southbound Route 57 to westbound Route 60 connector and detour traffic to exit at Sunset Crossings Rd. off-ramp; east to Diamond Bar Blvd.; south to Golden Springs Dr.; west to Grand Ave.; north to the on-ramp to westbound Route 60 freeway. Place a portable changeable message sign on the right shoulder of southbound Route 57 freeway, upstream of the Sunset Crossings Rd. off-ramp, with the message: "FREEWAY / CLOSED / AHEAD - USE / SUNSET / CROSSNGS".
Close the Sunset Crossings Rd. on-ramp.
A minimum of 4 special freeway detour signs shall be posted along the detour route as shown on the plans and as directed by the Engineer.

**Chart No. 12**
**Complete Freeway Closure Hours**

Location: Westbound Route 60 freeway; from Grand Ave. off-ramp to Brea Canyon on-ramp

| | a.m. | | | | | | | | | | | | p.m. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM HOUR TO HOUR | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Mondays through Thursdays | C | C | C | | | | | | | | | | | | | | | | | | | | | | |
| Fridays | C | C | C | | | | | | | | | | | | | | | | | | | | | | |
| Saturdays | | C | C | C | | | | | | | | | | | | | | | | | | | | | |
| Sundays | | C | C | C | C | C | | | | | | | | | | | | | | | | | | | |

Legend:

| | |
|---|---|
| C | Freeway may be closed completely |
| | No complete freeway closure is allowed |

REMARKS:
Detour westbound Route 60 traffic to exit at Grand Ave. off-ramp; south to Golden Springs Dr.; west to Brea Canyon Rd.; north to the on-ramp to westbound Route 60 freeway. Place a portable changeable message sign on the right shoulder of westbound Route 60 freeway, upstream of the Diamond Bar Blvd. off-ramp, with the message: "FREEWAY / CLOSED - GRAND AV / TO / BREA CYN".
A minimum of 10 special freeway detour signs shall be posted along the detour route as shown on the plans and as directed by the Engineer.
Close the Grand Ave. and Diamond Bar Blvd. on-ramps to westbound Route 60 freeway.
Detour the connector traffic for northbound Route 57 to westbound Route 60 to exit at Pathfinder Rd. off-ramp; west to Brea Canyon Rd.; north to the on-ramp to westbound Route 60 freeway. Place a portable changeable message sign on the northbound Route 57 freeway, inside the gore area of the Diamond Bar Blvd. off-ramp, with the message: "WEST 60 / EXIT / CLOSED - USE / PATHFNDR".
A minimum of 3 special freeway detour signs shall be posted along the detour route as shown on the plans and as directed by the Engineer.
Close the southbound Route 57 to westbound Route 60 connector and detour traffic per the requirements in Chart 16.

**Chart No. 13**
**Complete Freeway Closure Hours**

Location: Westbound Route 60 freeway; from Brea Canyon Rd. off-ramp to Fairway Dr. on-ramp

| | a.m. | | | | | | | | | | | | p.m. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM HOUR TO HOUR | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Mondays through Thursdays | C | C | C | | | | | | | | | | | | | | | | | | | | | | |
| Fridays | C | C | C | | | | | | | | | | | | | | | | | | | | | | |
| Saturdays | | C | C | C | | | | | | | | | | | | | | | | | | | | | |
| Sundays | | | C | C | C | C | | | | | | | | | | | | | | | | | | | |

Legend:

| | |
|---|---|
| C | Freeway may be closed completely |
| | No complete freeway closure is allowed |

REMARKS:
Detour westbound Route 60 traffic to exit at Brea Canyon Rd. off-ramp; north to Valley Blvd.; west to Fairway Dr.; south to the on-ramp to westbound Route 60 freeway. Place a portable changeable message sign on the right shoulder of westbound Route 60 freeway, inside the gore area of the southbound Route 57 on-connector, with the message: "FREEWAY / CLOSED - BREA CYN / TO / FAIRWAY".
A minimum of 10 special freeway detour signs shall be posted along the detour route as shown on the plans and as directed by the Engineer.
Close the Brea Canyon Rd. on-ramp to the westbound Route 60 freeway.
Close the northbound Route 57 to westbound Route 60 connector and detour traffic to exit at Pathfinder Rd. off-ramp; west to Brea Canyon Rd.; north to Golden Springs Dr.; west to Nogales St.; north to the on-ramp to westbound Route 60 freeway. Place a portable changeable message sign on the northbound Route 57 freeway, inside the gore area of the Diamond Bar Blvd. off-ramp, with the message: "WEST 60 / FREEWAY / CLOSED - BREA CYN / TO / FAIRWAY". Place a second portable changeable message sign, upstream of the Pathfinder Rd. off-ramp, with the message: "WEST 60 / EXIT / CLOSED - USE / PATHFNDR / RD".
Close the Pathfinder Rd. on-ramp.

**Chart No. 14**
**Connector Closure Hours**

Location: Northbound Route 57 freeway to Eastbound Route 60/Northbound Route 57 freeway

| | a.m. | | | | | | | | | | | | p.m. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM HOUR TO HOUR | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Mondays through Thursdays | C | C | C | C | C | | | | | | | | | | | | | | | | | | | | C |
| Fridays | C | C | C | C | C | | | | | | | | | | | | | | | | | | | | |
| Saturdays | | C | C | C | C | C | C | | | | | | | | | | | | | | | | | | |
| Sundays | | C | C | C | C | C | C | C | | | | | | | | | | | | | | | | | C |

Legend:

| | |
|---|---|
| C | Connector may be closed |
| | Work permitted that does not require connector lane closure |

REMARKS:
Detour traffic to exit at the Pathfinder Rd. off-ramp; east to Diamond Bar Blvd.; north to the on-ramps to eastbound Route 60 freeway and northbound Route 57 freeway. Place a portable changeable message sign on the right shoulder of northbound Route 57 freeway, upstream of the Diamond Bar Blvd. off-ramp, with the message: "EAST 60 / EXIT / CLOSED - USE / PATHFNDR / RD".
A minimum of 12 special freeway detour signs shall be posted along the detour route as shown on the plans and as directed by the Engineer.
Close the Pathfinder Rd. on-ramp.

**Chart No. 15**
**Connector Closure Hours**

Location: Northbound Route 57 freeway to Westbound Route 60 freeway

| | a.m. | | | | | | | | | | | | p.m. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM HOUR TO HOUR | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Mondays through Thursdays | C | C | C | C | C | | | | | | | | | | | | | | | | | C | C | C |
| Fridays | C | C | C | C | C | | | | | | | | | | | | | | | | | C | C | C |
| Saturdays | C | C | C | C | C | C | C | C | C | | | | | | | | | | | | | C | C | C |
| Sundays | C | C | C | C | C | C | C | C | C | C | | | | | | | | | | C | C | C | C | C |

Legend:

| | |
|---|---|
| C | Connector may be closed |
| | Work permitted that does not require connector lane closure |

REMARKS:
Detour traffic to continue north on Route 57 and exit at the Grand Ave. off-ramp; west to the on-ramp to the westbound Route 60 freeway. Place a portable changeable message sign on the right shoulder of northbound Route 57 freeway, in the gore area of Diamond Bar Blvd. on-ramp, with the message: "WEST 60 / EXIT / CLOSED - DETOUR / USE / GRAND AV".
A minimum of 2 special freeway detour signs shall be posted along the detour route as shown on the plans and as directed by the Engineer.
Close the Pathfinder Rd. on-ramp.

**Chart No. 16**
**Connector Lane Requirements and Hours of Work**

Location: Southbound Route 57 freeway to Westbound Route 60/Southbound Route 57 freeway

| | a.m. | | | | | | | | | | | | p.m. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM HOUR TO HOUR | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Mondays through Thursdays | C | C | C | C | C | 1 | | | | | | | | | | | | | | | | 1 | C | C |
| Fridays | C | C | C | C | C | 1 | | | | | | | | | | | | | | | | | C | C |
| Saturdays | C | C | C | C | C | C | 1 | 1 | | | | | | | | | | | | | | | 1 | C |
| Sundays | C | C | C | C | C | C | C | C | 1 | 1 | | | | | | | | | | | | | 1 | C |

Legend:

| | |
|---|---|
| 1 | Provide at least one connector lane open in the direction of travel |
| C | Connector may be closed |
| | Work permitted that does not require connector lane closure |

REMARKS:
When the connector is closed, detour traffic to exit at the Sunset Crossing Rd. off-ramp; east to Diamond Bar Blvd.; south to Golden Springs Dr.; west to Brea Canyon Rd. to the on-ramps to Route 60 freeway. Place a portable changeable message sign on the right shoulder of southbound Route 57 freeway, upstream of the Sunset Crossings Rd. off-ramp, with the message: "WEST 60 / EXIT / CLOSED - USE / SUNSET / CROSSING". Place a second portable changeable message sign on the right shoulder of southbound Route 57 freeway, upstream of the Temple Ave. off-ramp, with the message: "FREEWAY / CLOSED - AT / SUNSET / CROSSING".
Close the Sunset Crossing Rd. on-ramp to southbound Route 57 freeway and the Diamond Bar Blvd. on-ramp to westbound Route 60 freeway.
A minimum of 12 special freeway detour signs shall be posted along the detour route as shown on the plans and as directed by the Engineer.

**Chart No. 17**
**Connector Lane Requirements and Hours of Work**

Location: Eastbound Route 60 freeway to Southbound Route 57 freeway connector

| | a.m. | | | | | | | | | | | | p.m. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM HOUR TO HOUR | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Mondays through Thursdays | C | C | C | C | C | 1 | | | | | | | | | | | | | | | 1 | C | C | C | |
| Fridays | C | C | C | C | C | 1 | | | | | | | | | | | | | | | 1 | C | C | C | |
| Saturdays | C | C | C | C | C | C | 1 | 1 | 1 | 1 | | | | | | | | | | | C | C | C | C | |
| Sundays | C | C | C | C | C | C | C | C | C | C | C | 1 | | | | | | 1 | 1 | C | C | C | C | C | |

Legend:

| | |
|---|---|
| 1 | Provide at least one connector lane open in the direction of travel |
| C | Connector may be closed |
| | Work permitted that does not require connector lane closure |

REMARKS:
When the connector is closed, detour traffic to exit at the Brea Canyon Rd. off-ramp; east on Golden Springs Dr.; south on Brea Canyon Rd.; east on Pathfinder Rd. to the on-ramp to southbound Route 57 freeway. Place a portable changeable message sign on the right shoulder of eastbound Route 60 freeway, in the gore area of the Nogales St. on-ramp, with the message: "SOUTH 57 / EXIT / CLOSED - USE / BREA CYN / RD."
A minimum of 5 special freeway detour signs shall be posted along the detour route as shown on the plan and as directed by the Engineer.
Close the Brea Canyon Rd. on-ramp.

**Chart No. 18**
**Connector Closure Hours**

Location: Westbound Route 60 freeway to Southbound Route 57 freeway

| | a.m. | | | | | | | | | | | | p.m. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM HOUR TO HOUR | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Mondays through Thursdays | C | C | C | C | | | | | | | | | | | | | | | | | | | C | C | |
| Fridays | C | C | C | C | | | | | | | | | | | | | | | | | | | | C | |
| Saturdays | C | C | C | C | C | C | | | | | | | | | | | | | | | | | | C | |
| Sundays | C | C | C | C | C | C | C | C | | | | | | | | | | | | | | | C | C | |

Legend:

| | |
|---|---|
| C | Connector may be closed |
| | Work permitted that does not require connector lane closure |

REMARKS:
Detour traffic to exit at the Grand Ave. off-ramp; south to Golden Springs Dr.; west to the on-ramp to eastbound Route 60 freeway. Place a portable changeable message sign on the right shoulder of westbound Route 60 freeway, in the gore area of Route 57 freeway on-connector, with the message: "SOUTH 57 / EXIT / CLOSED - USE / GRAND AV". Place a second portable changeable message sign on the right shoulder of westbound Route 60 freeway, upstream of the Diamond Bar Blvd. off-ramp with the message: "SOUTH 57 / EXIT / CLOSED". Place a third portable changeable message sign on the right shoulder of southbound Route 57 freeway, upstream of the Sunset Crossings Rd. off-ramp, with the message: "SOUTH 57 / FREEWAY / CLOSED - AT / RTE 60".
A minimum of 10 special freeway detour signs shall be posted along the detour route as shown on the plans and as directed by the Engineer.
Close the Grand Ave. on-ramps to westbound Route 60 freeway.

**Chart No. 19**
**Ramp Closure Hours**

Location: Northbound Route 57 freeway; Pathfinder Rd. on-ramp

| | a.m. | | | | | | | | | | | | p.m. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM HOUR TO HOUR | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Mondays through Thursdays | C | C | C | C | C | C | | | | | C | C | C | C | C | | | | | C | C | C | C | C | |
| Fridays | C | C | C | C | C | C | | | | | C | C | C | C | C | | | | | C | C | C | C | C | |
| Saturdays | C | C | C | C | C | C | C | C | C | | | | | | | | | C | C | C | C | C | C | C | |
| Sundays | C | C | C | C | C | C | C | C | C | C | | | | | | | | C | C | C | C | C | C | C | |

Legend:

| | |
|---|---|
| C | Ramp may be closed |
| | Work permitted anywhere that does not require ramp lane closure |

REMARKS: When the ramp is closed, public traffic shall be detoured to the next available on-ramp downstream of the closed ramp. A minimum of 9 special freeway detour signs shall be posted along the detour route as shown on the plans and as directed by the Engineer.

**Chart No. 20**
**Ramp Closure Hours**

Location: Southbound Route 57 freeway; Pathfinder Rd. off-ramp

| | a.m. | | | | | | | | | | | | p.m. | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM HOUR TO HOUR | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Mondays through Thursdays | C | C | C | C | C | C | | | | C | C | C | C | C | | | | | | | | C | C | C | |
| Fridays | C | C | C | C | C | C | | | | C | C | C | C | C | | | | | | | | C | C | C | |
| Saturdays | C | C | C | C | C | C | C | C | C | C | | | | | | | | | | | C | C | C | C | |
| Sundays | C | C | C | C | C | C | C | C | C | C | C | C | | | | | | | | | C | C | C | C | |

Legend:

| | |
|---|---|
| C | Ramp may be closed |
| | Work permitted anywhere that does not require ramp lane closure |

REMARKS:

**Chart No. 21**
**Ramp Closure Hours**

Location: Eastbound Route 60 freeway; Brea Canyon Rd. off-ramp

| | a.m. | | | | | | | | | | | | p.m. | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM HOUR TO HOUR | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Mondays through Thursdays | C | C | C | C | C | C | | | | C | C | C | C | C | C | | | | | | C | C | C | C | |
| Fridays | C | C | C | C | C | C | | | | C | C | C | C | C | C | | | | | | C | C | C | C | |
| Saturdays | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | |
| Sundays | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | |

Legend:

| | |
|---|---|
| C | Ramp may be closed |
| | Work permitted anywhere that does not require ramp lane closure |

REMARKS:
The full width of the traveled way shall be open for use by public traffic when construction operations are not actively in progress.

**Chart No. 22**
**Ramp Closure Hours**

Location: Eastbound Route 60 freeway; Brea Canyon Rd. on-ramp

| | a.m. | | | | | | | | | | | | p.m. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM HOUR TO HOUR | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Mondays through Thursdays | C | C | C | C | C | C | | | | | | | | | | | | | | | C | C | C | C | |
| Fridays | C | C | C | C | C | C | | | | | | | | | | | | | | | C | C | C | C | |
| Saturdays | C | C | C | C | C | C | C | C | C | | | | | | | | | | | | C | C | C | C | |
| Sundays | C | C | C | C | C | C | C | C | C | C | C | C | | | | | | | | | C | C | C | C | |

Legend:

| | |
|---|---|
| C | Ramp may be closed |
| | Work permitted anywhere that does not require ramp lane closure |

REMARKS: When the ramp is closed, public traffic shall be detoured to the next closest available on-ramp of the closed ramp. A minimum of 6 special freeway detour signs shall be posted along the detour route as shown on the plans and as directed by the Engineer.

**Chart No. 23**
**Ramp Closure Hours**

Location: Westbound Route 60 freeway; Brea Canyon Rd. off-ramp

| | a.m. | | | | | | | | | | | | p.m. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM HOUR TO HOUR | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Mondays through Thursdays | C | C | C | C | C | C | | | | C | C | C | C | C | C | | | | | C | C | C | C | C | |
| Fridays | C | C | C | C | C | C | | | | C | C | C | C | C | C | | | | | C | C | C | C | C | |
| Saturdays | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | |
| Sundays | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | |

Legend:

| | |
|---|---|
| C | Ramp may be closed |
| | Work permitted anywhere that does not require ramp lane closure |

REMARKS:
Close the Brea Canyon Rd. slip off-ramp from the northbound Route 57 to westbound Route 60 freeway connector.
The full width of the traveled way shall be open for use by public traffic when construction operations are not actively in progress.

**Chart No. 24**
**Ramp Closure Hours**

Location: Westbound Route 60 freeway; Brea Canyon Rd. on-ramp

| | a.m. | | | | | | | | | | | | p.m. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM HOUR TO HOUR | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Mondays through Thursdays | C | C | C | C | C | C | | | | | | | | | | | | | | | C | C | C | C | C |
| Fridays | C | C | C | C | C | C | | | | | | | | | | | | | | | C | C | C | C | C |
| Saturdays | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C |
| Sundays | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C |

Legend:

| | |
|---|---|
| C | Ramp may be closed |
| | Work permitted anywhere that does not require ramp lane closure |

REMARKS: When the ramp is closed, public traffic shall be detoured to the next available on-ramp downstream of the closed ramp. A minimum of 8 special freeway detour signs shall be posted along the detour route as shown on the plans and as directed by the Engineer.
The full width of the traveled way shall be open for use by public traffic when construction operations are not actively in progress.

**Chart No. 25**
**Ramp Closure Hours**

Location: Eastbound Route 60 freeway; Grand Av. off-ramp

| | a.m. | | | | | | | | | | | | p.m. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM HOUR TO HOUR | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Mondays through Thursdays | C | C | C | C | C | C | | | | | | | | | | | | | | | | | | | C |
| Fridays | C | C | C | C | C | C | | | | | | | | | | | | | | | | | | | |
| Saturdays | C | C | C | C | C | C | C | C | C | | | | | | | | | | | | | | | | |
| Sundays | C | C | C | C | C | C | C | C | C | C | | | | | | | | | | | | | | | C |

Legend:

| | |
|---|---|
| C | Ramp may be closed |
| | Work permitted anywhere that does not require ramp lane closure |

REMARKS:

**Chart No. 26**
**Ramp Closure Hours**

Location: Eastbound Route 60 freeway; Grand Av. on-ramp

| | a.m. | | | | | | | | | | | | p.m. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM HOUR TO HOUR | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Mondays through Thursdays | C | C | C | C | C | C | | | | | | | | | | | | | | | | | C | C | |
| Fridays | C | C | C | C | C | C | | | | | | | | | | | | | | | | | C | C | |
| Saturdays | C | C | C | C | C | C | C | C | C | C | | | | | | | | | | | | C | C | C | |
| Sundays | C | C | C | C | C | C | C | C | C | C | C | C | | | | | | | | | | C | C | C | |

Legend:

| | |
|---|---|
| C | Ramp may be closed |
| | Work permitted anywhere that does not require ramp lane closure |

REMARKS: When the ramp is closed, public traffic shall be detoured to the next available on-ramp downstream of the closed ramp. A minimum of 5 special freeway detour signs shall be posted along the detour route as shown on the plans and as directed by the Engineer.

**Chart No. 27**
**Ramp Closure Hours**

Location: Westbound Route 60 freeway; Grand Av. off-ramp

| | a.m. | | | | | | | | | | | | p.m. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM HOUR TO HOUR | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Mondays through Thursdays | C | C | C | C | C | C | | | | | | | | | | | | | | C | C | C | C | C | |
| Fridays | C | C | C | C | C | C | | | | | | | | | | | | | | C | C | C | C | C | |
| Saturdays | C | C | C | C | C | C | C | C | C | C | | | | | | | | | | | C | C | C | C | |
| Sundays | C | C | C | C | C | C | C | C | C | C | C | C | | | | | | | | | C | C | C | C | |

Legend:

| | |
|---|---|
| C | Ramp may be closed |
| | Work permitted anywhere that does not require ramp lane closure |

REMARKS:

**Chart No. 28**
**Ramp Closure Hours**

Location: Westbound Route 60 freeway; Grand Av. on-ramp

| | a.m. | | | | | | | | | | | | p.m. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM HOUR TO HOUR | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Mondays through Thursdays | C | C | C | C | C | | | | | | | | | | | | | | | | | C | C | C |
| Fridays | C | C | C | C | C | | | | | | | | | | | | | | | | | C | C | C |
| Saturdays | C | C | C | C | C | C | C | C | | | | | | | | | | | | | | C | C | C |
| Sundays | C | C | C | C | C | C | C | C | | | | | | | | | | | | | | C | C | C |

Legend:

| | |
|---|---|
| C | Ramp may be closed |
| | Work permitted anywhere that does not require ramp lane closure |

REMARKS: When the ramp is closed, public traffic shall be detoured to the next available on-ramp downstream of the closed ramp. A minimum of 7 special freeway detour signs shall be posted along the detour route as shown on the plans and as directed by the Engineer.

**Chart No. 29**
**Ramp Closure Hours**

Location: Eastbound Route 60 freeway; Diamond Bar Blvd. off-ramp

| | a.m. | | | | | | | | | | | | p.m. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM HOUR TO HOUR | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Mondays through Thursdays | C | C | C | C | C | C | | | | C | C | C | C | C | C | | | | | | | C | C | C |
| Fridays | C | C | C | C | C | C | | | | C | C | C | C | C | C | | | | | | | C | C | C |
| Saturdays | C | C | C | C | C | C | C | C | C | C | C | C | | | | | | | | C | C | C | C | C |
| Sundays | C | C | C | C | C | C | C | C | C | C | C | C | | | | | | | | C | C | C | C | C |

Legend:

| | |
|---|---|
| C | Ramp may be closed |
| | Work permitted anywhere that does not require ramp lane closure |

REMARKS:

TABLE A

PERMISSIBLE HOURS OF LANE CLOSURES FOR
CONCRETE SLAB AND APPROACH SLAB REPLACEMENT

| LOCATION: Eastbound Route 60 freeway at Lemon Ave. | | |
|---|---|---|
| Lane No. Being Replaced | Lane No. Closed | Remove, Replace, and Cure Slabs |
| | | Closure Hours |
| 1 | 1 & 2 | Midnight Saturday to 9:00 a.m. Sunday |
| 2 or 1&2 | 1, 2, & 3 | 1:00 a.m. Sunday to 9:00 a.m. Sunday |
| 3 or 3&4 | 2, 3, & 4 | 1:00 a.m. Sunday to 9:00 a.m. Sunday |
| 4 | 3 & 4 | Midnight Saturday to 9:00 a.m. Sunday |
| Lane No. Being Replaced | Other Closure Requirements | |
| 1 | Lane #2 shall be opened by 8:00 a.m.<br>Place a portable changeable message sign as shown on the plans. | |
| 2 or 1&2 | Lane #3 shall be opened by 6:00 a.m.<br>Close the southbound and northbound Fairway Dr. on-ramps to the eastbound Route 60 freeway.<br>Place a portable changeable message sign as shown on the plans. | |
| 3 or 3&4 | Lane #2 shall be opened by 6:00 a.m.<br>Close the southbound and northbound Fairway Dr. on-ramps to the eastbound Route 60 freeway.<br>Place a portable changeable message sign as shown on the plans. | |
| 4 | Lane #3 shall be opened by 8:00 a.m.<br>Close the southbound and northbound Fairway Dr. on-ramps to the eastbound Route 60 freeway.<br>Place a portable changeable message sign as shown on the plans. | |

Note: Median shoulder slabs may be reconstructed concurrently with the adjacent freeway slab.

TABLE B

PERMISSIBLE HOURS OF LANE CLOSURES FOR
CONCRETE SLAB AND APPROACH SLAB REPLACEMENT

| LOCATION: Westbound Route 60 freeway at Lemon Av. | | |
|---|---|---|
| Lane No. Being Replaced | Lane No. Closed | Remove, Replace, and Cure Slabs |
| | | Closure Hours |
| 1 | 1 & 2 | 11:00 p.m. Friday to 8:00 a.m. Saturday<br>11:00 p.m. Saturday to 9:00 a.m. Sunday |
| 2 or 1&2 | 1, 2, & 3 | Midnight Saturday to 9:00 a.m. Sunday |
| 3 or 2&3 | 2, 3, & 4 | Midnight Saturday to 9:00 a.m. Sunday |
| 4 | 3 & 4 | 11:00 p.m. Saturday to 8:00 a.m. Sunday<br>11:00 p.m. Saturday to 9:00 a.m. Sunday |
| Lane No. Being Replaced | Other Closure Requirements | |
| 1 | Lane #2 shall be opened by 5:00 a.m. on Saturday and by 8:00 a.m. on Sunday.<br>Close the Brea Canyon Rd. on-ramp to westbound Route 60 freeway.<br>Place a portable changeable message sign as shown on the plans. | |
| 2 or 1&2 | Lane #3 shall be opened by 6:00 a.m.<br>Close the Brea Canyon Rd. on-ramp to westbound Route 60 freeway.<br>Place a portable changeable message sign as shown on the plans. | |
| 3 or 3&4 | Lane #2 shall be opened by 6:00 a.m.<br>Close the Brea Canyon Rd. on-ramp to westbound Route 60 freeway.<br>Place a portable changeable message sign as shown on the plans. | |
| 4 | Lane #3 shall be opened by 5:00 a.m. on Saturday and by 8:00 a.m. on Sunday.<br>Close the Brea Canyon Rd. on-ramp to westbound Route 60 freeway.<br>Place a portable changeable message sign as shown on the plans. | |

Note: Median shoulder slabs may be reconstructed concurrently with the adjacent freeway slab.

## 10-1.13 CLOSURE REQUIREMENTS AND CONDITIONS

Lane closures shall conform to the provisions in "Maintaining Traffic" of these special provisions and these special provisions.

The term closure, as used herein, is defined as the closure of a traffic lane or lanes, including ramp or connector lanes, within a single traffic control system.

### CLOSURE SCHEDULE

By noon Monday, the Contractor shall submit a written schedule of planned closures for the following week period, defined as Friday noon through the following Friday noon.

The Closure Schedule shall show the locations and times when the proposed closures are to be in effect. The Contractor shall use the Closure Schedule request forms furnished by the Engineer. Closure Schedules submitted to the Engineer with incomplete, unintelligible or inaccurate information will be returned for correction and resubmittal. The Contractor will be notified of disapproved closures or closures that require coordination with other parties as a condition of approval.

Amendments to the Closure Schedule, including adding additional closures, shall be submitted to the Engineer, in writing, at least 3 working days in advance of a planned closure. Approval of amendments to the Closure Schedule will be at the discretion of the Engineer.

The Contractor shall confirm, in writing, all scheduled closures by no later than 8:00 a.m. 3 working days prior to the date on which the closure is to be made. Approval or denial of scheduled closures will be made no later than 4:00 p.m. 2 working days prior to the date on which the closure is to be made. Closures not confirmed or approved will not be allowed.

Confirmed closures that are cancelled due to unsuitable weather may be rescheduled at the discretion of the Engineer for the following working day.

### CONTINGENCY PLAN

The Contractor shall prepare a contingency plan for reopening closures to public traffic. The Contractor shall submit the contingency plan for a given operation to the Engineer within one working day of the Engineer's request.

### LATE REOPENING OF CLOSURES

If a closure is not reopened to public traffic by the specified time, work shall be suspended in conformance with the provisions in Section 8-1.05, "Temporary Suspension of Work," of the Standard Specifications. The Contractor shall not make any further closures until the Engineer has accepted a work plan, submitted by the Contractor, that will insure that future closures will be reopened to public traffic at the specified time. The Engineer will have 2 working days to accept or reject the Contractor's proposed work plan. The Contractor will not be entitled to any compensation for the suspension of work resulting from the late reopening of closures.

For each 10-minute interval, or fraction thereof past the time specified to reopen the closure, the Department will deduct $ 8600 per interval from moneys due or that may become due the Contractor under the contract.

### COMPENSATION

The Contractor shall notify the Engineer of any delay in the Contractor's operations due to the following conditions, and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of those conditions, and the Contractor's loss due to that delay could not have been avoided by rescheduling the affected closure or by judicious handling of forces, equipment and plant, the delay will be considered a right of way delay within the meaning of Section 8-1.09, "Right of Way Delays," and compensation for the delay will be determined in conformance with the provisions in Section 8-1.09:

A. The Contractor's proposed Closure Schedule is denied and his planned closures are within the time frame allowed for closures in "Maintaining Traffic" of these special provisions, except that the Contractor will not be entitled to any compensation for amendments to the Closure Schedule that are not approved.
B. The Contractor is denied a confirmed closure.

Should the Engineer direct the Contractor to remove a closure prior to the time designated in the approved Closure Schedule, any delay to the Contractor's schedule due to removal of the closure will be considered a right of way delay within the meaning of Section 8-1.09, "Right of Way Delays," and compensation for the delay will be determined in conformance with the provisions in Section 8-1.09.

## 10-1.14 TRAFFIC CONTROL SYSTEM FOR LANE CLOSURE

A traffic control system shall consist of closing traffic lanes and ramps in conformance with the details shown on the plans, the provisions in Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications, the provisions under "Maintaining Traffic" and "Construction Area Signs" of these special provisions, and these special provisions.

The provisions in this section will not relieve the Contractor of responsibility for providing additional devices or taking measures as may be necessary to comply with the provisions in Section 7-1.09, "Public Safety," of the Standard Specifications.

When performing traffic control in the high occupancy vehicle lane (HOV lane) or where the median shoulder is less than 2.4 meters, the Contractor shall conform to the requirements under the moving type lane closure for truck mounted attenuator (TMA).

During traffic stripe operations and pavement marker placement operations using bituminous adhesive, traffic shall be controlled, at the option of the Contractor, with either stationary or moving lane closures. During other operations, traffic shall be controlled with stationary lane closures. Attention is directed to the provisions in Section 84-1.04, "Protection From Damage," and Section 85-1.06, "Placement," of the Standard Specifications.

If components in the traffic control system are displaced or cease to operate or function as specified, from any cause, during the progress of the work, the Contractor shall immediately repair the components to the original condition or replace the components and shall restore the components to the original location.

**STATIONARY LANE CLOSURE**

When lane and ramp closures are made for work periods only, at the end of each work period, components of the traffic control system, except portable delineators placed along open trenches or excavation adjacent to the traveled way, shall be removed from the traveled way and shoulder. If the Contractor so elects, the components may be stored at selected central locations, designated by the Engineer within the limits of the highway right of way.

The 150-m section of a lane closure, shown along lane lines between the 300-m lane closure tapers on the plans entitled "Traffic Control System for Lane Closures on Freeways and Expressways" and "Traffic Control System for Lane and Complete Closures on Freeways and Expressways" shall not be used.

**MOVING LANE CLOSURE**

Flashing arrow signs used in moving lane closures shall be truck-mounted. Changeable message signs used in moving lane closure operations shall conform to the provisions in Section 12-3.12, "Portable Changeable Message Signs," of the Standard Specifications, except the signs shall be truck-mounted and the full operation height of the bottom of the sign may be less than 2.1 m above the ground, but should be as high as practicable.

Truck-mounted attenuators (TMA) for use in moving lane closures shall be any of the following approved models, or equal:

A. Hexfoam TMA Series 3000, Alpha 1000 TMA Series 1000 and Alpha 2001 TMA Series 2001, manufactured by Energy Absorption Systems, Inc., One East Wacker Drive, Chicago, IL 60601-2076, Telephone (312) 467-6750.

   1. Distributor (Northern): Traffic Control Service, Inc., 8585 Thys Court, Sacramento, CA 95828, Telephone 1-800-884-8274, FAX (916) 387-9734.
   2. Distributor (Southern): Traffic Control Service, Inc., 1881 Betmor Lane, Anaheim, CA 92805, Telephone 1-800-222-8274.

B. Cal T-001 Model 2 or Model 3, manufacturer and distributor: Hexcel Corporation, 11711 Dublin Boulevard, P.O. Box 2312, Dublin, CA 94568, Telephone (510) 828-4200.

C. Renco Rengard Model Nos. CAM 8-815 and RAM 8-815, manufacturer and distributor: Renco Inc., 1582 Pflugerville Loop Road, P.O. Box 730, Pflugerville, TX 78660-0730, Telephone 1-800-654-8182.

Each TMA shall be individually identified with the manufacturer's name, address, TMA model number, and a specific serial number. The names and numbers shall each be a minimum 13 mm high and located on the left (street) side at the lower front corner. The TMA shall have a message next to the name and model number in 13 mm high letters which states, "The bottom of this TMA shall be _____ mm ± _____ mm above the ground at all points for proper impact performance." Any TMA which is damaged or appears to be in poor condition shall not be used unless recertified by the manufacturer. The Engineer shall be the sole judge as to whether used TMAs supplied under this contract need recertification. Each unit shall be certified by the manufacturer to meet the requirements for TMA in conformance with the standards established by the Transportation Laboratory.

Approvals for new TMA designs proposed as equal to the above approved models shall be in conformance with the

procedures (including crash testing) established by the Transportation Laboratory. For information regarding submittal of new designs for evaluation contact: Transportation Laboratory, 5900 Folsom Boulevard, Sacramento, California 95819.

New TMAs proposed as equal to approved TMAs or approved TMAs determined by the Engineer to need recertification shall not be used until approved or recertified by the Transportation Laboratory.

**PAYMENT**

The contract lump sum price paid for traffic control system shall include full compensation for furnishing all labor, materials (including signs), tools, equipment, and incidentals, and for doing all the work involved in placing, removing, storing, maintaining, moving to new locations, replacing and disposing of the components of the traffic control system shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The adjustment provisions in Section 4-1.03, "Changes," of the Standard Specifications shall not apply to the item of traffic control system. Adjustments in compensation for traffic control system will be made only for increased or decreased traffic control system required by changes ordered by the Engineer and will be made on the basis of the cost of the increased or decreased traffic control necessary. The adjustment will be made on a force account basis as provided in Section 9-1.03, "Force Account Payment," of the Standard Specifications for increased work and estimated on the same basis in the case of decreased work.

Traffic control system required by work which is classed as extra work, as provided in Section 4-1.03D of the Standard Specifications, will be paid for as a part of the extra work.

## 10-1.15 TEMPORARY PAVEMENT DELINEATION

Temporary pavement delineation shall be furnished, placed, maintained, and removed in conformance with the provisions in Section 12-3.01, "General," of the Standard Specifications and these special provisions. Nothing in these special provisions shall be construed as reducing the minimum standards specified in the Manual of Traffic Controls published by the Department or as relieving the Contractor from the responsibilities specified in Section 7-1.09, "Public Safety," of the Standard Specifications.

**GENERAL**

Whenever the work causes obliteration of pavement delineation, temporary or permanent pavement delineation shall be in place prior to opening the traveled way to public traffic. Laneline or centerline pavement delineation shall be provided at all times for traveled ways open to public traffic. On multilane roadways (freeways and expressways) edgeline delineation shall be provided at all times for traveled ways open to public traffic.

The Contractor shall perform the work necessary to establish the alignment of temporary pavement delineation, including required lines or marks. Surfaces to receive temporary pavement delineation shall be dry and free of dirt and loose material. Temporary pavement delineation shall not be applied over existing pavement delineation or other temporary pavement delineation. Temporary pavement delineation shall be maintained until superseded or replaced with a new pattern of temporary pavement delineation or permanent pavement delineation.

Temporary pavement markers, including underlying adhesive, and removable traffic tape which are applied to the final layer of surfacing or existing pavement to remain in place or which conflicts with a subsequent or new traffic pattern for the area shall be removed when no longer required for the direction of public traffic, as determined by the Engineer.

**TEMPORARY LANELINE AND CENTERLINE DELINEATION**

Whenever lanelines or centerlines are obliterated and temporary pavement delineation to replace the lines is not shown on the plans, the minimum laneline and centerline delineation to be provided for that area shall be temporary pavement markers placed at longitudinal intervals of not more than 7.3 m. The temporary pavement markers shall be the same color as the laneline or centerline the pavement markers replace. Temporary pavement markers shall be, at the option of the Contractor, one of the temporary pavement markers listed for short term day/night use (14 days or less) or long term day/night use (6 months or less) in "Prequalified and Tested Signing and Delineation Materials" of these special provisions. The temporary pavement markers shall be placed in conformance with the manufacturer's instructions. Temporary pavement markers for long term day/night use (6 months or less) shall be cemented to the surfacing with the adhesive recommended by the manufacturer, except epoxy adhesive shall not be used to place the temporary pavement markers in areas where removal of the temporary pavement markers will be required.

Temporary laneline or centerline delineation consisting entirely of temporary pavement markers listed for short term day/night use (14 days or less), shall be placed on longitudinal intervals of not more than 7.3 m and shall be used for a maximum of 14 days on lanes opened to public traffic. Prior to the end of the 14 days the permanent pavement delineation shall be placed. If the permanent pavement delineation is not placed within the 14 days, the Contractor shall replace the temporary pavement markers and provide additional temporary pavement delineation and shall bear the cost thereof. The

additional temporary pavement delineation to be provided shall be equivalent to the pattern specified for the permanent pavement delineation for the area, as determined by the Engineer.

Full compensation for furnishing, placing, maintaining, and removing the temporary pavement markers (including underlying adhesive, layout (dribble) lines to establish alignment of temporary pavement markers or used for temporary laneline and centerline delineation) for those areas where temporary laneline and centerline delineation is not shown on the plans and for providing equivalent patterns of permanent traffic lines for those areas when required, shall be considered as included in the contract prices paid for the items of work that obliterated the laneline and centerline pavement delineation and no separate payment will be made therefor.

**TEMPORARY EDGELINE DELINEATION**

On multilane roadways (freeways and expressways), whenever edgelines are obliterated and temporary pavement delineation to replace those edgelines is not shown on the plans, the edgeline delineation to be provided for those areas adjacent to lanes open to public traffic shall be as follows:

A. Temporary pavement delineation for right edgelines shall, at the option of the Contractor, consist of either a solid 100-mm wide traffic stripe of the same color as the stripe the temporary edgeline delineation replaces, or traffic cones, portable delineators or channelizers placed at longitudinal intervals not to exceed 30 m.
B. Temporary pavement delineation for left edgelines shall, at the option of the Contractor, consist of either solid 100-mm wide traffic stripe of the same color as the stripe the temporary edgeline delineation replaces, traffic cones, portable delineators or channelizers placed at longitudinal intervals not to exceed 30 m or temporary pavement markers placed at longitudinal intervals of not more than 1.8 m. Temporary pavement markers used for temporary left edgeline delineation shall be one of the types of temporary pavement markers listed for short term day/night use (14 days or less) or long term day/night use (6 months or less) in "Prequalified and Tested Signing and Delineation Materials" of these special provisions.

Traffic stripe (100-mm wide) placed as temporary edgeline delineation which will require removal shall conform to the provisions of "Temporary Traffic Stripe (Tape)" of these special provisions. Where removal of the 100-mm wide traffic stripe will not be required, painted traffic stripe conforming to the provisions of "Temporary Traffic Stripe (Paint)" of these special provisions may be used. The quantity of temporary traffic stripe (tape) or temporary traffic stripe (paint) used for this temporary edgeline delineation will not be included in the quantities of tape or paint to be paid for.

The lateral offset for traffic cones, portable delineators or channelizers used for temporary edgeline delineation shall be as determined by the Engineer. If traffic cones or portable delineators are used as temporary pavement delineation for edgelines, the Contractor shall provide personnel to remain at the project site to maintain the cones or delineators during the hours of the day that the portable delineators are in use.

Channelizers used for temporary edgeline delineation shall be the surface mounted type and shall be orange in color. Channelizer bases shall be cemented to the pavement in the same manner provided for cementing pavement markers to pavement in "Pavement Markers" of these special provisions, except epoxy adhesive shall not be used to place channelizers on the top layer of pavement. Channelizers shall be, at the Contractor's option, one of the surface mount types (900 mm) listed in "Prequalified and Tested Signing and Delineation Materials" of these special provisions.

Temporary edgeline delineation shall be removed when no longer required for the direction of public traffic as determined by the Engineer.

The quantity of channelizers used as temporary edgeline delineation will not be included in the quantity of channelizers to be paid for. Full compensation for furnishing, placing, maintaining and removing temporary edgeline delineation for those areas where temporary edgeline delineation is not shown on the plans shall be considered as included in the contract prices paid for the items of work that obliterated the edgeline pavement delineation and no separate payment will be made therefor.

**TEMPORARY TRAFFIC STRIPE (PAINT)**

Temporary traffic stripe consisting of painted traffic stripe shall be applied and maintained at the locations shown on the plans. The painted temporary traffic stripe shall be complete in place at the location shown prior to opening the traveled way to public traffic. Removal of painted temporary traffic stripe will not be required.

Temporary painted traffic stripe shall conform to the provisions in "Paint Traffic Stripes and Pavement Markings" of these special provisions, except for payment. At the option of the Contractor, either one or 2 coats shall be applied regardless of whether on new or existing pavement.

At the Contractor's option, temporary removable striping tape listed in "Prequalified and Tested Signing and Delineation Materials" of these special provisions may be used instead of painted temporary traffic stripes. When traffic stripe tape is used in place of painted temporary traffic stripes, the tape will be measured and paid for by the meter as temporary traffic

stripe (paint).

When painted traffic stripe is specified for temporary left edgeline delineation, temporary pavement markers placed at longitudinal intervals of not more than 1.8 m may be used in place of the temporary painted traffic stripe. Temporary pavement markers shall be one of the types of temporary pavement markers listed for long term day/night use (6 months or less) in "Prequalified and Tested Signing and Delineation Materials" of these special provisions. When temporary reflective pavement markers are used in place of temporary painted traffic stripe, payment for those temporary pavement markers will be made on the basis of the theoretical quantity of temporary traffic stripe (paint) required for the left edgeline the temporary pavement markers replace.

**TEMPORARY PAVEMENT MARKING (PAINT)**

Temporary pavement marking consisting of painted pavement marking shall be applied and maintained at the locations shown on the plans. The painted temporary pavement marking shall be complete in place at the location shown prior to opening the traveled way to public traffic. Removal of painted temporary pavement marking will not be required.

Temporary painted pavement marking shall conform to the provisions in "Paint Traffic Stripes and Pavement Markings" of these special provisions, except for payment. At the option of the Contractor, either one or 2 coats shall be applied regardless whether on new or existing pavement.

At the Contractor's option, temporary removable pavement marking tape or permanent pavement marking tape listed in "Prequalified and Tested Signing and Delineation Materials" of these special provisions may be used instead of painted temporary pavement markings. When pavement marking tape is used, regardless of which type of tape is placed, the tape will be measured and paid for by the square meter as temporary pavement marking (paint).

**TEMPORARY PAVEMENT MARKERS**

Temporary pavement markers shall be applied at the locations shown on the plans. The pavement markers shall be applied complete in place at the locations shown prior to opening the traveled way to public traffic.

Temporary pavement markers shown on the plans shall be, at the option of the Contractor, one of the temporary pavement markers for long term day/night use (6 months or less) listed in "Prequalified and Tested Signing and Delineation Materials" of these special provisions.

Temporary pavement markers shall be placed in conformance with the manufacturer's instructions and shall be cemented to the surfacing with the adhesive recommended by the manufacturer, except epoxy adhesive shall not be used in areas where removal of the pavement markers will be required.

Where the temporary pavement delineation shown on the plans for lanelines or centerlines consists entirely of a pattern of broken traffic stripe and pavement markers, the Contractor may use groups of the temporary pavement markers for long term day/night use (6 months or less) in place of the temporary traffic stripe tape or painted temporary traffic stripe. The groups of pavement markers shall be spaced as shown on the plans for a similar pattern of permanent traffic line, except pavement markers shown to be placed in the gap between the broken traffic stripe shall be placed as part of the group to delineate the pattern of broken temporary traffic stripe. The kind of laneline and centerline delineation selected by the Contractor shall be continuous within a given location. Payment for those temporary pavement markers used in place of temporary traffic stripe will be made on the basis of the theoretical length of the patterns of temporary traffic stripe (tape) or temporary traffic stripe (paint).

Retroreflective pavement markers conforming to the provisions in "Pavement Markers" of these special provisions may be used in place of temporary pavement markers for long term day/night use (6 months or less) except to simulate patterns of broken traffic stripe. Placement of the retroreflective pavement markers used for temporary pavement markers shall conform to the provisions in "Pavement Markers" of these special provisions except the waiting period provisions before placing the pavement markers on new asphalt concrete surfacing as specified in Section 85-1.06, "Placement," of the Standard Specifications shall not apply and epoxy adhesive shall not be used to place pavement markers in areas where removal of the pavement markers will be required.

**MEASUREMENT AND PAYMENT**

Temporary traffic stripe (paint) and temporary pavement marking (paint) will be measured and paid for in the same manner specified for paint traffic stripe (1-coat) and paint pavement marking (1-coat) in Section 84-3.06, "Measurement," and Section 84-3.07, "Payment," of the Standard Specifications.

Temporary pavement markers, shown on the plans, will be measured and paid for by the unit in the same manner specified for retroreflective pavement markers in Section 85-1.08, "Measurement," and Section 85-1.09, "Payment," of the Standard Specifications. Temporary pavement markers used for temporary laneline and centerline delineation for areas which are not shown on the plans will not be included in the quantities of temporary pavement markers to be paid for. Full compensation for removing temporary pavement markers, when no longer required, shall be considered as included in the contract unit price paid for temporary pavement marker and no separate payment will be made therefor.

## 10-1.16 BARRICADE

Barricades shall be furnished, placed and maintained at the locations shown on the plans, specified in the Standard Specifications or in these special provisions or where designated by the Engineer. Barricades shall conform to the provisions in Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications and these special provisions.

Attention is directed to "Prequalified and Tested Signing and Delineation Materials" of these special provisions regarding retroreflective sheeting for barricades.

Construction area sign and marker panels conforming to the provisions in Section 12-3.06, "Construction Area Signs," of the Standard Specifications shall be installed on barricades in a manner determined by the Engineer at the locations shown on the plans.

Sign panels for construction area signs and marker panels installed on barricades shall conform to the provisions in Section 12-3.06A, "Stationary Mounted Signs," of the Standard Specifications.

Full compensation for furnishing, installing, maintaining, and removing construction area signs and marker panels on barricades shall be considered as included in the contract unit price paid for the type of barricade involved and no separate payment will be made therefor.

Barricades shown on the plans as part of a traffic control system will be paid for as provided in "Traffic Control System for Lane Closure" of these special provisions and will not be included in the count for payment of barricades.

## 10-1.17 PORTABLE CHANGEABLE MESSAGE SIGN

Portable changeable message signs shall be furnished, placed, operated, and maintained at those locations provided for in these special provisions and as shown on the plans or where designated by the Engineer in conformance with the provisions in Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications and these special provisions.

Attention is directed to Charts 6 through 18 and Tables A and B in "Maintaining Traffic" of these special provisions regarding the use and locations of the portable changeable message signs.

The message displayed on the portable changeable message sign, as specified in these special provisions, as shown on the plan, or as directed by the Engineer, shall not be displayed until 5 minutes prior to the actual closure installation as permitted by these special provisions. Portable changeable message sign shall have either a 24 hour timer control or remote control capability.

The Contractor shall provide a representative on the job site with a cellular phone who is capable of modifying the message as directed by the Engineer for each work shift which requires a portable changeable message sign.

Full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in furnishing, placing, operating, maintaining, repairing, replacing, transporting from location to location, modifying the message, and removing portable changeable message signs as specified in these special provisions as shown on the plan shall be considered as included in the contract lump sum price paid for traffic control system and no separate payment will be made therefor.

## 10-1.18 TEMPORARY RAILING

Temporary railing (Type K) shall be placed as shown on the plans, as specified in the Standard Specifications or these special provisions or where ordered by the Engineer and shall conform to the provisions in Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications and these special provisions.

Reflectors on temporary railing (Type K) shall conform to the provisions in "Prequalified and Tested Signing and Delineation Materials" of these special provisions.

Temporary railing (Type K), conforming to the details shown on Standard Plan T3 may be used. Temporary railing (Type K) fabricated prior to January 1, 1993, and conforming to 1988 Standard Plan B11-30 may be used, provided the fabrication date is printed on the required Certificate of Compliance and vertical holes are not drilled in the top of the temporary railing to secure temporary traffic screen to the temporary railing.

Attention is directed to "Public Safety" and "Order of Work" of these special provisions.

Temporary railing (Type K) placed in conformance with the provisions in "Public Safety" of these special provisions will be neither measured nor paid for.

Temporary terminal section (Type K) for connecting temporary railing (Type K) to Type 50 concrete barrier shall consist of either new or undamaged used precast units, as shown on the plans. Fabricating, placing, painting, and removing the units shall conform to the provisions specified for temporary railing (Type K).

Closure plate for the temporary terminal section (Type K) shall be of a good commercial quality steel shaped to conform to cross section of the barriers. Mechanical expansion anchors for connecting closure plate to railings shall conform to the provisions specified for concrete anchorage devices in Section 75-1.03, "Miscellaneous Bridge Metal," of the Standard Specifications.

Temporary terminal section (Type K) will be measured by the unit from actual count in place.

The contract unit price paid for temporary terminal section (Type K) shall include full compensation for furnishing all labor, materials (including reinforcement and concrete anchorage devices), tools, equipment, and incidentals, and for doing all the work involved in furnishing, placing, maintaining, repairing, replacing, and removing temporary terminal section (Type K), complete in place, including excavation, backfill, grout and concrete, and connecting to concrete barrier, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

### 10-1.19 CHANNELIZER

Channelizers shall conform to the provisions in Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications and these special provisions.

Channelizers shall conform to the provisions in "Prequalified and Tested Signing and Delineation Materials" of these special provisions.

When no longer required for the work as determined by the Engineer, channelizers and underlying adhesive used to cement the channelizer bases to the pavement shall be removed. Removed channelizers and adhesive shall become the property of the Contractor and shall be removed from the site of work.

### 10-1.20 TEMPORARY TRAFFIC SCREEN

Temporary traffic screen shall be furnished, installed, and maintained on top of temporary railing (Type K) as specified elsewhere in these special provisions, and shall conform to the provisions specified for traffic handling equipment and devices in Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications and these special provisions.

Temporary traffic screen panels shall be new or used CDX Grade, or better, plywood or weather resistant strandboard mounted and anchored on temporary railing (Type K). Wale boards shall be new or used Douglas fir, rough sawn, Construction Grade, or better. Pipe screen supports shall be new or used galvanized steel pipe, Schedule 40. Nuts, bolts, and washers shall be cadmium plated. Screws shall be black or cadmium plated flat head, cross slotted screws with full thread length.

When no longer required, as determined by the Engineer, temporary traffic screen shall be removed from the site of the work and shall become the property of the Contractor.

Attention is directed to "Maintaining Traffic" of these special provisions regarding temporary traffic screen provided at the Contractor's option.

### 10-1.21 TEMPORARY CRASH CUSHION MODULE

This work shall consist of furnishing, installing, and maintaining sand filled temporary crash cushion modules in groupings or arrays at each location shown on the plans, as specified in these special provisions or where designated by the Engineer. The grouping or array of sand filled modules shall form a complete sand filled temporary crash cushion in conformance with the details shown on the plans and these special provisions.

Attention is directed to "Public Safety", "Order of Work", and "Temporary Railing" of these special provisions.

Whenever the work or the Contractor's operations establishes a fixed obstacle, the exposed fixed obstacle shall be protected with a sand filled temporary crash cushion. The sand filled temporary crash cushion shall be in place prior to opening the lanes adjacent to the fixed obstacle to public traffic.

Sand filled temporary crash cushions shall be maintained in place at each location, including times when work is not actively in progress. Sand filled temporary crash cushions may be removed during a work period for access to the work provided that the exposed fixed obstacle is 4.6 m or more from a lane carrying public traffic and the temporary crash cushion is reset to protect the obstacle prior to the end of the work period in which the fixed obstacle was exposed. When no longer required, as determined by the Engineer, sand filled temporary crash cushions shall be removed from the site of the work.

At the Contractor's option, the modules for use in sand filled temporary crash cushions shall be either Energite III Inertial Modules, Fitch Inertial Modules or TrafFix Sand Barrels manufactured after March 31, 1997, or equal:

A. Energite III and Fitch Inertial Modules, manufactured by Energy Absorption Systems, Inc., One East Wacker Drive, Chicago, IL 60601-2076. Telephone 1-312-467-6750, FAX 1-800-770-6755

   1. Distributor (North): Traffic Control Service, Inc., 8585 Thys Court, Sacramento, CA 95828. Telephone 1-800-884-8274, FAX 1-916-387-9734
   2. Distributor (South): Traffic Control Service, Inc., 1881 Betmor Lane, Anaheim, CA 92805. Telephone 1-800-222-8274, FAX 1-714-937-1070

B. TrafFix Sand Barrels, manufactured by TrafFix Devices, Inc., 220 Calle Pintoresco, San Clemente, CA 92672. Telephone 1-949 361-5663, FAX 1-949 361-9205

1. Distributor (North): United Rentals, Inc., 1533 Berger Drive, San Jose, CA 95112. Telephone 1-408 287-4303, FAX 1-408 287-1929
2. Distributor (South): Statewide Safety & Sign, Inc., P.O. Box 1440, Pismo Beach, CA 93448. Telephone 1-800-559-7080, FAX 1-805 929-5786

Modules contained in each temporary crash cushion shall be of the same type at each location. The color of the modules shall be the standard yellow color, as furnished by the vendor, with black lids. The modules shall exhibit good workmanship free from structural flaws and objectionable surface defects. The modules need not be new. Good used undamaged modules conforming to color and quality of the types specified herein may be utilized. If used Fitch modules requiring a seal are furnished, the top edge of the seal shall be securely fastened to the wall of the module by a continuous strip of heavy duty tape.

Modules shall be filled with sand in conformance with the manufacturer's directions, and to the sand capacity in kilograms for each module shown on the plans. Sand for filling the modules shall be clean washed concrete sand of commercial quality. At the time of placing in the modules, the sand shall contain not more than 7 percent water as determined by California Test 226.

Modules damaged due to the Contractor's operations shall be repaired immediately by the Contractor at the Contractor's expense. Modules damaged beyond repair, as determined by the Engineer, due to the Contractor's operations shall be removed and replaced by the Contractor at the Contractor's expense.

Temporary crash cushion modules shall be placed on movable pallets or frames conforming to the dimensions shown on the plans. The pallets or frames shall provide a full bearing base beneath the modules. The modules and supporting pallets or frames shall not be moved by sliding or skidding along the pavement or bridge deck.

A Type R or P marker panel shall be attached to the front of the crash cushion as shown on the plans, when the closest point of the crash cushion array is within 3.6 m of the traveled way. The marker panel, when required, shall be firmly fastened to the crash cushion with commercial quality hardware or by other methods determined by the Engineer.

At the completion of the project, temporary crash cushion modules, sand filling, pallets or frames, and marker panels shall become the property of the Contractor and shall be removed from the site of the work. Temporary crash cushion modules shall not be installed in the permanent work.

Temporary crash cushion modules will be measured by the unit as determined from the actual count of modules used in the work or ordered by the Engineer at each location. Temporary crash cushion modules placed in conformance with the provisions in "Public Safety" of these special provisions and modules placed in excess of the number specified or shown will not be measured nor paid for.

Repairing modules damaged by public traffic will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications. Modules damaged beyond repair by public traffic, when ordered by the Engineer, shall be removed and replaced immediately by the Contractor. Modules replaced due to damage by public traffic will be measured and paid for as temporary crash cushion module.

If the Engineer orders a lateral move of the sand filled temporary crash cushions and the repositioning is not shown on the plans, moving the sand filled temporary crash cushion will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications and these temporary crash cushion modules will not be counted for payment in the new position.

The contract unit price paid for temporary crash cushion module shall include full compensation for furnishing all labor, materials (including sand, pallets or frames and marker panels), tools, equipment, and incidentals, and for doing all the work involved in furnishing, installing, maintaining, moving, and resetting during a work period for access to the work, and removing from the site of the work when no longer required (including those damaged by public traffic) sand filled temporary crash cushion modules, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

## 10-1.22 EXISTING HIGHWAY FACILITIES

The work performed in connection with various existing highway facilities shall conform to the provisions in Section 15, "Existing Highway Facilities," of the Standard Specifications and these special provisions.

Plans of the existing bridges may be requested by fax from the Office of Structure Maintenance and Investigations, 1801 30th Street, Sacramento, CA, Fax (916) 227-8357, and are available at the Office of Structure Maintenance and Investigations, Los Angeles, CA, Telephone (213) 897-6156.

Plans of the existing bridges available to the Contractor are reproductions of the original contract plans with significant changes noted and working drawings and do not necessarily show normal construction tolerances and variances. Where dimensions of new construction required by this contract are dependent on the dimensions of the existing bridges, the

Contractor shall verify the controlling field dimensions and shall be responsible for adjusting dimensions of the work to fit existing conditions.

Attention is directed to Section 7-1.06, "Safety and Health Provisions," of the Standard Specifications. Work practices and worker health and safety shall conform to the California Division of Occupational Safety and Health Construction Safety Orders Title 8, of the California Code of Regulations including Section 5158, "Other Confined Space Operations."

**REPAIR EXISTING ROADBED**

Where shown on the plans or designated by the Engineer, broken, failed or other unsatisfactory portions of the existing roadbed shall be removed and disposed of and the resulting hole shall be backfilled as directed by the Engineer.

Removing and replacing existing pavement will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

**REMOVE CHAIN LINK FENCE**

Existing chain link fence, including post footings and anchor blocks, where shown on the plans, shall be removed and disposed of.

Post footings which do not conflict with the installation of new barrier may remain in place.

**REMOVE METAL BEAM GUARD RAILING**

Existing metal beam guard railing, where shown on the plans to be removed, shall be removed and disposed of.

Existing concrete anchors or steel foundation tubes shall be completely removed and disposed of. Full compensation for removing concrete anchors shall be considered as included in the contract price paid per meter for remove metal beam guard railing and no separate payment will be made therefor.

Full compensation for removing cable anchor assemblies, terminal anchor assemblies or steel foundation tubes shall be considered as included in the contract price paid per meter for remove metal beam guard railing and no separate payment will be made therefor.

**REMOVE SIGN STRUCTURE**

Existing sign structures, where shown on the plans to be removed, shall be removed and disposed of.

Overhead sign structure removal shall consist of removing posts, frames, portions of foundations, sign panels, walkways with safety railings, and sign lighting electrical equipment.

A sign structure shall not be removed until the structure is no longer required for the direction of public traffic.

Concrete foundations may be abandoned in place, except that the top portion, including anchor bolts, reinforcing steel, and conduits shall be removed to a depth of not less than 1.0 m below the adjacent finished grade. The resulting holes shall be backfilled and compacted with material equivalent to the surrounding material.

Electrical wiring shall be removed to the nearest pull box. Fuses within spliced connections in the pull box shall be removed and disposed of.

Electrical equipment, where shown on the plans, shall be salvaged.

**REMOVE PAVEMENT MARKER**

Existing pavement markers, including underlying adhesive, when no longer required for traffic lane delineation as determined by the Engineer, shall be removed and disposed of.

**REMOVE TRAFFIC STRIPE AND PAVEMENT MARKING**

Traffic stripe and pavement marking shall be removed at the locations shown on the plans and as directed by the Engineer.

Attention is directed to "Water Pollution Control" of these special provisions.

**REMOVE DRAINAGE FACILITY**

Existing pipes, inlets, and headwalls, where any portion of these structures is within one meter of the grading plane in excavation areas, or within 0.3-m of original ground in embankment areas, or where shown on the plans to be removed, shall be completely removed and disposed of.

**REMOVE ROADSIDE SIGN**

Existing roadside signs, at those locations shown on the plans to be removed, shall be removed and disposed of.

Where shown on the plans, sign panels shall be reused in the new work.

Existing roadside signs shall not be removed until replacement signs have been installed or until the existing signs are no longer required for the direction of public traffic, unless otherwise directed by the Engineer.

**RECONSTRUCT CHAIN LINK FENCE**

Existing chain link fence, at the locations shown on the plans, shall be removed and reconstructed.

Fence removed in excess of that required for reconstructing chain link fence shall be disposed of.

Full compensation for removing and disposing of excess fence shall be considered as included in the contract price paid per meter for reconstruct chain link fence and no separate payment will be made therefor.

**RECONSTRUCT CHAIN LINK GATE**

Existing chain link gate, at the locations shown on the plans, shall be removed and reconstructed.

The contract unit price paid for reconstruct chain link gate shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in reconstructing chain link gate, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

**RECONSTRUCT METAL BEAM GUARD RAILING**

Existing metal beam guard railing, where shown on the plans to be reconstructed, shall be reconstructed.

Attention is directed to "Order of Work" of these special provisions regarding the reconstruction of metal beam guard railing at those locations exposed to public traffic.

Cable anchor assemblies or terminal anchor assemblies, including concrete anchors and steel foundation tubes, shall be completely removed and disposed of.

New posts, blocks, and hardware shall be added as necessary to conform to the post spacing shown on the plans for new metal beam guard railing. New posts and blocks shall be alternated with existing posts and blocks in the new location. New posts, blocks, and hardware shall conform to the provisions in Section 83-1.02B, "Metal Beam Guard Railing," of the Standard Specifications.

New posts, blocks, and hardware shall be furnished and used to reconstruct metal beam guard railing. New posts and blocks shall conform to the provisions in Section 83-1.02B, "Metal Beam Guard Railing," of the Standard Specifications.

Posts, blocks, and other components of the removed metal beam guard railing, including terminal sections, that are not used in the reconstruction work shall be disposed of.

Full compensation for furnishing and installing new posts, blocks, and hardware; for connecting reconstructed metal beam guard railing to existing structures, other flat concrete surfaces or terminal systems; and for removing and disposing of anchor assemblies shall be considered as included in the contract price paid per meter for reconstruct metal beam guard railing and no separate payment will be made therefor.

Terminal anchor assemblies (Type SFT) and terminal anchor assemblies (Type CA) for reconstructed metal beam guard railing will be measured and paid for separately and shall conform to the provisions in "Metal Beam Guard Railing" of these special provisions.

Terminal System (Type SRT) and Terminal System (Type CAT) for connection to reconstructed metal beam guard railing will be measured and paid for separately in conformance with the provisions in "Terminal System (Type SRT)" and "Terminal System (Type CAT)" of these special provisions.

**RELOCATE ROADSIDE SIGN**

Existing roadside signs shall be removed and relocated to the new locations shown on the plans.

Each roadside sign shall be installed at the new location on the same day that the sign is removed from its original location.

Two holes shall be drilled in each existing post as required to provide the breakaway feature shown on the plans.

**OBLITERATE SURFACING**

Existing surfacing, when no longer required for the passage of public traffic, shall be obliterated at the locations shown on the plans.

Surfacing shall not be obliterated by the earth cover method.

Obliteration shall consist of rooting, plowing, pulverizing or scarifying the existing surfacing in conformance with the provisions in Section 15-2.02A, "Obliterating Roads and Detours," of the Standard Specifications.

**REMOVE PORTLAND CEMENT CONCRETE PAVEMENT**

Removing portland cement concrete pavement shall conform to the provisions in Section 15-3, "Removing Concrete," of

the Standard Specifications.

Where no joint exists in the pavement on the line at which concrete is to be removed, a straight, neat cut with a power driven saw shall be made along the line to a minimum depth of 50 mm before removing the concrete.

The quantities of portland cement concrete pavement removed will be measured and paid for by the square meter.

No deduction will be made from any excavation quantities for the quantity of portland cement concrete pavement removed.

Full compensation for removing bituminous or other overlying material and sawing joints at removal lines, as required, shall be considered as included in the contract price paid per square meter for remove concrete pavement and no additional compensation will be allowed therefor.

**COLD PLANE ASPHALT CONCRETE PAVEMENT**

Existing asphalt concrete pavement shall be cold planed at the locations and to the dimensions shown on the plans.

Planing asphalt concrete pavement shall be performed by the cold planing method. Planing of the asphalt concrete pavement shall not be done by the heater planing method.

Cold planing machines shall be equipped with a cutter head not less than 750 mm in width and shall be operated so that no fumes or smoke will be produced. The cold planing machine shall plane the pavement without requiring the use of a heating device to soften the pavement during or prior to the planing operation.

The depth, width, and shape of the cut shall be as shown on the typical cross sections or as designated by the Engineer. The final cut shall result in a uniform surface conforming to the typical cross sections. The outside lines of the planed area shall be neat and uniform. Planing asphalt concrete pavement operations shall be performed without damage to the surfacing to remain in place.

Planed widths of pavement shall be continuous except for intersections at cross streets where the planing shall be carried around the corners and through the conform lines. Following planing operations, a drop-off of more than 45 mm will not be allowed between adjacent lanes open to public traffic.

Where transverse joints are planed in the pavement at conform lines no drop-off shall remain between the existing pavement and the planed area when the pavement is opened to public traffic. If asphalt concrete has not been placed to the level of existing pavement before the pavement is to be opened to public traffic a temporary asphalt concrete taper shall be constructed. Asphalt concrete for temporary tapers shall be placed to the level of the existing pavement and tapered on a slope of 1:30 (Vertical: Horizontal) or flatter to the level of the planed area.

Asphalt concrete for temporary tapers shall be commercial quality and may be spread and compacted by any method that will produce a smooth riding surface. Temporary asphalt concrete tapers shall be completely removed, including the removal of loose material from the underlying surface, before placing the permanent surfacing. The removed material shall be disposed of outside the highway right of way in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

The material planed from the roadway surface, including material deposited in existing gutters or on the adjacent traveled way, shall be removed and disposed of outside the highway right of way in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications. Removal operations of cold planed material shall be concurrent with planing operations and follow within 15 m of the planer, unless otherwise directed by the Engineer.

Cold plane asphalt concrete pavement will be measured by the square meter for the depth (maximum) designated in the Engineer's Estimate. The quantity to be paid for will be the actual area of surface cold planed for the depth (maximum) designated in the Engineer's Estimate, irrespective of the number of passes required to obtain the depth shown on the plans.

The contract price paid per square meter for cold plane asphalt concrete pavement for the depth (maximum) designated in the Engineer's Estimate shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in cold planing asphalt concrete surfacing and disposing of planed material, including furnishing the asphalt concrete for and constructing, maintaining, removing, and disposing of temporary asphalt concrete tapers, as specified in the Standard Specifications and these special provisions and as directed by the Engineer.

**MODIFY INLET**

Existing concrete drainage inlets, where shown on the plans to be modified, shall be modified.

Portland cement concrete shall be minor concrete or may be produced from commercial quality aggregates and cement containing not less than 350 kg of cement per cubic meter.

Concrete removal shall be performed without damage to portions of the inlet that are to remain in place. Damage to existing concrete, which is to remain in place, shall be repaired by the Contractor to a condition equal to that existing prior to the beginning of removal operations. The repair of existing concrete damaged by the Contractor's operations shall be at the Contractor's expense.

Existing reinforcement that is to be incorporated in the new work shall be protected from damage and shall be

thoroughly cleaned of adhering material before being embedded in the new concrete.

The quantity of modifying inlets will be determined as units from actual count.

Existing frames and grates shall be removed and disposed of.

New metal frame and grates which are incorporated into the modified inlet shall conform to the provisions in Section 75, "Miscellaneous Metals", of the Standard Specifications.

The contract unit price paid for modify inlet shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in modifying inlets, including removing portions of inlets, bar reinforcing steel, removing and disposing of existing frame and grate, furnishing and installing frame and grate, and structure excavation and structure backfill, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

**CAP INLET AND RISER**

Existing pipe inlets and concrete drainage inlets and risers, where shown on the plans to be capped, shall be capped and the bottoms of the inlets shall be rounded with portland cement concrete as shown on the plans.

Portland cement concrete shall be minor concrete or may be produced from commercial quality aggregates and cement containing not less than 350 kg of cement per cubic meter.

Inlets shall be removed to a depth of at least 0.3-m below the grading plane.

Concrete removal shall be performed without damage to portions of the inlet that are to remain in place. Damage to existing concrete, which is to remain in place, shall be repaired by the Contractor to a condition equal to that existing prior to the beginning of removal operations. The repair of existing concrete damaged by the Contractor's operations shall be at the Contractor's expense.

Existing reinforcement that is to be incorporated in the new work shall be protected from damage and shall be thoroughly cleaned of adhering material before being embedded in the new concrete.

The quantity of capping inlets and risers will be determined as units from actual count.

The contract unit price paid for cap inlet and riser shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in capping inlets and risers, including removing portions of inlets and risers, rounding bottoms of inlets and risers, bar reinforcing steel, and structure excavation and structure backfill, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

**REMOVE CRASH CUSHION**

Existing crash cushions, at those locations shown on the plans to be removed, shall be removed and disposed of.

The contract unit price paid for remove crash cushion shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in removing crash cushion, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

**EXISTING LOOP DETECTORS**

The existing inductive loop detectors shown on the plans shall remain in place.

If part of the loop conductor, including the portion leading to the adjacent pull box, is damaged by the Contractor's operations, the entire detector loop shall be replaced at the Contractor's expense. Adjacent loops damaged during the replacement shall also be replaced.

**REMOVE CONCRETE**

Concrete, concrete curb, concrete barrier, and concrete sidewalk, where shown on the plans to be removed, shall be removed.

The pay quantities of concrete to be removed will be measured by the cubic meter, measured before and during removal operations.

Removing concrete curb and concrete barrier will be measured by the meter, measured along the curb or barrier before removal operations.

Removing concrete sidewalk will be measured by the square meter before removal operations.

Concrete removed shall be disposed of outside the highway right of way in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Where no joint exists between concrete to be removed and concrete to remain in place, the concrete shall be cut on a neat line to a minimum depth of 50 mm with a power driven saw before the concrete is removed.

Where concrete has been removed outside the roadway prism, the backfilled areas shall be graded to drain and blend in with the surrounding terrain.

**ACCESS OPENING, SOFFIT**

Access openings in bridge soffits shall consist of removing portions of existing box girder bridge soffits at the locations and to the dimensions shown on the plans.

A 19-mm deep saw cut shall be made around the perimeter of the soffit areas to be removed.

Bar reinforcing steel shall be removed as shown on the plans. The ends of the remaining bars shall be coated with 2 applications of a zinc-rich primer in the same manner specified for exposed ends of prestressing steel in Section 50-1.05, "Prestressing Steel," of the Standard Specifications.

Within a cell where work is to be performed, existing formwork and miscellaneous concrete that will interfere with the work shall be removed. All material removed shall become the property of the Contractor and shall be disposed of outside the highway right of way as provided in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

When no longer required, soffit access openings shall be closed as shown on the plans. All materials, including galvanized sheet metal covers, steel hardware, hinges, and corrosion resistant concrete expansion anchorage devices, shall be commercial quality.

Thread locking system shall conform to the provisions in Section 75, "Miscellaneous Metal," of the Standard Specifications.

Unless specified as an option, using deck access openings in lieu of soffit access openings will not be allowed.

Access openings through soffits will be measured and paid for by the unit as access opening, soffit. Openings to be paid for will be determined from actual count of the completed units in place.

The contract unit price paid for access opening, soffit shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the soffit access opening, complete in place, including closing the soffit access opening and removing forms and miscellaneous concrete, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

## 10-1.23 CLEARING AND GRUBBING

Clearing and grubbing shall conform to the provisions in Section 16, "Clearing and Grubbing," of the Standard Specifications and these special provisions.

Attention is directed to “Aerially Deposited Lead,” of these special provisions.

Vegetation shall be cleared and grubbed only within the excavation and embankment slope lines.

At locations where there is no grading adjacent to a bridge or other structure, clearing and grubbing of vegetation shall be limited to 1.5 m outside the physical limits of the bridge or structure.

Existing vegetation outside the areas to be cleared and grubbed shall be protected from injury or damage resulting from the Contractor's operations.

Activities controlled by the Contractor, except cleanup or other required work, shall be confined within the graded areas of the roadway.

Nothing herein shall be construed as relieving the Contractor of the Contractor's responsibility for final cleanup of the highway as provided in Section 4-1.02, "Final Cleaning Up," of the Standard Specifications.

## 10-1.24 EARTHWORK

Earthwork shall conform to the provisions in Section 19, "Earthwork," of the Standard Specifications and these special provisions.

The finished grade shall be left in a rough grade. The rough grade shall then be tracked walked parallel to the toe of slope to a depth of 0.20m. The use of cutting edges such as motorgrader blades, shall not be used for the final cutting of the slopes.

All areas with gullies, rills, or proposed regrading, shall be left in a smooth, firm, stable condition, free of rocks, clods, foliage, roots or other material.

Surplus excavated material shall become the property of the Contractor and shall be disposed of outside the highway right of way in accordance with the provisions in Section 7—1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Attention is directed to "Material Containing Aerially Deposited Lead" of these special provisions.

The grading plane of embankments beneath structure approach slabs and beneath the thickened portion of sleeper slabs shall not project above the grade established by the Engineer.

Surplus excavated material not designated or determined to contain aerially deposited lead shall become the property of the Contractor and shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Where a portion of the existing surfacing is to be removed, the outline of the area to be removed shall be cut on a neat line with a power-driven saw to a minimum depth of 50 mm before removing the surfacing. Full compensation for cutting the existing surfacing shall be considered as included in the contract price paid per cubic meter for roadway excavation and no additional compensation will be allowed therefor.

The portion of imported borrow placed within 1.5 m of the finished grade shall have a Resistance (R-Value) of not less than 15.

Reinforcement or metal attached to reinforced concrete rubble placed in embankments shall not protrude above the grading plane. Prior to placement within 0.6-m below the grading plane of embankments, reinforcement or metal shall be trimmed to no greater than 20 mm from the face of reinforced concrete rubble. Full compensation for trimming reinforcement or metal shall be considered as included in the contract prices paid per cubic meter for the types of excavation shown in the Engineer's estimate, or the contract prices paid for furnishing and placing imported borrow or embankment material, as the case may be, and no additional compensation will be allowed therefor.

If the Contractor elects to use the "Weep Hole and Geocomposite Drain" alternative where permitted on the plans, the geocomposite drain shall conform to the details shown on the plans and the following:

A. Attention is directed to "Engineering Fabrics" under "Materials" of these special provisions.
B. Geocomposite drain shall consist of a manufactured core not less than 6.35 mm thick nor more than 50 mm thick with one or both sides covered with a layer of filter fabric that will provide a drainage void. The drain shall produce a flow rate, through the drainage void, of at least 25 liters per minute per meter of width at a hydraulic gradient of 1.0 and a minimum externally applied pressure of 168 kPa.
C. A Certificate of Compliance conforming to the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications shall be furnished for the geocomposite drain certifying that the drain produces the required flow rate and complies with these special provisions. The Certificate of Compliance shall be accompanied by a flow capability graph for the geocomposite drain showing flow rates for externally applied pressures and hydraulic gradients. The flow capability graph shall be stamped with the verification of an independent testing laboratory.
D. Filter fabric for the geocomposite drain shall conform to the provisions for fabric for underdrains in Section 88, "Engineering Fabrics," of the Standard Specifications.
E. The manufactured core shall be either a preformed grid of embossed plastic, a mat of random shapes of plastic fibers, a drainage net consisting of a uniform pattern of polymeric strands forming 2 sets of continuous flow channels, or a system of plastic pillars and interconnections forming a semirigid mat.
F. The core material and filter fabric shall be capable of maintaining the drainage void for the entire height of geocomposite drain. Filter fabric shall be integrally bonded to the side of the core material with the drainage void. Core material manufactured from impermeable plastic sheeting having nonconnecting corrugations shall be placed with the corrugations approximately perpendicular to the drainage collection system.
G. The geocomposite drain shall be installed with the drainage void and the filter fabric facing the embankment. The fabric facing the embankment side shall overlap a minimum of 75 mm at all joints and wrap around the exterior edges a minimum of 75 mm beyond the exterior edge. If additional fabric is needed to provide overlap at joints and wrap-around at edges, the added fabric shall overlap the fabric on the geocomposite drain at least 150 mm and be attached thereto.
H. Should the fabric on the geocomposite drain be torn or punctured, the damaged section shall be replaced completely or repaired by placing a piece of fabric that is large enough to cover the damaged area and provide a minimum 150-mm overlap.
I. Plastic pipe shall conform to the provisions for edge drain pipe and edge drain outlets in Section 68-3, "Edge Drains," of the Standard Specifications.
J. Treated permeable base to be placed around the slotted plastic pipe at the bottom of the geocomposite drain shall be cement treated permeable base conforming to the provisions for cement treated permeable base in Section 29, "Treated Permeable Bases," of the Standard Specifications and these special provisions.
K. The treated permeable base shall be enclosed with a high density polyethylene sheet or PVC geomembrane, not less than 250 µm thick, which is bonded with a suitable adhesive to the concrete and geocomposite drain. Surfaces to receive the polyethylene sheet shall be cleaned before applying the adhesive. The treated permeable base shall be compacted with a vibrating shoe type compactor.

If structure excavation or structure backfill involved in bridges is not otherwise designated by type, and payment for the structure excavation or structure backfill has not otherwise been provided for in the Standard Specifications or these special provisions, the structure excavation or structure backfill will be paid for at the contract price per cubic meter for structure excavation (bridge) or structure backfill (bridge).

Full compensation for working drawings and construction sequence, and temporary supports and shoring, if required, for soldier pile wall construction shall be considered as included in the contract price paid per cubic meter for structure

excavation (retaining wall) and no additional compensation will be allowed therefor.

Full compensation for filter fabric shall be considered as included in the contract price paid per cubic meter for gravel fill and no additional compensation will be allowed therefor.

**10-1.25 EARTH RETAINING STRUCTURES**

Earth retaining structures, consisting of mechanically stabilized embankment, shall conform to the details shown on the plans and these special provisions.

At the Contractor's option, one of the following acceptable alternative earth retaining systems may be constructed:

| Proprietary Earth Retaining System | Address and Phone Number |
|---|---|
| Reinforced Earth | The Reinforced Earth Company<br>20381 Lake Forest Drive, Suite B-2<br>Lake Forest, CA 92630<br>(949) 587-3060<br>www.reinforcedearth.com |
| Retained Earth (1.52-meter square concrete face panels) | Foster Geotechnical<br>1660 Hotel Circle North - Suite 304<br>San Diego, CA 92108<br>(619) 688-2400<br>www.lbfoster.com |
| MSE Plus | SSL<br>4740 Scotts Valley Drive, Suite "E"<br>Scotts Valley, CA 95066<br>(831) 430-9300 |

Only one type of earth retaining system shall be used at any one location.

The above list of acceptable alternative earth retaining systems has been selected from the Department's current list of prequalified earth retaining systems and is limited only to those systems determined to have characteristics suitable for this project. Among the alternatives shown, some systems may be proprietary.

The list of prequalified earth retaining systems has been developed from data previously furnished by suppliers or manufacturers of each system. Approval of additional earth retaining systems is contingent on the system meeting the full range of parameters for which prequalification is required. The prequalification requirements can be obtained from the Office of Structure Design, Mail Station 9-2/9I, 1801 30th Street, Sacramento, CA 95816.

**WORKING DRAWINGS**

If the Contractor elects to use a proprietary earth retaining system from the list of acceptable alternative systems, the Contractor shall submit complete working drawings for each installation of the system to the Office of Structure Design (OSD) in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. For initial review, 4 sets of drawings shall be submitted. After review between 6 and 12 sets, as requested by the Engineer, shall be submitted to OSD for final approval and use during construction.

Working drawings shall be 279 mm x 432 mm in size, and each drawing and calculation sheet shall include the State assigned designations for the contract number, bridge number, full name of the structure as shown on the contract plans, and District-County-Route-kilometer Post. The design firm's name, address, and phone number shall be shown on the working drawings. Each sheet shall be numbered in the lower right hand corner and shall contain a blank space in the upper right hand corner for future contract sheet numbers.

The Contractor shall verify the existing ground elevations at the site before preparing the working drawings. The working drawings shall contain all information required for the proper construction of the system at each location including existing ground line at face of wall as verified at the site and any required revisions or additions to drainage systems or other facilities. The working drawings shall include "General Notes" which contain design parameters, material notes, and wall construction procedures. The working drawings shall be stamped and signed by an engineer who is registered as a Civil Engineer in the State of California. The Contractor shall allow the Engineer 4 weeks to review the drawings after a complete set has been received.

Unless otherwise specified, at the completion of each structure for which working drawings were submitted, and if the work detailed in these working drawings is permanent, the Contractor shall submit to the Engineer one set of corrected as-built prints 279 mm x 432 mm in size and on 75-g/m$^2$ (minimum) bond paper, showing as built conditions. As-built

drawings that are common to more than one structure shall be submitted for each structure.

## MATERIALS

### Earthwork

Excavation and backfill shall conform to the details shown on the plans, the provisions in Section 19, "Earthwork," of the Standard Specifications, and these special provisions.

Imported borrow (lightweight aggregate) shall conform to “Imported Borrow (lightweight aggregate)” of these special provisions.

Gravel fill shall conform to the provisions in Section 19-3.065, “Pervious Backfill Material”, of the Standard Specifications and these special provisions.

Water used for earthwork or dust control within 150 meters of the earth retaining structures with metallic soil reinforcement shall conform to the provisions for water in Section 90-2.03, "Water," of the Standard Specifications.

### Concrete

Concrete used in precast and cast-in-place reinforced concrete members of earth retaining structures shall conform to the details shown on the plans, the provisions in Section 51, "Concrete Structures," of the Standard Specifications, and these special provisions.

The concrete leveling pads for the Mechanically Stabilized Embankment (MSE) system shall conform to the provisions in Section 90-10, "Minor Concrete," of the Standard Specifications.

### Reinforcement

Reinforcement shall conform to the provisions in Section 52, "Reinforcement," of the Standard Specifications and these special provisions.

### Galvanizing

Soil reinforcement, connecting elements, and other steel components that are in contact with the earth shall be galvanized in conformance with the provisions in Section 75-1.05, "Galvanizing," of the Standard Specifications.

### Inspection Wire

If a proprietary alternative system is selected, inspection elements representative of the particular soil reinforcement shall be furnished in the same number and approximate location as shown on the plans for the MSE system.

The threaded end of the inspection wire may be formed before or after galvanizing. The end 100 mm of the wire shall be coated with 2 applications of an approved unthinned commercial quality zinc-rich primer (organic vehicle type). The threaded end of the wire shall be encapsulated with corrosion inhibiting, mastic filled, round vinyl enclosure secured with a nylon tie as shown on the plans. If the threaded end is galvanized after threading, the threads shall be cleaned before painting. There shall be no damage to the unthreaded portion of the galvanized inspection wire.

### Drainage System

The drainage system shall conform to the details shown on the plans and these special provisions.

Corrugated steel pipe shall conform to the provisions in Section 66, "Corrugated Metal Pipe," of the Standard Specifications.

Perforated steel pipe underdrains and underdrain outlets and risers shall conform to the provisions in Section 68-1, "Underdrains," of the Standard Specifications.

The class of rock used for rock slope protection at drain pipe outlets shall be No. 3 Backing, and shall conform to the provisions in Section 72-2, "Rock Slope Protection," of the Standard Specifications.

Filter fabric shall conform to the provisions for fabric for underdrains in Section 88-1.03, "Filter Fabric," of the Standard Specifications, and these special provisions.

Adhesive for bonding filter fabric to concrete panels shall be commercial grade.

### Soil Reinforcement

Soil reinforcement shall conform to the details shown on the plans and these special provisions.

MW70 and MW130 steel wire shall conform to the requirements in ASTM Designation: A 82. The welded wire mat shall conform to the requirements in ASTM Designation: A 185. MD70 and MD130 deformed steel wire may be substituted for MW70 and MW130 steel wire, respectively. The welded wire mat utilizing deformed steel wire shall conform to the

requirements in ASTM Designation: A 496 and ASTM Designation: A 497.

The button on button-headed wires shall conform to the provisions in Section 50-1.05, "Prestressing Steel," of the Standard Specifications.

The coupler at the mat connection shall be a seamless steel sleeve. The coupler shall be applied over the button-headed wires and swaged by means of a hydraulic press. The coupler shall develop the minimum tensile strength of the wire without exceeding a total slip of the wires of 5.0 mm.

Splicing of the welded wire mat along its length shall be by a mechanical coupler, which shall develop the minimum tensile strength of the wire. The mechanical coupler shall be approved by the Engineer.

### Miscellaneous

Resin bonded cork for horizontal joints shall conform to the requirements in ASTM Designation: D 1752, Type II with a compressive load of not less than 690 kPa.

Pipe for the pipe pin shall conform to the requirements in ASTM Designation: A 53, Standard weight, except the amount of the zinc coating per square meter of actual surface shall average not less than 610 g and no individual specimen shall be less than 550 g.

## CONSTRUCTION

Earth retaining structures shall be constructed to the lines, grades, and details shown on the plans, and shall conform to these special provisions.

### Earthwork

Structure backfill material shall be placed and compacted simultaneously with the erection of the facing panels. Placement and compaction shall be accomplished without distortion of the soil reinforcement or displacement of facing panels. Structure backfill at the front of the wall shall be completed prior to backfilling more than 4 m above the bottom of the lowermost face element.

Structure backfill for earth retaining structures with soil reinforcement shall be compacted to a relative compaction of not less than 90 percent, except when the backfill is within 50 meters of a bridge abutment or for a minimum depth of one meter below the grading plane for the width between the outer edges of shoulders, the backfill shall be compacted to a relative compaction of not less than 95 percent.

A relative compaction of not less than 95 percent shall be obtained for embankment under earth retaining structures with soil reinforcement within the limits established by inclined planes sloping 1:1.5 (vertical:horizontal) out and down from lines 0.3-m outside the bottom limits of structure backfill, including permeable material when required.

Sheepsfoot or grid-type rollers shall not be used for compacting material within the limits of the soil reinforcement. Hand-held or hand-guided compacting equipment shall be used to compact structure backfill material within one meter of the facing panels.

At each level of the soil reinforcement the structure backfill shall be constructed to a plane 45 mm above the elevation of the soil reinforcement connection and shall start one meter from the back of the face panel and extend for at least the remaining length of soil reinforcement. This grading shall be complete before placing the next layer of soil reinforcement.

Permeable material and filter fabric shall be placed along with structure backfill as shown on the plans. Compaction of the permeable material for the drainage system outside the limits of the soil reinforcement is not required, and equipment shall not be operated directly on the permeable material or filter fabric. If a sloped layer of permeable material is placed to facilitate the work or to satisfy safety considerations, the vertical limits of permeable material shall remain unchanged, and the thickness of the layer of permeable material shall be measured normal to the slope.

Permeable material shall be placed in layers not exceeding 0.6-m in thickness.

### Filter Fabric

Filter fabric shall be placed at the locations and in conformance with the details shown on the plans and these special provisions.

Immediately prior to placing filter fabric, the subgrade to receive the filter fabric shall conform to the compaction and elevation tolerance specified for the material involved and shall be free of loose or extraneous material and sharp objects that may damage the filter fabric during installation.

Filter fabric shall be handled and placed in conformance with the manufacturer's recommendations.

Filter fabric shall be stretched, aligned, and placed in a wrinkle-free manner.

Adjacent borders of filter fabric shall be stitched or overlapped from 300 mm to 450 mm. The preceding roll shall overlap the following roll in the direction the material is being spread or shall be stitched. When filter fabric is joined by stitching it shall be stitched with yarn of a contrasting color. The size and composition of the yarn shall be as recommended

by the filter fabric manufacturer. The stitches shall number 2 to 3 per centimeter of seam.

If the filter fabric is damaged during installation, it shall be repaired by placing a piece of filter fabric that is large enough to cover the damaged area and which meets the overlap requirement.

During spreading of the permeable material, a minimum of 150 mm of the material shall be maintained between the filter fabric and the Contractor's equipment. Where structure backfill material is to be placed on filter fabric, a minimum of 450 mm of structure backfill material shall be maintained between the filter fabric and the Contractor's equipment. Equipment or vehicles shall not be operated or driven directly on filter fabric.

**Concrete**

Concrete for the leveling pads shall be placed at least 24 hours prior to erecting face panels.

Exposed surfaces of precast and cast-in-place concrete members shall receive a surface finish conforming to the provisions in Section 51-1.18B, "Class 1 Surface Finish," of the Standard Specifications. For exposed surfaces of precast and cast-in-place concrete members with architectural treatment see “Architectural Treatment” of these special provisions

**Mechanically Stabilized Embankment System**

If the Contractor elects to construct one of the earth retaining structures shown on the plans, the structure shall conform to the lines, grades, and details shown on the plans and these special provisions.

Concrete panel surfaces, which are to receive filter fabric, shall be dry and thoroughly cleaned of dust and deleterious materials.

After placement of an inspection element and placement of backfill to a level at least 0.6-m above the inspection element, the void in the face panel shall be dry packed with portland cement mortar as shown on the plans. Dry pack shall conform to the provisions in Section 51-1.135, "Mortar," of the Standard Specifications, except that the proportion of cement to sand shall be that required to achieve a 28-day mortar compressive strength of 7 MPa to 10 MPa.

**Proprietary Earth Retaining Systems**

If the Contractor elects to construct one of the acceptable proprietary alternative earth retaining systems, the structure shall be constructed to the lines and grades shown on the plans. Vertical and horizontal alignment shall be checked at every course throughout the erection process. The construction shall include a drainage system where shown on the plans, and shall conform to the details shown on the approved working drawings, approved proprietary system details, and these special provisions.

The top of wall profile of alternative earth retaining systems shall conform to the profile shown on the plans. The bottom of face panels shall be at or below the elevations shown on the plans. The height and length to be used for any system shall be the minimums for that system that will effectively retain the earth behind the structure for the loading conditions and the contours, profile, or slope lines shown on the plans. The length of soil reinforcement for any system shall be not less than that shown on the plans. In addition, if the plans or special provisions indicate limiting parameters for alternative systems, the system shall conform to those parameters.

The top of face panels, assuming no leveling pad settlement, shall be covered by the coping lip or concrete barrier slab lip at a minimum of 170 mm. The coping height may be increased from 460 mm to 600 mm maximum along the entire length of the wall at the Contractor's expense.

The top level of soil reinforcement shall be placed parallel to the top of the concrete panel at a distance below the top of the wall as shown on the plans. The top level of soil reinforcement shall also be 1) placed a minimum of 75 mm below the bottom of the barrier slab lip or the bottom of the concrete gutter behind coping and 2) placed a minimum of 125 mm below the top edge of the concrete panel.

**MEASUREMENT AND PAYMENT**

Earth retaining structures will be measured and paid for by the square meter. Regardless of the type of earth retaining structure actually constructed, the square meter area for payment will be based on the length and vertical height of each section of mechanically stabilized embankment system shown on the plans which was or would have been constructed. The vertical height of each section will be taken as the difference in elevation on the outer face from the top of footing to the top of wall profile.

The contract price paid per square meter for earth retaining structure at each location shown on the plans shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the earth retaining structure and inspection elements, including earthwork, leveling pad, coping, bearing pads, and drainage systems, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for structure backfill (lightweight aggregate) shall be considered as included in the contract price paid per square meter for earth retaining structure (MSE wall) and no additional compensation will be allowed therefor.

Full compensation for fractured rib texture shall be considered as included in the contract price paid per square meter for earth retaining structure (MSE wall) and no separate payment will be made therefor.

The contract price paid per cubic meter for structural concrete, barrier slab shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the barrier slab, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for revisions to the barrier support, drainage system, or other facilities made necessary by the use of an alternative earth retaining system shall be considered as included in the contract price paid per square meter for earth retaining structure, and no separate payment will be made therefor.

## 10-1.26 SOIL NAIL WALL EARTHWORK

Soil nail wall earthwork consisting of excavation, drilling holes for installation of soil nail assemblies, and backfilling around these completed walls shall conform to the provisions in Section 19-3, "Structure Excavation and Backfill," of the Standard Specifications and these special provisions.

### WORKING DRAWINGS

The Contractor shall submit complete working drawings for earthwork for each soil nail wall to the Division of Structure Design (DSD) in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. All working drawings for wall earthwork shall be 559 mm by 864 mm in size. For initial review, 5 sets of drawings shall be submitted. After review, between 6 and 12 sets, as requested by the Engineer, shall be submitted to DSD for final approval and use during construction.

Working drawings for wall earthwork shall show the State assigned designations for the contract number, structure number, full name of the structure as shown on the contract plans, and District-County-Route-Kilometer Post on each drawing and calculation sheet. The Contractor name, address, and phone number shall be shown on the working drawings. Each sheet shall be numbered in the lower right hand corner.

Working drawings for wall earthwork shall contain all information required for the construction and quality control of the earthwork, including the following:

A. The proposed schedule and detailed construction sequence. Construction sequence shall include measures to ensure wall and slope stability during all stages of wall construction including provisions for discontinuous rows of nails.
B. Methods of excavation to the staged lifts indicated and excavation equipment types.
C. Temporary shoring plans.
D. Drilling methods and equipment including proposed drill hole size and any variation of these along the alignments.
E. Information on space requirements for installation equipment.
F. A detailed construction dewatering plan addressing all elements necessary to divert, control and dispose of surface water.

A supplement to the working drawings shall include the following:

A. Independently checked calculations for wall and slope stability during various stages of wall construction including geotechnical assessment of information provided by the Department for this contract. At the Contractor's option, the Contractor may conduct additional geotechnical investigation for the purpose of developing wall earthwork working drawings.
B. Information on provisions for working in the proximity of underground facilities.

The working drawings and supplement shall be stamped and signed by an engineer who is registered as a Civil Engineer in the State of California.

The Contractor shall allow the Engineer 4 weeks to review the working drawing submittal after a complete set has been received.

Should the Engineer fail to review the complete working drawing submittal within the time specified and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in reviewing the wall earthwork working drawing submittal, an extension of time commensurate with the delay in completion of the work thus caused will be granted in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

### EXCAVATION

Care shall be taken during excavation for soil nail walls to prevent disturbing the natural foundation materials behind the

face of excavation. During initial mass grading, the Contractor shall not excavate the full wall height to the wall alignment as shown on the plans, but the Contractor shall maintain a working berm of native material in front of the wall to serve as a work bench for the drill equipment. The working berm shall extend out from the wall a minimum distance of 5 m and shall be cut down from that point at the slope shown on the approved wall earthwork working drawings. The original ground beyond the wall alignment for the back or ends of the wall as shown on the plans shall not be over excavated. Any such over excavation shall be restored by the Contractor, at the Contractor's expense, using methods and materials approved in writing by the Engineer. Soil stabilization methods or temporary backing or lagging placed behind the excavation face may be required to prevent disturbing the natural foundation materials.

Excavation for walls shall be limited to that area which can be nailed and covered with shotcrete during the same work shift in which the excavation is done. Subsequent excavation shall not be made within 3 m of previously nailed and covered portions of the wall until those nailed and covered portions are structurally complete. A portion of the wall will be considered structurally complete when the soil nail assemblies have been installed, the shotcrete cover has set, specified testing has been completed for that portion of the wall, and the test results have been furnished to the Engineer.

Excavation to the final wall alignment for the full wall height shall incorporate a working berm which shall be constructed from the top down in a staged lift sequence as shown on the approved wall earthwork working drawings. The ground level in front of the wall face shall not be excavated more than one meter below the level of the row of soil nails to be installed in that same lift.

At the option of the Contractor, in addition to the working berm described above, the Contractor may maintain a stabilizing berm to support the excavation face during nail installation. The stabilizing berm shall extend horizontally from the bottom of the shotcrete a minimum distance of 0.3-m and shall be cut down from that point at a slope as shown on the approved wall earthwork working drawings.

After soil nails are complete in place for a given lift, the stabilizing berm shall be removed during excavation to the final wall alignment. The complete excavated face shall be cleaned of all loose materials, mud, rebound, and other materials that could prevent or reduce shotcrete bond to the excavated face and soil nails.

Temporary backing or lagging for excavation at walls may be left in place if approved in writing by the Engineer. There shall be no voids behind wall temporary backing or lagging that is left in place. Fillers used to eliminate voids between the excavation face and temporary backing or lagging shall be dimensionally stable, non-deteriorating material capable of supporting the earth pressures in both water saturated and dry conditions.

Timber backing or lagging at walls which is to remain in place and is greater than one inch total thickness shall be pressure treated with wood preservative for soil and fresh water use in conformance with the provisions in Section 58, "Preservative Treatment of Lumber, Timber and Piling," of the Standard Specifications. Wood preservative shall be one of the following: creosote, creosote-coal tar solution, pentachlorophenol, copper naphthenate, ammonia copper arsenate, ammoniacal copper zinc arsenate, acid copper chromate, or chromated copper arsenate.

The Contractor shall remove all cobbles, boulders or portions of boulders, rubble, or debris which are encountered at the final wall alignment during wall face excavation and which protrude from the excavated face more than 50 mm into the design shotcrete thickness as shown on the plans. Such over excavation shall be backfilled with shotcrete.

The Contractor shall immediately notify the Engineer of the occurrence of raveling or local instability of the final wall face excavation due to the presence of groundwater, soil conditions, equipment vibration, or other causes.

Unstable areas shall be temporarily stabilized by means of buttressing the exposed excavation face with an earth berm or other methods approved in writing by the Engineer. Construction of the wall in unstable areas shall be suspended until remedial measures, submitted by the Contractor, and approved by the Engineer, have been taken.

The Contractor shall protect installed nails during excavation and subsequent operations. Any nails damaged during construction shall be replaced by the Contractor, at the Contractor's expense.

**MEASUREMENT AND PAYMENT**

Excavation for soil nail wall construction will be measured and paid for as structure excavation (retaining wall).

Full compensation for working drawings and supplements, and for furnishing, constructing and removing shoring, working berms, and stabilizing berms, if required, for soil nail wall construction shall be considered as included in the contract price paid per cubic meter for structure excavation (retaining wall) and no additional compensation will be allowed therefor.

Full compensation for shotcrete used to fill voids created by the removal of cobbles and boulders or other obstructions shall be considered as included in the contract price paid per cubic meter for shotcrete and no additional compensation will be allowed therefor.

## 10-1.27 SOIL NAIL ASSEMBLY

Soil nail assemblies and test soil nail assemblies, consisting of drilling holes in natural foundation materials, installing and grouting steel bars in drilled holes, anchorage systems, and testing of test soil nail assemblies, shall conform to the

details shown on the plans and the provisions of the Standard Specifications and these special provisions.

Foundation recommendations are included in the "Information Handout" available to the Contractor in conformance with the provisions in Section 2-1.03, "Examination of Plans, Specifications, Contract, and Site of Work," of the Standard Specifications.

Attention is directed to "Soil Nail Wall Earthwork," of these special provisions.

**MATERIALS**

The materials specified below shall be used for construction of soil nail assemblies and test soil nail assemblies.

**Soil Nail**

Soil nails shall conform to the provisions for bar reinforcement in Section 52, "Reinforcement," of the Standard Specifications. When Grade 420 soil nails are shown on the plans, the soil nails shall also conform to the requirements in ASTM Designation: A 615/A 615M or A706/A706M. When Grade 520 soil nails are shown on the plans, the soil nails shall also conform to the requirements in ASTM Designation: A 615/A 615M. The soil nail shall be either a reinforcing bar encapsulated full length in a grouted corrugated plastic sheathing or an epoxy coated reinforcing bar partially encapsulated in a grouted corrugated plastic sheathing. The bar shall be centered in the sheathing and the space between the sheathing and the bar shall be filled with grout. The epoxy coating shall have a minimum thickness of 305 μm.

Soil nail assemblies shall be lengthened or additional soil nail assemblies shall be installed when ordered by the Engineer. The lengthening or addition of soil nail assemblies, when ordered by the Engineer, will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

Soil nails shall have a minimum length of 150 mm of thread on the anchorage end. Threading may be continuous spiral deformed ribbing provided by the bar deformations or may be cut into a reinforcing bar. If threads are cut into a reinforcing bar, the bar size shall be the next larger bar designation number from that shown on the plans and coarse threads shall be used. The epoxy coating at the anchorage end of epoxy coated bars may be omitted for a maximum length of 150 mm. Metal surfaces of assembled splices of epoxy coated bars shall be epoxy coated.

Corrugated plastic sheathing shall be either polyvinyl chloride (PVC) or high density polyethylene (HDPE). The minimum sheathing wall thickness shall be 1.0 mm.

HDPE shall have a density between 0.940 and 0.960-gram/cm$^3$ when measured in conformance with the requirements in ASTM Designation: D 792, A-2.

The sheathing shall have sufficient strength to prevent damage during construction operations, shall be watertight, chemically stable without embrittlement or softening, and nonreactive with concrete.

Splicing of soil nails shall be made only at the locations shown on the plans or at ends of soil nails which the Engineer has ordered to be lengthened.

**Test Soil Nail**

Test soil nails shall conform to the provisions for bar reinforcement in Section 52, "Reinforcement," of the Standard Specifications, and shall be of a size and grade determined by the Contractor.

Test soil nail assemblies shall be lengthened or additional test soil nail assemblies shall be installed when ordered by the Engineer. The lengthening or addition of test soil nail assemblies, when ordered by the Engineer, will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

Test soil nails need not be epoxy coated or encapsulated in grouted plastic sheathing.

Splicing of test soil nails shall be made only at locations outside of the bonded length.

**Anchorage System**

Anchorage for soil nails shall conform to the details shown on the plans and the provisions in Section 75-1.02, "Miscellaneous Iron and Steel," of the Standard Specifications except that nuts, washers, wedges, and bearing plates to be fully encased in concrete, grout, or shotcrete need not be galvanized. Concrete anchors on the bearing plates shall conform to the provisions for stud connectors in Section 55-2, "Materials," of the Standard Specifications.

The ultimate strength of the soil nail anchorage shall be at least the value shown below for the size of the soil nail bar shown on the plans.

| BAR SIZE | ANCHORAGE ULTIMATE STRENGTH (kilonewtons) | |
|---|---|---|
| | Grade 420 | Grade 520 |
| No. 16 | 123 | 137 |
| No. 19 | 178 | 198 |

| | | |
|---|---|---|
| No. 22 | 240 | 267 |
| No. 25 | 314 | 350 |
| No. 29 | 401 | 446 |
| No. 32 | 508 | 565 |

**Grout**

Grout shall conform to the provisions in Section 50-1.09, "Bonding and Grouting," of the Standard Specifications. California Test 541 will not be required nor will the grout be required to pass through a screen with a 1.80-mm maximum clear opening prior to being introduced into the grout pump. Fine aggregate may be added to the grout mixture of portland cement and water in drilled holes 150 mm or greater in diameter, but only to the extent that the cement content of the grout is not less than 600 kilograms per cubic meter of grout. Fine aggregate, if used, shall conform to the provisions in Section 90-2, "Materials," and Section 90-3, "Aggregate Gradings," of the Standard Specifications. Grout with fine aggregate shall have a nominal penetration equal to or greater than 90 mm when measured in conformance with California Test 533, and shall have an air content of equal to or less than 2 percent when measured in conformance with California Test 504. Air entraining admixtures shall not be used for grout with fine aggregate.

The consistency of grout with fine aggregate shall be verified prior to use by producing a batch to be tested. The test batch shall be produced and delivered to the project under conditions and in time periods similar to those expected during the placement of grout in the soil nails. Grout for the test batch shall be placed in an excavated hole or suitable container of adequate size to allow testing in conformance with California Test 533. The test batch shall demonstrate that the proposed grout mix achieves the specified nominal penetration. Upon completion of the testing, the grout shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

**CONSTRUCTION**

Soil nails shall be installed in drilled holes in an expeditious manner so that caving or deterioration of the drilled hole does not occur. No portion of the drilled hole shall be left open for more than 60 minutes prior to soil nail placement and grouting unless otherwise approved by the Engineer.

Only one row of soil nails may be excavated at any one time. The excavation for a row of soil nails should only be performed after the row of soil nails above has been shotcreted, cured, and tested.

**Drilling**

Drilling equipment shall be designed to drill straight and clean holes. The drilling method and the size and capability of the drilling equipment shall be as approved in the working drawings. Drill rigs shall have the capability of anchorage installation and grout placement through the use of drill casing or hollow-stem augers. When caving conditions are anticipated, sufficient casing and auger lengths shall be available on site to maintain uninterrupted installation of anchors.

Where hard drilling conditions such as rock, cobbles, boulders, or obstructions are anticipated, a down hole pneumatic hammer drill rig and drill bit shall be available on site to drill holes for soil nail assemblies.

Drilled holes for walls shall not extend beyond the right-of-way or easement limits as shown on the plans or as specified in these special provisions.

Holes shall be drilled in the natural foundation materials. Holes for test soil nail assemblies shall be of the same diameter as those for the production soil nail assemblies they represent.

Holes shall be cleaned to remove material resulting from the drilling operations and to remove any other material that would impair the strength of the soil nail assemblies or test soil nail assemblies. Foreign material dislodged or drawn into the holes during construction of the assemblies shall be removed. Water for cleaning holes shall not be used, unless full hole length hollow-stem augers or casing is maintained in the same hole during cleaning and soil nail assembly installation. Soil nail assemblies and test soil nail assemblies shall not be installed in the drilled holes until the holes have been inspected by the Engineer.

**Installing Soil Nails and Test Soil Nails**

Soil nails and test soil nails shall be installed in the drilled holes using centralizers. Centralizers shall adequately support the bar in the center of the drilled hole and shall be spaced at a maximum of 1.5 m on center along the length of the bar, and 0.5-m from the end of the bar.

Where the soil nail cannot be completely inserted, the Contractor shall remove the bar and clean or redrill the hole to permit unobstructed installation. Partially installed bars shall not be driven or forced into the drilled hole and will be rejected. When open-hole drilling methods are being used, the Contractor shall have hole cleaning tools on-site suitable for

cleaning drilled holes along their full length just prior to bar insertion and grouting.

**Grouting**

The length of drilled hole shall be verified and recorded by the Contractor before grouting.

Grout shall be injected at the low end of the drilled hole and shall fill the drilled hole with a dense grout free of voids or inclusion of foreign material. Cold joints shall not be used in grout placement. Soil nails shall be grouted full length.

Only the bonded length of test soil nails shall be initially grouted. Initial grouting shall be confined to the bonded length by packers or other approved devices. For test soil nails, grouting of the remainder of the drilled hole shall not be done until pullout tests have been completed and approved by the Engineer.

After placing the grout for soil nails and test soil nails, they shall remain undisturbed for the cure time stated in the approved soil nail working drawings.

**Securing Soil Nails**

Any remaining void at the exterior end of the drilled hole for a soil nail assembly shall be filled with shotcrete and the soil nail secured at the face of the shotcrete. The steel bearing plate shall be seated with full bearing on the shotcrete surface and the nut for the soil nail shall be hand tightened before the initial set of the shotcrete. The nut shall be made wrench tight after the shotcrete has set for 24 hours, unless a shorter time is approved by the Engineer.

**Securing Test Soil Nails**

Testing shall be performed against a temporary bearing yoke which bears directly on the shotcrete facing. Test loads transmitted through the temporary bearing yoke shall not fracture the shotcrete or cause displacement or sloughing of the soil surrounding the drilled hole. No part of the yoke shall bear within 150 mm of the edge of blockout.

Test soil nails shall be removed to behind the front face of the shotcrete after testing has been completed. The remaining length of void in the drilled hole shall be grouted and the blockout in the shotcrete facing filled with either grout or shotcrete.

**TESTING**

Test soil nail assemblies shall be pullout tested by the Contractor in the presence of the Engineer. A pullout test shall consist of incrementally loading the assembly until one of the following conditions has been reached: 1) the maximum test load, 2) the point where the movement of the test soil nail continues without an increase in the load, or 3) the point when the soil nail has displaced 50 mm. This load at which this condition is reached shall be recorded as part of the test data.

The Contractor shall monitor and record displacement of the test soil nail relative to the grout during application of the test load.

Applied test loads shall be determined by using either a calibrated pressure gage or a load cell. Movements of the end of the soil nail, relative to an independent fixed reference point, shall be measured and recorded to the nearest 25 µm at each increment of load, including the ending alignment load, during the load tests.

The pressure gage shall have an accurately reading dial at least 150 mm in diameter and each jack and its gage shall be calibrated as a unit with the cylinder extension in the approximate position that it will have at final jacking force, and shall be accompanied by a certified calibration chart. The load cell shall be calibrated and shall be provided with an indicator by means of which the test load in the soil nail may be determined. The range of the load cell shall be such that the lower 10 percent of the manufacturer's rated capacity will not be used in determining the jacking force.

The test load may be verified by State forces with either State-furnished load cells or pressure cells, or with State-furnished Vibra-Tension equipment operated in conformance with the requirements of California Test 677. The Contractor shall provide sufficient labor, equipment, and material to install and support such testing equipment at the soil nails and to remove the testing equipment after the testing is complete, as ordered by the Engineer.

The pullout test procedures shall conform to the following:

A. The pullout test shall be conducted by measuring and recording the test load applied to the test soil nail and the test soil nail end movement at each load listed in the following loading schedule.

PULLOUT TEST LOADING SCHEDULE

AL
0.10M
0.20M
0.30M

0.40M
0.50M
0.60M
0.70M (PULLOUT TEST LOAD)
0.80M
0.90M
1.00M
AL

(M = MAXIMUM TEST LOAD (kN) = $0.0141\sigma_b D$)
Where $\sigma_b$=Ultimate bond stress between grout and drilled hole as shown on the plans, in kPa; and D=actual drilled hole diameter, in millimeters.
(AL = ALIGNMENT LOAD = 0.1M)

B. Each increment of load shall be applied in less than one minute and held for at least one minute but not more than 2 minutes, except that load equal to 0.70M shall be held for 10 minutes. During the 10-minute load hold, the movement of the end of the soil nail shall be measured at 1, 2, 3, 4, 5, 6, and 10 minutes. The observation period for the 10-minute load hold shall start when the pump begins to apply the increment of load from 0.60M to 0.70M. If the movement measured between one minute and 10 minutes is less than 2 mm, the load shall continue to be increased incrementally to 1.0M, then reduced to the ending alignment load.
C. If the load of 0.70M cannot be maintained for 10 minutes with 2 mm or less movement, the 0.70M load shall be maintained for an additional 50 minutes. Total movement shall be measured at 15, 20, 25, 30, 45, and 60 minutes. After the 60 minute movement measurement, the load shall continue to be increased incrementally to 1.0M, then be reduced to the ending alignment load.
D. The soil nail shall be unloaded only after completion of the test.

If a test soil nail fails to achieve the load equal to 0.70M, that soil nail shall be extracted when requested by the Engineer. Full compensation for extracting test soil nails shall be considered as included in the contract price paid per meter for soil nail assembly, and no separate payment will be made therefor.

The Contractor shall furnish to the Engineer complete test results for each soil nail assembly tested. Data for each test shall list key personnel, test loading equipment, test soil nail location, hole diameter and depth, bonded length, type of soil, method of drilling, and amount of ground water encountered within the bond length. Test data shall also include the dates and times of drilling, test soil nail installation, grouting, and testing. The test load and amount of displacement shall be included in the test data when any displacement of the test soil nail relative to the grout occurs during application of the test load.

**MEASUREMENT**

Soil nail assembly and test soil nail assembly will be measured and paid for by the meter. The length to be paid for will be the length of soil nail assembly or test soil nail assembly measured along the bar centerline from the back face of shotcrete to the tip end shown on the plans or ordered in writing by the Engineer.

**PAYMENT**

The contract price paid per meter for soil nail assembly shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the soil nail assemblies, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Test soil nail assemblies will be paid for as soil nail assembly.

Full compensation for testing of the test soil nail assemblies shown on the plans shall be considered as included in the contract price paid per meter for soil nail assembly, and no separate payment will be made therefor.

Full compensation for repair of all damage to existing structures, restoration of grade in subsided areas, and all other damage done by drilling shall be considered as included in the contract price paid per meter for soil nail assembly, and no additional compensation will be allowed therefor.

Full compensation for furnishing, installing, and removing casing shall be considered as included in the contract price paid per meter for soil nail assembly, and no additional compensation will be allowed therefor.

The quantities of trial batch grout will not be included in any contract item of work, and full compensation for furnishing, producing, and disposing of trial batches shall be considered as included in the contract price paid per meter for soil nail assembly, and no additional compensation will be allowed therefor.

## 10-1.28 IMPORTED BORROW (LIGHTWEIGHT AGGREGATE)

Imported borrow (lightweight aggregate) shall conform to the provisions in Section 19, "Earthwork," of the Standard Specifications and these special provisions.

Imported borrow (lightweight aggregate) shall consist of a rotary kiln expanded shale aggregate of the extruded type or a processed, naturally-occurring volcanic aggregate.

Imported borrow (lightweight aggregate) grading shall be as specified in these special provisions.

Imported borrow (lightweight aggregate) material, when deposited in place, shall conform to the following grading and quality requirements:

Grading Requirements

| Sieve Sizes | Percentage Passing |
|---|---|
| 37.5-mm | 100 |
| 25-mm | 95 - 100 |
| 19-mm | 90 - 100 |
| 9.5-mm | 15 - 85 |
| 75-µm | 0 - 9 |

Grading will be determined in conformance with the requirements of California Test 202, except shaking in the sieves shall be limited to 5 minutes.

Quality Requirements

| Test | Requirement |
|---|---|
| Resistance (R-Value) | 50 min |
| Durability Index | 35 min |

When imported borrow (lightweight aggregate) is used as structure backfill for galvanized steel or reinforced concrete pipe culverts, the imported borrow (lightweight aggregate) shall have a minimum resistivity greater than or equal to 1000 ohm-cm and a pH greater than or equal to 5.5. Minimum resistivity and pH shall be determined in conformance with the requirements of California Test Method 643, chloride content shall be determined in conformance with the requirements of California Test Method 422, and sulfate content shall be determined in conformance with the requirements of California Test Method 417.

At locations directed by the Engineer, the structure backfill placed within 0.6-m of finished ground around abutments, retaining walls, and other portions of structures shall be a compacted impervious material, conforming to the provisions in Section 19-3.06, "Structure Backfill," of the Standard Specifications. If the minimum resistivity of the native soil is less than 1,000 ohm-cm, then the imported borrow (lightweight aggregate) shall have a chloride content less than or equal to _____ parts per million and a sulfate content less than or equal to_____ parts per million.

Imported borrow (lightweight aggregate) shall have a maximum calculated saturated surface dry unit weight of 960 $kg/m^3$. The saturated surface dry unit weight shall be calculated using the dry loose unit weight and the absorption of the coarse and fine aggregates. Dry loose unit weight shall be determined in conformance with the requirements in California Test Method 212, using test procedure (b) Compaction Method (by jigging). Absorption of the coarse and fine aggregates shall be determined in conformance with the requirements in California Test Methods 206 and 207, except that the samples shall be oven dry before soaking and shall be soaked for 24 hours plus or minus 30 minutes. Saturated surface dry unit weight shall be calculated as follows:

1. multiply the percent coarse aggregate by the absorption of the coarse aggregate;
2. multiply the percent fine aggregate by the absorption of the fine aggregate;
3. add the two values from 1. and 2. and divide by 10000;
4. add one (1) to the result from 3. and multiply by the dry loose unit weight.

Imported borrow (lightweight aggregate) shall be placed and compacted to the designated dimensions in conformance with the provisions in Sections 19-1.03, "Grade Tolerance," and 19-6, "Embankment Construction," of the Standard Specifications. The provisions in Section 19-5, "Compaction," of the Standard Specifications shall not apply.

## 10-1.29 SOIL-CEMENT

This work shall consist of furnishing and installing soil-cement by deep mixing at the locations shown on the plans.

Deep soil-cement mixing shall be performed by mixing in-situ soil with cement grout to form a uniform mixture, blended thoroughly and evenly by controlled methods.

Foundation recommendations are included in the "Information Handout" available to the Contractor as provided for in Section 2-1.03, "Examination of Plans, Specifications, Contract, and Site of Work," of the Standard Specifications.

Attention is directed to Section 7-1.11, "Preservation of Property," of the Standard Specifications regarding damage soil densification operations to existing utilities, improvements and facilities.

Difficult soil-cement installation is anticipated due to the presence of groundwater, sound control, vibration monitoring, and traffic control.

The ground improvement shall extend to 1 m below the top of the competent soils or rocks, or otherwise approved by the Engineer. The estimated elevations of the top of competent soils or rocks are shown in the plans.

The Contractor may provide an alternative plan meeting the minimum performance requirement specified herein. The alternative plan shall be submitted as an attachment to the pre-construction submittal for approval by the Engineer.

The Contractor shall conduct a Pre-Production (PPC) Program within the limits of soil-cement areas shown on the plans prior to commencing soil-cement mixing to establish production parameters, procedures, and materials to be used during the production phase.

The PPC Program shall produce soil-cement mix design and procedures for production mixing based upon the information provided from the PPC Program including: estimated in-situ 28-day and 56-day compressive strength of the soil-cement, cement-grout injection pressure and rates, mixing rotational speeds, penetration and withdrawal rates of the mixing tools, and mixing times at bottom of the soil-cement element when there is no vertical movement of the mixing tools, and complete description of all mixing operations.

**SUBMITTALS**

The submittals and other additional submittals shall conform to the requirements in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications and these special provisions, and shall be stamped by a California Registered Professional Civil Engineer.

Submittals shall be stamped by a California Registered Professional Civil Engineer except for survey data which shall be stamped by a California Registered Professional Civil Engineer or a California Registered Land Surveyor.

The Contractor shall submit, for review by the Engineer, a statement of the previous work experience similar to that described in these special provisions. The statement shall include at least 10 successful soil-cement mixing projects within past five years. This statement shall include a written description of each project, owner's contact name and current phone number, the dates and the extent of the work, the manner of its execution, and any other information that supports the Contractor's ability to carry out the work described in these special provisions.

**Pre-construction Submittals**

At least four weeks prior to commencement of any mobilization of deep soil-cement mixing equipment for production mixing, the Contractor shall submit the following to the Engineer:

A. Names and qualifications of the soil-cement mixing personnel and surveyors, including project experience, resumes and other documentation that demonstrate the experience of the project engineers, field superintendents, rig operators, and batchplant operators for the deep soil-cement mixing.

B. A list of Contractors, responsible engineers, project descriptions and personnel responsibilities from soil-cement mixing projects completed by the soil-cement mixing Project Engineers and Field Superintendents during the past ten years. Contractor's names, addresses and telephone numbers shall be included for these projects representing the individuals comparable experience. The projects listed to demonstrate personnel qualifications shall have employed equipment using similar auger configuration(s) as proposed for the work of this Contract.

C. Submit data on equipment to be used for the deep soil-cement mixing, proportioning, pumping, injecting and mixing soil-cement as wells as all other ancillary equipment, including equipment capable of remixing non-conforming soil-cement.

D. Spoil containment (sheet piling or other) structures and methods to be used to prevent the migration or leakage of spoil return, disturbed in-situ soils or other spoil material beyond the immediate limits of soil-cement mixing operations. The Contractor shall demonstrate that the containment structure is stable under loads applied by soil-cement, water, in-situ soils, overlying fill materials, construction equipment, other surcharge loads and loads applied by the subsequent deep mixing operations. Include also details and methods to be used to collect and dispose of the

spoil return and other spoil materials.

E. Sequence and time schedule of all operations including plan location and sequence of all deep soil-cement mixing. The Contractor shall submit a soil-cement element Layout Plan based on the limits shown on the Plans to achieve the required plan area configurations and coverage and necessary overlaps and auger re-penetrations over the depths and limits shown on the Plans. Plan locations of all proposed soil-cement mixing shall be shown on Layout Plans of suitable scale to clearly show the details of the layout. Soil-cement elements on the Layout Plans shall be numbered and dimensioned.

F. Cement grout mix design including: cement type, cement source, cement compound composition, water-cement ratio by weight and other pertinent details. Limit water- cement ratio to (1:1 maximum), unless otherwise demonstrated in the Pre-Production (PPC) Program specified in these special provisions.

G. The results of the PPC Program including, but not limited to: estimated in-situ 28-day and 56-day compressive strength of the soil-cement, cement-grout injection pressure and rates, mixing rotational speeds, penetration and withdrawal rates of the mixing tools, and mixing times at bottom of the soil-cement element when there is no vertical movement of the mixing tools, and complete description of all mixing operations.

H. Description of Quality Control Plan for deep soil-cement mixing including, but not limited to, the following:

1. A detailed description of the Quality Control Plan to be undertaken each day during soil-cement mixing to confirm that the installed soil-cement conforms to the required compressive strengths and unit weights specified, the plan area coverage over the required depths and limits, and required horizontal and vertical alignments.

2. Details of procedures to obtain soil-cement samples, catalog cuts of the soil- cement sampling device and curing boxes.

3. Measures to be implemented each day during soil-cement mixing to continuously monitor, modify and control: water-cement ratios; cement-grout injection pressures and quantities; mixing rotational speeds; penetration and withdrawal rates of the mixing equipment; horizontal and vertical alignments of the soil- cement elements; and other related aspects of the soil-cement mixing process.

4. Example formats of Daily Production Reports conforming to the requirements stated herein.

I. Proposed details and formats of all required tabular and graphical data presentations to be submitted to the Engineer during the course of the Work.

J. **Construction Submittals**

Within two working days after the completion of each soil-cement element, submit the following:

Deviations of the center coordinates from the layout plan to the nearest 75 mm at the top of the element.

Vertical alignment profiles shall be submitted in accordance with the frequencies specified to the nearest 13 mm over the measurement length along axes parallel and perpendicular to the line of longitudinal progression; the elevation to the nearest 30 mm of the top and bottom of the element.

Within one working day after the end of a work shift, submit Daily Production Reports for the work shift to the Engineer. Daily Production Reports shall be filled out, checked for correctness, and signed by the Deep Soil Mixing Contractor’s field superintendent and the Contractor's field superintendent at the end of every work shift. The reports shall contain, but not be limited, to the following information:

Day, month, year, time of work, shift, beginning and end; names of each superintendent in charge of the Work for both the soil-cement mixing firm and the Contractor; a list of all workers' names associated with each soil-cement mixing machine; and a summary of equipment used during the shift.

The location and "neat" limits as shown on the Working Drawings of each completed soil-cement element installed

during the work shift and all soil-cement elements completed to date, on a plan of suitable scale to clearly detail the locations of the elements.

Time of day of beginning and completion of each soil-cement element installed during the work shift.

Water-cement ratios, cement type, brand, and cement grout injection pressures and rates, mixing rotational speeds, penetration and withdrawal rates of the mixing equipment, batch plant production records, and installation sequence for every soil- cement element.

Other pertinent observations including, but not limited to; spoil returns, cement grout escapes, ground settlement and/or heave, collapses of the soil-cement element, advancement rates of the mixing equipment, and any unusual behavior of any equipment during the soil-cement mixing process and other noteworthy events. In the event of any Contractor claim, the Daily Production Reports shall be the primary documents to substantiate the reasons and basis for the claim.

Date, time, plan location, sample designation and elevation, and other details of soil- cement sampling.

Summary of any downtime or unproductive time, including start and end time, duration, and reason.

Within five weeks after completion of the deep soil-cement mixing, the Contractor shall submit survey data including:

A final Layout Plan of suitable scales showing the locations of each soil-cement element at the top of the element.

A tabular summary of layout center coordinates modified to reflect any measured- deviations of each soil-cement element at the top of the element, the elevation of the top and bottom of each element.

A compilation of all vertical alignment profiles.

**SOIL-CEMENT QUALITY CONTROL**

The Contractor shall verify that the installed soil-cement elements conform to these special provisions.

The Contractor shall obtain soil-cement samples, including fluid and core samples, and provide them to the Engineer. The Engineer will form preserve, cure, transport, and test the samples and report the test results. The Contractor shall coordinate sampling activities and Soil-Cement Quality Control with the Engineer. The Contractor shall supply incidental items, access, inside storage space, curing boxes and electrical power to the curing boxes. The Contractor shall supply molds for use in forming the samples.

**Wet Grab Soil-Cement Samples**

A minimum of two in-situ sampling rounds shall be performed daily at locations selected by the Engineer. The Contractor shall obtain sampling rounds at the same soil-cement element, which shall consist of non-cured soil-cement samples from three depths selected by the Engineer. The Contractor shall obtain up to 20 additional wet grab sample test rounds as directed by the Engineer.

Separate soil-cement samples shall be retrieved within 60 minutes of the completion of the soil-cement column. The device used to retrieve the wet grab soil-cement samples shall be capable of obtaining a discrete fluid sample of soil-cement at a depth determined by the Engineer and shall be capable of accepting particles not thoroughly mixed that are up to 150 mm in dimension. The sampler shall be lowered empty, air only, to the required depth in the soil-cement element and then opened. Once filled with the soil-cement the sampler shall be closed to exclude entry or loss of soil- cement and shall be expeditiously raised to ground surface.

Each retrieved soil-cement sample shall be of sufficient volume to produce a minimum of six full cylinders, 75 mm diameter by 150 mm. The Contractor shall separate and retain all soil-cement retrieved from each depth. The Contractor shall then cut all retrieved particles of soil larger than 25 mm into smaller pieces that will pass a 25 mm sieve, and then immediately form the six cylinders with material passing through a 25 mm sieve, including particles of soil that were cut up.

Soil-cement samples shall be formed, cured and preserved in accordance with AASHTO T 23 and protected from freezing and extreme weather conditions which could have deleterious effect, at all times.

The Contractor may obtain additional samples and perform additional testing for his or her own information, at the Contractor's expense.

If the Contractor cannot obtain all of the required wet grab samples of the soil-cement in the designated soil-cement element, the Contractor shall obtain a full round of wet grab samples from the next soil-cement element installed by that rig. Continue taking wet grab samples in subsequent soil-cement elements until a full round is obtained.

From each sampling round, one cylinder from each sampling depth shall be used to determine the cement factor based on the cement content determined in accordance with AASHTO Specification T 144 (or ASTM D 806). Unless otherwise directed by the Engineer, for each soil-cement element, the Contractor shall test one cylinder at 7 days, one cylinder at 14 days, two cylinders at 28 days, and two cylinders at 56 days for unconfined compressive strength in accordance with ASTM Designation: D 2166. Submit the laboratory test results to the Engineer in accordance with these special provisions. Submit 3 cylinders from each of the three depths sampled for each soil-cement element to the Engineer.

Wet Grab Soil Cement Sample Sampling and Testing Schedule

| | Frequency | Quantity | Note |
|---|---|---|---|
| Number of sampling rounds (soil-cement elements) | Per day | 2 | At soil-cement elements determined by the Engineer |
| Number of wet grab soil-cement samples | Per soil-cement element | 3 | At depths determined by the Engineer |
| Number of cylinders | Per wet-grab soil-cement sample | 6 | 75 mm diameter x 150mm high cylinder |
| Total cylinders | Per sampling round | 18 (6 x 3) | |
| Number of cylinders for test of cement factor and cement content | Per sampling round | 3 | At each of the 3 sampling depths |
| Number of cylinders for unconfined compressive strength test | Per sampling round | 6 | Test one at 7 days, one at 14 days, two at 28 days, and two at 56 days |
| Number of cylinders shall be submitted to the Engineer | Per sampling round | 9 | 3 at each of the 3 sampling depths |

**Core Samples**

Core samples shall be taken by the Contractor, for the purpose of obtaining and testing in-situ samples to evaluate compressive strength, unit weight, vertical alignment, and composition of the soil-cement. Coring of soil-cement shall be performed in accordance with AASHTO T 225 and the requirements stated herein.

Continuous core samples of soil-cement elements shall be obtained at up to 25 separate locations selected by the Engineer and over the entire depth of the soil-cement. The samples shall be obtained using a PQ-size triple tube core barrel with a side discharge.

Immediately after retrieving the soil-cement core samples from a specific boring, wrap preserve and submit to the Engineer seven core samples per boring selected by the Engineer for subsequent evaluation and testing. Grout and completely fill the borehole after coring with cement mixture, minimum unconfined compressive strength of 2000 kPa, designed by the Contractor and approved by the Engineer.

Remaining core samples shall be boxed, stored, preserved and delivered. Core samples shall be protected from freezing and extreme weather conditions at all time.

If recovered core samples from any boring provide less than 90% recovery, or less than 50% RQD, or fewer than two intact cores of length more than 200 mm, in each core run, the Engineer may direct the Contractor to drill up to 2 additional borings and recover additional core samples for testing. If the samples from either of these additional borings do not provide required recovery, this process shall be repeated until coring provides required samples. These additional borings and core sampling shall be performed at the Contractor's expense.

**Vertical Alignment Profiles**

The Contractor shall obtain vertical alignment profiles for one soil-cement element per day and shall advise the Engineer within one hour after measuring the vertical alignment profile, of any non-compliance with tolerance requirements. The Contractor shall, at the direction of the Engineer, obtain and submit up to three additional vertical alignment profiles per day.

**VIBRATION, GROUND MOVEMENT, AND NOISE**

The Contractor shall not damage existing structures and services by excessive vibration, by inducing vertical or lateral ground movements beneath or adjacent to them, by the rise or fall of groundwater levels, or by the off-site discharge of unacceptable waste water or sediment.

The Contractor shall take precautions such that vibration from the soil-cement work will not cause undue interference or damage to neighboring properties or buildings.

If, in the opinion of the Engineer, ground vibrations, movements or noise from soil-cement mixing work adversely affect the project and neighboring properties and buildings, the Engineer may direct the Contractor to use alternative methods or procedures of soil-cement mixing construction. Alternate methods shall be subject to the prior approval of the Engineer but shall remain the responsibility of the Contractor.

**CEMENT GROUT**

Cement shall conform to AASHTO M85, Type II, and shall be as specified in the submitted cement grout mix design approved by the Engineer. Slag cement or fly ash shall not be allowed without the approval of the Engineer and submission of test data by the Contractor, which confirm no deleterious impact to the soil-cement.

Measure, handle, transport and store bulk cement in accordance with the manufacturer's recommendations. Cement packaged in cloth or paper bags shall be sealed within plastic or rubber vapor barriers.

Store cement to prevent damage by moisture. Material that has become caked due to moisture absorption shall not be used. Bags of cement shall be stacked no more than ten bags high to avoid compaction. Cement containing lumps or foreign matter of a nature and in amounts that may be deleterious to the grouting operations shall not be used.

Tricalcium aluminate content shall not exceed 8 percent.

Water used in soil-cement and cement grout mixing and all other applications shall be potable, clean, of neutral pH and free from sewage, oil, acid, alkali, salts, organic materials and other contamination.

Cement grout shall be a stable homogeneous mixture of cement and water. The ratios of the components shall be included in the pre-construction submittal. Cement grout composition shall not change throughout the soil-cement mixing unless requested in writing by the Contractor and approved in writing by the Engineer.

**SOIL-CEMENT**

Soil-cement shall be a stable, uniform mixture of cement grout and the in-situ soils. The properties listed below shall be verified in conformance with the approved Soil-cement Quality submittal.

The ratios of various soil-cement components shall be proposed by the Contractor or as approved in the pre-construction submittal subject to review by the Engineer. The Contractor shall adjust the mix design throughout the course of the Work in order to achieve the required compressive strengths and total unit weights. The Contractor shall submit changes in the mix design or cement factor and obtain the Engineer's approval prior to implementing these changes.

Soil-cement obtained from wet grab samples shall conform to the following minimum compressive strength requirements. Unconfined compressive strength testing shall be performed in accordance with ASTM Designation: D-2166:

A. The average 56-day unconfined compressive strength within each soil-cement element shall be no less than 2000kPa. The average strength shall be computed by summing all individual unconfined compressive strength tests performed on any full-depth sample and dividing by the number of tests. The Contractor may use 14-day or 28-day strength tests as strength predictors, the strength acceptance criteria will be based only on test results from 56-day tests.

B. No more than 5% of the samples tested shall exhibit a strength less than 60% of the average unconfined compressive strength.

The total unit weight of soil-cement samples shall be measured and shall be at least 15 $kN/m^3$ or as determined and approved by the Engineer based on the result of approved PPC submittal. For each test round the average total unit weight of all soil-cement samples within the round will be calculated. If the average total weight from any two consecutive test rounds is less than 14 $kN/m^3$, or a value determined and approved by the Engineer based on the result of approved PPC submittal, the Contractor shall adjust its mix as necessary to achieve the required unit weight.

Conformance with soil-cement uniformity criteria will be determined by the Engineer by evaluation of core samples. The soil-cement shall contain soil fragments with a maximum dimension not to exceed 1/4 of the diameter of the auger or 300 mm whichever is smaller. In addition, seventy percent of the depth cored shall have a minimum core sample 56-day unconfined compressive strength of 2000 kPa.

**CONSTRUCTION**

The Contractor shall provide on-site project engineers during deep mixing soil-cement operations. The project engineers shall be experienced in work comparable to that described herein, and having at least five full years experience as full time responsible Project Engineers, within the past ten years, in deep soil-cement mixing. Experience as full time Project Engineer within the last ten years shall include at least two projects, each of which had installations of at least 7,500 cubic meters of soil-cement to depths exceeding 25 meters and which required mixing in cohesive soils to create soil-cement

structures similar to those required on this project.

Field Superintendents shall be present continuously on site, each shift of operation. The Field Superintendents shall each have at least three years accumulated experience with soil-cement techniques similar to the techniques in the approved PPC submittal; including at least two projects, one of which within the past five years requiring deep mixing in cohesive soils similar to this project.

Soil-cement mixing rig operators shall have accumulated a minimum of one year experience with soil-cement mixing technique and a minimum 200 hours of operating time on the soil-cement mixing rig under the direct supervision of the Field Superintendent and equipment manufacturer representative.

Grout mixing plant operators shall have a minimum 3 years experience in operating computer based cement grout mixing batch plants similar to the cement grout mixing batch plants in the approved PPC submittal.

Equipment shall have devices to permit accurate and continuous monitoring and control of: water-cement ratios, cement-grout injection pressures and quantities, mixing rotational speeds, advancement and withdrawal rates of the mixing tools, and other operations required to install and mix the soil-cement.

The soil-cement mixing machines shall be of sufficient size, capacity, torque, and capable of performing deep mixing to the required depths shown on the plans. The soil-cement mixing machine shall be capable of advancing and withdrawing the mixing tools while simultaneously injecting cement-grout and mixing in-situ soils.

Deep soil-cement mixing equipment shall use single or multiple-shaft mixing equipment with multiple auger centers configured in one straight line. Shafts shall uniformly inject cement grout at the bottom of the assembly. Mixing equipment shall be capable of advancing through previously installed and hardened soil-cement. Continuous flight augers longer than 1.5 m are not allowed. Auger flights and mixing paddles on a shaft shall extend to the full diameter of the element being formed, and shall have discontinuous lengths and be spaced to overlap with paddles of adjacent shafts in order to thoroughly break up the in-situ soils and blend them with injected cement grout to form a homogeneous mixture. If used to breakup and blend in-situ soil and cement grout, high-pressure jets shall not be directed radially to extend beyond the perimeter of the auger flights. Air shall not be injected into the in-situ soils.

Within 14 days after receiving the Engineer's notification of PPC approval and authorization to proceed with deep soil-cement mixing, the Contractor may begin substantive deep soil-cement mixing activities.

**Installation of Soil-Cement**

Soil-cement mixing shall be installed in uniformly and discretely distributed regular patterns and arrangements to achieve the minimum area ratio, the ratio of each soil-cement element to its tributary area, of 50% within the soil-cement mixing areas as shown on the approved plans, and with soil-cement elements conforming to the alignment tolerances and required compressive strength and unit weights stated herein.

Soil-cement elements shall be installed with the equipment, materials, and procedures in the approved PPC submittal. The Contractor shall adjust the mix design, as necessary, throughout the course of the work in order to achieve the required compressive strength and total unit weight. The Contractor shall submit changes in the mix design to the Engineer for the review and approval prior to implementing the changes.

Soil-cement elements shall penetrate through the soft silty clay and loose silty sand alluvial deposit materials and key into the competent soil or rock by no less than 1 m and no more than 2 m. The estimated elevations of top of competent soil or rock are shown on the plans.

During soil-cement mixing, grout shall be introduced only by injecting cement grout through the bottom of the operating mixing equipment. Grout shall be introduced during the initial penetration of the augers, or during subsequent downstrokes of the augers, for the entire depth of the elements.

After final grouting of the soil-cement element, the Contractor shall obtain samples of in-situ soil-cement samples in accordance with the locations and frequencies in "Soil-Cement Quality" of these special provisions.

Water, debris or spoil material shall not be dumped or otherwise allowed to enter the soil-cement element.

Any soil cement element which exhibits partial or total instability, shall be backfilled with cement grout and be remixed full depth, at the Contractor's expense. Among other possibilities, signs of instability which could be observed during construction could include excess flow of grout from the hole, settlement of ground, and squeezing in on the drill rods.

**Horizontal and Vertical Alignment Tolerances**

The maximum horizontal deviation of the as-installed center of any soil-cement element at the ground surface or mudline installation level shall not exceed 75 mm from the layout center coordinate, shown on the approved Contractor's submittal.

The measured vertical alignment of soil-cement elements shall not deviate in any direction more than two percent from vertical of the measured length, or be inclined more than two percent from vertical anywhere along the measured length.

At the direction of the Engineer, any soil-cement elements which exceeds the allowable horizontal or vertical alignment tolerances shall be re-mixed or supplemented with one or more adjacent or overlapping elements, at no additional cost to

Caltrans.

If obstructions are encountered, the Contractor shall notify the Engineer in writing, and provide all pertinent information relating to the nature, depth, plan location coordinates, expected extent of the obstruction, and proposed procedures to overcome the obstruction. Such construction to overcome an obstruction shall only be performed with the written authorization of the Engineer, and will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

The Contractor may elect to remove geological hindrances, install soil cement by an alternate soil-cement mixing pattern that avoids or encapsulates the hindrance but that achieves the required soil-cement area ratio, subject to the approval of the Engineer.

**Containment, Collection and Disposal of Spoil Return**

At all times during and at completion of soil-cement mixing operations, the site shall be maintained cleared of all debris and water. Spoil return and other spoil material shall be piped or channeled to holding ponds, tanks, or other retention structures or facilities. The Contractor shall remove and dispose of all waste materials in accordance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

All soil-cement collection, containment and disposal methods shall be thoroughly explained and shown on Working Drawings in the Contractor's submittals to the Engineer prior to the start of deep soil-cement mixing. The Contractor shall incorporate and be responsible for all sedimentation and turbidity control measures required by applicable federal, state and local regulations.

The Contractor shall take all necessary precautions and implement measures to prevent any spoil return, other spoil material or stockpiled materials from entering storm drain structures, drainage courses and other utility lines or from leaving the site via surface runoff. The Contractor shall prevent the migration of spoil return, spoil material or stockpiled materials into any surface water body, beyond the immediate limits of soil-cement mixing operations.

**MEASUREMENT**

Soil-cement will be measured by the cubic meter. The volume shall be determined by multiplying the treated area, which are locations replaced with soil-cement, by the depth of the soil-cement elements. The quantity of soil-cement to be paid for shall be the quantity of soil-cement furnished and installed within the soil-cement treatment areas shown on the plans. Areas of overlapping and overdrilling will not be measured more than once.

**PAYMENT**

The contract price per cubic meter for soil-cement shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in mixing soil-cement, complete-in-place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for soil-cement quality control shall be considered as included in the contract price paid per cubic meter for soil-cement and no separate payment will be allowed therefor.

Full compensation for containment and disposal of spoils shall be considered as included in the contract price paid per cubic meter for soil-cement and no separate payment will be allowed therefor.

## 10-1.30 MATERIAL CONTAINING AERIALLY DEPOSITED LEAD

Earthwork involving materials containing aerially deposited lead shall conform to the provisions in "Earthwork" and this section "Material Containing Aerially Deposited Lead" of these special provisions.

Attention is directed to "Aerially Deposited Lead" of these special provisions.

Type Y material contains aerially deposited lead in average concentrations greater than or equal to 5.0 mg/L Soluble Lead and between 0 - 350 mg/kg (inclusive) Total Lead, as tested using the California Waste Extraction Test. Type Y material exists as shown on the plans, unless otherwise directed by the Engineer, and covered with a minimum 0.3-m layer of non-hazardous soil or pavement. These materials are hazardous waste regulated by the State of California that may be reused as permitted under the Variance of the Department of Toxic Substances Control. Temporary surplus material may be generated on this project due to the requirements of stage construction. Temporary surplus material shall not be transported outside the project limits. In order to conform to the requirements of these provisions, it may be necessary to stockpile materials for subsequent stages or construct some embankments out of stage or handle temporary surplus material more than once.

**LEAD COMPLIANCE PLAN**

The Contractor shall prepare a project specific Lead Compliance Plan to prevent or minimize worker exposure to lead while handling material containing aerially deposited lead. Attention is directed to Title 8, California Code of Regulations,

Section 1532.1, “Lead,” for specific Cal-OSHA requirements when working with lead.

The Lead Compliance Plan shall contain the elements listed in Title 8, California Code of Regulations, Section 1532.1(e)(2)(B). Before submission to the Engineer, the Lead Compliance Plan shall be approved by an Industrial Hygienist certified in Comprehensive Practice by the American Board of Industrial Hygiene. The Plan shall be submitted to the Engineer for review and acceptance at least 15 days prior to beginning work in areas containing aerially deposited lead.

The Contractor shall not work in areas containing aerially deposited lead within the project limits, unless authorized in writing by the Engineer, until the Engineer has accepted the Lead Compliance Plan.

Prior to performing work in areas containing aerially deposited lead, personnel who have no prior training or are not current in their training status, including State personnel, shall complete a safety training program provided by the Contractor. The safety training program shall meet the requirements of Title 8, California Code of Regulations, Section 1532.1, "Lead."

Personal protective equipment, training, and washing facilities required by the Contractor's Lead Compliance Plan shall be supplied to State personnel by the Contractor. The number of State personnel will be 3.

The Engineer will notify the Contractor of acceptance or rejection of any submitted or revised Lead Compliance Plan not more than 10 days after submittal of the plan.

The contract lump sum price paid for Lead Compliance Plan shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in preparing the Lead Compliance Plan, including paying the Certified Industrial Hygienist, and for providing personal protective equipment, training and medical surveillance, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

**EXCAVATION AND TRANSPORTATION PLAN**

Within 15 days after approval of the contract, the Contractor shall submit 3 copies of the Excavation and Transportation Plan to the Engineer. The Engineer will have 7 days to review the Excavation and Transportation Plan. If revisions are required, as determined by the Engineer, the Contractor shall revise and resubmit the Excavation and Transportation Plan within 7 days of receipt of the Engineer's comments. The Engineer will have 7 days to review the revisions. Upon the Engineer's approval of the Excavation and Transportation Plan, 3 additional copies of the Excavation and Transportation Plan incorporating the required changes shall be submitted to the Engineer. Minor changes or clarifications to the initial submittal may be made and attached as amendments to the Excavation and Transportation Plan. In order to allow construction to proceed, the Engineer may conditionally approve the Excavation and Transportation Plan while minor revisions or amendments to the Plan are being completed.

The Contractor shall prepare a written, project specific Excavation and Transportation Plan establishing the procedures the Contractor will use to comply with requirements for excavating, transporting, and placing (or disposing) of material containing aerially deposited lead. The Excavation and Transportation Plan shall conform to the regulations of the Department of Toxic Substance Control and the California Division of Occupational Safety and Health Administration (Cal-OSHA). The sampling and analysis plans shall meet the requirements for the design and development of the sampling plan, statistical analysis, and reporting of test results contained in USEPA, SW 846, "Test Methods for Evaluating Solid Waste," Volume II: Field Manual Physical/Chemical, Chapter Nine, Section 9.1. The plan shall contain, but not be limited to the following elements:

A. Excavation schedule (by location and date)
B. Temporary locations of stockpiled material
C. Sampling and analysis plans for areas after removal of a stockpile
    1. Location and number of samples
    2. Analytical laboratory
D. Sampling and analysis plan for soil cover
E. Sampling and analysis plan for post excavation as shown on the plans.
F. Dust control measures
G. Transportation equipment and routes
H. Method for preventing spills and tracking material onto public roads
I. Truck waiting and staging areas
J. Site for disposal of hazardous waste
K. Spill Contingency Plan for material containing aerially deposited lead

**DUST CONTROL**

Excavation, transportation, placement, and handling of materials containing aerially deposited lead shall result in no visible dust migration. The Contractor shall have a water truck or tank on the job site at all times while clearing and grubbing and performing earthwork operations in work areas containing aerially deposited lead.

Stockpiles of material containing aerially deposited lead shall not be placed where affected by surface run-on or run-off. Stockpiles shall be covered with plastic sheeting 0.33 mm minimum thickness or 0.3 m of non-hazardous material. Stockpiles shall not be placed in environmentally sensitive areas. Stockpiled material shall not enter storm drains, inlets, or waters of the State.

**MATERIAL TRANSPORTATION**

Prior to traveling on public roads, loose and extraneous material shall be removed from surfaces outside the cargo areas of the transporting vehicles and the cargo shall be covered with tarpaulins, or other cover, as outlined in the approved Excavation and Transportation Plan. The Contractor shall be responsible for costs due to spillage of material containing lead during transport. The Department will not consider the Contractor a generator of these hazardous materials, and the Contractor will not be obligated for further cleanup, removal, or remedial action for such materials handled or disposed of in conformance with the requirements specified in these special provisions and the appropriate State and Federal laws and regulations and county and municipal ordinances and regulations regarding hazardous waste.

**DISPOSAL**

Surplus materials whose lead content is not known shall be analyzed for aerially deposited lead by the Contractor prior to removing the materials from within the project limits. The Contractor shall submit a sampling and analysis plan and the name of the analytical laboratory to the Engineer at least 15 days prior to beginning sampling or analysis. The Contractor shall use a laboratory certified by the California Department of Health Services. Sampling shall be at a minimum rate of one sample for each 150 $m^3$ of surplus material and tested for lead using EPA Method 6010 or 7000 series.

Sampling, analyses, and reporting of results for surplus materials not previously sampled will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications.

Materials containing aerially deposited lead shall be disposed of within California. The disposal site shall be operating under a permit issued by the California Environmental Protection Agency (Cal-EPA) Boards.

The Engineer will obtain the Environmental Protection Agency (EPA) Generator Identification Number for hazardous material disposal. The Engineer will sign all hazardous waste manifests. The Contractor shall notify the Engineer five days before the manifests are to be signed.

Sampling, analyzing, transporting, and disposing of materials containing aerially deposited lead excavated outside the pay limits of excavation will be at the Contractor's expense.

**MEASUREMENT AND PAYMENT**

Quantities of roadway excavation (aerially deposited lead) and structure excavation (aerially deposited lead), of the types shown in the Engineer's Estimate, will be measured and paid for in the same manner specified for roadway excavation and structure excavation, respectively, in Section 19, "Earthwork," of the Standard Specifications.

Full compensation for preparing an approved Excavation and Transportation Plan, transporting material containing aerially deposited lead reused in the work from location to location, and transporting and disposing of material containing aerially deposited lead shall be considered as included in the contract prices paid per cubic meter for the items of roadway excavation (aerially deposited lead) and structure excavation (aerially deposited lead) involved, and no additional compensation will be allowed therefor.

No payment for stockpiling of material containing aerially deposited lead will be made, unless the stockpiling is ordered by the Engineer.

**10-1.31 DUFF**

This work shall consist of excavating, stockpiling, removing from stockpiles, spreading, and compacting duff in conformance with these special provisions.

Duff shall consist of a mixture of existing decomposed, chopped, broken or chipped plant material, leaves, grasses, weeds, and other plant material excavated from areas within the project limits. Existing shrubs and other small plants shall be incorporated into the duff by discing, or by other methods which will break or chop the material into particles not greater than 150 mm in greatest dimension. Any woody material greater than 50 mm in diameter found within any area disturbed by the contractors operations shall be chipped and spread over the area to receive duff prior to duff being placed.

When duff is to be excavated to a specified depth, duff may consist of plant material and soil. Rocks and plant material in excess of 150 mm in greatest dimension shall be removed from the excavated duff.

Trash and objectionable material shall be removed from duff excavation sites prior to duff excavation. The trash and objectionable material shall be removed and disposed of outside the highway right of way in conformance with the provisions in Section 7-l.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Duff shall be obtained by excavating the top 50 mm of existing material from proposed excavation and embankment

areas and other areas designated by the Engineer. Duff shall be stockpiled along the top of proposed excavation slopes and along the toe of proposed embankment slopes. When duff cannot be stockpiled outside the slope lines as specified herein, excavated duff material may be stockpiled at other locations when designated by the Engineer.

Upon completion of the grading operations for the excavation and embankment slopes the duff shall be spread on the excavation and embankment areas, and disturbed areas designated by the Engineer. A 1 m wide strip adjacent to the edge of shoulder shall not receive duff. Duff shall be placed to a uniform depth of not less than 50 mm and shall be compacted or stabilized in a manner that retains the material in place on the slopes. Duff shall not be compacted or stabilized to the degree that the duff is not maintained as a viable growing medium.

Duff shall be placed on designated excavation and embankment slopes prior to applying erosion control materials. Erosion control materials shall be furnished and applied as specified in these special provisions.

Duff placed on the finished slopes will be measured by the hectare. The areas of duff will be calculated on the basis of actual or computed slope measurements.

The contract price paid per hectare for duff shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in excavating, stockpiling, removing duff from stockpiles, spreading and compacting or stabilizing duff, complete in place, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

## 10-1.32 MOVE-IN/MOVE-OUT (EROSION CONTROL)

Move-in/move-out (erosion control) shall include moving onto the project when an area is ready to receive erosion control as determined by the Engineer, setting up all required personnel and equipment for the application of erosion control materials and moving out all personnel and equipment when erosion control in that area is completed.

When areas are ready to receive applications of erosion control, as determined by the Engineer, the Contractor shall begin erosion control work in that area within 5 working days of the Engineer's notification to perform the erosion control work.

Attention is directed to the requirements of erosion control elsewhere in these special provisions.

Quantities of move-in/move-out (erosion control) will be determined as units from actual count as determined by the Engineer. For measurement purposes, a move-in followed by a move-out will be considered as one unit.

The contract unit price paid for move-in/move-out (erosion control) shall include full compensation for furnishing all labor, materials (excluding erosion control materials), tools, equipment, and incidentals and for doing all the work involved in moving in and removing from the project all personnel and equipment necessary for application of erosion control, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

No adjustment of compensation will be made for any increase or decrease in the quantities of move-in/move-out (erosion control) required, regardless of the reason for the increase or decrease. The provisions in Section 4-1.03B, "Increased or Decreased Quantities," of the Standard Specifications shall not apply to the item of move-in/move-out (erosion control).

## 10-1.33 EROSION CONTROL

Erosion control shall conform to the provisions in Section 20-3, "Erosion Control," of the Standard Specifications and these special provisions.

Erosion control, application one, shall consist of incorporating straw and applying other erosion control materials to embankment slopes that are 1:4 (vertical:horizontal) or steeper and more than 4 meters in length.

Erosion control, application two, shall consist of applying erosion control materials to excavation and embankment slopes less than 4 meters in length, and all other areas disturbed by construction activities as specified by the Engineer

Erosion control shall be applied when an area is ready to receive erosion control as determined by the Engineer and in conformance with the provisions in "Move-in/Move-out (Erosion Control)" of these special provisions.

Prior to installing erosion control materials, soil surface preparation shall conform to the provisions in Section 19-2.05, "Slopes," of the Standard Specifications, except that rills and gullies exceeding 50 mm in depth or width shall be leveled. Vegetative growth, temporary erosion control materials, and other debris shall be removed from areas to receive erosion control.

### MATERIALS

Materials shall conform to the provisions in Section 20-2, "Materials," of the Standard Specifications and these special provisions.

#### Seed

Seed shall conform to the provisions in Section 20-2.10, "Seed," of the Standard Specifications. Individual seed species

shall be measured and mixed in the presence of the Engineer.

Seed shall be delivered to the job site in unopened separate containers with the seed tag attached. Containers without a seed tag attached will not be accepted.

A sample of approximately 30 g of seed will be taken from each seed container by the Engineer.

**Legume Seed**

Legume seed shall be pellet-inoculated or industrial-inoculated and shall conform to the following:

A. Inoculated seed shall be inoculated in conformance with the provisions in Section 20-2.10, "Seed," of the Standard Specifications.
B. Inoculated seed shall have a calcium carbonate coating.
C. Industrial-inoculated seed shall be inoculated with Rhizobia and coated using an industrial process by a manufacturer whose principal business is seed coating and seed inoculation.
D. Industrial-inoculated seed shall be sown within 180 calendar days after inoculation.
E. Legume seed shall consist of the following:

LEGUME SEED

| Botanical Name (Common Name) | Percent Germination (Minimum) | Kilograms Pure Live Seed Per Hectare (Slope Measurement) |
|---|---|---|
| Lupinus Bicolor (Pygmy-leaf Lupine) | 40 | 1.0 |
| Lupinus Succulentus (Arroyo Lupine) | 40 | 3.4 |
| Lotus Scoparius (Deerweed) | 40 | 4.5 |

**Non-Legume Seed**

Non-legume seed shall consist of the following:

NON-LEGUME SEED

| Botanical Name (Common Name) | Percent Germination (Minimum) | Kilograms Pure Live Seed Per Hectare (Slope Measurement) |
|---|---|---|
| Artemisia Californica (California Sagebrush) | 25 | .30 |
| Bromus Carinatus (Cucamonga) | 40 | 7.0 |
| Encelia Californica (Bush Sunflower) | 30 | .60 |
| Eriogonum Fasciculatum (California Buckwheat) | 05 | 1.0 |
| Eriophyllum Confertiflorum (Golden Yarrow) | 30 | .30 |
| Eschscholzia Californica (California Poppy) | 40 | 2.3 |
| Nassella Pulchra (Purple Needlegrass) | 40 | 6.0 |
| Vulpia Mycrostachys (Small Fesque) | 40 | 4.5 |

**Straw**

Straw shall conform to the provisions in Section 20-2.06, "Straw," of the Standard Specifications and these special provisions.

Straw shall be derived from rice.

**Compost**

Compost shall be derived from green material consisting of chipped, shredded or ground vegetation or clean processed recycled wood products or Class A, exceptional quality biosolids composts, as required by the United States Environmental Protection Agency (EPA), 40 CFR, Part 503c regulations or a combination of green material and biosolids compost. The compost shall be processed or completed to reduce weed seeds, pathogens and deleterious material, and shall not contain paint, petroleum products, herbicides, fungicides or other chemical residues that would be harmful to plant or animal life. Other deleterious material, plastic, glass, metal or rocks shall not exceed 0.1 percent by weight or volume. A minimum internal temperature of 57°C shall be maintained for at least 15 continuous days during the composting process. The compost shall be thoroughly turned a minimum of 5 times during the composting process and shall go through a minimum 90-day curing period after the 15-day thermophilic compost process has been completed. Compost shall be screened through a maximum 9.5-mm screen. The moisture content of the compost shall not exceed 35 percent. Compost products with a higher moisture content may be used provided the weight of the compost is increased to equal the compost with a moisture content of 35 percent. Moist samples of compost on an as received basis shall be dried in an oven at a temperature between 105°C and 115°C until a constant dry weight of the sample is achieved. The percentage of moisture will be determined by dividing the dry weight of the sample by the moist weight of the sample and then multiplying by 100. Compost will be tested for maturity and stability with a Solvita test kit. The compost shall measure a minimum of 6 on the maturity and stability scale.

**APPLICATION ONE**

Erosion control materials shall be applied in separate applications in the following sequence:

A. Straw shall be applied and incorporated into the soil at the rate of 3.5 tonnes per hectare (slope measurement).
B. The following mixture in the proportions indicated shall be applied. If hydro-seeding equipment is used, the mixture shall be applied within 60 minutes after the seed has been added to the mixture.

| Material | Kilograms Per Hectare (Slope Measurement) |
|---|---|
| Legume Sees | 8.9 |
| Non-Legume Seed | 22.0 |
| Fiber | 340 |
| Compost | 2270 |

C. A second application of straw shall be applied and incorporated into the soil at the rate of 3.5 tonnes per hectare based on slope measurements.

**APPLICATION TWO**

Erosion control materials shall be applied in separate applications in the following sequence:

A. The following mixture in the proportions indicated shall be applied with hydro-seeding equipment within 60 minutes after the seed has been added to the mixture:

| Material | Kilograms Per Hectare (Slope Measurement) |
|---|---|
| Legume Seed | 4.9 |
| Non-Legume Seed | 22.0 |
| Fiber | 340 |
| Compost | 1700 |

B. Straw shall be applied at the rate of 3.5 tonnes per hectare based on slope measurements. Incorporation of straw will not be required. Straw shall be distributed evenly without clumping or piling.
C. The following mixture in the proportions indicated shall be applied with hydro-seeding equipment:

| Material | Kilograms Per Hectare (Slope Measurement) |
|---|---|
| Fiber | 450 |
| Compost | 2270 |
| Stabilizing Emulsion (Solids) | 170 |

The ratio of total water to total stabilizing emulsion in the mixture shall be as recommended by the manufacturer.

Once straw work is started in an area, stabilizing emulsion applications shall be completed in that area on the same working day.

The proportions of erosion control materials for applications one and two may be changed by the Engineer to meet field conditions. A strip 1 m wide adjacent to the edge of shoulder for applications one and two shall not be seeded.

**MEASUREMENT AND PAYMENT**

Compost (erosion control) will be measured by the kilogram or tonne, whichever unit is designated in the Engineer's Estimate The weight will be as determined by the Engineer from marked mass and sack count or from scale weighings.

The contract price paid per kilogram or tonne for compost (erosion control) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in applying compost for erosion control, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

## 10-1.34 IRRIGATION CROSSOVERS

Irrigation crossovers shall conform to the provisions in Section 20-5, "Irrigation Systems," of the Standard Specifications and these special provisions.

Conduits shall be placed in open trenches in conformance with the provisions in Section 20-5.03B, "Conduit for Irrigation Crossovers," of the Standard Specifications.

Conduits shall be corrugated high density polyethylene (CHDPE) pipe. Corrugated high density polyethylene pipe shall conform to the requirements in ASTM Designation: F 405 or F 667, or AASHTO Designation: M 252 or M 294 and shall be Type S. Couplings and fittings shall be as recommended by the pipe manufacturer.

Water line crossovers shall conform to the provisions in Section 20-5.03C, "Water Line Crossovers," of the Standard Specifications.

Sprinkler control crossovers shall conform to the provisions in Section 20-5.027D, "Sprinkler Control Crossovers," of the Standard Specifications.

Installation of pull boxes shall conform to the provisions in Section 20-5.027I, "Conductors, Electrical Conduit and Pull Boxes," of the Standard Specifications. When no conductors are installed in electrical conduits, pull boxes for irrigation crossovers shall be installed on a foundation of compacted soil.

## 10-1.35 EXTEND IRRIGATION CROSSOVERS

Extend existing irrigation crossovers shall conform to the provisions in Section 20-5, "Irrigation Systems," of the Standard Specifications and these special provisions.

Extend irrigation crossovers shall include conduit, water line crossover, and sprinkler control crossover extensions and appurtenances, locating existing irrigation crossovers and pressure testing existing and new water line crossovers. The sizes of conduit, water line crossover, and sprinkler control crossover extensions shall be as shown on the plans.

Before work is started in an area where an existing irrigation crossover conduit is to be extended, the existing conduit shall be located by the Contractor. When exploratory holes are used to locate the existing conduit, the exploratory holes shall be excavated in conformance with the provisions in Section 20-5.03B, "Conduit for Irrigation Crossovers," of the Standard Specifications.

If debris is encountered in the ends of conduits to be extended, the debris shall be removed prior to extending conduits. Removal of debris within the first meter in the conduits shall be at the Contractor's expense. If debris is encountered in the conduit more than one meter from the ends of the conduits to be extended, the additional debris shall be removed as directed by the Engineer and will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

Prior to installation of water line crossover extensions, the existing water lines shall be pressure tested for leakage in conformance with the provisions in Section 20-5.03H, "Pressure Testing," of the Standard Specifications. Repairs to the existing water line crossover, when ordered by the Engineer, will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

Conduit extensions shall be corrugated high density polyethylene (CHDPE) pipe.

Water line crossover extensions shall be plastic pipe (PR 315) (supply line).

Sprinkler control crossover extensions shall be Type 3 electrical conduit.

Conductors shall be removed from existing sprinkler control crossovers to be extended.

After installation of the sprinkler control crossover extensions, new conductors shall be installed without splices in existing and extended sprinkler control crossovers. New conductors shall match the removed conductors in color and size and shall be spliced to the existing conductors in adjacent pull boxes. After the new conductors are installed, the conductors shall be tested in the same manner specified for traffic signal, sign illumination, and lighting circuits in conformance with the provisions in Section 86-2.14B, "Field Testing," of the Standard Specifications.

After water line crossover extensions have been installed, existing and extended water line crossovers shall be retested for leakage in conformance with the provisions in Section 20-5.03H, "Pressure Testing," of the Standard Specifications. Leaks that develop shall be repaired at the Contractor's expense and the water line crossovers shall be retested until a satisfactory pressure test is achieved.

**10-1.36 AGGREGATE SUBBASE**

Aggregate subbase shall be Class 4 and shall conform to the provisions in Section 25, "Aggregate Subbases," of the Standard Specifications and these special provisions.

The restriction that the amount of reclaimed material included in Class 4 aggregate subbase not exceed 50 percent of the total volume of the aggregate used shall not apply. Aggregate for Class 4 aggregate subbase may include reclaimed glass. Aggregate subbase incorporating reclaimed glass shall not be placed at locations where surfacing will not be placed over the aggregate subbase.

The percentage composition by mass of Class 4 aggregate subbase shall conform to the following grading requirements:

Grading Requirements (Percentage Passing)

| Sieve Sizes | Operating Range | Contract Compliance |
|---|---|---|
| 75-mm | 100 | 100 |
| 63-mm | 87-100 | 90-100 |
| 4.75-mm | 30-100 | 35-100 |
| 75-µm | 0-23 | 0-20 |

Class 4 aggregate subbase shall also conform to the following quality requirements:

Quality Requirements

| Test | Operating Range | Contract Compliance |
|---|---|---|
| Sand Equivalent | 21 Min. | 18 Min. |
| Resistance (R-value) | ---- | 50 Min. |

The provisions of the last 4 paragraphs in Section 25-1.02A, "Class 1, Class 2, and Class 3 Aggregate Subbases," of the Standard Specifications shall apply to Class 4 aggregate subbase.

At the option of the Contractor, Class 2 aggregate subbase conforming to the grading and quality requirements in Section 25-1.02A, may be used in place of Class 4 aggregate subbase. The restriction that the amount of reclaimed material included in Class 2 aggregate subbase not exceed 50 percent of the total volume of the aggregate used shall not apply. Aggregate for Class 2 aggregate subbase may include reclaimed glass. Aggregate subbase incorporating reclaimed glass shall not be placed at locations where surfacing will not be placed over the aggregate subbase. Once a class of aggregate subbase is selected, the class shall not be changed without written approval of the Engineer.

Regardless of the class of aggregate subbase supplied under the provisions of this section, payment for all aggregate subbase will be made as Class 4 aggregate subbase.

**10-1.37 AGGREGATE BASE**

Aggregate bases shall be Class 2 and Class 3 and shall conform to the provisions in Section 26, "Aggregate Bases," of the Standard Specifications and these special provisions.

The restriction that the amount of reclaimed material included in Class 2 and Class 3 aggregate base not exceed 50 percent of the total volume of the aggregate used shall not apply. Aggregate for Class 2 and Class 3 aggregate base may include reclaimed glass. Aggregate base incorporating reclaimed glass shall not be placed at locations where surfacing will not be placed over the aggregate base.

At the option of the Contractor, the aggregate for Class 3 aggregate base shall conform to either the 37.5-mm maximum or the 19-mm maximum grading.

Aggregate for Class 3 aggregate base shall be clean and free from organic matter and other deleterious substances and shall conform to the following grading and quality requirements:

Grading Requirements (Percentage Passing )

| | 37.5-mm Maximum | | 19-mm Maximum | |
|---|---|---|---|---|
| Sieve Sizes | Operating Range | Contract Compliance | Operating Range | Contract Compliance |
| 50-mm | 100 | 100 | ------- | ------- |
| 37.5-mm | 90 - 100 | 87 - 100 | ------- | ------- |

| | | | | |
|---|---|---|---|---|
| 25-mm | ------- | ------- | 100 | 100 |
| 19-mm | 50 - 90 | 45 - 95 | 90 - 100 | 87 - 100 |
| 4.75-mm | 25 - 60 | 20 - 65 | 40 - 70 | 35 - 75 |
| 600-µm | 10 - 35 | 6 - 39 | 12 - 40 | 7 - 45 |
| 75-µm | 3 - 15 | 0 - 19 | 3 - 15 | 0 - 19 |

Quality Requirements

| Tests | Operating Range | Contract Compliance |
|---|---|---|
| Sand Equivalent | 21 Min. | 18 Min. |
| Resistance (R-value) | --------- | 50 Min. |

The provisions of the third paragraph in Section 26-1.02A, "Class 2 Aggregate Base," of the Standard Specifications shall apply to Class 3 aggregate base.

The requirements of the last 4 paragraphs in Section 26-1.02A of the Standard Specifications shall apply to Class 3 aggregate base.

**10-1.38 LEAN CONCRETE BASE**

Lean concrete base shall conform to the provisions in Section 28, "Lean Concrete Base," of the Standard Specifications.

**10-1.39 ASPHALT CONCRETE**

Asphalt concrete shall be Type B and shall conform to the provisions in Section 39, "Asphalt Concrete," of the Standard Specifications and these special provisions.

The aggregate for Type B asphalt concrete shall be lime treated in conformance with "Lime Treated Aggregates" of these special provisions.

The amount of asphalt binder used in asphalt concrete placed in dikes, gutters, gutter flares, overside drains and aprons at the ends of drainage structures shall be increased one percent by mass of the aggregate over the amount of asphalt binder determined for use in asphalt concrete placed on the traveled way.

A prime coat of liquid asphalt, SC-70 shall be applied.

The miscellaneous areas to be paid for at the contract price per square meter for place asphalt concrete (miscellaneous area), in addition to the prices paid for the materials involved, shall be limited to the areas listed on the plans.

In median areas adjacent to slotted median drains, each layer of asphalt concrete shall not exceed 45 mm, maximum compacted thickness.

Aggregate for asphalt concrete dikes shall be in conformance with the provisions for 9.5-mm Maximum grading in Section 39-2.02, "Aggregate," of the Standard Specifications.

If the Contractor selects the batch mixing method, asphalt concrete shall be produced by the automatic batch mixing method in conformance with the provisions in Section 39-3.03A(2), "Automatic Proportioning," of the Standard Specifications.

If the finished surface of the asphalt concrete on Route 57 and Route 60 traffic lanes does not meet the specified surface tolerances, the surfacing shall be brought within tolerance by either (1) abrasive grinding (with fog seal coat on the areas which have been ground), (2) removal and replacement or (3) placing an overlay of asphalt concrete. The method will be selected by the Engineer. The corrective work shall be at the Contractor's expense.

If abrasive grinding is used to bring the finished surface to the specified surface tolerances, additional grinding shall be performed, as necessary, to extend the area ground in each lateral direction so that the lateral limits of grinding are at a constant offset from, and parallel to, the nearest lane line or pavement edge, and in each longitudinal direction so that the grinding begins and ends at lines normal to the pavement centerline, within any ground area. Ground areas shall be neat rectangular areas of uniform surface appearance. Abrasive grinding shall conform to the provisions in the first paragraph and the last 4 paragraphs in Section 42-2.02, "Construction," of the Standard Specifications.

The area to which paint binder has been applied shall be closed to public traffic. Care shall be taken to avoid tracking binder material onto existing pavement surfaces beyond the limits of construction.

The Contractor shall schedule paving operations so that each layer of asphalt concrete is placed on contiguous lanes of the traveled way during each work shift. At the end of each work shift, the distance between the ends of the layers of asphalt concrete on adjacent lanes shall not be greater than 3 m or less than 1.5 m. Additional asphalt concrete shall be placed along the transverse edge at the end of each lane and along the exposed longitudinal edges between adjacent lanes, hand raked, and compacted to form temporary conforms. Kraft paper, or other approved bond breaker, may be placed under the conform tapers to facilitate the removal of the taper when paving operations resume.

Half-width surfacing operations shall be performed in a manner that, at the end of each day's work, the distance between

the ends of adjacent surfaced lanes shall not be greater than can be completed in the following day of normal surfacing operations.

Where the existing pavement is to be widened by constructing a new structural section adjacent to the existing pavement, the new structural section, on both sides of the existing pavement, shall be completed to match the elevation of the edge of the existing pavement for the entire length of the project prior to spreading and compacting asphalt concrete over the adjacent existing pavement.

Where the existing pavement is to be widened by constructing a new structural section adjacent to the existing pavement, the new structural section, on both sides of the existing pavement, shall be completed to match the elevation of the edge of the existing pavement at each location prior to spreading and compacting asphalt concrete over the adjacent existing pavement.

Asphalt concrete surfacing shall be placed on existing surfacing, including curve widening, chain control lanes, turnouts, left turn lanes, and public and private road connections shown on the plans, unless otherwise directed by the Engineer.

Additional asphalt concrete surfacing material shall be placed along the edge of the surfacing at road connections and private drives, hand raked, if necessary, and compacted to form smooth tapered conforms. Full compensation for furnishing all labor and tools and for doing all the work necessary to hand rake these conforms shall be considered as included in the contract prices paid per tonne for the various items of asphalt concrete surfacing involved and no additional compensation will be allowed therefor.

## 10-1.40 RUBBERIZED ASPHALT CONCRETE (TYPE G)

Rubberized asphalt concrete (Type G) shall consist of furnishing and mixing gap graded aggregate and asphalt-rubber binder and spreading and compacting the mixture. Type G rubberized asphalt concrete shall conform, except as otherwise provided, to the provisions for Type A asphalt concrete in Section 39, "Asphalt Concrete," of the Standard Specifications and these special provisions.

### GENERAL

The Contractor shall furnish samples of aggregate to the Engineer in conformance with the provisions in Section 39-3.03, "Proportioning," of the Standard Specifications.

Aggregate for Type G rubberized asphalt concrete shall be of such quality that the optimum amount of asphalt-rubber binder to be mixed with the aggregate, as determined by the Engineer in conformance with the requirements in California Test 367 (as amended below), shall be a minimum of 7.0 percent by mass of dry aggregate and a maximum of 9.0 percent by mass of dry aggregate. Aggregates which result in an optimum asphalt-rubber binder content of less than 7.0 percent or more than 9.0 percent by mass of dry aggregate shall not be used. The Engineer will determine the exact amount of asphalt-rubber binder to be mixed with the aggregate in conformance with the requirements in California Test 367, except as follows:

A. The specific gravity used in California Test 367, Section "B. Voids Content of Specimen," will be determined using California Test 308, Method A.
B. California Test 367, Section "C. Optimum Bitumen Content," is revised as follows:

    1. Plot asphalt-rubber binder content versus void content for each specimen on Form TL-306 (Figure 3), and connect adjacent points with straight lines.
    2. From Figure 3 select the theoretical asphalt-rubber binder content that has 5 percent voids.
    3. Record the asphalt-rubber binder content in Step 2 as the Optimum Bitumen Content (OBC).
    4. To establish a recommended range, use the Optimum Bitumen Content (OBC) as the high value and 0.3 percent less as the low value. Notwithstanding, the recommended range shall not extend below 7.0 percent nor shall the high value to establish the recommended range be above 9.0 percent. If the OBC is 7.0 percent, then there shall be no recommended range, and 7.0 percent shall be the recommended value.

C. Laboratory mixing and compaction shall be in conformance with the requirements of California Test 304, except that the mixing temperature of the aggregate shall be between 149°C and 163°C. The compaction temperature of the combined mixture shall be between 143°C and 149°C.

The rubberized asphalt concrete mixture, composed of the aggregate proposed for use and the optimum amount of asphalt-rubber binder as determined in conformance with the requirements in California Test 367 modified above, shall conform to the following quality requirements:

| Test Parameter | California Test | Requirement |
|---|---|---|
| Stabilometer Value, Minimum | 304 and 366 | 23 |
| Voids in Mineral Aggregate, Percent, Minimum | See Note | 18 |

Note: Voids in mineral aggregate test shall be determined as described in Asphalt Institute Mix Design Methods for Asphalt Concrete (MS-2).

The asphalt-rubber binder content of the rubberized asphalt concrete (Type G) will be determined by extraction tests in conformance with the requirements in California Test 362, or will be determined in conformance with the requirements in California Test 379.

The Contractor shall furnish a Certificate of Compliance to the Engineer in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for each material used in asphalt-rubber binder and the asphalt-rubber binder mixture. The Certificate of Compliance shall certify that the material conforms to the provisions in these special provisions. When requested by the Engineer, the Contractor shall submit samples with the Certificate of Compliance. The Contractor shall provide the Engineer a Material Safety Data Sheet (MSDS) for each of the constituent components of the asphalt-rubber binder, for the completed mixture of asphalt-rubber binder and for the Type G rubberized asphalt concrete.

The Contractor shall provide a Certificate of Compliance for each truck load of crumb rubber modifier (CRM), paving asphalt, and asphalt modifier delivered to the project. The Quality Control Program used by the manufacturer of each ingredient shall include a sampling and testing frequency as shown below:

A. CRM shall be tested, except for the grading requirement, at least once for every 225 tonnes of production, with a minimum of once for each project. CRM shall be tested for grading for every truck load delivered to the project.
B. Paving asphalt shall be tested at least once for every 180 tonnes of production with a minimum of once for each project.
C. Asphalt modifier shall be tested at least once for every 23 tonnes of production with a minimum of once for each project.
D. A copy of the laboratory test results for the test parameters specified in these special provisions for CRM, paving asphalt, and asphalt modifier shall be submitted to the Engineer with the Certificate of Compliance for each truck load of individual material delivered to the project.

Certified volume or weight slips shall be delivered to the Engineer for the materials supplied.

**PAVING ASPHALT**

The grade of paving asphalt to be used in the asphalt-rubber binder shall be AR-4000 and shall conform to the provisions in Section 92, "Asphalts," of the Standard Specifications and these special provisions.

The paving asphalt for use in asphalt-rubber binder shall be modified with an asphalt modifier.

**ASPHALT MODIFIER**

The asphalt modifier shall be a resinous, high flash point, aromatic hydrocarbon compound and shall conform to the following requirements:

ASPHALT MODIFIER

| Test Parameter | ASTM Designation | Requirement |
|---|---|---|
| Viscosity, $m^2/s$ ($x10^{-6}$) at 100°C | D 445 | X ± 3* |
| Flash Point, CL.O.C., °C | D 92 | 207 min. |
| Molecular Analysis: | | |
| Asphaltenes, percent by mass | D 2007 | 0.1 max. |
| Aromatics, percent by mass | D 2007 | 55 min. |

* The symbol "X" is the viscosity of the asphalt modifier the Contractor proposes to furnish. The value "X" which the Contractor proposes shall be between the limits 19 and 36 and shall be submitted in writing to the Engineer. A proposed change, requested by the Contractor, in the value "X" shall require a new asphalt-rubber binder design.

The asphalt modifier shall be proportionately added to the paving asphalt at the production site where the asphalt-rubber binder is blended and reacted. Asphalt modifier shall be added in an amount of 2.5 percent to 6.0 percent by mass of the paving asphalt based on the recommendation of the asphalt-rubber binder supplier. The paving asphalt shall be at a temperature of not less than 190°C or more than 226°C when the asphalt modifier is added. If the asphalt modifier is combined with the paving asphalt, before being blended with the CRM, the combined paving asphalt and asphalt modifier shall be mixed by circulation for a period of not less than 20 minutes. Premixing of asphalt modifier and paving asphalt will not be required when the ingredients of the asphalt-rubber binder are proportioned and mixed simultaneously. Asphalt modifier and paving asphalt shall be measured for proportioning with meters conforming to the provisions in Section 9-1.01, "Measurement of Quantities," of the Standard Specifications.

**CRUMB RUBBER MODIFIER (CRM)**

Crumb rubber modifier (CRM) shall consist of a combination of scrap tire CRM and high natural CRM. The scrap tire CRM shall consist of ground or granulated rubber derived from a combination of automobile tires, truck tires or tire buffings. The high natural CRM shall consist of ground or granulated rubber derived from materials that utilize high natural rubber sources.

Steel and fiber separation may be accomplished by any method. Cryogenic separation, if utilized, shall be performed separately from and prior to grinding or granulating.

CRM shall be ground or granulated at ambient temperature. Cryogenically produced CRM particles which can pass through the grinder or granulator without being ground or granulated respectively shall not be used.

CRM shall not contain more than 0.01-percent wire (by mass of CRM) and shall be free of other contaminants, except fabric. Fabric shall not exceed 0.05-percent by mass of CRM. The test and method for determining the percent by mass of wire and fabric is available at the Transportation Laboratory, Pavement Branch, Telephone 916-227-7300, and will be furnished to interested persons upon request. A Certificate of Compliance certifying these percentages shall be furnished to the Engineer in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

The length of an individual CRM particle shall not exceed 4.75 mm.

The CRM shall be sufficiently dry so that the CRM will be free flowing and not produce foaming when combined with the blended paving asphalt and asphalt modifier mixture. Calcium carbonate or talc may be added at a maximum amount of 3 percent by mass of CRM to prevent CRM particles from sticking together. The CRM shall have a specific gravity between 1.1 and 1.2 as determined by California Test 208. Scrap tire CRM and high natural CRM shall be delivered to the production site in separate bags and shall be sampled and tested separately. CRM material shall conform to the following requirements of ASTM Designation: D 297:

SCRAP TIRE CRUMB RUBBER MODIFIER

| Test Parameter | Percent | |
|---|---|---|
| | Min. | Max. |
| Acetone Extract | 6.0 | 16.0 |
| Ash Content | — | 8.0 |
| Carbon Black Content | 28.0 | 38.0 |
| Rubber Hydrocarbon | 42.0 | 65.0 |
| Natural Rubber Content | 22.0 | 39.0 |

HIGH NATURAL CRUMB RUBBER MODIFIER

| Test Parameter | Percent | |
|---|---|---|
| | Min. | Max. |
| Acetone Extract | 4.0 | 16.0 |
| Rubber Hydrocarbon | 50.0 | — |
| Natural Rubber Content | 40.0 | 48.0 |

The CRM for asphalt-rubber binder shall conform to the gradations specified below when tested in conformance with the requirements in ASTM Designation: C 136, except as follows:

A. Split or quarter 100 g ± 5 g from the CRM sample and dry to a constant mass at a temperature of not less than 57°C or more than 63°C and record the dry sample mass. Place the CRM sample and 5.0 g of talc in a 0.5-L jar. Seal the jar, then shake it by hand for a minimum of one minute to mix the CRM and the talc. Continue shaking or open the jar and stir until particle agglomerates and clumps are broken and the talc is uniformly mixed.

B. Place one rubber ball on each sieve. Each ball shall have a mass of 8.5 g ± 0.5 g, have a diameter of 24.5 mm ± 0.5 mm, and shall have a Shore Durometer "A" hardness of 50 ± 5 in conformance with the requirements in ASTM Designation: D 2240. After sieving the combined material for 10 minutes ± 1 minute, disassemble the sieves. Material adhering to the bottom of a sieve shall be brushed into the next finer sieve. Weigh and record the mass of the material retained on the 2.36-mm sieve and leave this material (do not discard) on the scale or balance. Observed fabric balls shall remain on the scale or balance and shall be placed together on the side of the scale or balance to prevent the fabric balls from being covered or disturbed when placing the material from finer sieves onto the scale or balance. The material retained on the next finer sieve (2.00-mm sieve) shall be added to the scale or balance. Weigh and record that mass as the accumulative mass retained on that sieve (2.00-mm sieve). Continue weighing and recording the accumulated masses retained on the remaining sieves until the accumulated mass retained in the pan has been determined. Prior to discarding the CRM sample, separately weigh and record the total mass of fabric balls in the sample.

C. Determine the mass of material passing the 75-µm sieve (or mass retained in the pan) by subtracting the accumulated mass retained on the 75-µm sieve from the accumulated mass retained in the pan. If the material passing the 75-µm sieve (or mass retained in the pan) has a mass of 5 g or less, cross out the recorded number for the accumulated mass retained in the pan and copy the number recorded for the accumulated mass retained on the 75-µm sieve and record that number (next to the crossed out number) as the accumulated mass retained in the pan. If the material passing the 75-µm sieve (or mass retained in the pan) has a mass greater than 5 g, cross out the recorded number for the accumulated mass retained in the pan, subtract 5 g from that number and record the difference next to the crossed out number. The adjustment to the accumulated mass retained in the pan is made to account for the 5 g of talc added to the sample. For calculation purposes, the adjusted total sample mass is the same as the adjusted accumulated mass retained in the pan. Determine the percent passing based on the adjusted total sample mass and record to the nearest 0.1 percent.

CRM GRADATIONS

| Sieve Size | Scrap Tire CRM Percent Passing | High Natural CRM Percent Passing |
|---|---|---|
| 2.36-mm | 100 | 100 |
| 2.00-mm | 98-100 | 100 |
| 1.18-mm | 45-75 | 95-100 |
| 600-µm | 2-20 | 35-85 |
| 300-µm | 0-6 | 10-30 |
| 150-µm | 0-2 | 0-4 |
| 75-µm | 0 | 0-1 |

**ASPHALT-RUBBER BINDER**

Asphalt-rubber binder shall consist of a mixture of paving asphalt, asphalt modifier, and crumb rubber modifier.

At least 2 weeks before the binder's intended use, the Contractor shall furnish the Engineer 4 one-liter cans filled with the asphalt-rubber binder proposed for use on the project. The Contractor shall supply the Engineer, for approval, a binder formulation and samples of the materials to be used in the asphalt-rubber binder at least 2 weeks before construction is scheduled to begin. The binder formulations shall consist of the following information:

A. Paving Asphalt and Modifiers:

1. Source and grade of paving asphalt.
2. Source and identification (or type) of modifiers used.
3. Percentage of asphalt modifier by mass of paving asphalt.
4. Percentage of the combined blend of paving asphalt and asphalt modifier by total mass of asphalt-rubber binder to be used.
5. Laboratory test results for test parameters shown in these special provisions.

B Crumb Rubber Modifier (CRM):

1. Source and identification (or type) of scrap tire and high natural CRM.
2. Percentage of scrap tire and high natural CRM by total mass of the asphalt-rubber blend.
3. If CRM from more than one source is used, the above information will be required for each CRM source used.
4. Laboratory test results for test parameters shown in these special provisions.

C. Asphalt-Rubber Binder:

1. Laboratory test results of the proposed blend for test parameters shown in these special provisions.
2. The minimum reaction time and temperature.

The method and equipment for combining paving asphalt, asphalt modifier, and CRM shall be so designed and accessible that the Engineer can readily determine the percentages by mass for each material being incorporated into the mixture.

The proportions of the materials, by total mass of asphalt-rubber binder, shall be 80 percent ± 2 percent combined paving asphalt and asphalt modifier, and 20 percent ± 2 percent CRM. However, the minimum amount of CRM shall not be less than 18.0 percent. Lower values which are rounded up shall not be allowed. The CRM shall be combined at the production site and shall contain 75 percent ± 2 percent scrap tire CRM and 25 percent ± 2 percent high natural CRM, by mass.

The paving asphalt and asphalt modifier shall be combined into a blended mixture that is chemically compatible with the crumb rubber modifier to be used. The blended mixture is considered to be chemically compatible when it meets the provisions for asphalt-rubber binder (after reacting) found in these special provisions.

The blended paving asphalt and asphalt modifier mixture, and the CRM shall be combined and mixed together at the production site in a blender unit to produce a homogeneous mixture.

The temperature of the blended paving asphalt and asphalt modifier mixture shall be not less than 190°C nor more than 226°C when the CRM is added. The combined materials shall be reacted for a minimum of 45 minutes after incorporation of the CRM at a temperature of not less than 190°C nor more than 218°C. The temperature shall not be higher than 6°C below the actual flash point of the asphalt-rubber binder.

After reacting, the asphalt-rubber binder shall conform to the following requirements:

ASPHALT-RUBBER BINDER

| Test Parameter | ASTM Test Method | Requirement | |
|---|---|---|---|
| | | Min. | Max. |
| Cone Penetration @ 25°C, 1/10 mm | D 217 | 25 | 70 |
| Resilience @ 25°C, Percent rebound | D 3407 | 18 | — |
| Field Softening Point, °C | D 36 | 52 | 74 |
| Viscosity @ 190°C, Pa • s ($x10^{-3}$) | See Note | 1500 | 4000 |

NOTE: The viscosity test shall be conducted using a hand held Haake Viscometer Model VT-02 with Rotor 1, 24 mm in depth x 53 mm in height, or equivalent, as determined by the Engineer. The accuracy of the viscometer shall be verified by comparing the viscosity results obtained with the hand held viscometer to 3 separate calibration fluids of known viscosities ranging from 1000 to 5000 Pa • s ($x10^{-3}$). The viscometer will be considered accurate if the values obtained are within 300 Pa • s ($x10^{-3}$) of the known viscosity. The known viscosity value shall be based on the fluid manufacturers standard test temperature or the test temperature versus viscosity correlation table provided by the fluid manufacturer. Viscometers used on the project shall be verified to be accurate. The test method for determining the viscosity of asphalt-rubber binder using a hand held viscometer is available at the Transportation Laboratory, Pavement Branch, Telephone (916) 227-7300. The accuracy verification results shall be provided to the Engineer and shall be certified by a Certificate of Compliance. The Certificate of Compliance shall be furnished to the Engineer in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

The Contractor shall provide a Haake Viscometer, or equivalent, at the production site during combining of asphalt-rubber binder materials. The Contractor shall take viscosity readings of asphalt-rubber binder from samples taken from the feed line connecting the storage and reaction tank to the asphalt concrete plant. Readings shall be taken at least every hour with not less than one reading for each batch of asphalt-rubber binder. The Contractor shall log these results, including time and asphalt-rubber binder temperature, and a copy of the log shall be submitted to the Engineer on a daily basis. As determined by the Engineer, the Contractor shall either notify the Engineer at least 15 minutes prior to each test or provide the Engineer a schedule of testing times.

The reacted asphalt-rubber binder shall be maintained at a temperature of not less than 190°C nor more than 218°C.

If any of the material in a batch of asphalt-rubber binder is not used within 4 hours after the 45-minute reaction period, heating of the material shall be discontinued. Any time the asphalt-rubber binder cools below 190°C and is reheated shall be considered a reheat cycle. The total number of reheat cycles shall not exceed 2. The material shall be uniformly reheated to a temperature of not less than 190°C nor more than 218°C prior to use. Additional scrap tire CRM may be added to the reheated binder and reacted for a minimum of 45 minutes. The cumulative amount of additional scrap tire CRM shall not

exceed 10 percent of the total binder mass. Reheated asphalt-rubber binder shall conform to the provisions for asphalt-rubber binder.

**EQUIPMENT FOR PRODUCTION OF ASPHALT-RUBBER BINDER**

The Contractor shall utilize the following equipment for production of asphalt-rubber binder:

A. An asphalt heating tank equipped to heat and maintain the blended paving asphalt and asphalt modifier mixture at the necessary temperature before blending with the CRM. This unit shall be equipped with a thermostatic heat control device and a temperature reading device and shall be accurate to within ± 3°C and shall be of the recording type.
B. A mechanical mixer for the complete, homogeneous blending of paving asphalt, asphalt modifier, and CRM. Paving asphalt and asphalt modifier shall be introduced into the mixer through meters conforming to the provisions in Section 9-1.01, "Measurement of Quantities," of the Standard Specifications. The blending system shall be capable of varying the rate of delivery of paving asphalt and asphalt modifier proportionate with the delivery of CRM. During the proportioning and blending of the liquid ingredients, the temperature of paving asphalt and the asphalt modifier shall not vary more than ± 14°C. The paving asphalt feed, the asphalt modifier feed, and CRM feed shall be equipped with devices by which the rate of feed can be determined during the proportioning operation. Meters used for proportioning individual ingredients shall be equipped with rate-of-flow indicators to show the rates of delivery and resettable totalizers so that the total amounts of liquid ingredients introduced into the mixture can be determined. The liquid and dry ingredients shall be fed directly into the mixer at a uniform and controlled rate. The rate of feed to the mixer shall not exceed that which will permit complete mixing of the materials. Dead areas in the mixer, in which the material does not move or is not sufficiently agitated, shall be corrected by a reduction in the volume of material or by other adjustments. Mixing shall continue until a homogeneous mixture of uniformly distributed and properly blended asphalt-rubber binder of unchanging appearance and consistency is produced. The Contractor shall provide a safe sampling device capable of delivering a representative sample of the completed asphalt-rubber binder of sufficient size to permit the required tests.
C. An asphalt-rubber binder storage tank equipped with a heating system furnished with a temperature reading device to maintain the proper temperature of the asphalt-rubber binder and an internal mixing unit capable of maintaining a homogeneous mixture of paving asphalt, asphalt modifier, and CRM.

The equipment shall be approved by the Engineer prior to use.

**AGGREGATE**

The aggregate for Type G rubberized asphalt concrete shall conform to the following grading and shall meet the quality provisions specified for Type A asphalt concrete in Section 39-2.02, "Aggregate," of the Standard Specifications, except as follows:

A. California Test 211, Los Angeles Rattler loss at 500 revolutions shall be 40 percent maximum.
B. California Test 205, Section D, definition of a crushed particle is revised as follows: "A particle having 2 or more fresh mechanically fractured faces shall be considered a crushed particle."
C. The swell and moisture vapor susceptibility requirements shall not apply.

The symbol "X" in the following table is the gradation which the Contractor proposes to furnish for the specific sieve.

Aggregate Grading Requirements
Percentage Passing
19-mm maximum

| Sieve Size | Limits of Proposed Gradation | Operating Range | Contract Compliance |
|---|---|---|---|
| 25-mm | — | 100 | 100 |
| 19-mm | — | 95-100 | 90-100 |
| 12.5-mm | 83-87 | X±5 | X±7 |
| 9.5-mm | 65-70 | X±5 | X±7 |
| 4.75-mm | 33-37 | X±5 | X±7 |
| 2.36-mm | 18-22 | X±4 | X±5 |
| 600-µm | 8-12 | X±4 | X±5 |
| 75-µm | — | 2-7 | 0-8 |

**PROPORTIONING, SPREADING AND COMPACTING**

When batch type asphalt concrete plants are used to produce Type G rubberized asphalt concrete, the asphalt-rubber binder and mineral aggregate shall be proportioned by mass.

When continuous mixing type asphalt concrete plants are used to produce Type G rubberized asphalt concrete, the asphalt-rubber binder shall be proportioned by an asphalt meter of the mass flow, Coriolis effect type. The meter shall have been Type-approved by the Division of Measurement Standards prior to the start of production. The meter shall be calibrated in conformance with the requirements in California Test 109. The meter shall be interfaced with the existing continuous mixing plant controller in use on the asphalt concrete plant.

Type G rubberized asphalt concrete shall be placed only when the atmospheric and pavement surface temperatures are 13°C or above.

When the atmospheric and pavement surface temperature is 18°C or higher, the following shall apply:

A. The temperature of the aggregate shall not be greater than 163°C at the time the asphalt-rubber binder is added to the aggregate.
B. Type G rubberized asphalt concrete shall be spread at a temperature of not less than 138°C or more than 163°C, measured in the mat directly behind the paving machine.
C. The first coverage of initial or breakdown compaction shall be performed when the temperature of the Type G rubberized asphalt concrete is not less than 135°C. Breakdown compaction shall be completed before the temperature of the Type G rubberized asphalt concrete drops below 121°C.

When the atmospheric or pavement surface temperature is below 18°C, the following shall apply:

A The temperature of the aggregate shall not be less than 149°C nor more than 163°C at the time the asphalt-rubber binder is added to the aggregate.
B. The Contractor shall cover the loads of Type G rubberized asphalt concrete with tarpaulins. The tarpaulins shall completely cover the exposed Type G rubberized asphalt concrete until the Type G rubberized asphalt concrete has been completely transferred into the asphalt concrete paver hopper or deposited on the roadbed.
C. Type G rubberized asphalt concrete shall be spread at a temperature of not less than 143°C nor more than 163°C, measured in the mat directly behind the paving machine.
D. The first coverage of initial or breakdown compaction shall be performed when the temperature of the Type G rubberized asphalt concrete is not less than 138°C. Breakdown compaction shall be completed before the temperature of the Type G rubberized asphalt concrete drops below 127°C.

Pneumatic tired rollers shall not be used to compact Type G rubberized asphalt concrete.

Alternative compacting equipment conforming to the provisions in Section 39-6.03, "Compacting," of the Standard Specifications shall be used to compact the Type G rubberized asphalt concrete.

Traffic shall not be allowed on the Type G rubberized asphalt concrete until final rolling operations have been completed and sand has been applied to the surface.

Sand shall be spread on the surface of Type G rubberized asphalt concrete at a rate of 0.5 kg/m$^2$ to 1.0 kg/m$^2$. The exact rate will be determined by the Engineer. When ordered by the Engineer excess sand shall be removed from the pavement surface by sweeping. Sand shall be free from clay or organic material. Sand shall conform to the fine aggregate grading provisions in Section 90-3.03, "Fine Aggregate Grading," of the Standard Specifications.

**MEASUREMENT AND PAYMENT**

Rubberized asphalt concrete (Type G) will be measured and paid for by the tonne in the same manner specified for asphalt concrete in Section 39-8, "Measurement and Payment," of the Standard Specifications.

Full compensation for furnishing and spreading sand on the rubberized asphalt concrete surface and for sweeping and removing excess sand from the pavement surface shall be considered as included in the contract price paid per tonne for rubberized asphalt concrete (Type G) and no separate payment will be made therefor.

## 10-1.41 CONCRETE PAVEMENT (WITH DOWELED TRANSVERSE WEAKENED PLANE JOINTS)

**GENERAL**

Portland cement concrete pavement shall conform to the provisions in Section 40, "Portland Cement Concrete Pavement," of the Standard Specifications and these special provisions.

Insert method for forming joints in pavement shall not be used.

**PREPAVING CONFERENCE**

Supervisory personnel of the Contractor and any subcontractor who are to be involved in the concrete paving work shall meet with the Engineer at a prepaving conference, at a mutually agreed time, to discuss methods of accomplishing all phases of the paving work.

The Contractor shall provide the facility for the prepaving conference. Attendance at the prepaving conference is mandatory for the Contractor's project superintendent, paving construction foreman, paving subcontractors, concrete plant operations personnel (including plant supervisors, manager, and operator) and paving operators. All conference attendees will sign an attendance sheet provided by the Engineer. Production and placement shall not begin nor proceed unless the above-mentioned personnel have attended the mandatory prepaving conference.

The above-mentioned personnel along with the Engineer's representatives shall attend a 4-hour training class on portland cement concrete and paving techniques as part of the prepaving conference. This training class time will be in addition to the regular conference time. The class shall be scheduled no more than 2 weeks prior to the placement of portland cement concrete pavement. The class shall be held during normal working hours. Selection of the instructor of the class shall be as agreed to by the Engineer and the Contractor.

**TEST STRIP**

At the beginning of paving operations, the Contractor shall construct an initial test strip of concrete pavement at least 200 meters, but not more than 300 meters, in length at the specified paving width. If the test strip conforms to specifications, it will become part of the project's paving surface and will be measured and paid for as concrete pavement and seal pavement joint. The Engineer will determine the specified paving width. The Contractor shall use the same equipment for the remainder of the paving operations. The Contractor shall not perform further paving until the test strip is evaluated in conformance with the provisions in Section 40-1.10, "Final Finishing," of the Standard Specifications regarding surface straight edge and profile requirements; for dowel and tie bar alignment verification; concrete quality; and pavement thickness. An additional test strip will be required when:

1. The Contractor proposes using different paving equipment including the batch plant, paver, dowel inserter, tie bar inserter, tining, or curing equipment, or
2. Any portion of a test strip fails to conform to the provisions in Section 40-1.10, "Final Finishing," of the Standard Specifications for straight edge and profile requirements without the use of grinding or other corrective method, or
3. The dowel tolerances are not met, or
4. The pavement thickness deficiency is greater than 15 mm, or
5. A change in concrete mix design has occurred.

The Contractor shall perform coring of the test strips, as directed by the Engineer, as part of the dowel or tie bar placement tolerance verification. A minimum of six dowel bars shall be cored for each test strip. After removal of cores, voids in concrete pavement shall be cleaned and filled with hydraulic cement grout conforming to the provisions in "Core Drilling for Dowel Placement Alignment Assurance Testing" of these special provisions.

Regardless of the placement method [load transfer assemblies (dowel baskets) or mechanical inserters] chosen by the Contractor, after the initial test strip is placed, operations shall be suspended until the Engineer has sufficient time to inspect dowel positioning to insure that proper alignment of dowels is being achieved. Dowel alignment tolerance allowance shall be in conformance to the requirements of these special provisions.

If mechanical inserters are to be used, the Contractor shall demonstrate that the insertion equipment will not leave surface irregularities such as depressions, dips, or high areas adjacent to the dowel insertion point.

Prior to placement of the test strip, the Contractor shall submit a written procedure to locate transverse weakened plane joints that will coincide with the center of the dowels being placed. This procedure shall take into account inadvertent covering of paint markings after applying curing compound, misalignment by transferring marking spots, and inadequate staking of joints.

The Contractor shall change methods or equipment and construct additional test strips until a test strip conforms to the provisions in Section 40-1.10, "Final Finishing," of the Standard Specifications, and dowel bar alignment verification, without grinding or other corrective work. Each additional test strip shall be limited to 200 meters in length.

If test strip fails to conform to the specifications, before grinding, test strip shall be removed at the Contractor's expense. Additional test strips shall be constructed until the Contractor can demonstrate that test strip will conform to the requirements of these specifications.

The Engineer may waive the initial test strip if the Contractor proposes to use a batch plant mixer and paving equipment with the same personnel that were satisfactorily used on a Department project within the preceding 12 months and the mixer has not been altered or moved. The personnel shall be individuals listed in the prepaving conference used on the preceding

Department project.

Materials resulting from the construction of all rejected test strips shall become the property of the Contractor and shall be removed and disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

## MATERIALS

### Concrete

The concrete for pavement shall contain a minimum of 400 kilograms of portland cement per cubic meter.

### Tie Bars

Tie bars shall be deformed reinforcing steel bars conforming to the requirements of ASTM Designation: A 615/A 615M, Grade 300 or 420, and shall be epoxy-coated in conformance with the provisions in Section 52-1.02B, "Epoxy-coated Reinforcement," of the Standard Specifications, except that references made to ASTM Designation D 3963 shall be deemed to mean ASTM Designation A 934 or A 775. Epoxy-coated tie bars shall not be bent after installation.

### Epoxy

If used, epoxy resin to bond tie bars to existing concrete shall conform to the provisions in Section 95-2.03, "Epoxy Resin Adhesive for Bonding New Concrete to Old Concrete," of the Standard Specifications.

### Dowels

Dowels shall be smooth, round, epoxy-coated steel conforming to the requirements of ASTM Designation: A 615/A 615M, Grade 300 or 420, the details shown on the plans and the provisions in Section 52-1.02B, "Epoxy-coated Reinforcement," of the Standard Specifications, except that references made to ASTM Designation D 3963/D 3963M shall be deemed to mean ASTM Designation A 934/A 934M.

Dowels shall be plain, smooth, round bars. Dowels shall be free from burrs or other deformations detrimental to free movement of the bars in the concrete.

### Bond Breaker

Dowels shall be lubricated with a bond breaker over the entire bar. A bond breaker application of petroleum paraffin based lubricant or white pigmented curing compound shall be used to coat the dowels completely prior to placement. Oil and asphalt based bond breakers shall not be used. Paraffin based lubricant shall be Dayton Superior DSC BB-Coat or Valvoline Tectyl 506 or an approved equal. Paraffin based lubricant shall be factory applied. White pigmented curing compound shall conform to the requirements of ASTM Designation: C309, Type 2, Class A, and shall contain 22 percent minimum nonvolatile vehicles consisting of at least 50 percent paraffin wax. Curing compound shall be applied in two separate applications. Each application of curing compound shall be applied at the approximate rate of one liter per 3.7 $m^2$.

### Load Transfer Assemblies (Dowel Basket)

Load transfer assemblies shall be manufactured with a minimum welded wire gage number of 3/0 (9.2 mm). Assemblies shall be either a U- or a A-frame. J-frame shapes shall not be used. Assemblies shall be fabricated in conformance with the requirements of ASTM Designation: A 82. Welding of assemblies shall conform to the requirements of AWS D1.1. A broken weld will be a cause for rejection of the assembly. Assemblies shall be epoxy coated in conformance with the requirements of ASTM Designation: A 884/A 884M.

Wire for staking pins shall conform to the requirements of ASTM Designation: A 82. Staking pins shall not be less than 7 mm wire diameter.

Concrete fasteners shall be driven fasteners (concrete nails) used specifically for fastening to hardened concrete conforming to the requirements of ASTM Designation: F1667. Shank diameter shall be a minimum of 4 mm with a minimum shank length of 64 mm. Clips shall be commercial quality manufactured for use with dowel assemblies.

Surface of staking pins, concrete fasteners and clips shall be either zinc electroplated or galvanized with a minimum coating thickness of 0.005 mm.

### Preformed Compression Joint Sealant

Preformed compression seals shall conform to the requirements of ASTM Designation: D 2628. All preformed compression seals shall have 5 or 6 cells. Lubricant adhesive used with preformed compression seals shall conform to the requirements of ASTM Designation D 2835. Compression seals along with lubricant adhesive shall be installed in

conformance with the manufacturer's recommendations. The manufacture's recommendations shall be submitted to the Engineer at the prepaving conference.

Each lot of compression seal and lubricant adhesive shall be accompanied by a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications, and shall be accompanied with storage instructions and precautionary instructions for use. The Contractor shall also submit the manufacturer's data sheet with installation instructions and recommended model or type of preformed compression seal for the joint size and depth as shown on the plans. The manufacturer's selected compression seal shall show evidence that the seal is being compressed at level between 20 and 50 percent at all times for the joint width and depth shown on the plans.

**Joint Filler Material**

Joint filler material shall be preformed expansion joint filler for concrete (bituminous type), conforming to the requirements of ASTM Designation: D 994.

**SUBMITTALS**

Samples of the following materials used in the work shall be submitted for the Engineer's approval, 10 days prior to installation or placement of the materials:

Dowel Bars
Bond Breaker
Tie Bars
Epoxy
Load Transfer Assemblies
Staking Pins
Concrete Nails and clips
Joint Sealant
Backer Rods
Joint Filler Material

**INSTALLING TIE BARS**

Tie bars shall be installed at longitudinal contact joints and longitudinal weakened plane joints as shown on the plans. In no case, shall any consecutive width of new portland cement concrete pavement tied together with tie bars exceed 15 meters. In no case shall tie bars be used at a joint where portland cement concrete and asphalt concrete pavements abut.

Tie bars shall be installed at longitudinal joints by one of the 3 following methods:

1. Drilling and bonding tie bars with epoxy shall conform to the details shown on the plans. The epoxy shall be a two-component, epoxy-resin, conforming to the requirements of ASTM Designation: C881, Type V. Grade 3 (Non-Sagging), and Class A. Epoxy shall be accompanied by a certificate of compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications. A copy of the manufacturer's recommended installation procedure shall be provided to the Engineer at least 7 days prior to the start of work or at the prepaving conference, which ever occurs first. The drilled holes shall be cleaned in conformance with the epoxy manufacturer's instructions and shall be dry at the time of placing the epoxy and tie bars. Immediately after inserting the tie bars into the epoxy, the tie bars shall be supported as necessary to prevent movement during the curing and shall remain undisturbed until the epoxy has cured a minimum time as specified by the manufacturer. Tie bars that are improperly bonded, as determined by the Engineer, will be rejected. If rejected, adjacent new holes shall be drilled, as directed by the Engineer, and new tie bars shall be placed and securely bonded to the concrete. All work necessary to correct improperly bonded tie bars shall be performed at the Contractor's expense.
2. By inserting the tie bars into the plastic slipformed concrete before finishing the concrete. Inserted tie bars shall have full contact between the bar and the concrete. When tie bars are inserted through the pavement surface, the concrete over the tie bars shall be reworked and refinished to such an extent that there is no evidence on the surface of the completed pavement that there has been any insertion performed. Any loose tie bars shall be replaced by drilling and grouting into place with epoxy as described in method 1 above at the Contractor's expense.
3. By using threaded dowel splice couplers fabricated from deformed bar reinforcement material, free of external welding or machining. Threaded dowel splice couplers shall be accompanied by a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications, and shall be accompanied with installation instructions. The Certificate of Compliance shall be provided to the Engineer at the prepaving conference. Installation of threaded dowel splice couplers shall conform to the

requirements of the manufacturer's recommendations.

**DOWEL PLACEMENT**

Dowels at transverse weakened plane joints and at transverse contact joints shall be placed as shown on the plans. Prior to placement of the dowels, the Contractor shall submit to the Engineer in writing, a daily procedure to identify the transverse weakened plane joint location relative to the middle of the dowel bars. This procedure shall be verified by either coring, or any other method that is approved by the Engineer. Sawcuts for transverse weakened plane joints that are not directly over the center of the dowel bar (tolerance ±25 mm) will be rejected and shall be corrected in conformance with "Core Drilling for Dowel Placement Alignment Assurance Testing" of these special provisions.

Dowels shall be placed by using load transfer assemblies (dowel baskets) or by mechanical insertion. Dowels shall be oriented parallel to the pavement lane centerline and surface of the pavement at mid slab depth. Dowel alignment shall be ±6 mm per 300 mm of dowel length in both horizontal and vertical planes.

When dowels are placed by mechanical insertion, the concrete over the tie bars shall be reworked and refinished to such an extent that there is no evidence on the surface of the completed pavement that there has been any insertion performed. When load transfer assemblies (dowel baskets) are used, they shall be securely anchored firmly to the base to hold all the dowel bars at the specified depth and alignment during concrete placement without displacement. For granular or non-stabilized bases, a minimum of 8 alternating, equally spaced, steel staking pins with a welded hook shall be used to anchor each 3.6 m assembly (4 per lower runner wire). Staking pins shall penetrate at least 300 mm into the granular base. For stabilized base such as cement treated base or lean concrete base, a minimum of 8 alternating, equally spaced, concrete fasteners with clips shall be used to anchor each 3.6 m assembly (4 per lower runner wire). At least 10 staking pins or concrete fasteners shall be used for assembly sections greater than 3.6 m and less than or equal to 4.9 mm. Temporary spacer wires connecting load transfer assemblies shall be cut or removed after the assemblies are anchored into position prior to concrete placement. Paving shall be suspended when approved assemblies are not in place at least 60 m in advance of the concrete placement operation. The Engineer may waive this requirement upon written request by the Contractor, in areas where access is restricted, or other construction limitations are encountered.

If load transfer assemblies are to be used, the Contractor shall submit working drawings in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. The Contractor shall submit the working drawings 14 days prior to installation or at the prepaving conference.

Approval of the initial placement of load transfer assemblies shall not constitute acceptance of the final position of the dowel bars.

**CORE DRILLING FOR DOWEL PLACEMENT ALIGNMENT ASSURANCE TESTING**

Coring, to confirm dowel placement, shall be provided by the Contractor throughout the project and, as directed by the Engineer. Immediately after coring, the concrete cores shall be identified by the Contractor with a location description and submitted to the Engineer for inspection. The holes shall be cored by methods that will not shatter or damage the concrete adjacent to the holes.

After removal of cores, core hole voids in concrete pavement shall be cleaned and filled with hydraulic cement grout conforming to ASTM Designation: C1107. At the Contractor's option, the grout shall be extended with clean pea gravel by an amount not exceeding that printed on the grout's packaging.

After placement of hydraulic cement grout, the material while still plastic shall be trowelled smooth to match the pavement surface. The backfill material shall not evidence any depressions or surplus material above the level surface of the pavement.

Water for core drilling operations shall be from a local domestic water supply. Water used for coring shall not contain more than 1000 parts per million of chlorides as Cl, nor more than 1300 parts per million of sulfates as $SO_4$, nor shall it contain any impurities in a sufficient amount to cause discoloration of the concrete or produce etching of the surface.

Water from core drilling operations shall not be permitted to fall on public traffic, to flow across shoulders or lanes occupied by public traffic, or to flow into gutters or other drainage facilities.

The Engineer will randomly check dowel positioning by coring or other methods. Each day's paving will be checked by the Engineer within 2 calendar days by performing one test for every 1670 square meters of doweled pavement or fraction thereof. One test shall consist of drilling 2 cores, one on each end of a dowel bar to expose both ends and allow measurement for proper alignment. If the dowel bars are located incorrectly or air voids exist surrounding the dowel bars, additional cores will be required to determine the severity. The Engineer will select the location for performing the test.

Dowel alignment shall conform to the specified tolerances. If at any time dowels are found to be installed improperly, the paving operations will be suspended and operations shall not begin until the Contractor has demonstrated to the Engineer that the problem which causes the improper dowel positioning has been corrected.

Joints containing dowels that do not conform to specifications will be rejected. The Contractor shall replace rejected joints by saw cutting on each side of the joint a minimum of 0.9-m, lifting out concrete to be removed, installing dowels,

placing concrete, and installing new joints. New dowel holes shall be drilled by the use of an automatic dowel-drilling rig for the dowels to be installed at the contact joint. Dowels shall be placed at the locations as shown on the plans for 2 new contact joints. No additional payment will be made for replacement of slabs and joints required due to joints (dowel placement) not conforming to the specified tolerances.

**PREFORMED COMPRESSION JOINT SEAL INSTALLATION**

The compression seal alternative joint detail for transverse and longitudinal joints, as shown on the plans, shall apply only to weakened plane joints. Weakened plane joints shall be constructed by the sawing method. Should grinding or grooving be required over or adjacent to any joint after the compression seal has been placed, the joint materials shall be completely removed and disposed of, and replaced at the Contractor's expense. Compression seal shall be recessed below the final finished surface as shown on the plans.

At the Contractor's option, transverse weakened plane joints shall be either Type DSC or Type SSC as shown on the plans. Longitudinal weakened plane joints shall be Type SSC only as shown on the plans.

Seven days after the concrete pavement placement and not more than 4 hours before placing preformed compression joint seals, the joint walls shall be cleaned by the dry sand blast method and other means as necessary to completely remove from the joint all objectionable material such as soil, asphalt, curing compound, paint and rust. After cleaning the joint, all traces of sand, dust and loose material shall be removed from and near the joint for a distance along the pavement surfaces of at least 50 mm on each side of the joint by the use of a vacuum device. Surface moisture shall be removed at the joints by means of compressed air or moderate hot compressed air or other means approved by the Engineer. Drying procedures that leave a residue or film on the joint wall shall not be used. Sandblasting equipment shall have a maximum nozzle diameter size of 6 ± 1 mm and a minimum pressure of 0.62-MPa.

**CONSTRUCTING TRANSVERSE CONTACT JOINTS**

A transverse (contact) construction joint shall be constructed at the end of each day's work or where concrete placement is interrupted for more than 30 minutes, to coincide with the next weakened plane joint location.

If sufficient concrete has not been mixed to form a slab to match the next weakened plane joint, when an interruption occurs, the excess concrete shall be removed and disposed of back to the last preceding joint. The cost of removing and disposing of any excess concrete shall be at the Contractor's expense. Any excess material shall be become the property of the Contractor and shall be properly disposed of.

A metal or wooden bulkhead (header) shall be used to form the joint. The bulkhead shall be designed to accommodate the installation of dowel bars.

**CONSTRUCTING LONGITUDINAL ISOLATION JOINTS**

Prior to placing concrete, joint filler material shall be placed as shown on the plans. The joint filler shall be secured to the face of the existing pavement joint face by a method that will hold the joint filler in place during placement of concrete.

Sealant for longitudinal isolation joint shall be compression seal and placed in accordance with the requirements for liquid joint sealant installation as specified above, except references to backer rods shall not apply.

**MEASUREMENT AND PAYMENT**

Sealing longitudinal and transverse weakened plane joints, and longitudinal isolation joints in portland cement concrete pavement will be measured by the meter.

The contract price paid per meter for seal pavement joint shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in sealing pavement joints complete in place, including sawing, cleaning and preparing the joints in the concrete pavement, furnishing and installing compression seals, repairing and patching spalled or raveled sawed joints, and replacing or repairing rejected joints, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract price paid per meter for seal longitudinal isolation joint shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in sealing longitudinal isolation joints complete in place, including sawing, cleaning and preparing the joints in the concrete pavement, furnishing and installing joint filler material, repairing and patching spalled or raveled sawed joints, and replacing or repairing rejected joints, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for furnishing and placing epoxy-coated tie bars and lubricated epoxy- coated dowels with epoxy–coated dowel assemblies with fasteners or staking pins in portland cement concrete pavement shall be considered as included in the contract price paid per cubic meter for concrete pavement and no separate payment will be made therefor.

Full compensation for drilling holes and bonding tie bars with epoxy resin shall be considered as included in the contract price paid per cubic meter for concrete pavement and no additional compensation will be allowed therefor.

Full compensation for constructing test strips and coring the test strip shall be considered as included in the contract price paid per cubic meter for concrete pavement and no additional compensation will be allowed therefor.

Full compensation for providing the prepaving conference facility and the required Contractor personnel at the conference, and for doing all the work involved in arranging for the prepaving conference (except for the costs involved in providing an instructor for the training class) shall be considered as included in the contract price paid per cubic meter for concrete pavement and no additional compensation will be allowed therefor.

The costs involved in providing an instructor at the 4-hour training class as part of the prepaving conference will be paid for as extra work in conformance with the provisions in Section 4-1.03D, "Extra Work," of the Standard Specifications except that if payment is made by force account as provided in Section 9-1.03, "Force Account Payment," of the Standard Specifications, no markups will be added to the costs involved.

Full compensation for core drilling and backfilling with hydraulic cement grout shall be shall be included in the contract price per cubic meter for concrete pavement and no additional compensation will be allowed therefor.

If the cores show that the dowels are within alignment tolerances and the Engineer orders more dowel coring than the one test for every 1670 square meters of doweled pavement, the additional cores will be paid for as extra work in conformance with the provisions in Section 4-1.03D, "Extra Work," of the Standard Specifications.

If the cores show the dowels are out of alignment and the Engineer orders more dowel coring, the additional drilling for the cores shall be included in the contract price per cubic meter for concrete pavement and no additional compensation will be allowed therefor.

## 10-1.42 REPLACE CONCRETE PAVEMENT (RAPID STRENGTH CONCRETE)

Replace concrete pavement (Rapid Strength Concrete) shall consist of removing existing portland cement concrete pavement and underlying cement treated base and constructing rapid strength concrete (RSC) pavement as shown on the plans and in conformance with Section 40, "Portland Cement Concrete Pavement," of the Standard Specifications and these special provisions.

### DEFINITIONS

The following definitions shall apply to this section:

A. EARLY AGE. – A time less than 10 times the final set time of the concrete.
B. FINAL SET TIME. – The elapsed time after initial contact of cement and water, or accelerator, if used, at which a specific penetration resistance of 27.6 MPa is achieved in conformance with the requirements in ASTM Designation: C 403.
C. OPENING AGE. – The age at which the concrete will achieve the specified strength for opening to public or Contractor traffic.

### PRE-OPERATION CONFERENCE

The Contractor and subcontractors involved in construction operations of RSC shall meet with the Engineer at a pre-operation conference, at a mutually agreed time, to discuss methods of accomplishing all phases of the construction operation, contingency planning, and standards of workmanship for the completed item of work.

The Contractor shall provide the facility for the pre-operation conference. The Contractor's superintendent, foremen, subcontractors, field staff, plant personnel including plant supervisors, manager, and operator involved with RSC shall attend the pre-operation conference. The Contractor shall submit a list of participants to the Engineer for approval. The complete listing shall identify each participant's name, employer, title and role in construction of RSC. The pre-operation conference shall be held for no less than 2 hours. Construction operations of RSC shall not begin until the specified personnel have completed the mandatory pre-operation conference.

### TRIAL SLAB

Prior to beginning work on replacement concrete pavement (RSC), the Contractor shall successfully complete one or more trial slabs for each RSC mix design to be used in constructing RSC pavement. Trial slabs shall be constructed, finished, cured and tested with the materials, tools, equipment, personnel and methods to be used in completing RSC pavement. Trial slabs shall demonstrate that the Contractor is capable of producing RSC pavement in conformance with the provisions in this section, within anticipated time periods including delivery, placement, finishing and curing times, and under similar atmospheric and temperature conditions expected during replacement operations. Multiple trial slabs for each RSC mix design may be required to envelop variable atmospheric and temperature conditions.

The minimum trial slab dimensions shall be 3 m by 6 m and shall be 225 mm thick where planned replacement pavement nominal thickness is less than 255 mm. The trial slab thickness shall be 260 mm where planned replacement

pavement nominal thickness is 255 mm or greater. Where there are planned slab replacements with greater and less than 255 mm thickness then two trial slabs shall be required one at 225 mm thick and one at 260 mm thick. Trial slabs shall be placed near the project site at a location mutually acceptable to the Engineer and the Contractor except slabs shall not be placed on the roadway or within the project limits.

During trial slab construction and within 20 minutes of RSC delivery, beams shall be fabricated in conformance with the requirements in California Test 523. Beams shall be used to determine early age and 7-day modulus of rupture values. Beams fabricated for early age testing shall be cured so that the monitored temperature in the beams and the trial slab are within 3°C at all times. Internal temperatures of trial slab and early age beams shall be monitored and recorded at minimum time intervals of 5 minutes by installing thermocouples and or thermistors connected to strip-chart recorders or digital data loggers. Temperature recording devices shall be accurate to within ±1ºC. Internal temperature readings shall be measured at 25 mm from the top and 25 mm from the bottom, no closer than 75 mm from any edge of the concrete elements, until early age testing is completed. Beams fabricated for 7-day testing shall be cured in conformance with California Test 523 except they shall be placed into sand at between 5 and 10 times final set time or 24 hours, whichever is earlier. Trial slabs 225 mm thick shall have an early age modulus of rupture of not less than 2.8 MPa and a 7-day modulus of rupture of not less than 4.2 MPa. Trial slabs 260 mm thick shall have an early age modulus of rupture of not less than 2.3 MPa and a 7-day modulus of rupture of not less than 4.2 MPa. Beams failing early age or 7-day modulus of rupture requirements shall be cause for rejection of the trial slab.

Materials resulting from construction of trial slabs and test specimens shall become the property of the Contractor and shall be removed and disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

**REMOVING EXISTING PAVEMENT AND BASE MATERIALS**

Exact limits of concrete pavement to be replaced will be determined by the Engineer.

Existing concrete pavement and underlying base material shall be removed and replaced with base material and RSC pavement within the same work period. In the event existing pavement or base materials are removed and the Contractor is unable to construct, finish, and cure RSC pavement prior to the specified traffic opening time, a temporary roadway structural section shall be constructed.

The outline of concrete pavement to be removed shall be sawed full depth with a power-driven saw except where the pavement is located adjacent to an asphalt concrete shoulder. Saw cuts within concrete pavement slabs shall be cut no more than 2 days prior to concrete pavement slab removal. Saw cuts made in work shifts prior to the actual removal work shift shall not be made parallel or diagonal to the traveled way and shall be cut so that traffic will not dislodge any pieces or segments.

Concrete pavement shall be removed by non-impacting methods. Each pavement panel shall be removed in one or more pieces without disturbance or damage to the underlying base.

Equipment used to remove concrete pavement within the sawed outline, shall not impact the surface of the concrete to be removed within 0.5-m of pavement to remain in place. Pavement and base removal shall be performed without damage to pavement or base to remain in place. Damage to pavement or base to remain in place, shall be repaired or removed and replaced. Repair, or removal and replacement of the damaged pavement and base shall be at the Contractor’s expense and will not be measured nor paid for.

Removed materials shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

The material remaining in place, after removing pavement and base to the required depth, shall be graded to a uniform plane, moisture conditioned, and compacted by methods that will produce a firm and stable base. The finished surface of the remaining material shall not extend above the grade established by the Engineer. Areas that are low as a result of over excavation during base removal shall be filled, at the Contractor's expense, with base replacement material at the time and in the same operation that the base replacement layer is placed.

**TEMPORARY ROADWAY STRUCTURAL SECTION**

Asphalt concrete and aggregate base, equal to the quantity of pavement removed during the work shift, shall be provided on site for construction of a temporary roadway structural section where existing pavement is to be replaced. The quantity and location of standby material shall be included in the Contractor's contingency plan in conformance with the requirements of these special provisions. Temporary roadway structural section shall be maintained and later removed as the first order of work when replace concrete pavement (Rapid Strength Concrete) operations resume. The temporary roadway structural section shall consist of 90-mm thick asphalt concrete over aggregate base. RSC not conforming to these special provisions for RSC may be used for temporary roadway structural section with the Engineer's approval.

Aggregate base for temporary roadway structural section shall be produced from commercial quality aggregates consisting of broken stone, crushed gravel, natural rough-surfaced gravel, reclaimed concrete and sand, or any combination

thereof. Grading of aggregate base shall conform to the 19-mm maximum grading specified in Section 26-1.02A, "Class 2 Aggregate Base," of the Standard Specifications.

Asphalt concrete for temporary roadway structural section shall be produced from commercial quality aggregates and asphalt binder. Grading of aggregate shall conform to the 19-mm maximum, medium grading in Section 39-2.02, "Aggregate," of the Standard Specifications and asphalt binder shall conform to requirements for liquid asphalt SC-800 in Section 93, "Liquid Asphalts," of the Standard Specifications. Amount of asphalt binder to be mixed with the aggregate shall be approximately 0.3 percent less than the optimum bitumen content determined in conformance with the requirements in California Test 367.

Aggregate base and asphalt concrete for the temporary roadway structural section shall be spread and compacted by methods that will produce a well-compacted, uniform base, with a surface of uniform smoothness, texture and density. Surfaces shall be free from pockets of coarse or fine material. Aggregate base may be spread and compacted in one layer. Asphalt concrete may be spread and compacted in one layer. Finished surface of asphalt concrete shall not vary more than 15 mm from the lower edge of a 3.6-m ±0.06 m long straightedge placed parallel with the centerline and shall match the elevation of existing concrete pavement along the joints between the existing pavement and temporary surfacing.

Removed temporary roadway structural section materials shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications, except that removed aggregate base may be stockpiled at the project site and reused for construction of temporary roadway structural sections. When no longer required, standby material or stockpiled material for construction of temporary roadway structural sections shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

**RAPID STRENGTH CONCRETE**

**General**

Rapid Strength Concrete (RSC) shall be a concrete made with hydraulic cement that develops opening age and 7-day specified modulus of rupture strengths.

Requirements of Sections 40-1.015, "Cement Content," 40-1.05, "Proportioning," and 90-1.01, "Description," of the Standard Specifications shall not apply.

Combined aggregate grading used in RSC shall be either the 37.5-mm, maximum grading, or 25-mm, maximum grading, at the option of the Contractor.

Cement for RSC shall be hydraulic cement as defined in ASTM Designation: C 219 and shall conform to the following requirements:

| Test Description | Test Method | Requirement |
|---|---|---|
| Contraction in Air | California Test 527,W/C Ratio = 0.39 ± 0.010 | 0.053 %, max. |
| Mortar Expansion in Water | ASTM Designation: C 1038 | 0.04 %, max. |
| Soluble Chloride* | California Test 422 | 0.05 %, max. |
| Soluble Sulfates* | California Test 417 | 0.30 %, max. |
| Thermal Stability | California Test 553 | 60 %, min. |
| Compressive Strength @ 3 days | ASTM Designation: C 109 | 17 MPa |

*Test is to be done on a cube specimen, fabricated in conformance with the requirements in ASTM Designation: C 109, cured at least 14 days and then pulverized to 100% passing the 300-µm sieve

At least 45 days prior to intended use, the Contractor shall furnish a sample of cement from each lot proposed for use and all admixtures proposed for use in the quantities ordered by the Engineer.

The Contractor shall submit uniformity reports for cement used in RSC to the Engineer. Uniformity reports shall conform to the requirements in ASTM Designation: C 917, except that testing age and water content may be modified to suit the particular material. Uniformity reports shall be submitted at least every 30 days during RSC pavement operations.

Type C accelerating chemical admixtures conforming to the provisions in Section 90-4, "Admixtures," of the Standard Specifications may be used. In addition to the admixtures listed on the Department's current list of approved admixtures, citric acid or borax may be used if requested in writing by the cement manufacturer and a sample is submitted to the Engineer. Chemical admixtures, if used, shall be included in the testing for requirements listed in the table above.

At least 10 days prior to use in the trial slab, the Contractor shall submit a mix design for RSC that shall include the following:

A. Opening age
B. Proposed aggregate gradings
C. Mix proportions of hydraulic cement and aggregate

D. Types and amounts of chemical admixtures
E. Maximum time allowed between batching RSC and placing roadway pavement
F. Range of ambient temperatures over which the mix design is effective (10˚C maximum range)
G. Final set time of the concrete
H. Any special instructions or conditions, including but not limited to, water temperature requirements when appropriate

The Contractor shall submit more than one mix design to plan for ambient temperature variations anticipated during placement of the roadway pavement. Each mix shall be designed for a maximum ambient temperature range of 10°C. The Contractor shall develop and furnish modulus of rupture development data for each proposed mix design. Modulus of rupture development data for up to 7 days shall be provided to the Engineer prior to beginning paving operations. Modulus of rupture development data may be developed from laboratory prepared samples. The testing ages for modulus of rupture development data shall include one hour before opening age, opening age, one hour after opening age, 24 hours, 7 days and 28 days.

Concrete pavement penetration requirements in Section 90-6.06, "Amount of Water and Penetration," of the Standard Specifications shall not apply to RSC.

RSC pavement shall develop a minimum modulus of rupture of as specified in "Pay Factor Adjustment for Low Modulus of Rupture" of these special provisions before opening to public or Contractor traffic. In addition, RSC pavement shall develop a minimum modulus of rupture of 4.2 MPa in 7 days after placement. RSC pavement that attains a modulus of rupture of less than specified may be accepted in conformance with "Pay Factor Adjustment for Low Modulus of Rupture" specified herein. Modulus of rupture shall be determined by averaging results from 3 beam specimens tested in conformance with the requirements in California Test 523. Beam specimens may be fabricated using an internal vibrator in conformance with the requirements in ASTM Designation: C 31. No single test shall represent more than the production of that day or 100 cubic meters, whichever is less.

Modulus of rupture at early age may be estimated using the correlation established during trial slab placement or by using results from beam specimens cured under atmospheric conditions and at a temperature within 3°C of the pavement. Modulus of rupture at other ages will be determined using beams cured and tested in conformance with California Test 523 except beams will be placed into sand between 5 and 10 times final set time or 24 hours, whichever is earlier. The Engineer will perform the testing to determine modulus of rupture values of the RSC pavement. The modulus of rupture, as determined above, will be the basis for accepting or rejecting the RSC pavement for modulus of rupture requirements.

**Pay Factor Adjustment for Low Modulus of Rupture**

Where planned replacement pavement nominal thickness is less than 255 mm, payment for replace concrete pavement (Rapid Strength Concrete) will be adjusted for low modulus of rupture tests as follows:

A. Replace concrete pavement (Rapid Strength Concrete) with modulus of rupture of 2.8 MPa or greater before the lane is opened to the traffic and 7-day modulus of rupture of 4.2 MPa or greater will be paid for at the contract price per cubic meter for replace concrete pavement (Rapid Strength Concrete).
B. Replace concrete pavement (Rapid Strength Concrete) with a 7-day modulus of rupture of less than 3.4 MPa will not be paid for, and shall be removed and replaced, at the Contractor's expense with replace concrete pavement (Rapid Strength Concrete) conforming to the requirements of these special provisions.
C. Replace concrete pavement (Rapid Strength Concrete) with modulus of rupture of 2.4 MPa or greater before the lane is opened to traffic and a 7-day modulus of rupture of equal to or greater than 3.4 MPa will be paid for at a percentage of the contract price per cubic meter for replace concrete pavement (Rapid Strength Concrete) in conformance with the percentages in the pay table below.
D. Replace concrete pavement (Rapid Strength Concrete) with modulus of rupture of less than 2.4 MPa when the lane is opened to traffic will be rejected and shall be removed and replaced at the Contractor's expense with replace concrete pavement (Rapid Strength Concrete) conforming to the requirements of these special provisions.

Percentage Pay Table

| Modulus of Rupture (MPa) at opening to traffic | 7-Day Modulus of Rupture (MPa) | | |
|---|---|---|---|
| | Greater than or equal to 4.2 | Less than 4.2 and greater than or equal to 3.8 | Less than 3.8 and greater than or equal to 3.4 |
| Greater than or equal to 2.8 | 100% | 95% | 90% |
| Less than 2.8 and greater than or equal to 2.4 | 95% | 95% | 90% |
| Less than 2.4 | zero | zero | zero |

The Contractor shall pay to the State adjustments in payment for low modulus of rupture tests in conformance with the requirements specified in the tables in this section. The Department will deduct the amount of the adjustments from moneys due or that may become due, the Contractor under the contract.

**Proportioning**

Weighing, measuring and metering devices used for proportioning materials shall conform to the provisions in Section 9-1.01, "Measurement of Quantities," of the Standard Specifications and these special provisions.

Over and under dials, and other indicators for weighing and measuring systems used in proportioning materials shall be grouped so that the smallest increment for each indicator can be accurately read from the point at which the proportioning operation is controlled for ingredients batched at a central batch plant. In addition, indicators for weighing and measuring cement batched from a remote weighing system shall also be placed so that each indicator can be accurately read from the point at which the proportioning operation is controlled

Aggregates shall be handled and stored in conformance with the provisions in Section 90-5.01, "Storage of Aggregates," of the Standard Specifications. Liquid admixtures shall be proportioned in conformance with the provisions in Section 90-4.10, "Proportioning and Dispensing Liquid Admixtures," of the Standard Specifications. Mineral admixtures shall be protected from exposure to moisture until used. Adequate facilities shall be provided to assure that mineral admixtures meeting the specified requirements are kept separate from other mineral admixtures to easily track the materials that are entering the work. Safe and suitable facilities for sampling mineral admixtures shall be provided at the weigh hopper or in the feed line immediately in advance of the hopper.

Weighing equipment shall be insulated against vibration or movement of other operating equipment. When the plant is in operation, the mass of each draft of material shall not vary from the designated mass by more than the tolerances specified herein. Each scale graduation shall be 0.001 of the usable scale capacity.

Aggregate shall be weighed cumulatively and equipment for the weighing of aggregate shall have a zero tolerance of ±0.5 percent of the designated total batch mass of the aggregate. Equipment for the separate weighing of the cement or mineral admixture shall have a zero tolerance of ±0.5 percent of their designated individual batch drafts. Equipment for measuring water shall have a zero tolerance of ±0.5 percent of its designated mass or volume.

The mass indicated for any individual batch of material shall not vary from the preselected scale setting by more than the following:

| Material | Tolerance |
|---|---|
| Aggregate | ± 1.0 percent of designated batch mass |
| Cement | ± 0.5 percent of designated batch mass |
| Mineral Admixture | ± 1.0 percent of designated batch mass |
| Water | ± 1.5 percent of designated batch mass or volume |

Proportioning shall consist of dividing the aggregates into the specified sizes, each stored in a separate bin, and combining them with cement, mineral admixture and water as provided in these special provisions. Dry ingredients shall be proportioned by mass. Liquid ingredients shall be proportioned by mass or volume.

At the time of batching, aggregates shall have been dried or drained sufficiently to result in stable moisture content, so that no visible separation of water from aggregate will take place during the proportioning process. In no event shall the free moisture content of the fine aggregate at the time of batching exceed 8 percent of its saturated, surface-dry mass.

If separate supplies of aggregate material of the same size group with different moisture content or specific gravity or surface characteristics affecting workability are available at the proportioning plant, withdrawals shall be made from one supply exclusively and the materials therein completely exhausted before starting upon another supply.

Cement shall be kept separate from the aggregates until released for discharge into the mixer. Cement shall be free of lumps and clods when discharged into the mixer. Fabric containers used for transportation or proportioning of cement shall be clean and free of residue before reuse.

Weigh systems for proportioning aggregate, cement, and mineral admixture shall be individual and distinct from all other weigh systems. Each weigh system shall be equipped with a hopper, a lever system, and an indicator to constitute an individual and distinct material-weighing device.

For batches with a volume of one cubic meter or more, proportioning equipment shall conform to one of the following methods:

A. All ingredients shall be batched at a central batch plant and charged into a mixer truck for transportation to the pour site. Ingredient proportioning shall meet the requirements of Section 90-5, "Proportioning," of the Standard Specifications.
B. All ingredients except the cement shall be batched at a central batch plant and charged into a mixer truck for transportation to a remote located silo and weigh system for the proportioning of the cement. The remote system shall proportion cement for charging the mixer truck.
C. All ingredients except the cement shall be batched at a central batch plant and charged into a mixer truck for transportation to a remote location where pre-weighed, containerized cement shall be added to the mixer truck. The cement pre-weighing operation shall utilize a platform scale. The platform scale shall have a maximum capacity of 2.5 tonnes with a maximum graduation size of 0.5 kilograms. Cement shall be pre-weighed into a fabric container. The minimum amount of cement to be proportioned into any single container shall be one half of the total amount required for the load of RSC being produced.
D. Cement, water, and aggregate shall be proportioned volumetrically in conformance with these special provisions.

In order to check the accuracy of batch masses, the gross mass and tare mass of truck mixers shall be determined when ordered by the Engineer. The equipment shall be weighed at the Contractor's expense on scales designated by the Engineer.

The Contractor shall install and maintain in operating condition an electrically actuated moisture meter. The meter shall indicate, on a readily visible scale, changes in the moisture content of the fine aggregate as it is batched. The meter shall have a sensitivity of 0.5 percent by mass of the fine aggregate.

No additional mixing water shall be incorporated into the concrete during hauling or after arrival at the delivery point, unless authorized by the Engineer. If the Engineer authorizes additional water to be incorporated into the concrete, the drum shall be revolved not less than 30 revolutions at mixing speed after the water is added and before discharge is commenced. Water added to the truck mixer at the job site shall be measured through a meter that conforms to the provisions in Section 9-1.01, "Measurement of Quantities," of the Standard Specifications.

Aggregate discharged from several bins shall be controlled by gates or by mechanical conveyors. The means of discharge from the bins and from the weigh hopper shall be interlocked so that no more than one bin can discharge at a time, and so that the weigh hopper can not be discharged until the required quantity from each of the bins has been deposited in the weigh hopper.

**Weighmaster Certificates**

Weighmaster certificates for RSC, regardless of the proportioning method used, shall include all information necessary to trace the manufacturer, and manufacturer's lot number for the cement being used. When proportioned into fabric containers the weighmaster certificates for the cement shall contain date of proportioning, location of proportioning and actual net draft mass of the cement. When proportioned at the pour site from a storage silo the weighmaster certificates shall contain date of proportioning, location of proportioning and the net draft mass of the cement used in the load.

**Volumetric Proportioning**

When RSC is proportioned by volume, the method shall conform to requirements specified herein.

Aggregates shall be handled and stored in conformance with the provisions in Section 90-5.01, "Storage of Aggregates," of the Standard Specifications. Liquid admixtures shall be proportioned in conformance with the provisions in Section 90-4.10, "Proportioning and Dispensing Liquid Admixtures," of the Standard Specifications. Mineral admixtures shall be protected from exposure to moisture until used. Adequate facilities shall be provided to assure that mineral admixtures meeting the specified requirements are kept separate from other mineral admixtures in order to prevent any but the specified mineral admixtures from entering the work. Safe and suitable facilities for sampling mineral admixtures shall be provided at the batch-mixer storage hopper or in the feed line.

Batch-mixer trucks shall be equipped to proportion cement, water, aggregate and additives by volume. Aggregate feeders shall be connected directly to the drive on the cement vane feeder. The cement feed rate shall be tied directly to the feed rate for the aggregate and other ingredients. Any change in the ratio of cement to aggregate shall be accomplished by changing the gate opening for the aggregate feed. The drive shaft of the aggregate feeder shall be equipped with a revolution counter reading to the nearest full or partial revolution of the aggregate delivery belt.

Aggregate shall be proportioned using a belt feeder operated with an adjustable cutoff gate delineated to the nearest quarter increment. Height of the gate opening shall be readily determinable. Cement shall be proportioned by a method that

conforms to the accuracy requirements of these special provisions. Water shall be proportioned by a meter conforming to the provisions in Section 9-1.01, "Measurement and Payment," of the Standard Specifications and these special provisions.

Delivery rate of aggregate and cement per revolution of the aggregate feeder shall be calibrated at appropriate gate settings for each batch-mixer truck used on the project and for each aggregate source. Batch-mixer trucks shall be calibrated at 3 different aggregate gate settings that are commensurate with production needs. Two or more calibration runs shall be required at each of the different aggregate gate openings. The actual mass of material delivered for aggregate proportioning device calibrations shall be determined by a platform scale as specified in these special provisions.

Aggregate belt feeder shall deliver aggregate to the mixer with volumetric consistency so that deviation for any individual aggregate delivery rate check-run shall not exceed 1.0 percent of the mathematical average of all runs for the same gate opening and aggregate type. Each test run shall be at least 500 kg. Fine aggregate used for calibration shall not be reused for device calibration.

At the time of batching, aggregates shall be dried or drained sufficiently to result in stable moisture content, so that no visible separation of water from aggregate takes place during the proportioning process. In no event shall the free moisture content of the fine aggregate at the time of batching exceed 8 percent of its saturated, surface-dry mass.

If separate supplies of aggregate material of the same size group with different moisture content or specific gravity or surface characteristics affecting workability are available at the proportioning plant, withdrawals shall be made from one supply exclusively and the materials therein completely exhausted before starting another supply.

Rotating and reciprocating equipment on batch-mixer trucks shall be covered with metal guards.

The cement proportioning system shall deliver cement to the mixer with a volumetric consistency so that the deviation for any individual delivery rate check-run shall not exceed 1.0 percent of the mathematical average of 3 runs of at least 500 kg each. Cement used for calibration shall not be reused for device calibration.

Water meter accuracy shall be such that, when operating between 50 percent and 100 percent of production capacity, the difference between the indicated mass of water delivered and the actual mass delivered shall not exceed 1.5 percent of the actual mass for each of two individual runs of 1200 liters. The water meter shall be calibrated in conformance with the requirements of California Test 109 and shall be equipped with a resettable totalizer and display the operating rate.

Calibration tests for aggregate, cement and water proportioning devices shall be conducted with a platform scale located at the calibration site. Weighing of test run calibration material shall be performed on a platform scale having a maximum capacity not exceeding 2.5 tonnes with maximum graduations of 0.5-kg. The platform scale shall be error tested within 8 hours of calibration of batch-mixer truck proportioning devices. Error testing shall be performed with test masses conforming to California Test 109 and shall produce a witness scale that is within 2 graduations of the test mass load. The scale shall be available for use at the production site throughout the production period. Equipment needed for the calibration of proportioning systems shall remain available at the production site throughout the production period. A Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," shall be furnished with each delivery of aggregate, cement, and admixtures used for calibration tests and shall be submitted to the Engineer with a certified copies of the mass of each delivery. The Certificate of Compliance shall state that the source of materials used for the calibration tests is from the same source as to be used for the planned work. The Certificate of Compliance shall state that the material supplied conforms to the Standard Specifications and these Special Provisions and shall be signed by an authorized representative who shall have the authority to represent and act for the Contractor.

The batch-mixer truck shall be equipped so that an accuracy check can be made prior to the first operation for the project and at any other time as directed by the Engineer. Further calibration of proportioning devices shall be required every 30 days after production begins or when the source or type of any ingredient is changed. A spot calibration shall consist of calibration of the cement proportioning system only. A two run spot re-calibration of the cement proportioning system shall be performed each time 50 tonnes of cement has passed through the batch-mixer truck. Should the spot re-calibration of the cement proportioning system fall outside the limitations specified herein, a full calibration of the cement proportioning system shall be completed before the resumption of production.

Liquid admixtures shall be proportioned by a meter.

Cement storage shall be located immediately before the cement feeder and shall be equipped with a device that will automatically shut down the power to the cement feeder and aggregate belt feeder when the cement storage level is lowered to a point where less than 20 percent of the total volume is left in storage.

The Contractor shall furnish aggregate moisture determinations, made in conformance with the requirements of California Test 223, at least every 2 hours during proportioning and mixing operations. Moisture determinations shall be recorded and presented to the Engineer at the end of the production shift.

Each aggregate bin shall be equipped with a device that will automatically shut down the power to the cement feeder and the aggregate belt feeder when the aggregate discharge rate is less than 95 percent of the scheduled discharge rate of any bin.

Indicators specified herein shall be in working order prior to commencing proportioning and mixing operations and shall be visible when standing near the batch-mixer truck.

Identifying numbers of batch-mixer trucks shall be at least 75 mm in height, and be located on the front and rear of the vehicles.

Volumetric proportioned RSC shall be mixed in a mechanically operated mixer of adequate size and power for the type of RSC to be placed. Mixers may be of the auger type and shall be operated uniformly at the mixing speed recommended by the manufacturer. Mixers that have an accumulation of hard concrete or mortar shall be removed from service until cleaned. Other types of mixers may be used provided mixing quality will meet the requirements of these special provisions.

Charge or rate of feed to the mixer shall not exceed that which will permit complete mixing of the materials. Dead areas in the mixer, where material does not move or is not sufficiently agitated, shall be corrected by a reduction in the volume of material or by other adjustments. The mixer shall be designed to provide sufficient mixing action and movement to produce properly mixed RSC. Mixing shall continue until a homogeneous mixture is produced at discharge from the mixer. There shall be no lumps or evidence of non-dispersed cement at discharge from the mixer. No water shall be added to the RSC after discharge from the mixer.

Equipment having components made of aluminum or magnesium alloys, which may have contact with plastic concrete during mixing or transporting of RSC, shall not be used.

Uniformity of concrete mixtures will be determined by differences in penetration measurement made in conformance with the requirements in California Test 533. Difference in penetration, determined by comparing penetration tests on 2 samples of mixed concrete from the same batch or truck mixer load, shall not exceed 15 mm. The Contractor shall furnish samples of freshly mixed concrete and provide facilities for obtaining the samples. Sampling facilities shall be safe, accessible, clean and produce a sample which is representative of production. Sample devices and sampling methods shall also conform to the requirements of California Test 125.

Ice shall not be used to cool RSC directly. When ice is used to cool water used in the mix, all of the ice shall be melted before entering the mixer.

Cement shall be proportioned and charged into the mixer by means that will result in no losses of cement due to wind, or due to accumulation on equipment, or other conditions which will vary the required quantity of cement.

Each mixer shall have a metal plate or plates, prominently attached, on which the following information is provided:

A. Uses for which the equipment is designed.
B. Manufacturer's guaranteed capacity of the mixer in terms of the volume of mixed concrete.
C. Speed of rotation of the mixer.

Consistency and workability of mixed concrete when discharged at the delivery point shall be suitable for placement and consolidation.

Information generated by volumetric devices will not be used for payment calculations.

The device that controls the proportioning of cement, aggregate and water shall produce a log of production data. The log of production data shall consist of a series of snapshots captured at 15-minute intervals throughout the period of daily production. Each snapshot of production data shall be a register of production activity at that time and not a summation of the data over the preceding 15 minutes. The amount of material represented by each snapshot shall be the amount produced in the period of time from 7.5 minutes before to 7.5 minutes after the capture time. The daily log shall be submitted to the Engineer, in electronic or printed media, at the end of each production shift or as requested by the Engineer, and shall include the following:

A. Mass of cement per revolution count.
B. Mass of each aggregate size per revolution count.
C. Gate openings for each aggregate size being used.
D. Mass of water added to the concrete per revolution count.
E. Moisture content of each aggregate size being used.
F. Individual volume of all other admixtures per revolution count.
G. Time of day.
H. Day of week.
I. Production start and stop times.
J. Batch-mixer truck identification.
K. Name of supplier.
L. Specific type, size, or designation of concrete being produced.
M. Source of the individual aggregate sizes being used.
N. Source, brand and type of cement being used.
O. Source, brand and type of individual admixtures being used.
P. Name and signature of operator.

Required report items may be input by hand into a pre-printed form or captured and printed by the proportioning device. Electronic media containing recorded production data shall be presented in a tab delimited format on a 90-mm diskette with a

capacity of at least 1.4 megabytes. Each snapshot of the continuous production shall be followed by a line-feed carriage-return with allowances for sufficient fields to satisfy the amount of data required by these specifications. The reported data shall be in the above order and shall include data titles at least once per report.

**Replacement Base Layer**

Base materials removed shall be replaced with replacement base layer. Replacement base layer shall consist of rapid strength concrete and shall be placed in a separate and distinct operation from that of replacing concrete pavement.

Replacement base layer shall be finished to the grade of the original base layer. The surface shall not be textured and shall be finished to a smooth surface, free of mortar ridges and other projections. The finished surface shall be free from voids and porous areas.

**Bond Breaker**

Bond breaker shall be placed between replacement pavement and existing lean concrete base, cement treated base or new base replacement layer. Bond breaker shall be one of the following:

A. Curing paper conforming to the requirements in ASTM Designation: C 171, white.
B. Polyethylene film conforming to the requirements in ASTM Designation: C 171, except that the minimum thickness shall be 0.15 mm, white opaque.
C. Paving asphalt, Grade AR-4000, conforming to the provisions in Section 92, "Asphalts," of the Standard Specifications.
D. Pigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 2, Class A, containing a minimum of 22 percent nonvolatile vehicles consisting of at least 50 percent paraffin wax.

When curing paper or polyethylene film is used, material shall be placed in a wrinkle free manner. Adjacent sheets shall be overlapped a minimum of 150 mm.

When curing compound or paving asphalt is used, all foreign and loose materials remaining from slab removal shall be removed prior to application.

When paving asphalt is used, no water shall be added before applying asphalt to the surface of the base. The paving asphalt shall be applied in one even application at a rate of 0.10 to 0.45-L/$m^2$ over the entire base surface area. Concrete pavement shall not be placed until the paving asphalt has cured.

When curing compound is used, the curing compound shall be applied in two separate applications. Each application shall be applied evenly at a rate of 0.3 to 0.5-L/$m^2$ over the entire base surface area.

**Spreading, Compacting and Shaping**

Metal or wood side forms may be used. Wood side forms shall not be less than 38-mm thick. Side forms shall be of sufficient rigidity, both in the form and in the connection with adjoining forms, that movement will not occur under the force from subgrading and paving equipment or from the pressure of concrete.

Side forms shall remain in place until the pavement edge no longer requires the protection of forms. Side forms shall be thoroughly cleaned and oiled prior to each use.

Consolidation of RSC shall be by means of high-frequency internal vibrators after the RSC is deposited on the subgrade. Vibrating shall be done in a manner to assure uniform consolidation adjacent to forms and across the full paving width. RSC shall be placed as nearly as possible in its final position and use of vibrators for extensive shifting of the mass of RSC will not be permitted.

RSC shall be spread and shaped by suitable powered finishing machines and supplemented by hand finishing as necessary. Methods of spreading, shaping and consolidating that result in segregation, voids or rock pockets shall be discontinued. The Contractor shall use methods that will produce dense homogeneous pavement conforming to the required cross section.

After the RSC has been mixed and placed, no additional water shall be added to the surface to facilitate finishing. Surface finishing additives, when used, shall be as recommended by the manufacturer of the cement and shall be approved by the Engineer prior to use.

**Joints**

Prior to placing concrete against existing concrete, a 6-mm thick commercial quality polyethylene flexible foam expansion joint filler shall be placed across the original transverse and longitudinal joint faces and extend the full depth of the excavation. The top of the joint filler shall be placed flush with the top of pavement. Joint filler shall be secured to the joint face of the existing pavement by a method that will hold the joint filler in place during the placement of concrete.

Transverse weakened plane joints in pavement widenings shall be constructed to match the spacing and skew of the

weakened plane joints in the adjacent existing pavement. Where the existing transverse weakened plane joint spacing in an adjacent lane exceeds 4.6 m, an additional transverse weakened plane joint shall be constructed midway between the existing joints. The provisions in the second and third paragraphs in Section 40-1.08B, "Weakened Plane Joints," and the third paragraph in Section 40-1.08B(1), "Sawing Method," of the Standard Specifications shall not apply. Sawing of weakened plane joints shall be completed within 2 hours of completion of final finishing. Minimum depth of cut for weakened plane joints shall be 90 mm.

**Final Finishing**

Tests to determine coefficient of friction of the final textured surface will be made only if the Engineer determines by visual inspection that the final texturing may not have produced a surface having the specified coefficient of friction. Any tests to determine the coefficient of friction will be made after the pavement is opened to public traffic, but not later than 5 days after concrete placement. Pavement areas having a coefficient of friction as determined in conformance with the requirements in California Test 342 of less than 0.30 shall be grooved in conformance with the provisions in Section 42-1.02, "Construction," of the Standard Specifications. Grooving shall be performed prior to the installation of any required edge drains adjacent to the areas to be grooved.

Transverse straightedge and longitudinal straightedge requirements will not apply to the pavement surface within 300 mm of the existing concrete pavement except as required in these special provisions. Longitudinal straightedge requirements in Section 40-1.10, "Final Finishing," of the Standard Specifications, shall be applied at transverse contact joints with existing concrete pavement where the straightedge is to be placed with the midpoint coincident with the joints. Pavement not meeting this straightedge requirement shall be corrected within 48 hours by grinding or other methods as approved by the Engineer.

Profiles of the completed pavement surface specified in Section 40-1.10, "Final Finishing," of the Standard Specifications will not be required. The Profile Index requirements in Section 40-1.10, "Final Finishing," of the Standard Specifications shall not apply.

**Curing Method**

The curing method for replacement pavement shall be as recommended by the manufacturer of the cement and as approved by the Engineer.

**REPLACE EXISTING PAVEMENT DELINEATION**

Whenever existing pavement delineation is removed, obliterated or damaged due to the work involved in replacing concrete pavement, the Contractor shall replace the delineation in conformance with the requirements of these special provisions.

**MEASUREMENT AND PAYMENT**

Replace concrete pavement (Rapid Strength Concrete) will be measured and paid for in the same manner specified for concrete pavement in Sections 40-1.13, "Measurement," and 40-1.14, "Payment," of the Standard Specifications, and these special provisions.

Replace concrete pavement (Rapid Strength Concrete) payments will be subject to the pay factor values listed in "Pay Factor Adjustment for Low Modulus of Rupture" of these special provisions.

Full compensation for the pre-operation conference, including furnishing the facility to hold the pre-operation conference in, shall be considered as included in the contract prices paid for the item involving RSC and no additional compensation will be made therefor.

The provisions in Section 40-1.135, "Pavement Thickness," of the Standard Specifications shall not apply.

Full compensation for removing and disposing of existing concrete pavement and underlying base, constructing trial slabs, furnishing and placing bond breaker, furnishing and disposing of standby materials for temporary roadway structural section, and constructing, maintaining, removing and disposing of temporary roadway structural section, for furnishing and applying replacement pavement delineation, shall be considered as included in the contract price paid per cubic meter for replace concrete pavement (Rapid Strength Concrete), and no additional compensation will be allowed therefor.

The contract unit price paid for tie bar (drill and bond) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in placing epoxy-coated tie bars, drilling holes and bonding tie bars with epoxy resin, or furnishing and placing threaded dowel splice couplers, in concrete pavement complete in place, including properly aligning tie bars as shown on the plans, as specified in the Standard Specifications, and these special provisions, and as directed by the Engineer.

If calibration of volumetric batch-trucks is performed more than 160 km from the project limits, additional inspection expenses will be sustained by the State. Whereas it is and will be impracticable and extremely difficult to ascertain and determine the actual increase in these expenses, it is agreed that payment to the Contractor for Replace Concrete Pavement

(Rapid Strength Concrete) will be reduced $1000.

**10-1.43 GRIND EXISTING CONCRETE PAVEMENT**

This work shall consist of grinding existing portland cement concrete as shown on the plans, as specified in Section 42-2, "Grinding," of the Standard Specifications and these special provisions, and as directed by the Engineer.

Grinding equipment for grinding concrete pavements shall use diamond blades mounted on a self-propelled machine designed for grinding and texturing concrete pavements. Grinding equipment that causes raveling, aggregate fracturing, or spalling, or that damages the transverse or longitudinal joints shall not be used.

Grinding shall be performed in the longitudinal direction of the traveled way and shall be done full lane width so that the grinding begins and ends at lines perpendicular to the pavement centerline.

Grinding concrete pavement shall result in a parallel corduroy texture consisting of grooves 2 mm to 3 mm wide with 183 to 193 grooves per meter width of grinding. Tops of ridges shall be between 1.5 mm and 2.0 mm from the bottom of the blade grooves.

The ground surface at transverse joints or cracks will be tested with a 3.6 m ± 0.06-m long straightedge laid on the pavement parallel with the centerline with its midpoint at the joint or crack. The surface shall not vary by more than 2 mm from the lower edge of the straightedge.

Cross-slope uniformity and positive drainage shall be maintained across the entire traveled way and shoulder. The cross-slope shall be uniform so that when tested with a 3.6 m ± 0.06-m long straightedge placed perpendicular to the centerline, the ground pavement surface shall not vary more than 6 mm from the lower edge of the straightedge.

After grinding has been completed, the pavement surface shall be profiled in conformance with the requirements of Section 40-1.10, "Final Finishing," of the Standard Specifications. Two profiles shall be obtained in each lane approximately one meter from the lane lines. The average profile index shall be determined by averaging the two profiles in each lane. Additional grinding shall be performed, where necessary, to bring the ground pavement surface within the Profile Index requirements specified in Section 40-1.10, "Final Finishing," of the Standard Specifications.

Removed residue from grinding portland cement concrete pavement shall be disposed of outside the highway right of way in accordance with the provisions in Section 7-1.13, "Disposal of Material Outside of the Highway Right of Way," of the Standard Specifications.

There is no "'Materials Information" listing locations where grinding residue may be disposed of for this contract.

Residue from grinding portland cement concrete pavement shall be disposed of at a site chosen by the Contractor provided the Contractor has obtained approval from the California Regional Water Quality Control Board having jurisdiction over any required site. The Contractor shall deliver to the Engineer a copy of the approval or approvals not less than 5 working days prior to disposing any residue at the disposal site.

The Contractor shall provide to the Engineer a landfill receipt and weight ticket to verify that the material has been disposed of in a manner consistent with this section of these special provisions.

The drying or storing of wet residue within the project limits or elsewhere within the State right of way will not be permitted. The wet residue shall be transported to a suitable intermediate location obtained by the Contractor to dry the material. This off-site drying location shall be approved by the California Regional Water Quality Control Board. The Contractor shall deliver to the Engineer a copy of the approval or approvals from the California Regional Water Quality Board not less than 5 working days prior to beginning any portland cement concrete grinding. Dried residue material shall be disposed at a disposal site qualified to receive it.

The Contractor shall make all necessary arrangements for the disposal of the residue from the grinding of portland cement concrete pavement, including but not limited to the drying of the material, agreements with property owners and obtaining necessary permits, licenses and environmental clearances. Before performing the grinding of Portland cement concrete pavement, the Contractor shall furnish to the Engineer satisfactory evidence that the Contractor has made all arrangements required above.

Full compensation for profiling the ground pavement surface with a California profilograph or equivalent, any necessary additional grinding to bring the finished surface within the specified tolerances, furnishing final profilograms to the Engineer, obtaining a permit from the California Regional Water Quality Board, and securing a site for disposing of grinding residue shall be considered as included in the contract price paid per square meter for grind existing concrete pavement and no additional compensation will be allowed therefor.

**10-1.44 EXIT RAMP TERMINI**

Portland cement concrete pavement at exit ramp termini shall be constructed as shown on the plans and as provided in Section 40, "Portland Cement Concrete Pavement," of the Standard Specifications and these special provisions.

The concrete for portland cement concrete pavement at exit ramp termini shall contain a minimum of 400 kg of portland cement per cubic meter.

## 10-1.45 PILING

### GENERAL

Piling shall conform to the provisions in Section 49, "Piling," of the Standard Specifications, and these special provisions.

Unless otherwise specified, welding of any work performed in conformance with the provisions in Section 49, "Piling," of the Standard Specifications, shall be in conformance with the requirements in AWS D1.1.

Foundation recommendations are included in the "Information Handout" available to the Contractor as provided for in Section 2-1.03, "Examination of Plans, Specifications, Contract, and Site of Work," of the Standard Specifications.

Attention is directed to "Welding " of these special provisions.

Bridge number 53-2918-Difficult pile installation is anticipated due to the presence of soft soils, caving soils, high ground water the requirements of pile embedment into rock, sound control, and traffic control.

Bridge number 53-2917-Difficult pile installation is anticipated due to the presence of soft soils, caving soils, high ground water, the requirements of pile embedment into rock, sound control, and traffic control.

#### Driving System Submittal

Prior to installing driven piling, the Contractor shall provide a driving system submittal, including driveability analysis, in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. A submittal shall be made for Bridge No. 53-2917 . All proposed driving systems (i.e., each hammer that may be brought onto the site) shall be included in the submittal.

The driving system submittal shall contain an analysis showing that the proposed driving systems will install piling to the specified tip elevation and specified bearing. Driving systems shall generate sufficient energy to drive the piles with stresses not more than 95 percent of the specified yield strength of the steel pile or unfilled steel shell. Submittals shall include the following:

A. Complete description of soil parameters used, including soil quake and damping coefficients, skin friction distribution, ratio of shaft resistance to nominal compression resistance, assumptions made regarding the formation of soil plugs, and assumptions made regarding drilling through the center of open ended steel shells.
B. List of all hammer operation parameters assumed in the analysis, including fuel settings, stroke limitations, and hammer efficiency.
C. Driveability studies that are based on a wave equation analysis using a computer program that has been approved by the Engineer. Driveability studies shall model the Contractor's proposed driving systems, including the hammers, capblocks, and pile cushions, as well as determine driving resistance and pile stresses for assumed site conditions. Separate analyses shall be completed at elevations above the specified tip elevations where difficult driving is anticipated. Studies shall include plots for a range of pile compression capacities above and below the nominal compression resistance shown on the plans. Plots shall include the following:

    1. Pile compressive stress versus blows per 0.30-m.
    2. Pile tensile stress versus blows per 0.30-m.
    3. Nominal compression resistance versus blows per 0.30-m.

D. Copies of all test results from any previous pile load tests, dynamic monitoring, and all driving records used in the analyses.
E. Completed "Pile and Driving Data Form," which is shown in these special provisions.

The driving system submittal shall be stamped and signed by an engineer who is registered as a Civil Engineer in the State of California. Prior to installing piling, the Contractor shall allow the Engineer 15 working days to review a driving system submittal after a complete set, as determined by the Engineer, has been received. Should the Engineer fail to complete his review within the time allowance, and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in the driving system submittal review, the delay will be considered a right of way delay in conformance with the provisions in Section 8-1.09, "Right of Way Delays" of the Standard Specifications.

The Contractor shall use the driving system and installation methods described in the approved driving system submittal for a given control location. Any change in hammers from those submitted and approved by the Engineer shall also meet the requirements for driving system submittals. Revised and new driving system submittals shall be approved by the Engineer prior to using corresponding driving systems on production piling. The Contractor shall allow the Engineer 15 working days to review each revised and each new driving system submittal after a complete set, as determined by the Engineer, has been

received.

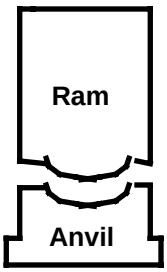
Approval of pile driving equipment will not relieve the Contractor of his responsibility to drive piling, free of damage, to the specified penetration.

Full compensation for driving system submittals shall be considered as included in the contract unit price paid for drive pile, and no additional compensation will be allowed therefor.

CALIFORNIA DEPARTMENT OF TRANSPORTATION
TRANSPORTATION LABORATORY

# PILE AND DRIVING DATA FORM

Structure Name :_____ Contract No.:_____
_____ Project:_____
Structure No.:_____ Pile Driving Contractor or Subcontractor____
Dist./Co./Rte./kilo.post:_____ _____
(Pile Driven By)



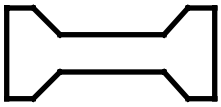

**Hammer**

Manufacturer:_____ Model:_____
Type:_____Serial No.:_____
Rated Energy:_____ at _____ Length of Stroke

Modifications: _____
_____
_____
_____
_____

**Capblock (Hammer Cushion)**

Material:_____
Thickness:_____mm Area:_____$mm^2$
Modulus of Elasticity - E:_____MPa
Coefficient of Restitution - e:_____



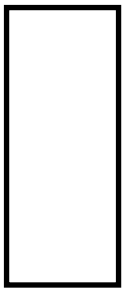
**Pile Cap**

Helmet
Bonnet
Anvil Block
Drivehead

Mass:_____kg

**Pile**

Material:_____
Thickness:_____mm Area: _____$mm^2$
Modulus of Elasticity - E:_____MPa
Coefficient of Restitution - e:_____



**Pile**

Pile Type:_____
Length (In Leads):_____m
kg/m.:_____Taper:_____
Wall Thickness:_____mm
Cross Sectional Area:_____ $mm^2$
Design Pile Capacity:_____kN
Description of Splice:_____
_____
Tip Treatment Description:_____
_____

**DISTRIBUTE one copy**

- ☐ Translab, DSF Foundation Testing & Instrumentation
- ☐ Translab, DSF Structures Foundations
- ☐ Resident Engineer

Note: If mandrel is used to drive the pile, attach separate manufacturer's detail sheet(s) including mass (kg) and dimensions.

Submitted By:_____ Date:_____

Phone No.:_____

**Load Test Piles**

The Contractor shall notify the Engineer, in writing, not less than 10 days in advance of drilling or driving the piles to be load tested.

Before the piles for bent 2 through bent 10 are drilled, cast, cut to length or driven, load testing of the load test pile shown on the plans for Bridge No. 53-2917 shall be completed.

The bottom of footing excavation shall be dewatered and made level before pile load testing. The excavation shall be kept dewatered during load testing.

Unless otherwise specified or shown on the plans, steel plates welded to the load test and anchor piling shall conform to the requirements in ASTM Designation: A 709/A 709M, Grade 36 [250], and shall be welded to the piling in conformance with the requirements in AWS D1.1.

Pipe, couplings and fittings shall be commercially available materials of the types and ratings shown on the plans.

Extensometer conduit shall be installed on straight alignment and at the location shown on the plans. The conduit shall be blocked and tied to the reinforcement to prevent displacement of the conduit while placing pile concrete. The spacing of conduit blocking and ties shall not exceed 2 m.

**Dynamic Monitoring**

Driven test piles and anchor piles will be monitored during the final 8 m of driving for dynamic response to the driving equipment. Monitoring will be done by State forces using State-furnished dynamic pile analyzer monitoring instruments.

The Engineer will determine which piles will receive dynamic monitoring from each control location. Piles to be dynamically monitored shall be made available to State forces 2 working days prior to driving. The piles shall be safely supported a minimum of 150 mm off the ground in a horizontal position on at least 2 support blocks. The pile shall be positioned so that State forces have safe access to the entire pile length and circumference for the installation of anchorages and control marks for monitoring. The Contractor shall rotate the piles on the blocks as directed by the Engineer.

Piles to be dynamically monitored shall be prepared and driven in the following sequence:

A. Prior to driving, the Contractor shall rotate and align the pile in the driving leads as directed by the Engineer
B. The Contractor shall temporarily suspend driving operations for approximately 15 minutes when the pile tip is 8 m above the elevation to which the tip is required to be finally driven.
C. During the 15 minute suspension, the Contractor shall bolt the 0.5-kg instrument package securely to plugs or expansion anchors previously installed in the pile by the State. The Contractor shall connect electrical cables to the instrument package as directed by the Engineer.
D. Driving operations shall resume as directed by the Engineer. Driving operations shall be suspended approximately 0.5-m above the required tip elevation, as directed by the Engineer.
E. The Contractor shall remove the cables and instrument package from the pile and deliver them to the Engineer.
F. The following work day, the Contractor shall install the instrument package on the pile and attach the cables and resume driving the pile to the required tip elevation, as directed by the Engineer.
G. The Contractor shall remove the cables and instruments from the monitored pile and deliver them to the Engineer.

The Contractor shall be responsible for damage to the State's cables and instruments caused by the Contractor's operations, and shall replace damaged cables or instruments in kind.

**Wave Equation**

The second paragraph of Section 49-1.03, "Determination of Length," and paragraphs 3 and 4 of Section 49-1.08, "Bearing Value and Penetration," of the Standard Specifications shall not apply to the pile types at the control locations listed herein. The Engineer will conduct a penetration and bearing analysis in conjunction with pile load testing and dynamic monitoring of the piles at these locations and develop bearing acceptance criteria curves for these piles. Penetration and bearing analyses will be based on a wave equation analysis.

The Engineer shall be allowed 22 working days to perform the load test, complete dynamic monitoring, revise specified tip elevations, and to provide the bearing acceptance criteria curves for a given control location. Day one of 22 shall be the first day after the load test and anchor piles have been installed at that same control location.

Should the Engineer fail to provide the bearing acceptance criteria curves for production piles within the time specified and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in providing the bearing acceptance criteria curves, the delay will be considered a right of way delay in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

Production piles, other than load test and anchor piles, shall not be installed until the bearing acceptance criteria curves for piles within the corresponding control location have been provided by the Engineer.

## CAST-IN-DRILLED-HOLE CONCRETE PILES

Cast-in-drilled-hole concrete piling shall conform to the provisions in Section 49-4, "Cast-In-Place Concrete Piles," of the Standard Specifications and these special provisions.

Cast-in-drilled-hole concrete piling (rock socket) shall consist of drilling or coring sockets in bedrock to the depths or lengths specified and filling with reinforced concrete in conformance with the details shown on the plans and these special provisions. Cored holes, if used, shall conform to the provisions of Section 49-4.03, "Drilled Holes," of the Standard Specifications.

The provisions of "Welding " of these special provisions shall not apply to temporary steel casings.

Cast-in-drilled-hole concrete piles 600 mm in diameter or larger may be constructed by excavation and depositing concrete under slurry.

### Materials

Concrete deposited under slurry shall have a nominal penetration equal to or greater than 90 mm. Concrete shall be proportioned to prevent excessive bleed water and segregation.

Concrete deposited under slurry shall contain not less than 400 kg of cementitious material per cubic meter.

The combined aggregate grading used in concrete for cast-in-drilled-hole concrete piling shall be either the 25-mm maximum grading, the 12.5-mm maximum grading, or the 9.5-mm maximum grading and shall conform to the requirements in Section 90-3 "Aggregate Gradings," of the Standard Specifications.

### Mineral Slurry

Mineral slurry shall be mixed and thoroughly hydrated in slurry tanks, and slurry shall be sampled from the slurry tanks and tested before placement in the drilled hole.

Slurry shall be recirculated or continuously agitated in the drilled hole to maintain the specified properties.

Recirculation shall include removal of drill cuttings from the slurry before discharging the slurry back into the drilled hole. When recirculation is used, the slurry shall be sampled and tested at least every 2 hours after beginning its use until tests show that the samples taken from the slurry tank and from near the bottom of the hole have consistent specified properties. Subsequently, slurry shall be sampled at least twice per shift as long as the specified properties remain consistent.

Slurry that is not recirculated in the drilled hole shall be sampled and tested at least every 2 hours after beginning its use. The slurry shall be sampled midheight and near the bottom of the hole. Slurry shall be recirculated when tests show that the samples taken from midheight and near the bottom of the hole do not have consistent specified properties.

Slurry shall also be sampled and tested prior to final cleaning of the bottom of the hole and again just prior to placing concrete. Samples shall be taken from midheight and near the bottom of the hole. Cleaning of the bottom of the hole and placement of the concrete shall not start until tests show that the samples taken from midheight and near the bottom of the hole have consistent specified properties.

Mineral slurry shall be tested for conformance to the requirements shown in the following table:

| MINERAL SLURRY | | |
|---|---|---|
| PROPERTY | REQUIREMENT | TEST |
| Density ($kg/m^3$)<br><br>- before placement in the drilled hole<br>- during drilling<br><br>- prior to final cleaning<br>- immediately prior to placing concrete | 1030* to 1110*<br><br>1030* to 1200* | Mud Weight (Density) API 13B-1 Section 1 |
| Viscosity (seconds/liter)<br><br>bentonite<br><br>attapulgite | 29 to 53<br><br>29 to 42 | Marsh Funnel and Cup API 13B-1 Section 2.2 |
| pH | 8 to 10.5 | Glass Electrode pH Meter or pH Paper |
| Sand Content (percent)<br><br>- prior to final cleaning<br>- immediately prior to placing concrete | less than or equal to 4.0 | Sand API 13B-1 Section 5 |
| *When approved by the Engineer, slurry may be used in salt water, and the allowable densities may be increased up to 32 $kg/m^3$.<br>Slurry temperature shall be at least 4 degrees Celsius when tested. | | |

Any caked slurry on the sides or bottom of hole shall be removed before placing reinforcement. If concrete is not placed immediately after placing reinforcement, the reinforcement shall be removed and cleaned of slurry, the sides of the drilled hole cleaned of caked slurry, and the reinforcement again placed in the hole for concrete placement.

**Synthetic Slurry**

Synthetic slurries shall be used in conformance with the manufacturer's recommendations and these special provisions. The following synthetic slurries may be used:

| PRODUCT | MANUFACTURER |
|---|---|
| SlurryPro CDP | KB Technologies Ltd.<br>Suite 216<br>735 Broad Street<br>Chattanooga, TN 37402<br>(800) 525-5237 |
| Super Mud | PDS Company<br>c/o Champion Equipment Company<br>8140 East Rosecrans Ave.<br>Paramount, CA 90723<br>(562) 634-8180 |
| Shore Pac GCV | CETCO Drilling Products Group |

| | |
|---|---|
| | 1350 West Shure Drive<br>Arlington Heights, IL 60004<br>(847) 392-5800 |

Inclusion of a synthetic slurry on the above list may be obtained by meeting the Department's requirements for synthetic slurries. The requirements can be obtained from the Office of Structure Design, P.O. Box 942874, Sacramento, CA 94274-0001.

Synthetic slurries listed may not be appropriate for a given site.

Synthetic slurries shall not be used in holes drilled in primarily soft or very soft cohesive soils as determined by the Engineer.

A manufacturer's representative, as approved by the Engineer, shall provide technical assistance for the use of their product, shall be at the site prior to introduction of the synthetic slurry into a drilled hole, and shall remain at the site until released by the Engineer.

Synthetic slurries shall be sampled and tested at both mid-height and near the bottom of the drilled hole. Samples shall be taken and tested during drilling as necessary to verify the control of the properties of the slurry. Samples shall be taken and tested when drilling is complete, but prior to final cleaning of the bottom of the hole. When samples are in conformance with the requirements shown in the following tables for each slurry product, the bottom of the hole shall be cleaned and any loose or settled material removed. Samples shall be obtained and tested after final cleaning with steel reinforcement in place and just prior to placing concrete.

SlurryPro CDP synthetic slurries shall be tested for conformance to the requirements shown in the following table:

| SLURRYPRO CDP<br>KB Technologies Ltd. | | |
|---|---|---|
| PROPERTY | REQUIREMENT | TEST |
| Density ($kg/m^3$)<br><br>- during drilling<br><br>- prior to final cleaning<br>- just prior to placing concrete | <br><br>less than or equal to 1075*<br><br>less than or equal to 1025* | Mud Weight (Density)<br>API 13B-1<br>Section 1 |
| Viscosity (seconds/liter)<br><br>- during drilling<br><br>-prior to final cleaning<br>- just prior to placing concrete | <br><br>53 to 127<br><br>less than or equal to 74 | Marsh Funnel and Cup<br>API 13B-1<br>Section 2.2 |
| pH | 6 to 11.5 | Glass Electrode pH Meter or pH Paper |
| Sand Content (percent)<br><br>- prior to final cleaning<br>- just prior to placing concrete | <br><br>less than or equal to 0.5 | Sand<br>API 13B-1<br>Section 5 |
| *When approved by the Engineer, slurry may be used in salt water, and the allowable densities may be increased up to 32 $kg/m^3$.<br>Slurry temperature shall be at least 4 degrees Celsius when | | |

tested.

Super Mud synthetic slurries shall be tested for conformance to the requirements shown in the following table:

| SUPER MUD<br>PDS Company | | |
|---|---|---|
| PROPERTY | REQUIREMENT | TEST |
| Density ($kg/m^3$)<br><br>- prior to final cleaning<br>- just prior to placing concrete | less than or equal to 1025* | Mud Weight (Density)<br>API 13B-1<br>Section 1 |
| Viscosity (seconds/liter)<br><br>- during drilling<br><br>- prior to final cleaning<br>- just prior to placing concrete | 34 to 64<br><br>less than or equal to 64 | Marsh Funnel and Cup<br>API 13B-1<br>Section 2.2 |
| pH | 8 to 10.0 | Glass Electrode pH Meter or pH Paper |
| Sand Content (percent)<br><br>- prior to final cleaning<br>-just prior to placing concrete | less than or equal to 0.5 | Sand<br>API 13B-1<br>Section 5 |
| *When approved by the Engineer, slurry may be used in salt water, and the allowable densities may be increased up to 32 $kg/m^3$.<br>Slurry temperature shall be at least 4 degrees Celsius when tested. | | |

Shore Pac GCV synthetic slurries shall be tested for conformance to the requirements shown in the following table:

| Shore Pac GCV<br>CETCO Drilling Products Group | | |
|---|---|---|
| PROPERTY | REQUIREMENT | TEST |
| Density ($kg/m^3$)<br><br>- prior to final cleaning<br>- just prior to placing concrete | less than or equal to 1025* | Mud Weight (Density)<br>API 13B-1<br>Section 1 |
| Viscosity (seconds/liter)<br><br>- during drilling<br><br>- prior to final cleaning<br>- just prior to placing concrete | 35 to 78<br><br>less than or equal to 60 | Marsh Funnel and Cup<br>API 13B-1<br>Section 2.2 |
| pH | 8.0 to 11.0 | Glass Electrode pH Meter or pH Paper |
| Sand Content (percent)<br><br>- prior to final cleaning<br>-just prior to placing concrete | less than or equal to 0.5 | Sand<br>API 13B-1<br>Section 5 |
| *When approved by the Engineer, slurry may be used in salt water, and the allowable densities may be increased up to 32 $kg/m^3$.<br>Slurry temperature shall be at least 4 degrees Celsius when tested. | | |

**Water Slurry**

At the option of the Contractor water may be used as slurry when casing is used for the entire length of the drilled hole. Water slurry shall be tested for conformance to the requirements shown in the following table:

| WATER SLURRY | | |
|---|---|---|
| PROPERTY | REQUIREMENT | TEST |
| Density ($kg/m^3$)<br><br>- prior to final cleaning<br>- just prior to placing concrete | 1017 * | Mud Weight (Density)<br>API 13B-1<br>Section 1 |
| Sand Content (percent)<br><br>- prior to final cleaning<br>-just prior to | less than or equal to 0.5 | Sand<br>API 13B-1<br>Section 5 |

| | | |
|---|---|---|
| placing concrete | | |
| *When approved by the Engineer, salt water slurry may be used, and the allowable densities may be increased up to 32 kg/m$^3$. | | |

**Construction**

The Contractor shall submit a placing plan to the Engineer for approval prior to producing the test batch for cast-in-drilled-hole concrete piling and at least 10 working days prior to constructing piling. The plan shall include complete description, details, and supporting calculations as listed below:

A. Requirements for all cast-in-drilled hole concrete piling:

1. Concrete mix design, certified test data, and trial batch reports.
2. Drilling or coring methods and equipment.
3. Proposed method for casing installation and removal when necessary.
4. Plan view drawing of pile showing reinforcement and inspection pipes, if required.
5. Methods for placing, positioning, and supporting bar reinforcement.
6. Methods and equipment for accurately determining the depth of concrete and actual and theoretical volume placed, including effects on volume of concrete when any casings are withdrawn.
7. Methods and equipment for verifying that the bottom of the drilled hole is clean prior to placing concrete.
8. Methods and equipment for preventing upward movement of reinforcement, including the Contractor's means of detecting and measuring upward movement during concrete placement operations.

B. Additional requirements when concrete is placed under slurry:

1. Concrete batching, delivery, and placing systems including time schedules and capacities therefor. Time schedules shall include the time required for each concrete placing operation at each pile.
2. Concrete placing rate calculations. When requested by the Engineer, calculations shall be based on the initial pump pressures or static head on the concrete and losses throughout the placing system, including anticipated head of slurry and concrete to be displaced.
3. Suppliers test reports on the physical and chemical properties of the slurry and any proposed slurry chemical additives including Material Safety Data Sheet.
4. Slurry testing equipment and procedures.
5. Removal and disposal of excavation, slurry, and contaminated concrete, including methods and rates of removal.
6. Slurry agitating, recirculating, and cleaning methods and equipment.

In addition to compressive strength requirements, the consistency of the concrete to be deposited under slurry shall be verified before use by producing a batch to be tested. The test batch shall be produced and delivered to the project under conditions and in time periods similar to those expected during the placement of concrete in the piles. Concrete for the test batch shall be placed in an excavated hole or suitable container of adequate size to allow testing in conformance with California Test 533. Depositing of test batch concrete under slurry will not be required. For piles where the time required for each concrete placing operation, as submitted in the placing plan, will be 2 hours or less, the test batch shall demonstrate that the proposed concrete mix design achieves both the specified nominal penetration and a penetration of at least 50 mm after twice that time has elapsed. For piles where the time required for each concrete placing operation, as submitted in the placing plan, will be more than 2 hours, the test batch shall demonstrate that the proposed concrete mix design achieves both the specified nominal penetration and a penetration of at least 50 mm after that time plus 2 hours has elapsed. The time period shall begin at the start of placement. The concrete shall not be vibrated or agitated during the test period. Upon completion of testing, the concrete shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Concrete deposited under slurry shall not be vibrated until all temporary casing is removed and concrete contaminated with soil, slurry, or other materials is removed. Concrete deposited under slurry shall be vibrated in the upper 2 m of the pile.

The concrete deposited under slurry shall be carefully placed in a compact, monolithic mass and by a method that will prevent washing of the concrete. Placing concrete shall be a continuous operation lasting not more than the time required for each concrete placing operation at each pile, as submitted in the placing plan, unless otherwise approved in writing by the Engineer. The concrete shall be placed with concrete pumps and delivery tube system of adequate number and size to complete the placing of concrete in the time specified. The delivery tube system shall consist of one of the following:

A. A tremie tube or tubes, each of which are at least 250 mm in diameter, fed by one or more concrete pumps.
B. One or more concrete pump tubes, each fed by a single concrete pump.

The delivery tube system shall consist of watertight tubes with sufficient rigidity to keep the ends always in the mass of concrete placed. If only one delivery tube is utilized to place the concrete, the tube shall be placed near the center of the drilled hole. Multiple tubes shall be uniformly spaced in the hole. Internal bracing for the steel reinforcing cage shall accommodate the delivery tube system. Tremies shall not be used for piles without space for a 250-mm tube.

Spillage of concrete into the slurry during concrete placing operations shall not be allowed. Delivery tubes shall be capped with a water tight cap, or plugged above the slurry level with a good quality, tight fitting, moving plug that will expel the slurry from the tube as the tube is charged with concrete. The cap or plug shall be designed to be released as the tube is charged. The pump discharge or tremie tube shall extend to the bottom of the hole before charging the tube with concrete. After charging the delivery tube system with concrete, the flow of concrete through a tube shall be induced by slightly raising the discharge end. During concrete placement, the tip of the delivery tube shall be maintained to prevent reentry of the slurry into the tube. Until at least 3 m of concrete has been placed, the tip of the delivery tube shall be within 150 mm of the bottom of the drilled hole, and then the embedment of the tip shall be maintained at least 3 m below the top surface of the concrete. Rapid raising or lowering of the delivery tube shall not be permitted. If the seal is lost or the delivery tube becomes plugged and must be removed, the tube shall be withdrawn, the tube cleaned, the tip of the tube capped to prevent entrance of the slurry, and the operation restarted by pushing the capped tube 3 m into the concrete and then reinitiating the flow of concrete.

When slurry is used, a fully operational standby concrete pump, adequate to complete the work in the time specified, shall be provided at the site during concrete placement. The slurry level shall be maintained within 300 mm of the top of the drilled hole.

A log of concrete placement for each drilled hole shall be maintained by the Contractor when concrete is deposited under slurry. The log shall show the pile location, tip elevation, dates of excavation and concrete placement, total quantity of concrete deposited, length and tip elevation of any casing, and details of any hole stabilization method and materials used. The log shall include a 215 mm x 280 mm sized graph of the concrete placed versus depth of hole filled. The graph shall be plotted continuously throughout placing of concrete. The depth of drilled hole filled shall be plotted vertically with the pile tip oriented at the bottom and the quantity of concrete shall be plotted horizontally. Readings shall be made at least at each 1.5 m of pile depth, and the time of the reading shall be indicated. The graph shall be labeled with the pile location, tip elevation, cutoff elevation, and the dates of excavation and concrete placement. The log shall be delivered to the Engineer within one working day of completion of placing concrete in the pile.

After placing reinforcement and prior to placing concrete in the drilled hole, if drill cuttings settle out of slurry, the bottom of the drilled hole shall be cleaned. The Contractor shall verify that the bottom of the drilled hole is clean.

If temporary casing is used, concrete placed under slurry shall be maintained at a level at least 1.5 m above the bottom of the casing. The withdrawal of casings shall not cause contamination of the concrete with slurry.

Any pile which has been increased in diameter as provided above will be paid for at the contract price per meter for the size of cast-in-drilled-hole concrete piling shown on the plans at that location.

**Acceptance Testing and Mitigation**

Vertical inspection pipes for acceptance testing shall be provided in all cast-in-drilled-hole concrete piles that are 600 mm in diameter or larger, except when the holes are dry or when the holes are dewatered without the use of temporary casing to control the groundwater.

Inspection pipes shall be Schedule 40 polyvinyl chloride pipe with a nominal inside diameter of 50 mm. Each inspection pipe shall be capped top and bottom and shall have watertight couplers to provide a clean, dry and unobstructed 50-mm diameter clear opening from 1.0 m above the pile cutoff down to the bottom of the reinforcing cage.

If the Contractor drills the hole below the specified tip elevation, the reinforcement and the inspection pipes shall be extended to 75 mm clear of the bottom of the drilled hole.

Inspection pipes shall be placed around the pile, inside the outermost spiral or hoop reinforcement, and 75 mm clear of the vertical reinforcement, at a uniform spacing not exceeding 840 mm measured along the circle passing through the centers of inspection pipes. A minimum of 2 inspection pipes per pile shall be used. When the vertical reinforcement is not bundled and each bar is not more than 26 mm in diameter, inspection pipes may be placed 50 mm clear of the vertical reinforcement. The inspection pipes shall be placed to provide the maximum diameter circle that passes through the centers of the inspection pipes while maintaining the clear spacing required herein. The pipes shall be installed in straight alignment, parallel to the main reinforcement, and securely fastened in place to prevent misalignment during installation of the reinforcement and placing of concrete in the hole.

The Contractor shall log the location of the inspection pipe couplers with respect to the plane of pile cut off, and these logs shall be delivered to the Engineer upon completion of the placement of concrete in the drilled hole.

After placing concrete and before requesting acceptance tests, each inspection pipe shall be tested by the Contractor in the presence of the Engineer by passing a 48.3-mm diameter rigid cylinder 610 mm long through the complete length of pipe. If the 48.3-mm diameter rigid cylinder fails to pass any of the inspection pipes, the Contractor shall attempt to pass a 32.0-mm diameter rigid cylinder 1.375 m long through the complete length of those pipes in the presence of the Engineer. If an inspection pipe fails to pass the 32.0-mm diameter cylinder, the Contractor shall immediately fill all inspection pipes in the pile with water.

The Contractor shall replace each inspection pipe that does not pass the 32.0-mm diameter cylinder with a 50.8-mm diameter hole cored through the concrete for the entire length of the pile. Cored holes shall be located as close as possible to the inspection pipes they are replacing, no more than 150 mm inside the reinforcement, and coring shall not damage the pile reinforcement. Cored holes shall be made with a double wall core barrel system utilizing a split tube type inner barrel. Coring with a solid type inner barrel will not be allowed. Coring methods and equipment shall provide intact cores for the entire length of the pile concrete. The coring operation shall be logged by an Engineering Geologist or Civil Engineer licensed in the State of California and experienced in core logging. Coring logs shall include complete descriptions of inclusions and voids encountered during coring, and shall be delivered to the Engineer upon completion. Concrete cores shall be preserved, identified with the exact location the core was recovered from within the pile, and made available for inspection by the Engineer.

Acceptance tests of the concrete will be made by the Engineer, without cost to the Contractor. Acceptance tests will evaluate the homogeneity of the placed concrete. Tests will include gamma-gamma logging. Tests may also include crosshole sonic logging and other means of inspection selected by the Engineer. The Contractor shall not conduct operations within 8.0 m of the gamma-gamma logging operations. The Contractor shall separate reinforcing steel as necessary to allow the Engineer access to the inspection pipes to perform gamma-gamma logging or other acceptance testing. After requesting acceptance tests and providing access to the piling, the Contractor shall allow 3 weeks for the Engineer to conduct these tests and make determination of acceptance if the 48.3-mm diameter cylinder passed all inspection pipes, and 4 weeks if only the 32.0-mm diameter cylinder passed all inspection pipes. Should the Engineer fail to complete these tests within the time allowance, and if in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in inspection, the delay will be considered a right of way delay as specified in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

All inspection pipes and cored holes in a pile shall be dewatered and filled with grout after notification by the Engineer that the pile is acceptable. Placement and removal of water in the inspection pipes shall be at the Contractors expense. Grout shall conform to the provisions in Section 50-1.09, "Bonding and Grouting," of the Standard Specifications. The inspection pipes and holes shall be filled using grout tubes that extend to the bottom of the pipe or hole or into the grout already placed.

If acceptance testing performed by the Engineer determines that a pile does not meet the requirements of the specifications, then that pile will be rejected and all depositing of concrete under slurry or concrete placed using temporary casing for the purpose of controlling groundwater shall be suspended until written changes to the methods of pile construction are approved in writing by the Engineer.

The Contractor shall submit to the Engineer for approval a mitigation plan for repair, supplementation, or replacement for each rejected cast-in-drilled-hole concrete pile, and this plan shall conform to the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. Prior to submitting this mitigation plan, the Engineer will hold a repair feasibility meeting with the Contractor to discuss the feasibility of repairing rejected piling. The Engineer will consider the size of the defect, the location of the defect, and the design information and corrosion protection considerations for the pile. This information will be made available to the Contractor, if appropriate, for the development of the mitigation plan. If the Engineer determines that it is not feasible to repair the rejected pile, the Contractor shall not include repair as a means of mitigation and shall proceed with the submittal of a mitigation plan for replacement or supplementation of the rejected pile.

If the Engineer determines that a rejected pile does not require mitigation due to structural, geotechnical, or corrosion concerns, the Contractor may elect to 1) repair the pile per the approved mitigation plan, or 2) not repair anomalies found during acceptance testing of that pile. For such unrepaired piles, the Contractor shall pay to the State, $400 per cubic meter for the portion of the pile affected by the anomalies. The volume, in cubic meters, of the portion of the pile affected by the anomalies, shall be calculated as the area of the cross-section of the pile affected by each anomaly, in square meters, as determined by the Engineer, multiplied by the distance, in meters, from the top of each anomaly to the specified tip of the pile. If the volume calculated for one anomaly overlaps the volume calculated for additional anomalies within the pile, the calculated volume for the overlap shall only be counted once. In no case shall the amount of the payment to the State for any such pile be less than $400. The Department may deduct the amount from any moneys due, or that may become due the Contractor under the contract.

Pile mitigation plans shall include the following:

A. The designation and location of the pile addressed by the mitigation plan.
B. A review of the structural, geotechnical, and corrosion design requirements of the rejected pile.

C. A step by step description of the mitigation work to be performed, including drawings if necessary.
D. An assessment of how the proposed mitigation work will address the structural, geotechnical, and corrosion design requirements of the rejected pile.
E. Methods for preservation or restoration of existing earthen materials.
F. A list of affected facilities, if any, with methods and equipment for protection of these facilities during mitigation.
G. The State assigned contract number, bridge number, full name of the structure as shown on the contract plans, District-County-Route-Kilometer Post, and the Contractor's (and Subcontractor's if applicable) name on each sheet.
H. A list of materials, with quantity estimates, and personnel, with qualifications, to be used to perform the mitigation work.
I. The seal and signature of an engineer who is licensed as a Civil Engineer by the State of California.

For rejected piles to be repaired, the Contractor shall submit a pile mitigation plan that contains the following additional information:

A. An assessment of the nature and size of the anomalies in the rejected pile.
B. Provisions for access for additional pile testing if required by the Engineer.

For rejected piles to be replaced or supplemented, the Contractor shall submit a pile mitigation plan that contains the following additional information:

A. The proposed location and size of additional piling.
B. Structural details and calculations for any modification to the structure to accommodate the replacement or supplemental piling.

All provisions for cast-in-drilled-hole concrete piling shall apply to replacement piling.

The Contractor shall allow the Engineer 3 weeks to review the mitigation plan after a complete submittal has been received.

Should the Engineer fail to review the complete pile mitigation submittal within the time specified, and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in reviewing the pile mitigation plan, an extension of time commensurate with the delay in completion of the work thus caused will be granted in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

When repairs are performed, the Contractor shall submit a mitigation report to the Engineer within 10 days of completion of the repair. This report shall state exactly what repair work was performed and quantify the success of the repairs relative to the submitted mitigation plan. The mitigation report shall be stamped and signed by an engineer that is licensed as a Civil Engineer by the State of California. The mitigation report shall show the State assigned contract number, bridge number, full name of the structure as shown on the contract plans, District-County-Route-Kilometer Post, and the Contractor (and Subcontractor if applicable) name on each sheet. The Engineer will be the sole judge as to whether a mitigation proposal is acceptable, the mitigation efforts are successful, and to whether additional repairs, removal and replacement, or construction of a supplemental foundation is required.

**STEEL PIPE PILING**

**General**

Steel pipe piling shall consist of unfilled steel pipe piling, steel shells for open and closed ended cast-in-steel-shell concrete piling, and permanent steel casing for cast-in-drilled-hole concrete piling. Steel pipe piling shall conform to the provisions in Section 49-5, "Steel Piles," of the Standard Specifications and these special provisions.

Wherever reference is made to the following American Petroleum Institute (API) specifications in the Standard Specifications, on the project plans, or in these special provisions, the year of adoption for these specifications shall be as follows:

| API Codes | Year of Adoption |
|---|---|
| API 2B | 1990 |
| API 5L | 1995 |

All requirements of the codes listed above shall apply unless specified otherwise in the Standard Specifications, on the plans or in these special provisions.

Only steel pipe pile seam welds may be made by the electric resistance welding method. Such welds shall be welded in

conformance with the requirements in API 5L and any amendments to API 5L in the Standard Specifications or these special provisions.

Seams in steel pipe piles made by submerged arc welding may be welded in conformance with the requirements in API 5L and any amendments to API 5L in the Standard Specifications or these special provisions.

Handling devices may be attached to steel pipe piling. Welds attaching these devices shall be aligned parallel to the axis of the pile and shall conform to the requirements for field welding specified herein. Permanent bolted connections shall be corrosion resistant. Prior to making attachments, the Contractor shall submit a plan to the Engineer that includes the locations, handling and fitting device details, and connection details. Attachments shall not be made to the steel pipe piling until the plan is approved in writing by the Engineer. The Engineer shall have 7 days to review the plan. Should the Engineer fail to complete the review within 7 days, and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in reviewing the plan, the delay will be considered a right of way delay in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

Each length of steel pipe piling shall be marked in conformance with the requirements in ASTM Designation: A 252.

For steel pipe piling, including bar reinforcement in the piling, the Engineer shall be allowed 48 hours to review the "Welding Report," specified in "Welding Quality Control" of these special provisions, and respond in writing after the required items have been received. No field welded steel pipe piling shall be installed, and no reinforcement in the piling shall be encased in concrete until the Engineer has approved the above requirements in writing. Should the Engineer fail to complete the review and provide notification within this time allowance, and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in notification, the delay will be considered a right of way delay in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

At the Contractor's option, a steel pipe pile may be re-tapped to prevent pile set-up; however, the field welded splice shall remain at least one meter above the work platform until that splice is approved in writing by the Engineer.

**Manufactured Steel Pipe**

Manufactured steel pipe is defined as pipe produced at a permanent facility where an automatic welding process, electric resistance welder, or seamless pipe operation is used in conformance with ASTM Designations: A 252, A 53, A 135, A 139, API 5L, or AWWA C200; where this steel pipe can be produced in lengths at least 9 m long without a circumferential splice; and where this manufacturing can be done on a daily basis. Manufactured steel pipe is not a specifically engineered product. (i.e. Manufactured steel pipe is an off-the-shelf item.)

Manufactured steel pipe used for steel pipe piling shall conform to the following requirements:

A. The outside circumference of the steel pipe piling end shall not vary by more than 10 mm from that corresponding to the diameter shown on the plans.
B. The maximum allowable misalignment for adjacent steel pipe pile edges to be welded shall be 0.1875 times the wall thickness, but not more than 1.6 mm.
C. Steel pipe pile straightness shall conform to the requirements in API 5L, Section 7.6, "Straightness."
D. Welds made at a permanent manufacturing facility shall be made by either an automatic welding process or an electric resistance welding process.

**Fabricated Steel Pipe**

Fabricated steel pipe is defined as pipe produced at a permanent facility where a variety of steel fabrication including roll forming and welding steel plate into pipe is performed, where this pipe is at least 19 mm in wall thickness, where this pipe is produced in conformance with API 2B, and where this fabrication can be done on a daily basis. Fabricated steel pipe is a specifically engineered product. (i.e. Fabricated steel pipe is engineered for a specific project.)

Fabricated steel pipe used for steel pipe piling shall conform to API 2B and the following requirements:

A. An API site license and API monogram are not required.
B. Weld filler metal shall conform to the requirements of AWS D1.5 for the welding of ASTM Designation: A 709, Grade 50 steel, except that the qualification, pretest, and verification test requirements need not be conducted if certified test reports are provided for the consumables to be used.

**Field Welding**

Field welding of steel piling is defined as welding performed after the certificate of compliance has been furnished by the manufacturer or fabricator and shall conform to the following requirements:

A. Match marking of pipe ends at the manufacturing or fabrication facility is recommended for piling to ensure weld

joint fit-up. Prior to positioning any 2 sections of steel pipe to be spliced by field welding, including those that have been match marked at the manufacturing or fabrication facility, the Contractor shall equalize the offsets of the pipe ends to be joined and match mark the pipe ends.

B. Welds made in the flat position or vertical position (where the longitudinal pipe axis is horizontal) shall be single-vee groove welds. Welds made in the horizontal position (where the longitudinal pipe axis is vertical) shall be single-bevel groove welds. Joint fit-ups shall conform to the requirements for tubular sections in AWS D1.1 and these special provisions.

C. The minimum thickness of the backing ring shall be 6 mm, and the ring shall be continuous. Splices in the backing ring shall be made by complete penetration welds. These welds shall be completed and inspected prior to final insertion into a pipe end. Attachment of backing rings to pipe ends shall be done using the minimum size and spacing of tack welds that will securely hold the backing ring in place. Tack welding shall be done in the root area of the weld splice. Cracked tack welds shall be removed and replaced prior to subsequent weld passes. The gap between the backing ring and the steel pipe piling wall shall be no greater than 2 mm. One localized portion of the splice, that is equal to or less than a length that is 20 percent of the outside circumference of the pipe, as determined by the Engineer, may be offset by a gap equal to or less than 6 mm provided that this localized portion is first seal welded using shielded metal arc E7016 or E7018 electrodes. The Contractor shall mark this localized portion so that it can be referenced during any required nondestructive testing (NDT). Backing rings shall have a minimum width of 1 1/2 times the thickness of the pile to be welded so that they will not interfere with the interpretation of the NDT.

D. For steel pipe with an outside diameter greater than 1.1 m, and with a wall thickness greater than 25.4 mm, the root opening tolerances may be increased to a maximum of 5 mm over the specified tolerances.

E. Weld filler metal shall conform to the requirements shown in AWS D1.5 for the welding of ASTM Designation: A 709, Grade 50 steel, except that the qualification, pretest, and verification test requirements need not be conducted if certified test reports are provided for the consumables to be used.

F. For field welding, including attaching backing rings and making repairs, the preheat and interpass temperature shall be in conformance with AWS D1.1, Section 3.5, "Minimum Preheat and Interpass Temperature Requirements," and with Table 3.2, Category C; and the minimum preheat and interpass temperature shall be 66°C, regardless of the pipe pile wall thickness or steel grade. In the event welding is disrupted, preheating to 66°C must occur before welding is resumed.

G. Welds shall not be water quenched. Welds shall be allowed to cool unassisted.

Radiographic, magnetic particle, or ultrasonic testing shall be used to assure soundness of backing rings in conformance with the requirements in AWS D1.1, Section 6.

**MEASUREMENT AND PAYMENT (PILING)**

Measurement and payment for the various types and classes of piles shall conform to the provisions in Sections 49-6.01, "Measurement," and 49-6.02, "Payment," of the Standard Specifications and these special provisions.

Payment for cast-in-place concrete piling shall conform to the provisions in Section 49-6.02, "Payment," of the Standard Specifications except that, when the diameter of cast-in-place concrete piling is shown on the plans as 600 mm or larger, reinforcement in the piling will be paid for by the kilogram as bar reinforcing steel (bridge).

Full compensation for furnishing and placing additional testing reinforcement, for load test anchorages, and for cutting off test piles as specified, shall be considered as included in the contract price paid for piling of the type or class shown in the Engineer's Estimate, and no additional compensation will be allowed.

Full compensation for 64 mm all-thread bars shall be considered as included in the contract price paid per meter for 1.8 m cast-in-drilled-hole concrete piling and no separate payment will be made therefor.

No additional compensation or extension of time will be made for additional foundation investigation, installation and testing of indicator piling, cutting off piling and restoring the foundation investigation and indicator pile sites, and review of request by the Engineer.

Full compensation for slurry, depositing concrete under slurry, test batches, inspection pipes, filling inspection holes and pipes with grout, drilling oversized cast-in-drilled-hole concrete piling, filling cave-ins and oversized piles with concrete, and redrilling through concrete, shall be considered as included in the contract prices paid per meter for cast-in-drilled-hole concrete piling of the types and sizes listed in the Engineer's Estimate, and no additional compensation will be allowed therefor.

The contract price paid per meter for cast-in-drilled-hole concrete piling (rock socket) of the sizes listed in the Engineer's Estimate shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in drilling or coring holes, disposing of the material resulting from drilling or coring holes, and furnishing and placing concrete, complete in place, to the required penetration, as shown on the plans, as specified in the

Standard Specifications and these special provisions, and as directed by the Engineer.

Additional cast-in-drilled-hole concrete piling, including inspection pipes, and bar reinforcing steel, required to maintain the length of cast-in-drilled-hole concrete piling (rock socket) into bedrock, as shown on the plans, will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications.

Full compensation for conforming to the provisions in "Steel Pipe Piling" and "Nondestructive Testing" of these special provisions shall be considered as included in the contract prices paid for the various items of work involved, and no additional compensation will be allowed therefor.

Full compensation for redriving monitored piles, for providing access for the Engineer, for dewatering during monitoring, and for installing and removing the instruments from the pile, shall be considered as included in the contract unit price paid for drive pile, and no separate payment will be made therefor. The length of piling to be paid for as furnish piling of the classes listed in the Engineer's Estimate shall include the lengths that monitored piles are redriven.

## 10-1.46 PRESTRESSING CONCRETE

Prestressing concrete shall conform to the provisions in Section 50, "Prestressing Concrete," of the Standard Specifications.

## 10-1.47 TIEBACK ANCHORS

Anchors at the retaining wall, consisting of holes drilled in foundation material, grouted steel bars or strands, and anchorage assemblies, and testing of installed anchors, shall conform to the details shown on the plans, the provisions in Section 50, "Prestressing Concrete," of the Standard Specifications and these special provisions.

Foundation recommendations are included in the "Information Handout" available to the Contractor in conformance with the provisions in Section 2-1.03, "Examination of Plans, Specifications, Contract, and Site of Work," of the Standard Specifications.

Difficult tieback installation is anticipated due to the presence of caving soils, existing abutment piles, low overhead clearance and traffic control.

The Contractor shall determine the bond length necessary to meet acceptance criteria specified herein.

The submittal of reduced prints of corrected original tracings will not be required for tieback anchor installations.

In fabricating, handling, shipping, and placing tieback anchors, adequate care shall be taken to avoid damage to the sheathing. All damage to the sheathing caused by handling and fabrication prior to tieback anchor installation shall be repaired or replaced as determined by the Engineer. Repair procedure for the sheathing shall be included in the working drawings.

The Contractor may submit, for approval by the Engineer and in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications, calculations and details for furnishing an alternative number of tiebacks that provides the same horizontal component and distribution of the design force as provided by the planned tiebacks. Alternative wall details shall be furnished, for approval by the Engineer, if the number of tiebacks is reduced. Alternative design calculations and details shall be signed by an engineer who is licensed as a Civil Engineer in the State of California.

### MATERIALS

Whenever "member" is referred to in Section 50, "Prestressing Concrete," of the Standard Specifications, it shall be considered to mean tieback anchor.

Structural steel for the tieback retaining wall shall conform to the provisions in Section 55, "Steel Structures," of the Standard Specifications and these special provisions. Structural steel shall consist of the anchorage assembly. The anchorage assembly shall be galvanized as indicated on the plans. The provisions of "Welding Quality Control" of these special provisions shall not apply to the anchorage enclosure or to the weld between the steel tube and the bearing plate of the anchorage assembly for tiebacks. Those provisions shall apply to all other welds of structural steel for tieback retaining walls.

The permanent bearing plate of the tieback anchor shall effectively distribute the design force (T), to the concrete, such that the concrete bearing stress does not exceed 11 MPa and the bending stress does not exceed 0.55 $f_y$ for steel nor 0.36 $f_y$ for cast steel or cast iron.

Grout shall conform to the provisions in Section 50-1.09, "Bonding and Grouting," of the Standard Specifications. Fine aggregate may be added to the grout mixture of portland cement and water used outside of the grouted sheathing in drilled holes which are 200 mm or greater in diameter, but only to the extent that the cement content of the grout is not less than 500 kg per cubic meter of grout. Fine aggregate, if used, shall conform to the provisions in Section 90-2, "Materials," and Section 90-3, "Aggregate Gradings," of the Standard Specifications.

The plastic sheathing for tieback anchors shall conform to the following: polyvinyl chloride (PVC) sheathing, high density polyethylene (HDPE) sheathing, and polypropylene sheathing.

Corrugated plastic sheathing shall be PVC or HDPE. The width of corrugations, the distance between corrugations, and the height of corrugations of corrugated plastic sheathing shall be approximately the same.

PVC sheathing may be used for smooth sheathing for bar tendons and corrugated sheathing. PVC sheathing shall conform to ASTM Designation: D 1784, Class 13464-B. Corrugated PVC sheathing shall have a nominal wall thickness of 1.0 mm. HDPE sheathing may be used for smooth sheathing for bar tendons and corrugated sheathing. HDPE sheathing shall have a density between 940 kg/m$^3$ and 960 kg/m$^3$ as measured in accordance with ASTM Designation: D 792, A-2. Corrugated HDPE sheathing shall have a nominal wall thickness of 1.5 mm for sheathing with an outside diameter of 75 mm or greater, and a nominal thickness of 1.0 mm for sheathing with an outside diameter less than 75 mm, with a tolerance of minus 0.25-mm.

HDPE sheathing may be used for the smooth sheathing encapsulating individual strands of strand type tendons. Smooth HDPE sheathing for encapsulating strands shall have a minimum wall thickness of 1.0 mm. Polypropylene sheathing may be used for the smooth plastic sheathing encapsulating individual strands of strand type tendons. Polypropylene sheathing shall have a density between 900 kg/m$^3$ and 910 kg/m$^3$. Smooth polypropylene sheathing shall have a minimum wall thickness of 1.0 mm.

The smooth sheathing for the unbonded length of the individual strands shall have sufficient strength to prevent damage during construction operations, shall be watertight, chemically stable without embrittlement or softening, and nonreactive with concrete, steel or corrosion inhibiting grease. Smooth plastic sheathing, including joints, shall be watertight.

The corrugated sheathing, including joints, shall have sufficient strength to prevent damage during construction operations, shall be grout-tight and watertight, chemically stable without embrittlement or softening, and nonreactive with concrete, steel or corrosion inhibiting grease.

The transition between the corrugated plastic sheathing and the anchorage assembly shall be an approved detail that allows stressing to the design force without evidence of distress in the corrugated plastic sheathing.

Additional requirements for tiebacks with strand type tendons are as follows:

A. The individual strands of a tendon, except for the bonded length, shall be fully coated with corrosion inhibiting grease and then encapsulated by a smooth HDPE or polypropylene sheath. The corrosion inhibiting grease shall fill all space between strand wires and shall encapsulate the strand giving an encasement diameter at least 0.12-mm greater than the diameter of the bare strand. The sheath shall be hot melt extruded onto the strand or shall be shop applied by an approved method that assures that all spaces between the sheath and the strand and between the strand wires are filled with corrosion inhibiting grease.
B. The corrosion inhibiting grease shall provide a continuous nonbrittle film of corrosion protection to the prestressing steel and lubrication between the strand and the sheathing, shall resist flow from the sheathing, shall be chemically stable and nonreactive with the prestressing steel, sheathing material and concrete, and shall be organic with appropriate polar, moisture displacing, and corrosion inhibiting additives.
C. The corrosion inhibiting grease shall have the physical properties listed in Table 3.2.1 of the Post Tensioning Manual, Fourth Edition, by the Post Tensioning Institute and as modified below. At least 40 days before use, a sample from the lot to be used and test results shall be provided for the corrosion inhibiting grease.

| Test | Requirements | ASTM Designation: |
|---|---|---|
| Water Soluble Ions:<br>Nitrates | 10 g/kg max. | D 3867 |
| Corrosion Test:<br>5% Salt Fog @ 38° C.<br>125 µm coating on<br>76 mm x 152 mm Q panel<br>Type S, 1000 hrs min. | Grade 7 or better | B 117, D 610 |
| Compatibility with sheathing:<br>Hardness change &<br>volume change of polymer after exposure to grease 40 days at 66° C. | 15% max.<br>10% max. | D 4289, Except use D 792 for density |

D. A Certificate of Compliance conforming to the provisions in Section 6-1.07, "Certificates of Compliance," of the

Standard Specifications, shall be furnished to the Engineer certifying that the corrosion inhibiting grease complies with the requirements herein if sample and test results are not provided for the lot used.

**CONSTRUCTION**

Tieback anchors shall be installed in accordance with the manufacturer's recommendations. In case of a conflict between the manufacturer's recommendations and these special provisions, these special provisions shall prevail.

Water and grout from tieback anchor construction operations shall not be permitted to fall on public traffic, to flow across shoulders or lanes occupied by public traffic, or to flow into landscaping, gutters or other drainage facilities. Excessive amounts of water shall not be used in any of the drilling and the tieback anchor installation procedures.

Tieback anchor steel shall be protected prior to completion of all grouting against rust, corrosion and physical damage in conformance with the provisions in Section 50, "Prestressing Concrete," of the Standard Specifications. In addition, there shall be no evidence of distress in the plastic sheathing or crushing of the cement grout within the pregrouted sheathing.

The tieback anchorage assembly shall be protected against rust, corrosion and physical damage, prior to completion of all grouting of enclosure or encasement in concrete.

The tieback anchor installation method selected by the Contractor shall be sufficient to achieve the loadings specified herein. Holes for tieback anchors shall be drilled in the foundation to a depth sufficient to provide the necessary bond length beyond the minimum unbonded length shown on the plans.

Tieback anchorage holes shall be drilled by either the rotary or rotary percussion drilling method.

The diameter of the drilled hole shall be large enough to provide a minimum of 25 mm grout cover within the bonded length of the tendon. Centralizers shall be used within the bonded length of the tendon.

Pregrouting shall occur at least 48 hours before placing the tendon in the drilled hole.

Prior to installing each anchor assembly into the drilled hole, the anchor assembly shall be clean and free of oil, grease or other extraneous substances, and any damage to the sheathing shall be repaired or replaced.

Grout for all stages of tieback construction shall be injected at the low end of the void being filled and shall be expelled at the high end until there is no evidence of entrapped air, water or diluted grout. The grout shall be placed using grout tubes, unless another method is approved by the Engineer. The quantity of the grout and the grout pressures shall be recorded.

After placing initial grout, the anchor shall remain undisturbed until the grout has reached a strength sufficient to provide anchorage during testing operations.

Additional requirements for tiebacks with bar type tendons are as follows:

A. The bar tendons in the unbonded area shall be sheathed with smooth sheathing that extends into the steel tube of the permanent tieback anchorage assembly, as shown on the plans. For this portion of smooth sheathing there is no minimum wall thickness and the sheathing shall be either PVC or HDPE.
B. In addition, bar tendons shall be sheathed full-length with corrugated sheathing. The annular space between the bar and the corrugated sheathing shall be pregrouted prior to placing the tendons in the drilled hole. The bar shall be centered in the sheathing.
C. There shall be a seal between the smooth sheathing and the corrugated sheathing at the top and bottom of the length of smooth sheathing.
D. For bar tendons, the initial grout in the drilled hole may be placed before or after insertion of the bar tendon.
E. For drilled holes 150 mm in diameter or less, the initial grout outside of the corrugated sheathing shall extend to within 150 mm of the end of the steel tube of the anchorage assembly. Grout in the unbonded length shall not be placed under pressure. For drilled holes greater than 150 mm in diameter, the initial grout outside of the corrugated sheathing shall be within the limits of the bonded length. After placing the initial grout, the anchor shall remain undisturbed until the grout has reached a strength sufficient to provide anchorage during testing operations.

Additional requirements for tiebacks with strand type tendons are as follows:

A. The Contractor shall have the option of using Alternative A or Alternative B as shown on the plans for tieback tendons.
B. For Alternative A and Alternative B, strand tendons shall be sheathed with corrugated sheathing. The individual strands within the bonded length shall be separated by spaces so that the entire surface of each strand is bonded in the grout. The maximum spacing of strand spacers shall be 1.50 m. The strand spacers shall be plastic and of a construction and strength that will provide support for the individual strands during construction operations.
C. For Alternative A, the bonded length of the tendon is sheathed with corrugated sheathing and pregrouted full length of the corrugated sheathing before placing the tendon in the hole. The corrugated sheathing shall lap the smooth sheathing on the strands 600 mm. For this alternative, the initial grout in the drilled hole may be placed before or

after insertion of the strand tendon.

D. For Alternative B, the tendon is sheathed full length with corrugated sheathing and pregrouted a minimum length of 600 mm before placing the tendon in the hole. After placing the tendon into the drilled hole and before placing initial grout in the drilled hole, the grout shall be injected at the low end of the corrugated sheathing and the grout shall be expelled at the high end until there is no evidence of entrapped air, water or diluted grout.

E. For Alternative A and Alternative B, anchors in holes of 150 mm diameter and smaller shall be initially grouted to within 150 mm of the end of the steel tube. Grout in the unbonded length shall not be placed under pressure. After placing the initial grout, the anchor shall remain undisturbed until the grout has reached a strength sufficient to provide anchorage during testing operations.

F. For Alternative A and Alternative B, anchors in holes of greater than 150 mm diameter shall be initially grouted within the bond length. After placing the initial grout, the anchor shall remain undisturbed until the grout has reached a strength sufficient to provide anchorage during testing operations.

**Testing**

All tiebacks shall be load tested by either a performance test or a proof test. The magnitude of applied test loads shall be determined with a calibrated pressure gauge or a load cell. Movements of the end of the tieback, relative to an independent fixed reference point, shall be measured and recorded to the nearest 0.025 mm at each load increment during the load tests. The Contractor shall perform the measuring and recording and shall furnish the Engineer copies of the recorded movements.

A minimum of 3 tiebacks per wall shall be performance tested. The Engineer shall determine the location of the tiebacks to be performance tested.

The performance test or proof test shall be conducted by measuring the test load applied to the tieback and the tieback end movement during incremental loading and unloading of the anchor in accordance with the loading schedule. The test load shall be held constant for 10 minutes. During the test load hold, the movement of the end of the tendon shall be measured at 1, 2, 3, 4, 5, 6, and 10 minutes. If the total movement between one minute and 10 minutes exceeds one mm, the test load shall be held for an additional 50 minutes. Total movement shall be measured at 15, 20, 25, 30, 45, and 60 minutes. If the test load is held for 60 minutes, a creep curve showing the creep movement between one minute and 60 minutes shall be plotted as a function of the logarithm of time.

| LOADING SCHEDULES | | |
|---|---|---|
| PERFORMANCE TEST | | PROOF TEST |
| | (CONT'D) | |
| AL | AL | AL |
| 0.25T | 0.25T | 0.25T |
| AL | 0.50T | 0.50T |
| 0.25T | 0.75T | 0.75T |
| 0.50T | 1.00T | 1.00T |
| AL | 1.25T | 1.25T |
| 0.25T | AL | 1.50T (TEST LOAD) |
| 0.50T | 0.25T | AL |
| 0.75T | 0.50T | |
| AL | 0.75T | |
| 0.25T | 1.00T | |
| 0.50T | 1.25T | |
| 0.75T | 1.50T (TEST LOAD) | |
| 1.00T (CONT'D) | AL | |
| T = Design force for the anchor shown on the plans | | |
| AL = Alignment load | | |

For performance and proof tests, each increment of load shall be applied in less than one minute and held for at least one minute but not more than 2 minutes or as specified above. The observation period for the load hold shall start when the pump begins to apply the last increment of load.

The jacking equipment, including the tendon movement measuring system, shall be stable during all phases of the tieback loading operations.

All tiebacks not performance tested shall be proof tested. If 1.5 times the design force cannot be obtained, the tieback

shall be redesigned and replaced. Tieback anchors shall not be retested, unless the tieback bond length is post-grouted after the unacceptable test.

A performance tested tieback is acceptable if:

A. The measured elastic movement exceeds 0.80 of the theoretical elongation of the unbonded length plus the jacking length at the maximum test load; and
B. The creep movement between one and 10 minutes is less than 1.0 mm.

A proof tested tieback is acceptable if:

A. The pattern of movements is similar to that of adjacent performance tested tiebacks; and
B. The creep movement between one and 10 minutes is less than 1.0 mm.

Performance tested or proof tested tiebacks which fail to meet acceptance criterion B will be acceptable if the maximum load is held for 60 minutes and the creep curve plotted from the movement data indicates a creep rate of less than 2.0 mm for the last log cycle of time.

**Lock-off**

After successful testing of the tiebacks, the tiebacks shall be tensioned against the structure and locked off at a load equal to 1.00 T. The lock-off force is the load on the jacks which is maintained while the anchor head or anchor nuts on the tieback are permanently set. Immediately after lock-off, a lift-off test shall be performed to demonstrate that the specified lock-off force was obtained. Adjustments in the shim thickness shall be made if required to maintain the specified lock-off force.

For strand tendons, the permanent wedges shall be fully set in the anchor head while the tendon is stressed to the test load of 1.50 T, and then locked off at the lock-off force by removal of the shims or other appropriate means.

Grouting to the level of secondary grouting to the dimensions shown on the plans shall be completed only after successful testing and lock-off has been completed. At least 24 hours after the secondary grout has set, the remaining void in the steel tube and bearing plate shall be filled with grout. Grout shall be injected at the low end and expelled at the high end until there is no evidence of entrapped air or water. A minimum grout head of 600 mm shall be maintained until the grout has set.

**MEASUREMENT AND PAYMENT**

No payment will be made for tiebacks which do not pass the specified testing requirements.

Tieback anchors will be measured and paid for by the unit, and the number for payment will be determined by the requirements of the details shown on the plans. No change in the number of tieback anchors to be paid for will be made because of the use by the Contractor of an alternative number of tiebacks.

The contract unit price paid for tieback anchor shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the tieback anchors, including special measures taken to contain grout in the drilled hole, testing, and furnishing and installing anchorage assemblies, complete in place, including repair or replacement of sheathing as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

## 10-1.48 CONCRETE STRUCTURES

Portland cement concrete structures shall conform to the provisions in Section 51, "Concrete Structures," of the Standard Specifications and these special provisions.

**GENERAL**

Shotcrete shall not be used as an alternative construction method for reinforced concrete members unless otherwise specified.

Neoprene strip shall be furnished and installed at abutment backwall joint protection in conformance with the details shown on the plans, the provisions in the Standard Specifications.

Furnishing and installing neoprene strip shall conform to the requirements for strip waterstops as provided in Section 51-1.145, "Strip Waterstops," of the Standard Specifications, except that the protective board will not be required.

Materials for access opening covers in soffits of new cast-in-place concrete box girder bridges shall conform to the provisions for materials in Section 75-1.03, "Miscellaneous Bridge Metal," of the Standard Specifications.

Plastic pipe located at vertical drains used behind retaining walls, including horizontal or sloping drains down slopes and

across sidewalk areas shall be polyvinyl chloride (PVC) plastic pipe, Schedule 80, conforming to the provisions for pipe for edge drains and edge drain outlets in Section 68-3.02, "Materials," of the Standard Specifications. The vertical drain pipe shall be rigidly supported in place during backfilling operations.

Concrete aprons, pads, wall gutter to inlet transitions, Type B drain to inlet transitions, and Type B drains will be measured and paid for as minor concrete (ditch lining).

Rectangular channels transitions, trapezoidal channel transitions, and culvert transitions will be measured and paid for as minor concrete (channel lining).

**FALSEWORK**

Falsework shall conform to the provisions in Section 51, "Concrete Structures," of the Standard Specifications and these special provisions.

In addition to the provisions in Section 51-1.06A, "Falsework Design and Drawings," of the Standard Specifications, the time to be provided for the Engineer's review of the working drawings for specific structures, or portions thereof, shall be as follows:

| Structure or Portion of Structure | Total Review Time - Weeks |
|---|---|
| Bridge No. 53-2917 | 4 |
| Bridge No. 53-2918 | 5 |

Temporary crash cushion modules, as shown on the plans and conforming to the provisions in "Temporary Crash Cushion Module" of these special provisions, shall be installed at the approach end of temporary railings which are located less than 4.6 m from the edge of a traffic lane. For 2-way traffic openings, temporary crash cushion modules shall be installed at the departing end of temporary railings which are located less than 1.8 m from the edge of a traffic lane.

**Welding and Nondestructive Testing**

Welding of steel members, except for previously welded splices and except for when fillet welds are used where load demands are less than or equal to 175 N/mm for each 3 mm of fillet weld, shall conform to AWS D1.1 or other recognized welding standard. The welding standard to be utilized shall be specified by the Contractor on the working drawings. Previously welded splices for falsework members are defined as splices made prior to the member being shipped to the project site.

Splices made by field welding of steel beams at the project site shall undergo nondestructive testing (NDT). At the option of the Contractor, either ultrasonic testing (UT) or radiographic testing (RT) shall be used as the method of NDT for each field weld and any repair made to a previously welded splice in a steel beam. Testing shall be performed at locations selected by the Contractor. The length of a splice weld where NDT is to be performed, shall be a cumulative weld length equal to 25 percent of the original splice weld length. The cover pass shall be ground smooth at the locations to be tested. The acceptance criteria shall conform to the requirements of AWS D1.1, Section 6, for cyclically loaded nontubular connections subject to tensile stress. If repairs are required in a portion of the weld, additional NDT shall be performed on the repaired sections. The NDT method chosen shall be used for an entire splice evaluation including any required repairs.

For all field welded splices, the Contractor shall furnish to the Engineer a letter of certification which certifies that all welding and NDT, including visual inspection, are in conformance with the specifications and the welding standard shown on the approved working drawings. This letter of certification shall be signed by an engineer who is registered as a Civil Engineer in the State of California and shall be provided prior to placing any concrete for which the falsework is being erected to support.

For previously welded splices, the Contractor shall determine and perform all necessary testing and inspection required to certify the ability of the falsework members to sustain the stresses required by the falsework design. This welding certification shall be in writing, shall be signed by an engineer who is registered as a Civil Engineer in the State of California, and shall be provided prior to placing any concrete for which the falsework is being erected to support.

The Contractor's engineer who signs the falsework drawings shall also certify in writing that the falsework is constructed in conformance with the approved drawings and the contract specifications prior to placing concrete. This certification shall include performing any testing necessary to verify the ability of the falsework members to sustain the stresses required by the falsework design. The engineer who signs the drawings may designate a representative to perform this certification. Where falsework contains openings for railroads, vehicular traffic, or pedestrians, the designated representative shall be qualified to perform this work, shall have at least three years of combined experience in falsework design or supervising falsework construction, and shall be registered as a Civil Engineer in the State of California. For other falsework, the designated representative shall be qualified to perform this work and shall have at least three years of combined experience in falsework design or supervising falsework construction. The Contractor shall certify the experience of the designated representative in writing and provide supporting documentation demonstrating the required experience if requested by the Engineer.

## ELASTOMERIC BEARING PADS

Elastomeric bearing pads shall conform to the provisions in Section 51-1.12H, "Elastomeric Bearing Pads," of the Standard Specifications and these special provisions.

## DECK CRACK TREATMENT

The Contractor shall use all means necessary to minimize the development of shrinkage cracks.

The Contractor shall remove all equipment and materials from the deck and clean the surface as necessary for the Engineer to measure the surface crack intensity. Surface crack intensity will be determined by the Engineer after completion of concrete cure, prior to prestressing, and prior to the release of falsework. In any 50-$m^2$ portion of deck within the limits of the new concrete deck, should the intensity of cracking be such that there are more than 5 m of cracks whose width at any location exceeds 0.5-mm, the deck shall be treated with methacrylate resin. The area of deck to be treated shall have a width that extends for the entire width of new deck inside the concrete barriers and a length that extends at least 1.5 m beyond the furthest single continuous crack outside the 50-$m^2$ portion, measured from where that crack exceeds 0.5-mm in width, as determined by the Engineer.

Deck crack treatment shall consist of test sealing, and furnishing and applying methacrylate resin in conformance with the requirements of these special provisions. If grinding operation is required, deck treatment shall take place after grinding.

Prior to the start of deck treatment work, the Contractor shall submit for approval by the Engineer, a program for public safety associated with the use of methacrylate resin. The program shall identify materials, equipment, and methods to be used. The Contractor shall not perform deck treatment work, other than that specifically authorized in writing by the Engineer, until the program has been approved.

If the measures being taken by the Contractor are inadequate to provide for public safety associated with use of methacrylate resin, the Engineer will direct the Contractor to revise the operations and the public safety program. Directions for revisions will be in writing and will specify the items in which the Contractor's program is inadequate. No further deck treatment shall be performed until public safety measures are adequate, and a revised program for public safety has been approved.

The Engineer will notify the Contractor of the approval or rejection of any submitted or revised program for public safety associated with the use of methacrylate resin within 10 working days of receipt of the final submitted program.

The State will not be liable to the Contractor for failure to approve all or any portion of an originally submitted or revised program for public safety associated with the use of methacrylate resin, nor for any delays to the work due to the Contractor's failure to submit an acceptable program for public safety associated with the use of methacrylate resin. If the Engineer does not review or approve the program submitted by the Contractor within the time specified and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in reviewing the program for public safety, the delay will be considered a right of way delay in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

### Materials

The material used for treating the deck shall be a low odor, high molecular weight methacrylate resin. Prior to adding initiator, the resin shall have a maximum volatile content of 30 percent when tested in conformance with the requirements in ASTM Designation: D 2369, and shall conform to the following:

| PROPERTY | TEST METHOD | REQUIREMENT |
|---|---|---|
| Viscosity mPa·s, maximum, (Brookfield RVT with UL adaptor, 50 RPM at 25°C) | ASTM D 2196 | 0.025 |
| Specific Gravity minimum, at 25°C | ASTM D 1475 | 0.90 |
| Flash Point °C, minimum | ASTM D 3278 | 82 |
| Vapor Pressure mm Hg, maximum, at 25°C | ASTM D 323 | 1.0 |
| Tack-free time minutes, maximum | California Test 551 | 400 |

| | | |
|---|---|---|
| at 25°C | | |
| PCC Saturated Surface-Dry Bond Strength MPa, minimum at 24 hours and 21±1°C | California Test 551 | 3.5 |
| * Test shall be performed prior to adding initiator. | | |

A Material Safety Data Sheet shall be furnished prior to use for each shipment of high molecular weight methacrylate resin.

The promoter and initiator, if supplied separately from the resin, shall not be mixed directly with each other. Containers of promoters and initiators shall not be stored together in a manner that will allow leakage or spillage from one to contact the containers or material of the other.

**Testing**

The Contractor shall allow 14 days for sampling and testing by the Engineer of the high molecular weight methacrylate resin prior to proposed use.

The Contractor shall treat a test area within the project limits of approximately 50 $m^2$ at a location approved by the Engineer. Conditions during the test treatment shall be similar to those expected on the deck. Equipment used in the test shall be similar to those used for the deck treating operations. If the test area is on the traveled way, traffic shall not be allowed on the treated test area until (1) the treated surface is tack free (non-oily), (2) the sand cover adheres sufficiently to resist brushing by hand, and (3) the coefficient of friction of the deck is at least 0.35 when tested in conformance with the requirements in California Test 342.

Should the above requirements for traffic use not be met, the Contractor shall suspend treating of bridge decks until another test area is treated and complies with the requirements.

**Construction**

Prior to deck treatment with methacrylate resin, the bridge deck surface shall be cleaned by abrasive blasting and all loose material shall be blown from visible cracks using high-pressure air. Concrete curing seals shall be cleaned from the deck surface to be treated, and the deck shall be dry when blast cleaning is performed. If the deck surface becomes contaminated at any time prior to placing the penetrating sealer, the deck surface shall be cleaned by abrasive blasting.

Equipment shall be fitted with suitable traps, filters, drip pans, or other devices as necessary to prevent oil or other deleterious material from being deposited on the deck.

Where abrasive blasting is being performed within 3 m of a lane occupied by public traffic, the residue including dust shall be removed immediately after contact between the abrasive and the surface being treated. The removal shall be by a vacuum attachment operating concurrently with the abrasive blasting operation.

The relative humidity shall be less than 90 percent at time of treatment.

A compatible promoter/initiator system shall be capable of providing a resin gel time of not less than 40 minutes nor more than 1.5 hours at the temperature of application. Gel time shall be adjusted to compensate for the changes in temperature throughout treatment application.

The quantity of resin mixed with promoter and initiator shall be limited to 20 L at a time for manual application.

Machine application of the resin shall be performed by using a two-part resin system using a promoted resin for one part and an initiated resin for the other part. This two-part resin system shall be combined at equal volumes to the spray bars through separate positive displacement pumps. Combining of the 2 components shall be by either static in-line mixers or by external intersecting spray fans. The pump pressure at the spray bars shall not be great enough to cause appreciable atomization of the resin. Compressed air shall not be used to produce the spray. A shroud shall be used to enclose the spray bar apparatus. Hand held spray apparatus shall not be used.

The Contractor shall allow methacrylate resin to be applied only to the specified area. Barrier rails, joints, and drainage facilities shall be adequately protected to prevent contamination by the treatment material. Contaminated items shall be repaired at the Contractor's expense.

The prepared area shall be dry and the surface temperature shall be less than or equal to 38°C when the resin is applied. The rate of application of promoted/initiated resin shall be approximately 2.5 square meters per liter, ± 0.1 square meter per liter.

The deck surfaces to be treated shall be flooded with resin, allowing penetration into the concrete and filling of all cracks. The treatment shall be applied within 5 minutes after complete mixing. A significant increase in viscosity shall be cause for rejection. Excess material shall be redistributed by squeegees or brooms within 10 minutes after application.

After the resin has been applied, at least 20 minutes shall elapse before applying sand. The sand shall be commercial quality dry blast sand. Ninety-five percent of the sand shall pass the 2.36-mm sieve, and 95 percent shall be retained on the 850-µm sieve. The sand shall be applied at a rate of one kilogram per square meter, ± 0.1 kilogram per square meter.

Excess sand shall be removed from the deck surface by vacuuming or sweeping prior to opening to traffic.

Traffic shall not be allowed on the treated area until (1) the treated surface is tack free (non-oily), (2) the sand cover adheres sufficiently to resist brushing by hand, and (3) the coefficient of friction of the deck is at least 0.35 when tested in conformance with the requirements in California Test 342.

**MEASUREMENT AND PAYMENT**

Measurement and payment for concrete in structures shall conform to the provisions in Section 51-1.22, "Measurement," and Section 51-1.23, "Payment," of the Standard Specifications and these special provisions.

Full compensation for furnishing and installing access opening covers in soffits of new cast-in-place box girder bridges shall be considered as included in the contract price paid per cubic meter for structural concrete, bridge and no separate payment will be made therefor.

Full compensation for furnishing and installing plastic pipe located at vertical drains used behind retaining walls and bridge abutments, including horizontal or sloping drains down slopes and across sidewalk areas, including excavation and backfill involved in placing the plastic pipe, shall be considered as included in the contract price paid per cubic meter for the various items of concrete work involved and no separate payment will be made therefor.

Full compensation for deck crack treatment, including a program for public safety and airborne monitoring, shall be considered as included in the contract price paid per cubic meter for structural concrete (bridge) and no additional compensation will be allowed therefor.

**10-1.49 PTFE BEARING**

PTFE bearings, consisting of steel reinforced elastomeric bearing pads, polytetrafluoroethylene (PTFE) surfacing, and stainless steel and steel plates, shall conform to the details shown on the plans, the provisions in Section 51, "Concrete Structures," of the Standard Specifications, and these special provisions.

The Contractor shall submit working drawings for the PTFE bearings to the Office of Structure Design, (OSD) for approval in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. For initial review, 6 sets of drawings shall be submitted for railroad bridges and 4 sets shall be submitted for other structures. After review, between 6 and 12 sets, as requested by the Engineer, shall be submitted to OSD for final approval and for use during construction.

Working drawings shall be 279 mm x 432 mm in size, and each drawing and calculation sheet shall include the name of the structure as shown on the contract plans, District-County-Route, bridge number, and contract number.

At the completion of each structure on the contract, one set of prints on 75-g/m$^2$ (minimum) bond paper, 279 mm x 432 mm in size, of the corrected original tracings of all working drawings for each structure shall be furnished to the Engineer. Prints of drawings which are common to more than one structure shall be submitted for each structure. An index prepared specifically for the drawings for each structure containing sheet numbers and titles shall be included on the first print in the set for each structure. Prints for each structure shall be arranged in the order of drawing numbers shown in the index.

The edge of the corrected original tracing image shall be clearly visible and visually parallel with the edges of the page. A clear, legible symbol shall be provided as near to the upper left side of each page as is feasible within the original print to show the amount of reduction and a horizontal and vertical scale shall be provided on each reduced print to facilitate enlargement to original scale.

The manufacturer shall furnish Certificates of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications, for all material used in the PTFE bearings.

The shear modulus of the elastomer in the elastomeric bearing pads shall be 750±75 kPa.

PTFE sheet shall be made from unfilled PTFE resin and shall conform to the following requirements:

| Test | Test Method | Requirements |
|---|---|---|
| Tensile strength (Minimum) | ASTM D 4894 or D 4895 | 19.3 MPa |
| Elongation (Minimum) | ASTM D 4894 or D 4895 | 200 % |

The PTFE resin shall be virgin material (not reprocessed) meeting the requirements of ASTM Designation: D 4894 or D 4895, with a minimum thickness of 6 mm. Specific gravity shall be from 2.13 to 2.19. Melting point shall be 327±10°C.

The PTFE sliding surface shall be provided with lubricant dimples with a maximum diameter of 8 mm, a minimum

depth of 2 mm, and a maximum depth of one half of the PTFE sheet thickness. The dimples shall be uniformly distributed within the area 6 mm from the edges of the PTFE sheet and occupy between 20 percent and 30 percent of the PTFE sheet area.

Stainless steel plates shall conform to the requirements of ASTM Designation: A 240, Type 304, with a minimum thickness of 3 mm.

Steel plates, except stainless steel, shall conform to the requirements of ASTM Designation: A 36/A 36M.

Welding of structural steel shall conform to the requirements of AWS D1.1. Welding of structural steel to stainless steel shall conform to the requirements of AWS D1.6.

The PTFE sheet shall be adhesive bonded in the recess of steel plate under controlled factory conditions. The adhesive material shall be an epoxy resin conforming to the requirements of Federal Specification: MMM-A-134.

Contact surfaces of PTFE sheet and steel plate to be bonded shall be uniformly roughened to a minimum roughness height value of 6.3 µm.

The side of the PTFE sheet to be bonded shall be factory treated by the sodium naphthalene or sodium ammonia process, after the contact surface is roughened.

After completion of the bonding operation the PTFE surface shall be smooth and free from bubbles. The PTFE sheet shall show no signs of delamination and shall be fully bonded within the recess.

The stainless steel plate shall be attached by perimeter welding using Type 309L electrodes. After completion of the weld operation, the stainless steel plate shall be smooth and free from waves.

The flatness of the bearing elements shall be controlled such that upon completion of the bearing assembly, the PTFE/stainless steel sliding interface shall be in full bearing.

The mating surface of the stainless steel plate with the PTFE surfacing shall have a minimum #8 mirror finish determined according to ANSI Standard B46.1. The sliding element of the production bearings shall have a first movement static coefficient of friction not exceeding 0.06 when tested without the coating of silicone grease.

Steel reinforced elastomeric bearing pads shall be fully vulcanized to the steel plates under factory controlled conditions, and the bond shall have a peel-strength of at least 5.3 Newtons per millimeter as determined by California Test 663.

Metal surfaces of bearings exposed to the atmosphere and in contact with the structure in the completed work, except stainless steel surfaces, shall be cleaned and painted in conformance with the provisions in Sections 59-2, "Painting Structural Steel," and 91, "Paint" of the Standard Specifications, and "Clean and Paint Structural Steel" of these special provisions.

Certification in conformance with the requirements in SSPC-QP 1, SSPC-QP 2, and SSPC-QP 3 of the "SSPC: The Society for Protective Coatings" will not be required for cleaning and painting PTFE bearings.

Finish coats will not be required on the bearings.

After installation, the top of the assembly shall be removed and a 1.5 mm thick coating of silicone grease shall be applied to the entire PTFE surface and the bearing reassembled without damage to the mating sliding surfaces. Silicone grease shall conform to the requirements in Military Specification: MIL-S-8660.

Damaged bearings and bearings with scratched mating surfaces shall be returned to the factory for replacement or resurfacing.

Prior to proof testing or painting, all individual components shall be permanently die-stamped on 2 of 4 sides with markings consisting of bearing number and contract number. Each bearing shall have a unique bearing number and match marks on plate edges to insure correct assembly at the job site.

Full sized PTFE bearings shall be proof tested and evaluated for compression and coefficient of initial static friction in the presence of the Engineer. The proof tests shall be performed on samples randomly selected by the Engineer from the production bearings to be used in the work. Proof testing shall be performed by the Contractor at the manufacturer's plant or at an approved laboratory. If proof tests can not be performed at the specified load, the Contractor shall submit to the Engineer for review and approval a testing plan listing additional physical tests. These tests shall be performed in the presence of the Engineer, and shall demonstrate that the requirements for proof testing at the specified load are satisfied. The Contractor shall give the Engineer at least 7 days notice before beginning proof testing. Proof testing of PTFE bearings shall conform to the following requirements:

A. One bearing per lot of production PTFE bearings shall be proof tested. A lot is defined as 25 PTFE bearings or fraction thereof of the same type, within a load category.
B. A load category shall consist of bearings of differing vertical load capacity within a range defined as follows:

    1. Bearings with less than or equal to 2225 kN maximum vertical load capacity.
    2. Bearings with greater than 2225 kN but less than or equal to 8900 kN maximum vertical load capacity.
    3. Bearings with greater than 8900 kN maximum vertical load capacity.

C. Bearings shall be proof tested for compression and coefficient of friction.

D. Proof tests for compression: The bearing shall be held for one hour at 1.5 times the maximum vertical load shown on the plans for the bearing.
E. Proof tests for coefficient of friction: The tests shall be performed at the minimum dead load shown on the plans for the bearing with the test load applied for 12 hours continuously and the test load shall not be reduced or removed prior to friction measurement and the following:

    1. The tests shall be arranged to allow measurement of the static coefficient of friction on the first movement of the bearing.
    2. The first movement static and dynamic coefficients of friction shall be measured at a sliding speed not exceeding 25 millimeters per minute and shall not exceed the specified coefficient of initial static friction.
    3. The test bearings shall be subjected to a minimum of 100 movements of at least 25 mm of relative movement at a sliding speed not exceeding 300 millimeters per minute. After cycling, the first movement static and dynamic coefficients of friction shall be measured again at a sliding speed not exceeding 25 millimeters per minute and shall not exceed the specified coefficient of initial static friction.

F. The bearing surfaces shall be cleaned prior to testing.
G. Proof testing of bearings shall be done after conditioning specimens for 12 hours at 24°±3°C.
H. The proof tested bearings shall show no visible sign of: (1) bond failure of bearing surfaces, (2) separation or lift-off of plates from each other or from PTFE surfaces, (3) excessive transfer of PTFE to the stainless steel surface, or (4) other defects. When a proof tested bearing fails to comply with these specifications, all bearings in that lot shall be individually tested for acceptance.
I. Proof test results shall be certified correct and signed by the testing laboratory personnel who conducted the test and interpreted the test results. Proof test results shall include the bearing numbers of the bearings tested.

One sample of elastomeric bearing pad, 57±3 mm high and not less than 200 mm x 300 mm in plan, shall be cut by the manufacturer from one of the thickest production elastomeric bearing pads, as directed by the Engineer, and furnished to the Transportation Laboratory. The Contractor shall allow 3 weeks for testing and obtaining satisfactory results after the sample elastomeric bearing pad has been received.

A test specimen taken from the sample furnished to the Transportation Laboratory will be tested in conformance with the requirements in California Test 663 for 10,000 cycles at the design load and 1/2 T (T = total thickness of elastomer) translation. The testing speed shall not exceed 115 millimeters per minute. Specimens tested shall show no indication of deterioration of elastomer or loss of bond between the elastomer and steel laminates.

PTFE bearing sole plates shall be temporarily supported during concrete placement. Temporary supports shall prevent the rotation or displacement of the bearings during concrete placing operations. Temporary supports shall not inhibit the functioning of the PTFE bearings after concrete is placed. Temporary supports shall not restrict the movement at bridge joints due to temperature changes and shortening from prestress forces. Materials for temporary supports within the limits for placing concrete shall conform to the requirements for form fasteners.

PTFE and stainless steel surfaces shall be protected from contamination and weather damage.

Quantities of PTFE bearings will be determined as units from actual count in the completed work. A PTFE bearing with more than one disc shall be considered a single PTFE bearing.

The contract unit price paid for PTFE bearing shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the bearing, complete in place, including temporary supports, proof testing, and cleaning and painting of PTFE bearings, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for furnishing the sample of elastomeric bearing pad shall be considered as included in the contract unit price paid for PTFE bearing, and no separate payment will be made therefor.

If a portion or all of PTFE bearings are either fabricated or tested at a site more than 480 air line kilometers from both Sacramento and Los Angeles, additional shop inspection expenses will be sustained by the State. Whereas it is and will be impractical and extremely difficult to ascertain and determine the actual increase in such expenses, it is agreed that payment to the Contractor for PTFE bearings will be reduced $5,000 for each fabrication or testing site located more than 480 air line kilometers from both Sacramento and Los Angeles and an additional $10,000 ($15,000 total) for each fabrication or testing site located more than 4800 air line kilometers from both Sacramento and Los Angeles.

**10-1.50 PTFE SPHERICAL BEARING**

PTFE spherical bearings, consisting of polytetrafluoro-ethylene (PTFE) and stainless steel bearing surfaces, structural steel plates and anchors shall conform to the details shown on the plans and these special provisions.

PTFE spherical bearings shall be of Expansion type with spherical and sliding bearing surfaces.

The manufacturer of the PTFE spherical bearings shall show evidence that PTFE spherical bearings furnished by the same manufacturer and used in conditions similar to this application have had at least 3 years of satisfactory service at each of 2 projects.

A qualified representative of the manufacturer shall be present during installation of the first bearing and shall be available for advice during any remaining installations.

The working drawings for PTFE spherical bearings shall include a description of the method of mechanical interlocking of the PTFE fabric to the metallic substrate and details of temporary support for the PTFE bearing sole plate during concrete placement.

Working drawings shall be 279 mm x 432 mm or 559 mm x 864 mm in size and each drawing and calculation sheet shall include the name of the structure as shown on the contract plans, District-County-Route, bridge number, and contract number.

At the completion of each structure on the contract, one set of reduced prints on 75-g/m$^2$ (minimum) bond paper, 279 mm x 432 mm in size, of the corrected original tracings of all working drawings for each structure shall be furnished to the Engineer. Reduced prints of drawings which are common to more than one structure shall be submitted for each structure. An index prepared specifically for the drawings for each structure containing sheet numbers and titles shall be included on the first reduced print in the set for each structure. Reduced prints for each structure shall be arranged in the order of drawing numbers shown in the index.

The edge of the corrected original tracing image shall be clearly visible and visually parallel with the edges of the page. A clear, legible symbol shall be provided as near to the upper left side of each page as is feasible within the original print to show the amount of reduction and a horizontal and vertical scale shall be provided on each reduced print to facilitate enlargement to original scale.

PTFE spherical bearings shall be installed on surfaces prepared in conformance with the provisions in Section 55-3.19, "Bearings and Anchorages," of the Standard Specifications.

The manufacturer shall furnish Certificates of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for all material used in the PTFE spherical bearings. The certification shall be supported by a copy of the results of all proof tests performed on the bearings.

PTFE surfaces of PTFE spherical bearings shall be unfilled PTFE fabric made from virgin PTFE oriented multifilament and other fibers. The resin in the filaments shall be virgin PTFE material (not reprocessed) in conformance with the requirements of ASTM Designation: D 4441.

At the highest point of substrate and after compression, the PTFE fabric shall have a minimum thickness of 1.6 mm and a maximum thickness of 3.2 mm.

Flat stainless steel surfaces shall be a weld overlay on structural steel plate, or solid or sheet stainless steel conforming to the requirements of ASTM Designation: A 240, Type 304 with a minimum thickness of 3.2 mm.

Curved stainless steel surfaces shall be solid stainless steel conforming to the requirements of ASTM Designation: A 240, Type 304.

Curved stainless steel surfaces with dimensions shown on the plans exceeding 101.6 mm in thickness shall be either a weld overlay on structural steel plate or solid stainless steel conforming to the requirements of ASTM Designation: A 240, Type 304. Stainless steel sheet will not be allowed.

When a weld overlay is used for stainless steel surfacing, the overlay shall be placed by submerged arc welding using Type 309L electrodes. The finished overlay shall have a 2.38 mm minimum thickness after welding, grinding and polishing. Prior to welding, the manufacturer must submit a complete weld procedure to the Engineer for approval.

When stainless steel sheets are used for stainless steel surfacing, the sheets shall be attached by perimeter arc welding using Type 309L electrodes. After completion of the weld operation, the stainless steel surface shall be smooth and free from waves.

Steel plates, except stainless steel, shall conform to the requirements of ASTM Designation: A 709/A 709, Grade 36 [250], 50 [345], or 50W [345W].

Welding of structural steel shall conform to the requirements of AWS D1.1. Welding of structural steel to stainless steel shall conform to the requirements of AWS D1.6.

Convex plate radius dimension tolerances shall be 0.000 to -250 µm. Concave plate radius dimensions shall be +250 to 0.000 µm.

The bearing manufacturer shall have full size convex and concave metal templates for the 2 spherical surfaces of each bearing radius. The templates shall be available to the inspector during all bearing inspections.

The PTFE fabric on spherical or sliding bearing surfaces shall be epoxy bonded and mechanically interlocked to the steel substrate. All bonding shall be done under controlled factory conditions. The mechanical interlock on the spherical concave surface must be integrally machined into the steel substrate. Welded retention grids will not be allowed on the concave surface. Any edges, other than the selvage shall be oversown or recessed so that no cut fabric edges are exposed.

After completion of the bonding operation the PTFE surface shall be smooth and free from bubbles.

The surface of the bearing elements shall be controlled such that upon completion of the bearing assembly the PTFE to stainless steel interface shall be in full bearing.

The mating surface of the flat stainless steel with the PTFE surfacing shall have a minimum #8 mirror finish as determined in conformance with the requirements in ANSI Standard B46.1. The mating surface of the curved stainless steel with the PTFE surfacing shall have a finish of less than 0.4 µm root-mean-square (rms), as determined in conformance with the requirements in ANSI Standard B46.1.

Metal surfaces of bearings exposed to the atmosphere and in contact with the structure of the completed work, except stainless steel surfaces, shall be cleaned and painted in conformance with the provisions in Sections 59-2, "Painting Structural Steel," and 91, "Paint" of the Standard Specifications, and "Clean and Paint Structural Steel" of these special provisions.

Certification in conformance with the requirements in SSPC-QP 1, SSPC-QP 2, and SSPC-QP 3 of the "SSPC: The Society for Protective Coatings" will not be required for PTFE spherical bearings.

Finish coats will not be required on the bearings.

PTFE spherical bearing assemblies shall be assembled at the factory. Each assembly shall have a minimum of 4 temporary steel straps which are bolted to threaded holes in the masonry and sole plates so that the entire assembly is shipped as a unit and remains intact when uncrated and installed. Welding of the steel straps will not be allowed. Straps must be adequate for vertical lifting purposes. Bearing dismantling will only be allowed under the direction and in the presence of the Engineer.

During fabrication, the maximum temperature of bonded PTFE surfaces shall be 150°C.

Damaged bearings and bearings with scratched mating surfaces shall be returned to the factory for replacement or resurfacing.

PTFE spherical bearing sole plates shall be temporarily supported during concrete placement. Temporary supports shall prevent the rotation or displacement of the bearing during concrete placing operations. Temporary supports shall not inhibit the functioning of the PTFE spherical bearing after concrete is placed. Temporary supports shall not restrict the movement at bridge joints due to temperature changes and shortening from prestress forces. Materials for temporary supports within the limits for placing concrete shall conform to the requirements for form fasteners.

PTFE spherical bearings shall have a first movement static coefficient of friction not exceeding 0.06.

Prior to proof testing, all bearings shall be permanently die-stamped on 2 of 4 sides with markings consisting of bearing number and contract number. Each bearing shall have a unique bearing number and match marks on plate edges to insure correct assembly at the job site.

Full sized PTFE spherical bearings shall be proof tested and evaluated for compression and coefficient of friction in the presence of the Engineer. The proof tests shall be performed on samples randomly selected by the Engineer from the production bearings to be used in the work. Proof testing shall be performed by the Contractor at the manufacturer's plant or at an approved laboratory. If proof tests can not performed at the specified load, the Contractor shall submit to the Engineer for review and approval a testing plan listing additional physical tests. These tests shall be performed in the presence of the Engineer and shall demonstrate that the requirements for proof testing at the specified load are satisfied. The Contractor shall give the Engineer at least 7 days notice before beginning proof testing. Proof testing of PTFE spherical bearings shall conform to the following requirements:

A. One bearing per lot of production bearings shall be proof tested. A lot is defined as 25 bearings or fraction thereof of the same type, within a load category. Bearings in two load categories with vertical load capacities within 800 kN of each other will be considered in one load category for testing.

B. The bearing type and proof tests required shall be as follows:

   1. Expansion type bearings shall be proof tested for compression and coefficient of friction.

C. A load category shall consist of bearings of differing vertical load capacity within a range defined as follows:

   1. Bearings with less than or equal to 2225 kN maximum vertical load capacity.
   2. Bearings with greater than 2225 kN but less than or equal to 8900 kN maximum vertical load capacity.
   3. Bearings with more than 8900 kN maximum vertical load capacity.

D. Proof tests for compression: The bearing shall be held at the design rotation or 0.02 radians whichever is greater for one hour at 1.5 times the maximum vertical load shown on the plans for the bearing. The device shall be in a rotated position during the test. The rotation may be imposed on the bearing by inserting a beveled plate between the bearing and the restraining surface prior to loading.

E. Proof tests for coefficient of friction: The tests shall be performed at the minimum vertical load shown on the plans

for the bearing with the test load applied for 12 hours prior to friction measurement and the following:

1. The tests shall be arranged to allow measurement of the static coefficient of friction on the first movement of the bearing.
2. The first movement static and dynamic coefficients of friction shall be measured at a sliding speed not exceeding 25 millimeters per minute and shall not exceed the specified coefficient of initial static friction.
3. The test bearings shall be subjected to a minimum of 100 movements of at least 25 mm of relative movement at a sliding speed not exceeding 300 millimeters per minute. After cycling, the first movement static and dynamic coefficients of friction shall be measured again at a sliding speed not exceeding 25 millimeters per minute and shall not exceed the specified coefficient of initial static friction.

F. The bearing surfaces shall be cleaned prior to proof testing.
G. Proof testing of bearings shall be done after conditioning specimens for 12 hours at 21°±8°C.
H. The proof tested bearings shall show no visible sign of: (1) bond failure of bearing surfaces, (2) separation or lift-off of plates from each other or from PTFE surfaces, or (3) other defects. When a proof tested bearing fails to comply with these specifications, all bearings in that lot shall be individually tested for acceptance.
I. Proof test results shall be certified correct and signed by the testing laboratory personnel who conducted the test and interpreted the test results. Proof test results shall include the bearing numbers of the bearings tested.

Quantities of PTFE spherical bearings will be determined as units from actual count in the completed work. A PTFE spherical bearing with more than one PTFE surface shall be considered a single PTFE spherical bearing.

The contract unit price paid for PTFE spherical bearing shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the bearing, complete in place, including masonry and sole plates, anchor bolts and sleeves, mortaring of bolts, temporary supports, proof testing, and cleaning and painting of PTFE spherical bearings, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

If a portion or all of PTFE spherical bearings are either fabricated or tested at a site more than 480 air line kilometers from both Sacramento and Los Angeles, additional shop inspection expenses will be sustained by the State. Whereas it is and will be impractical and extremely difficult to ascertain and determine the actual increase in such expenses, it is agreed that payment to the Contractor for PTFE spherical bearings will be reduced $5,000 for each fabrication or testing site located more than 480 air line kilometers from both Sacramento and Los Angeles and an additional $10,000 ($15,000 total) for each fabrication or testing site located more than 4800 air line kilometers from both Sacramento and Los Angeles.

## 10-1.51 STRUCTURE APPROACH SLABS (Type N)

This work shall consist of constructing reinforced concrete approach slabs, structure approach drainage system, and treated permeable base at structure approaches in conformance with the details shown on the plans, the provisions in Section 51, "Concrete Structures," of the Standard Specifications, and these special provisions.

### GENERAL

Attention is directed to "Engineering Fabrics" of these special provisions.

### STRUCTURE APPROACH DRAINAGE SYSTEM

#### Geocomposite Drain

Geocomposite drain shall consist of a manufactured core not less than 6.35 mm thick nor more than 50 mm thick with one or both sides covered with a layer of filter fabric that will provide a drainage void. The drain shall produce a flow rate, through the drainage void, of at least 25 liters per minute per meter of width at a hydraulic gradient of 1.0 and a minimum externally applied pressure of 168 kPa.

A Certificate of Compliance conforming to the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications shall be furnished for the geocomposite drain certifying that the drain produces the required flow rate and complies with these special provisions. The Certificate of Compliance shall be accompanied by a flow capability graph for the geocomposite drain showing flow rates and the externally applied pressures and hydraulic gradients. The flow capability graph shall be stamped with the verification of an independent testing laboratory.

Filter fabric for the geocomposite drain shall conform to the provisions for fabric for underdrains in Section 88, "Engineering Fabrics," of the Standard Specifications.

The manufactured core shall be either a preformed grid of embossed plastic, a mat of random shapes of plastic fibers, a drainage net consisting of a uniform pattern of polymeric strands forming 2 sets of continuous flow channels, or a system of

plastic pillars and interconnections forming a semirigid mat.

The core material and filter fabric shall be capable of maintaining the drainage void for the entire height of geocomposite drain. Filter fabric shall be integrally bonded to the side of the core material with the drainage void. Core material manufactured from impermeable plastic sheeting having nonconnecting corrugations shall be placed with the corrugations approximately perpendicular to the drainage collection system.

The geocomposite drain shall be installed with the drainage void and the filter fabric facing the embankment. The fabric facing the embankment side shall overlap a minimum of 75 mm at all joints and wrap around the exterior edges a minimum of 75 mm beyond the exterior edge. If additional fabric is needed to provide overlap at joints and wrap-around at edges, the added fabric shall overlap the fabric on the geocomposite drain at least 150 mm and be attached thereto.

Should the fabric on the geocomposite drain be torn or punctured, the damaged section shall be replaced completely or repaired by placing a piece of fabric that is large enough to cover the damaged area and provide a 150-mm overlap.

**Plastic Pipe**

Plastic pipe shall conform to the provisions for pipe for edge drains and edge drain outlets in Section 68-3, "Edge Drains," of the Standard Specifications.

**Drainage Pads**

Concrete for use in drainage pads shall be minor concrete, except the concrete shall contain not less than 300 kilograms of cement per cubic meter.

**Treated Permeable Base At Bottom Of Geocomposite Drains**

Treated permeable base to be placed around the slotted plastic pipe at the bottom of geocomposite drains shall conform to the provisions in "Treated Permeable Base Under Approach Slabs." If asphalt treated permeable base is used, it shall be placed at a temperature of not less than 82°C nor more than 110°C.

The filter fabric to be placed over the treated permeable base at the bottom of geocomposite drains shall conform to the provisions for filter fabric for edge drains in Section 88, "Engineering Fabrics," of the Standard Specifications.

**ENGINEERING FABRICS**

Filter fabric to be placed between the structure approach embankment material and the treated permeable base shall conform to the provisions for filter fabric for edge drains in Section 88, "Engineering Fabrics," of the Standard Specifications and these special provisions.

The subgrade to receive the filter fabric, immediately prior to placing, shall conform to the compaction and elevation tolerance specified for the material involved.

Filter fabric shall be aligned, handled, and placed in a wrinkle-free manner in conformance with the manufacturer's recommendations.

Adjacent borders of the filter fabric shall be overlapped from 300 to 450 mm or stitched. The preceding roll shall overlap the following roll in the direction the material is being spread or shall be stitched. When the fabric is joined by stitching, it shall be stitched with yarn of a contrasting color. The size and composition of the yarn shall be as recommended by the fabric manufacturer. The number of stitches per 25 mm of seam shall be 5 to 7.

Equipment or vehicles shall not be operated or driven directly on the filter fabric.

Woven tape fabric shall be treated to provide a minimum of 70 percent breaking strength retention after 500 hours exposure when tested in conformance with the requirements in ASTM Designation: D 4355. The Contractor shall notify the Engineer, in writing, of the source of woven tape fabric at least 45 days prior to use.

**TREATED PERMEABLE BASE UNDER APPROACH SLAB**

Treated permeable base under structure approach slabs shall consist of constructing either an asphalt treated permeable base or a cement treated permeable base in accordance with Section 29, "Treated Permeable Bases," of the Standard Specifications and these special provisions.

The type of treatment, asphalt or cement, to be used shall be at the option of the Contractor.

The Contractor shall notify the Engineer in writing, not less than 30 days prior to the start of placing the treated permeable base, which type of treated permeable base will be furnished. Once the Contractor has notified the Engineer of the selection, the type to be furnished shall not be changed without a prior written request to do so and approval thereof in writing by the Engineer.

Asphalt treated permeable base shall be placed at a temperature of not less than 93°C nor more than 121°C. Material stored in excess of 2 hours shall not be used in the work.

Asphalt treated permeable base material may be spread in one layer. The base material shall be compacted with a

vibrating shoe type compactor or rolled with a roller weighing at least 1.3 tonnes but no more than 4.5 tonnes. Rolling shall begin as soon as the mixture has cooled sufficiently to support the weight of the rolling equipment without undue displacement.

Cement treated permeable base material may be spread in one layer. The base material shall be compacted with either a vibrating shoe type compactor or with a steel-drum roller weighing at least 1.3 tonnes but no more than 4.5 tonnes. Compaction shall follow within one-half hour after the spreading operation and shall consist of 2 complete coverages of the treated material.

**APPROACH SLABS**

Concrete for use in approach slabs shall contain not less than 400 kilograms of cementitious material per cubic meter.

Structure approach slabs shall be cured for not less than 5 days prior to opening to public traffic, unless, at the option of the Contractor, the structure approach slabs are constructed using concrete with a non-chloride Type C chemical admixture conforming to these special provisions.

Portland cement for use in concrete using a non-chloride Type C chemical admixture shall be Type II Modified, Type II Prestress, or Type III. Type II Modified and Type III cement shall conform to the provisions in Section 90-2.01, "Cement," of the Standard Specifications. Type II Prestress cement shall conform to the requirements of Type II Modified cement, except the mortar containing the portland cement to be used and Ottawa sand, when tested in conformance with California Test 527, shall not contract in air more than 0.053-percent.

The non-chloride Type C chemical admixture, approved by the Engineer, shall conform to the requirements in ASTM Designation: C 494 and Section 90-4, "Admixtures," of the Standard Specifications.

The concrete with non-chloride Type C chemical admixture shall be prequalified prior to placement in conformance with the provisions for prequalification of concrete specified by compressive strength in Section 90-9.01, "General," of the Standard Specifications and the following:

A. Immediately after fabrication of the 5 test cylinders, the cylinders shall be stored in a temperature medium of 21 ± 1.5°C until the cylinders are tested.
B. The 6-hour average strength of the 5 test cylinders shall not be less than 5.85 MPa. No more than 2 test cylinders shall have a strength of less than 5.5 MPa.

The top surface of approach slabs shall be finished in conformance with the provisions in Section 51-1.17, "Finishing Bridge Decks," of the Standard Specifications. Edges of slabs shall be edger finished.

Approach slabs shall be cured with pigmented curing compound (1) in conformance with the provisions for curing structures in Section 90-7.01B, "Curing Compound Method," of the Standard Specifications.

Structure approach slabs constructed using concrete with a non-chloride Type C chemical admixture shall be cured for not less than 6 hours prior to opening to public traffic. The curing period shall be considered to begin at the start of discharge of the last truck load of concrete to be used in the slab.

If the ambient temperature is below 18°C during the curing period for approach slabs using concrete with a non-chloride Type C chemical admixture, an insulating layer or blanket shall be used to cover the surface. The insulating layer or blanket shall have an R-value rating given in the table below. At the Contractor's option, a heating tent may be used in lieu of or in combination with the insulating layer or blanket.

| Temperature range during curing period | R-value, minimum |
|---|---|
| 13°C to 18°C | 1 |
| 7°C to 13°C | 2 |
| 4°C to 7°C | 3 |

**JOINTS**

Hardboard and expanded polystyrene shall conform to the provisions in Section 51-1.12D, "Sheet Packing, Preformed Pads and Board Fillers," of the Standard Specifications.

Type AL joint seals shall conform to the provisions in Section 51-1.12F, "Sealed Joints" of the Standard Specifications. The sealant may be mixed by hand-held power-driven agitators and placed by hand methods.

The pourable seal between the steel angle and concrete barrier shall conform to the requirements for Type A and AL seals in Section 51-1.12F(3), "Materials and Installation," of the Standard Specifications. The sealant may be mixed by hand-held power-driven agitators and placed by hand methods. Immediately prior to placing the seal, the joint shall be thoroughly cleaned, including abrasive blast cleaning of the concrete surfaces, so that all foreign material and concrete spillage are removed from all joint surfaces. Joint surfaces shall be dry at the time the seal is placed.

**MEASUREMENT AND PAYMENT**

Structural concrete, approach slab (Type N) will be measured and paid for in conformance with the provisions in Section 51-1.22, "Measurement," and Section 51-1.23, "Payment," of the Standard Specifications and these special provisions.

Full compensation for the structure approach drainage system including geocomposite drain, plastic pipe, drainage pads, treated permeable base, filter fabric, woven tape fabric, miscellaneous metal, pourable seals, epoxy-coated bar reinforcement and epoxy-coated miscellaneous bridge metal, transverse joint seals at sleeper slabs, waterstops, and sliding joints shall be considered as included in the contract price paid per cubic meter for structural concrete, approach slab of the type shown in the Engineer's Estimate, and no additional compensation will be allowed therefor.

## 10-1.52 STRUCTURE APPROACH SLABS (TYPE R)

Structure approach slabs (Type R) shall consist of removing portions of existing structures, existing pavement and base including reinforced concrete approach slabs, asphalt concrete surfacing, portland cement concrete pavement, subsealing material, and cement treated base and constructing new reinforced concrete approach slabs and portions of reinforced concrete approach slabs at structure approaches as shown on the plans and in conformance with these special provisions.

**GENERAL**

The thickness shown on the plans for structure approach slabs is the minimum thickness. The thickness will vary depending on the thickness of the pavement and base materials removed.

Where pavement subsealing has been performed under existing approach slabs, the subsealing material shall be removed for its full depth. Where removal of cement treated base is required to construct the approach slab, the entire thickness of the cement treated base shall be removed.

Voids between the new reinforced structure approach slab and the base material remaining in place that are caused by removal of subsealing material or cement treated base shall be filled, at the option of the Contractor, with aggregate base (approach slab) or structure approach slab concrete.

The Contractor shall establish a grade line for new approach slabs and portions of approach slabs which shall provide a smooth profile grade. The profile grade will be subject to the approval of the Engineer.

The Contractor shall schedule his operations so that the pavement and base materials removed during a work period shall be replaced, in that same work period, with approach slab concrete that shall be cured for at least 6 hours prior to the time the lane is to be opened to public traffic as designated in "Maintaining Traffic" of these special provisions. In the event the existing pavement and base materials are removed and the Contractor is unable to construct, finish, and cure the new approach slab by the time the lane is to be opened to public traffic, the excavation shall be filled with a temporary roadway structural section as specified in this section, "Structure Approach Slabs (Type R)."

At locations where the removal of existing materials and approach slab construction is not required to be completed within the same work period, the requirements for "Temporary Roadway Structural Section" shall not apply. The Contractor shall have the option of:

A. Curing the approach slab concrete for not less than 5 days prior to opening to public traffic, or
B. Constructing the approach slab using concrete with a non-chloride Type C chemical admixture and curing the approach slab concrete at least 6 hours prior to opening to public traffic.

**TEMPORARY ROADWAY STRUCTURAL SECTION**

A standby quantity of asphalt concrete and aggregate base, equal to the quantity of pavement removed during the work shift, shall be provided at the project site for construction of a temporary roadway structural section where existing approaches to structures are being replaced. The temporary structural section shall be maintained and later removed as a first order of work when the Contractor is able to construct and cure the approach slab within the prescribed time limit. The temporary structural section shall consist of 90-mm thick layer of asphalt concrete over aggregate base.

The aggregate base for the temporary structural section shall conform to the requirements specified under "Aggregate Base (Approach Slab)" of these special provisions.

The asphalt concrete for the temporary structural section shall be produced from commercial quality aggregates and asphalt binder. The grading of the aggregate shall conform to the 19-mm maximum medium grading in Section 39-2.02, "Aggregate," of the Standard Specifications and the asphalt binder shall conform to the requirements of liquid asphalt SC-800 in Section 93, "Liquid Asphalts," of the Standard Specifications. The amount of asphalt binder to be mixed with the aggregate shall be approximately 0.3-percent less than the optimum bitumen content as determined by California Test 367.

Aggregate base and asphalt concrete for the temporary structural section shall be spread and compacted by methods that will produce a well-compacted, uniform base, free from pockets of coarse or fine material and a surfacing of uniform

smoothness, texture, and density. The aggregate base and the asphalt concrete may each be spread and compacted in one layer. The finished surface of the asphalt concrete shall not vary more than 15 mm from the lower edge of a 3.6-m straightedge placed parallel with the centerline and shall match the elevation of the existing concrete pavement and structure along the joints between the existing pavement and structure and the temporary surfacing.

The material from the removed temporary structural section shall be disposed of in conformance with Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications except that removed aggregate base may be stockpiled at the project site and reused for construction of another temporary structural section. When no longer required, standby material or stockpiled material for construction of temporary structural sections shall be removed and disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

**REMOVING EXISTING PAVEMENT AND BASE MATERIALS**

The outline of portland cement concrete to be removed shall be sawed full depth with a power-driven concrete saw.

The outlines of excavations in asphalt concrete shall be cut on a neat line to a minimum depth of 75 mm with a power-driven concrete saw or wheel-type rock cutting excavator before any asphalt concrete material is removed. These excavations shall be permanently or temporarily backfilled to conform to the grade of the adjacent pavement prior to opening the lane to public traffic. Surplus excavated material may be used as temporary backfill material.

Regardless of the type of equipment used to remove concrete within the sawed outline, the surface of the concrete to be removed shall not be impacted within 0.5-m of the pavement to remain in place. Removing existing pavement and base materials shall be performed without damage to the adjacent structure or pavement that is to remain in place. Damage to the structure or to the pavement that is to remain in place shall be repaired in conformance with the provisions in Section 7-1.11, "Preservation of Property," of the Standard Specifications.

Materials removed shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

The base material remaining in-place, after removing the existing pavement and base materials to the required depth, shall be graded uniformly, watered, and compacted. The finished surface of the base material at any point shall not extend above the grade approved by the Engineer.

Areas of the base material that are low as a result of over excavation shall be filled, at the Contractor's expense, with structure approach slab concrete at the time and in the same operation that the new concrete is placed.

**AGGREGATE BASE (APPROACH SLAB)**

The aggregate base (approach slab) for filling voids below the reinforced structure approach slab concrete shall be produced from commercial quality aggregates consisting of broken stone, crushed gravel or natural rough-surfaced gravel, and sand, or any combination thereof. The grading of the aggregate base shall conform to the 19-mm maximum grading specified in Section 26-1.02A, "Class 2 Aggregate Base," of the Standard Specifications.

Aggregate base (approach slab) for filling voids below the reinforced structure approach slab concrete shall be spread and compacted by methods that will produce a well-compacted, uniform base, free from pockets of coarse or fine material. The aggregate base shall be watered and compacted to the grade approved by the Engineer. Where the required thickness of aggregate base is 200 mm or less, the base may be spread and compacted in one layer. Where the required thickness of aggregate base is more than 200 mm, the base shall be spread and compacted in 2 or more layers of approximately equal thickness. The maximum compacted thickness of any one layer shall not exceed 200 mm. The finished surface of the base material at any point shall not extend above the grade approved by the Engineer. Areas of the base material that are lower than the grade approved by the Engineer, shall be filled with structure approach slab concrete at the time and in the same operation that the new concrete is placed.

**STRUCTURE APPROACH SLAB**

Reinforced concrete approach slabs shall conform to the provisions for approach slabs in Section 51, "Concrete Structures," of the Standard Specifications and these special provisions.

Concrete for use in approach slabs shall contain not less than 400 kg of cement per cubic meter.

Steel components of abutment ties including plates, nuts, washers, and rods shall conform to the provisions in Section 75-1.03, "Miscellaneous Bridge Metal," of the Standard Specifications.

Steel components of abutment ties including plates, nuts, washers, and rods shall conform to the provisions in Section 75-1.03, "Miscellaneous Metal," of the Standard Specifications and shall be epoxy-coated in conformance with the provisions in Section 52-1.02B, "Epoxy-coated Reinforcement" of the Standard Specifications. Galvanizing will not be required.

The steel angles at the concrete barrier joint shall conform to the provision in Section 75-1.03, "Miscellaneous Metal," of the Standard Specifications.

Approach slab concrete that requires a minimum curing period of 6 hours shall be constructed using a non-chloride Type C chemical admixture. Mineral admixture will not be required in this concrete.

Portland cement for use in concrete using a non-chloride Type C chemical admixture shall be Type II Modified, Type II Prestress, or Type III. Type II Modified and Type III cement shall conform to the provisions in Section 90-2.01, "Cement," of the Standard Specifications. Type II Prestress cement shall conform to the requirements of Type II Modified cement, except the mortar containing the portland cement to be used and Ottawa sand, when tested in conformance with California Test 527, shall not contract in air more than 0.053-percent.

The non-chloride Type C chemical admixture shall be approved by the Engineer and shall conform to the requirements in ASTM Designation: C 494 and Section 90-4, "Admixtures," of the Standard Specifications.

The concrete with non-chloride Type C chemical admixture shall be prequalified prior to placement in conformance with the provisions for prequalification of concrete specified by compressive strength in Section 90-9.01, "General," of the Standard Specifications and the following:

A. Immediately after fabrication of the 5 test cylinders, the cylinders shall be stored in a temperature medium of 21 ± 1.5°C until the cylinders are tested.
B. The 6-hour average strength of the 5 test cylinders shall not be less than 5.85 MPa. No more than 2 test cylinders shall have a strength of less than 5.5 MPa.

Building paper shall be commercial quality No. 30 asphalt felt.

Polyvinyl chloride (PVC) conduit used to encase the abutment tie rod shall be commercial quality.

Bar reinforcement or abutment tie rods in drilled holes shall be bonded in conformance with the provisions for drilling and bonding dowels in Section 83-2.02D(1), "General," of the Standard Specifications.

If reinforcement is encountered during drilling before the specified depth is attained, the Engineer shall be notified. Unless the Engineer approves coring through the reinforcement, the hole will be rejected and a new hole, in which reinforcement is not encountered, shall be drilled adjacent to the rejected hole to the depth shown on the plans.

The top surface of approach slabs shall be finished in conformance with the provisions in Section 51-1.17, "Finishing Bridge Decks," of the Standard Specifications. The finished top surface shall not vary more than 6 mm from the lower edge of a 3.6-m straightedge placed parallel with the centerline. Edges of slabs shall be edger finished.

The surface of the approach slab will not be profiled and the Profile Index requirements shall not apply.

Approach slabs shall be cured with pigmented curing compound (1) in conformance with the provisions for curing structures in Section 90-7.01B, "Curing Compound Method," of the Standard Specifications. The minimum curing period as specified herein shall be considered to begin at the start of discharge of the last truck load of concrete to be used in the slab. Fogging of the surface with water after the curing compound has been applied will not be required. Should the film of curing compound be damaged from any cause before the approach slab is opened to public traffic, the damaged portion shall be repaired immediately with additional compound, at the Contractor's expense. Damage to the curing compound after the approach slab is opened to public traffic shall not be repaired.

If the ambient temperature is below 18°C during the curing period, an insulating layer or blanket shall cover the surface. The insulation layer or blanket shall have an R-value rating given in the table below. At the Contractor's option, a heating tent may be used in lieu of or in combination with the insulating layer or blanket:

| Temperature range during curing period | R-value, minimum |
|---|---|
| 13°C to 18°C | 1 |
| 7°C to 13°C | 2 |
| 4°C to 7°C | 3 |

Tests to determine the coefficient of friction of the final textured surface will be made only if the Engineer determines by visual inspection that the final texturing may not have produced a surface having the specified coefficient of friction. Tests to determine the coefficient of friction will be made after the approach slab is opened to public traffic, but not later than 5 days after concrete placement. The coefficient of friction will be measured by California Test 342. Portions of completed concrete surfaces that are found to have a coefficient of friction less than 0.35 shall be ground or grooved parallel to the center line in conformance with the provisions for bridge decks in Section 42, "Groove and Grind Pavement," of the Standard Specifications.

**JOINTS**

Hardboard and expanded polystyrene shall conform to the provisions in Section 51-1.12D, "Sheet Packing, Preformed Pads and Board Fillers," of the Standard Specifications.

Type AL joint seals shall conform to the provisions in Section 51-1.12F, "Sealed Joints," of the Standard Specifications.

The sealant may be mixed by hand-held power-driven agitators and placed by hand methods.

**MEASUREMENT AND PAYMENT**

Structural concrete, approach slab (Type R) and structural concrete, approach slab (Type R Modified) will be measured and paid for in conformance with the provisions in Section 51-1.22, "Measurement," and Section 51-1.23, "Payment," of the Standard Specifications and these special provisions.

Full compensation for removing and disposing of portions of existing structures and pavement materials, and for furnishing and placing miscellaneous metal, epoxy-coated materials, Type AL joint seals, and pourable seals shall be considered as included in the contract price paid per cubic meter for structural concrete, approach slab (Type R) and structural concrete, approach slab (Type R Modified) and no separate payment will be made therefor.

The quantity of aggregate base (approach slab) to be paid for shall include the actual volume of aggregate base (approach slab) used to fill voids below the reinforced structure approach slab concrete, except for the volume of areas low as a result of over excavation. The volume to be paid for will be calculated on the basis of the constructed length, width, and thickness of the filled voids. Structure approach slab concrete used to fill voids lower than the approved grade of the base, except for the areas low as a result of over excavation by the Contractor, will be measured and paid for by the cubic meter as aggregate base (approach slab).

The contract price paid per cubic meter for aggregate base (approach slab) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing aggregate base (approach slab), complete in place, including excavation and removing and disposing of base and subsealing materials, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for furnishing, stockpiling, and disposing of standby material for construction of temporary structural sections; and for constructing, maintaining, removing, and disposing of temporary structural sections shall be considered as included in the contract price paid per cubic meter for structural concrete, approach slab (Type R) and structural concrete, approach slab (Type R Modified) and no separate payment will be made therefor.

Full compensation for drilling and bonding of bar reinforcement or abutment tie rods shall be considered as included in the contract price paid per cubic meter for structural concrete, approach slab (Type R) and structural concrete, approach slab (Type R Modified) and no separate payment will be made therefor.

## 10-1.53 PAVING NOTCH EXTENSION

This work shall consist of extending existing paving notches in conformance with the details shown on the plans and these special provisions.

Concrete for paving notch extension shall be a high-strength material consisting of either magnesium phosphate concrete, modified high alumina based concrete, or portland cement based concrete. Magnesium phosphate concrete shall conform to the provisions for magnesium phosphate concrete in Section 83-2.02D(1), "General," of the Standard Specifications and these special provisions. Modified high alumina based concrete and portland cement based concrete shall be water activated and shall conform to the provisions for single component (water activated) magnesium phosphate concrete in Section 83-2.02D(1), "General," of the Standard Specifications and these special provisions.

At least one hour shall elapse between the time of placing concrete for the paving notch extension and placing concrete for the structure approach slab.

A clean uniform rounded aggregate filler may be used to extend the concrete. The moisture content of the aggregate shall not exceed 0.5-percent. Grading of the aggregate shall conform to the following:

| Sieve Sizes | Percentage Passing |
|---|---|
| 12.5-mm | 100 |
| 1.18-mm | 0-5 |

The amount of aggregate filler shall conform to the manufacturer's recommendation, but in no case shall the concrete strengths be less than that specified for magnesium phosphate concrete in Section 83-2.02D(1), "General," of the Standard Specifications.

The components of dual component (with a prepackaged liquid activator) magnesium phosphate shall be combined by mixing complete units supplied by the manufacturer. Portions of units shall not be used. Water shall not be added to dual component magnesium phosphate.

Magnesium phosphate concrete shall not be mixed in containers or worked with tools containing zinc, cadmium, aluminum or copper. Modified high alumina based concrete shall not be mixed in containers or worked with tools containing aluminum.

Concrete shall not be retempered. Finishing tools that are cleaned with water shall be thoroughly dried before working the concrete.

When placing concrete on slopes exceeding 5 percent, the Engineer may require the Contractor to provide a flow controlled modified material.

Modified high alumina based concrete and portland cement based concrete shall be cured in conformance with the provisions in Section 90-7.01B, "Curing Compound Method," of the Standard Specifications. Magnesium phosphate concrete shall not be cured.

The surface temperature of the areas to receive the concrete shall be 5°C or above when the concrete is placed. The contact surface to receive the magnesium phosphate concrete shall be dry. The contact surfaces to receive the modified high alumina concrete or portland cement based concrete may be damp but not saturated.

The construction joint between the paving notch extension and the existing abutment shall conform to the provisions for horizontal construction joints in Section 51-1.13, "Bonding," of the Standard Specifications. Concrete shall be placed in the spalled portions of the existing paving notch concurrently with the concrete for the paving notch extension.

Attention is directed to "Reinforcement" of these special provisions.

Structure excavation and backfill shall conform to the provisions in Section 19-3, "Structure Excavation and Backfill," of the Standard Specifications, except for payment.

Drilling of holes and bonding of reinforcing steel dowels shall conform to the provisions for drilling and bonding dowels in Section 83-2.02D(1), "General," of the Standard Specifications. If reinforcement is encountered during drilling before the specified depth is attained, the Engineer shall be notified. Unless the Engineer approves coring through the reinforcement, the hole will be rejected and a new hole, in which reinforcement is not encountered, shall be drilled adjacent to the rejected hole to the depth shown on the plans.

The quantity of concrete for paving notch extension will be measured by the cubic meter as determined in conformance with the dimensions shown on the plans or other dimensions that may be ordered in writing by the Engineer.

The contract price paid per cubic meter for paving notch extension shall include full compensation for furnishing all labor, materials (including concrete for the paving notch spalled areas), tools, equipment, and incidentals, and for doing all the work involved in constructing the paving notch extension, complete in place, including structure excavation and backfill, reinforcement, and drilling and bonding dowels, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

## 10-1.54 SOUND WALL

### DESCRIPTION

This work shall consist of constructing sound walls of masonry block. Sound walls shall be supported on concrete barriers, retaining walls, and footings as shown on the plans.

The Contractor shall submit 2 sets of elevation and plan layout drawings to the Engineer, as provided in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. The drawings shall be to scale and shall show the proposed top and bottom elevation lines. The top and bottom elevation lines shown on the plans are minimum and shall be fully contained in the proposed layout drawings. The drawings shall include, within the limits shown on the plans, the panel sizes, pile spacing, post spacing, footing steps, aesthetic features, locations of expansion joints, and access gates. The Contractor shall allow 2 weeks after complete drawings are submitted for review.

### SOUND WALL (MASONRY BLOCK)

Sound wall (masonry block), consisting of a reinforced hollow unit masonry block stem, shall be constructed in conformance with the provisions in Sections 19, "Earthwork," 52, "Reinforcement," and 90, "Portland Cement Concrete," of the Standard Specifications and these special provisions.

Sound wall masonry unit stems shall be constructed with joints of portland cement mortar. Wall stems shall be constructed with hand laid block. Wall stems shall not be constructed with preassembled panels.

Concrete for sound wall footings, pile caps and grade beams, if required, shall be minor concrete.

Concrete masonry units shall be hollow, load bearing, conforming to the requirements in ASTM Designation: C 90, lightweight or medium weight classification, Type II. Standard or open end units may be used. Open end units, if used, shall not reduce the spacing of the bar reinforcement as shown on the plans.

The masonry units shall be nominal size and texture and of uniform color. The color shall be fawn, selected from the manufacturer's standards.

When high strength concrete masonry units with f'm=17.2 MPa are shown on the plans, the high strength masonry units shall have a minimum compressive strength of 26 MPa based on net area. Each high strength concrete masonry unit shall be identified with a groove embedded in an interior corner. The groove shall extend from a mortar surface for a length of about 50 mm and shall have a depth of about 5 mm.

Expansion joint filler shall conform to the requirements in ASTM Designation: D 1751 or ASTM Designation: D 2000

2AA-805.

Portland cement mortar shall be colored to match the units. Coloring shall be chemically inert, fade resistant mineral oxide or synthetic type.

Portland cement for wall stems shall conform to the provisions in Section 90-2.01, "Portland Cement," of the Standard Specifications.

Hydrated lime shall conform to the requirements in ASTM Designation: C 207, Type S.

Mortar sand shall be commercial quality.

Mortar for laying masonry units shall consist, by volume, of one part portland cement, 0 to 0.5 part hydrated lime, and 2.25 to 3 parts mortar sand. Sufficient water shall be added to make a workable mortar. Each batch of mortar shall be accurately measured and thoroughly mixed. Mortar shall be freshly mixed as required. Mortar shall not be retempered more than one hour after mixing.

Prepackaged mortar materials and mortar containing admixtures may be used when approved in writing by the Engineer, provided the mortar shall not contain more than 0.05 percent soluble chlorides when tested in conformance with California Test 422 nor more than 0.25 percent soluble sulfates, as $SO_4$, when tested in conformance with California Test 417.

Prior to laying masonry units using prepackaged mortar materials or mortar containing admixtures, the Contractor shall submit to the Engineer the proposed sources of the materials together with test data from an independent testing laboratory for mortar tested in conformance with California Test 551. The test data shall be from specimens having a moist cure, except, the sample shall not be immersed in lime water. The average 28-day compressive strength of the mortar shall be not less than 17.2 MPa.

At the option of the Contractor, grout for filling masonry units may be proportioned either by volume or mass. Grout shall contain only enough water to cause the grout to flow and fill the voids without segregation. The maximum amount of free water shall not exceed 0.7 times the weight of the cement for regular strength masonry. The maximum amount of free water shall not exceed 0.6 times the mass of the cement for high strength masonry.

Grout proportioned by volume for regular strength masonry shall consist of at least one part portland cement and 4.5 parts aggregate. Grout proportioned by volume for high strength masonry shall consist of at least one part portland cement and 3.5 parts aggregate. Aggregate volumes shall be based on a loose, air-dry condition.

Grout proportioned by mass for regular strength masonry shall contain not less than 325 kilograms of portland cement per cubic meter. Grout proportioned by mass for high strength masonry shall contain not less than 400 kilograms of portland cement per cubic meter.

Reinforced concrete masonry unit wall stems shall be constructed with portland cement mortar joints in conformance with the following:

A. Concrete masonry unit construction shall be true and plumb in the lateral direction and shall conform to the grade shown on the plans in the longitudinal direction. Bond beam units or recesses for horizontal reinforcement shall be provided.
B. Mortar joints shall be approximately 10 mm wide. Walls and cross webs forming cells to be filled with grout shall be full bedded in mortar to prevent leakage of grout. All head and bed joints shall be solidly filled with mortar for a distance in from the face of the wall or unit not less than the thickness of the longitudinal face shells. Head joints shall be shoved tight.
C. Mortared joints around cells to be filled shall be placed so as to preserve the unobstructed vertical continuity of the grout filling. Any overhanging mortar or other obstruction or debris shall be removed from the inside of such cells.
D. Reinforcement shall be securely held in position at top and bottom with either wire ties or spacing devices and at intervals not exceeding 192 bar diameters prior to placing any grout. Wire shall be 16-gage (1.57 mm) or heavier. Wooden, aluminum, or plastic spacing devices shall not be used.
E. Splices in vertical reinforcement shall be made only at the locations shown on the plans.
F. Only those cells containing reinforcement shall be filled solidly with grout. All grout in the cells shall be consolidated at the time of placement by vibrating, and reconsolidated after excess moisture has been absorbed, but before plasticity is lost. Grout shall not be sliced with a trowel.
G. Walls shall be constructed in 1.2-m maximum height lifts. Grouting of each lift shall be completed before beginning masonry unit construction for the next lift. The top course of each lift shall consist of a bond beam.
H. A construction joint shall be constructed at the top of the top course to permit placement of the mortar cap. The mix design for the mortar cap shall be as approved by the Engineer.
I. Construction joints shall be made when the placing of grout, in grout filled cells, is stopped for more than one hour. The construction joint shall be approximately 12 mm below the top of the last course filled with grout.
J. Bond beams shall be continuous. The top of unfilled cells under horizontal bond beams shall be covered with metal or plastic lath.
K. When fresh masonry joins masonry that is partially or totally set, the contact surface shall be cleaned, roughened, and lightly wetted.

L. Surfaces of concrete on which the masonry walls are to be constructed shall be roughened and cleaned, exposing the aggregate, and shall be flushed with water and allowed to dry to a surface dry condition immediately prior to laying the masonry units.
M. Where cutting of masonry units is necessary, all cuts shall be made with a masonry saw to neat and true lines. Masonry units with cracking or chipping of the finished exposed surfaces will not be acceptable.
N. Masonry shall be protected in the same manner specified for concrete structures in Section 90-8, "Protecting Concrete," of the Standard Specifications and these special provisions.
O. During erection, all cells shall be kept dry in inclement weather by covering partially completed walls. The covering shall be waterproof fabric, plastic or paper sheeting, or other approved material. Wooden boards and planks shall not be used as covering materials. The covering shall extend down each side of masonry walls approximately 0.6-m.
P. Splashes, stains or spots on the exposed faces of the wall shall be removed.

**MEASUREMENT AND PAYMENT**

Sound walls and sound walls (barrier) of the types designated in the Engineer's Estimate will be measured by the square meter of wall projected on a vertical plane between the elevation lines shown on the plans or for walls supported on barriers from the top of the barrier to the upper elevation line and length of wall (including the exposed posts, back up wall for access openings, and access gates).

The contract prices paid per square meter for sound wall and sound wall (barrier) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the sound wall, complete in place, including all supports (except retaining walls, barriers, and barrier supports), anchorages, access gates, ladders, corrugated steel pipe landings, excavation, backfill, reinforcement and grade beams, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer. Retaining walls, concrete barrier, and barrier supports supporting sound walls (barrier) will be measured and paid for as separate items of work.

## 10-1.55 CORE CONCRETE

Coring concrete shall consist of coring holes through reinforced concrete bridge members as shown on the plans and in conformance with these special provisions.

The holes shall be cored by methods that will not shatter or damage the concrete adjacent to the holes.

Water for core drilling operations shall be from the local domestic water supply or shall not contain more than 1000 parts per million of chlorides as Cl, nor more than 1300 parts per million of sulfates as $SO_4$, nor shall the water contain any impurities in a sufficient amount that would cause discoloration of the concrete or produce etching of the surface.

Water from core drilling operations shall not be permitted to fall on public traffic, to flow across shoulders or lanes occupied by public traffic, or to flow into gutters or other drainage facilities.

Coring concrete will be measured by the meter as core concrete of the sizes listed in the Engineer's Estimate. The cored concrete will be measured along the centerline of the hole without deduction for expansion joints.

The contract price paid per meter for core concrete of the sizes listed in the Engineer's Estimate shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in coring the holes, including control of water from core drilling and repairing any damaged reinforcement, as shown on the plans, as specified in these special provisions, and as directed by the Engineer.

## 10-1.56 SEALING JOINTS

Joints in concrete bridge decks and joints between concrete structures and concrete approach slabs shall be sealed in conformance with the details shown on the plans, the provisions in Section 51, "Concrete Structures," of the Standard Specifications, and these special provisions.

Where polyurethane seals are shown on the plans, a silicone sealant conforming to the provisions in Section 51–1.12F, "Sealed Joints," of the Standard Specifications may be used.

When ordered by the Engineer, a joint seal larger than called for by the Movement Rating shown on the plans shall be furnished and installed. Payment to the Contractor for furnishing the larger seal and for saw cutting the increment of additional depth of groove required will be determined as provided in Section 4-1.03, "Changes," of the Standard Specifications.

## 10-1.57 JOINT SEAL ASSEMBLIES (MOVEMENT RATING EXCEEDING 100 mm)

Joint seal assemblies with movement ratings greater than 100 mm shall consist of a metal frame system, supporting rails and support bars with intervening neoprene glands and shall conform to the details shown on the plans, the provisions in Section 51, "Concrete Structures," of the Standard Specifications and to these special provisions.

Joint seal assemblies will not be considered for approval without satisfactory evidence that the assemblies have had at least one year of satisfactory service under conditions similar to this application.

A qualified representative of the manufacturer shall be present during installation of the first assembly and shall be available for advice during any remaining installations.

The Contractor shall submit complete working drawings for each joint seal assembly to the Division of Structure Design (DSD) in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. The working drawings shall show complete details of the joint seal assembly and anchorage components and the method of installation to be followed, including concrete blockout details and any additions or rearrangements of the reinforcing steel from that shown on the plans. For initial review, 5 sets of drawings shall be submitted. After review, between 6 and 12 sets, as requested by the Engineer, shall be submitted to DSD for final approval and use during construction.

The working drawings shall be supplemented with complete calculations for the particular joint seal assembly, when requested by the Engineer. Working drawings shall be either 279 mm x 432 mm or 559 mm x 864 mm in size and each drawing and calculation sheet shall include the State assigned designations for the contract number, bridge number, full name of the structure as shown on the contract plans, and District-County-Route-Kilometer Post. The design firm's name, address, and phone number shall be shown on the working drawings. Each sheet shall be numbered in the lower right hand corner and shall contain a blank space in the upper right hand corner for future contract sheet numbers.

Calculations, when requested, and working drawings shall be stamped and signed by an engineer who is registered as a Civil Engineer. The Contractor shall allow the Engineer 4 weeks to review the drawings after a complete set has been received.

Within 3 weeks after final working drawing approval, one set of the corrected good quality prints on 75-g/m$^2$ (minimum) bond paper (559 mm x 864 mm in size) of all working drawings prepared by the Contractor for each joint seal assembly shall be furnished to OSD.

Each shipment of joint seal assembly materials shall be accompanied by a Certificate of Compliance in conformance with the provisions in Section 6-l.07, "Certificates of Compliance," of the Standard Specifications. The certificate shall state that the materials and fabrication involved comply in all respects to the specifications and data submitted in obtaining approval.

The neoprene glands shall conform to the requirements in Table 1 of ASTM Designation: D 2628 and the following, except that no recovery tests or compression-deflection tests will be required:

| Property | Requirement | ASTM Test Method |
|---|---|---|
| Hardness, Type A Durometer, points | 55-70 | D 2240 (Modified) |
| Compression set, 70 hours at 100°C, maximum, percent | 40 | D 395 Method B (Modified) |

All metal parts of the joint seal assembly shall conform to the provisions in Section 75-1.03, "Miscellaneous Bridge Metal," of the Standard Specifications. Bolts, nuts and washers shall conform to the requirements of ASTM Designation: A 325 or A 325M. At the Contractor's option, metal parts may conform to the requirements of ASTM Designation: A 572/A 572M.

At the Contractor's option, cleaning and painting of all new metal surfaces of the joint seal assembly, except stainless steel and anchorages embedded in concrete, may be substituted for galvanizing. Cleaning and painting shall be in conformance with the provisions in Sections 59-2, "Painting Structural Steel," and 91, "Paint," of the Standard Specifications, and "Clean and Paint Structural Steel" of these special provisions.

Certification in conformance with the requirements in SSPC-QP 1, SSPC-QP 2, and SSPC-QP 3 of the "SSPC: The Society for Protective Coatings" will not be required for cleaning and painting joint seal assemblies.

Finish coats will not be required on joint seal assemblies.

If the assembly consists of more than one component, the design of the assembly shall be such that the external components can be removed and reinstalled at any position, within the larger one-half of the movement rating shown on the plans, to permit the inspection of the internal components of the assembly.

Except for components in contact with the tires, the assembly and its components shall be designed to support the AASHTO HS20-44 loading with 100 percent impact. Each component in contact with the tires shall support a minimum of 80 percent of the AASHTO HS20-44 loading with 100 percent impact. The tire contact area used to distribute the tire loads

shall be 244 mm, measured normal to the longitudinal axis of the assembly, by 508 mm wide. The assembly shall provide a smooth riding joint without slapping of components or wheel tire rumble.

The movement rating of the assembly shall be measured normal to the longitudinal axis of the assembly. The dimensions for positioning the assembly within the movement rating during installation shall be measured normal to the longitudinal axis, disregarding any skew of the deck expansion joint. The assembly shall be capable of adjustment to the "a" dimension shown on the plans.

The maximum width of unsupported or yielding components or grooves in the roadway surface of the assembly, measured in the direction of vehicular traffic, shall be 75 mm.

The bridge deck surface shall conform to the provisions in Section 51-1.17 "Finishing Bridge Deck," of the Standard Specifications prior to placing joint seal assemblies and anchorage.

The assembly shall be completely shop-assembled and placed in a blocked out recess in the concrete deck surface. The depth and width of the recess shall permit the installation of the assembly anchorage components or anchorage bearing surface to the planned line and grade.

The maximum depth and width of the recess shall be such that the primary reinforcement to provide the necessary strength of the structural members is outside the recess. The maximum depth of the recess at abutments and at hinges shall be 400 mm. The maximum width of recess on each side of the expansion joint shall be 900 mm.

All reinforcement other than primary reinforcement shall continue through the recess construction joint into the recess and engage the anchorage components of the assembly.

The vertical expansion joint in barrier shall be available for inspection after placement of the recess concrete around the anchorage components of the assembly.

The assembly shall make a watertight, continuous return 150 mm up into the barrier at the low side of the deck joint. Neoprene glands shall be continuous without field splices or joints, including the return up into barrier.

Full compensation for any additional materials or work required because of the application of the optional cleaning and painting shall be considered as included in the contract price paid per linear meter for the joint seal assembly involved, and no additional compensation will be allowed therefor.

## 10-1.58 ARCHITECTURAL SURFACE (TEXTURED CONCRETE)

Architectural texture for concrete surfaces shall conform to the details shown on the plans and the provisions in Section 51, "Concrete Structures," of the Standard Specifications and these special provisions.

Architectural textures listed below are required at concrete surfaces shown on the plans:

A. Fractured rib texture
B. Formed relief texture

The fractured rib texture shall be an architectural texture simulating the appearance of straight ribs of concrete with a fractured concrete texture imparted to the raised surface between the ribs. Grooves between ribs shall be continuous with no apparent curves or discontinuities. Variation of the groove from straightness shall not exceed 6 mm for each 3 m of groove. The architectural texture shall have random shadow patterns. Broken concrete at adjoining ribs and groups of ribs shall have a random pattern. The architectural texture shall not have secondary patterns imparted by shadows or repetitive fractured surfaces.

The architectural texture shall simulate a formed relief constructed to the dimensions and shapes shown on the plans. Corners at the intersection of plane surfaces shall be sharp and crisp without easing or rounding. A Class 1 surface finish shall be applied to the architectural texture.

### TEST PANEL

A test panel at least 1.25 m x 1.25 m in size shall be successfully completed at a location approved by the Engineer before beginning work on architectural textures. The test panel shall be constructed and finished with the materials, tools, equipment and methods to be used in constructing the architectural texture. If ordered by the Engineer, additional test panels shall be constructed and finished until the specified finish, texture and color are obtained, as determined by the Engineer.

The test panel approved by the Engineer shall be used as the standard of comparison in determining acceptability of architectural texture for concrete surfaces.

### FORM LINERS

Form liners shall be used for textured concrete surfaces and shall be installed in conformance with the manufacturer's recommendations, unless other methods of forming textured concrete surfaces are approved by the Engineer. Form liners shall be manufactured from an elastomeric material or a semi-elastomeric polyurethane material by a manufacturer of commercially available concrete form liners. No substitution of other types of formliner material will be allowed. Form

liners shall leave crisp, sharp definition of the architectural surface. Recurring textural configurations exhibited by repeating, recognizable shadow patterns shall be prevented by proper casting of form liner patterns. Textured concrete surfaces with such recurring textural configurations shall be reworked to remove such patterns as approved by the Engineer or the concrete shall be replaced.

Form liners shall have the following properties:

| Description | ASTM Designation: | Range |
|---|---|---|
| Elastomeric material | | |
| Shore A hardness | D 2240 | 20 to 65 |
| Tensile strength (MPa) | D 412 | 0.9 to 6.2 |
| Semi-elastomeric polyurethane | | |
| Shore D hardness | D 2240 | 55 to 65 |
| Tensile strength (MPa) | D 2370 | 18 minimum |

Cuts and tears in form liners shall be sealed and repaired in conformance with the manufacturer's recommendations. Form liners that are delaminated from the form shall not be used. Form liners with deformations to the manufactured surface caused by improper storage practices or any other reason shall not be used.

Form liners shall extend the full length of texturing with transverse joints at 2.5 m minimum spacing. Small pieces of form liners shall not be used. Grooves shall be aligned straight and true. Grooves shall match at joints between form liners. Joints in the direction of grooves in grooved patterns shall be located only in the depressed portion of the textured concrete. Adjoining liners shall be butted together without distortion, open cracks or offsets at the joints. Joints between liners shall be cleaned before each use to remove any mortar in the joint.

Adhesives shall be compatible with the form liner material and with concrete. Adhesives shall be approved by the liner manufacturer. Adhesives shall not cause swelling of the liner material.

**RELEASING FORM LINERS**

Products and application procedures for form release agents shall be approved by the form liner manufacturer. Release agents shall not cause swelling of the liner material or delamination from the forms. Release agents shall not stain the concrete or react with the liner material. For reliefs simulating fractured concrete or wood grain surfaces the application method shall include the scrubbing method using a natural bristle scrub brush in the direction of grooves or grain The release agent shall coat the liner with a thin film. Following application of form release agent, the liner surfaces shall be cleaned of excess amounts of agent using compressed air. Buildup of form release agent caused by the reuse of a liner shall be removed at least every 5 uses.

Form liners shall release without leaving particles or pieces of liner material on the concrete and without pulling or breaking concrete from the textured surface. The concrete surfaces exposed by removing forms shall be protected from damage.

**CURING**

Concrete surfaces with architectural texture shall be cured only by the forms-in-place or water methods. Seals and curing compounds shall not be used.

**MEASUREMENT AND PAYMENT**

Architectural texture will be measured and paid for by the square meter.

The contract price paid per square meter for architectural texture of the types listed in the Engineer's Estimate shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work

involved in architectural texture, complete in place, including test panels, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

## 10-1.59 REINFORCEMENT

Reinforcement shall conform to the provisions in Section 52, "Reinforcement," of the Standard Specifications and these special provisions.

Individual hoops, made continuous with butt welded splices, which are substituted for spiral reinforcement, shall conform to the requirements for "Ultimate Butt Splices" of these special provisions.

Attention is directed to "Headed Bar Reinforcement" of these special provisions.

### ULTIMATE BUTT SPLICES

Ultimate butt splices shall be either welded or mechanical splices, shall be used at the locations shown on the plans, and shall conform to the provisions in Section 52, "Reinforcement," of the Standard Specifications and these special provisions.

#### General Requirements

The Contractor shall designate in writing an ultimate butt splicing Quality Control Manager (QCM). The QCM shall be responsible directly to the Contractor for 1) the quality of all ultimate butt splicing including the inspection of materials and workmanship performed by the Contractor and all subcontractors; and 2) submitting, receiving, and approving all correspondence, required submittals, and reports regarding ultimate butt splicing to and from the Engineer.

The QCM shall not be employed or compensated by any subcontractor, or by other persons or entities hired by subcontractors, who will provide other services or materials for the project. The QCM may be an employee of the Contractor.

The length of any type of ultimate mechanical butt splice shall not exceed 10 times the bar diameter of the larger bar to be spliced.

All ultimate prejob, production, and job control sample splices shall be 1) a minimum length of 1.5 meters for reinforcing bars No. 25 or smaller and 2 meters for reinforcing bars No. 29 or larger, with the splice located at mid-point, and 2) suitably identified prior to shipment with weatherproof markings that do not interfere with the Engineer's tamper-proof markings or seals. Any splice that shows signs of tampering will be rejected.

A minimum of one control bar shall be removed from the same bar as, and adjacent to, all ultimate prejob, production, and job control sample splices. Control bars shall be 1) a minimum length of one meter for reinforcing bars No. 25 or smaller and 1.5 meters for reinforcing bars No. 29 or larger, and 2) suitably identified prior to shipment with weatherproof markings that do not interfere with the Engineer's tamper-proof markings or seals. The portion of adjacent bar remaining in the work shall also be identified with weatherproof markings that correspond to its adjacent control bar.

Shorter length sample splice and control bars may be furnished if approved in writing by the Engineer.

Each sample splice and its associated control bar shall be identified and marked as a set. Each set shall be identified as representing a prejob, production, or job control sample splice.

The portion of hoop reinforcing bar, removed to obtain a sample splice and control bar, shall be replaced using a prequalified ultimate mechanical butt splice, or the hoop shall be replaced in kind.

Reinforcing bars, other than hoops, from which sample splices are removed, shall be repaired using ultimate mechanical butt splices conforming to the provisions in "Prejob Test Requirements for Ultimate Butt Splices" specified herein, or the bars shall be replaced in kind. These bars shall be repaired or replaced such that no splices are located in the "No Splice Zone" shown on the plans.

Section 52-1.08E, "Job Control Tests," of the Standard Specifications shall not apply.

The provisions for total slip shall not apply to any ultimate splices that are welded or that are used on hoops.

The independent qualified testing laboratory used to perform the testing of all ultimate butt sample splices and control bars shall not be employed or compensated by any subcontractor, or by other persons or entities hired by subcontractors who will provide other services or materials for the project, and shall have the following:

A. Proper facilities, including a tensile testing machine capable of breaking the largest size of reinforcing bar to be tested.
B. A device for measuring the total slip of the reinforcing bars across the splice to the nearest 25 µm, that, when placed parallel to the longitudinal axis of the bar is able to simultaneously measure movement across the splice, at 2 locations, 180 degrees apart.
C. Operators who have received formal training for performing the testing requirements of ASTM Designation: A 370/A 370M and California Test 670.
D. A record of annual calibration of testing equipment performed by an independent third party that has 1) standards that are traceable to the National Institute of Standards and Technology, and 2) a formal reporting procedure,

including published test forms.

**Ultimate Butt Splice Test Criteria**

Ultimate prejob, production, and job control sample splices shall be tensile tested in conformance with the requirements described in ASTM Designation: A 370/A 370M and California Test 670.

Ultimate prejob and production sample splices shall rupture in the reinforcing bar either: 1) outside of the affected zone or 2) within the affected zone, provided that the sample has achieved at least 95 percent of the ultimate tensile strength of the control bar associated with the sample. In addition, necking of the bar shall be visibly evident at rupture regardless of whether the bar breaks inside or outside the affected zone.

The affected zone is the portion of the reinforcing bar where any properties of the bar, including the physical, metallurgical, or material characteristics, have been altered by fabrication or installation of the splice.

The ultimate tensile strength of each control bar shall be determined by tensile testing the bar to rupture and shall be determined for all control bars, regardless of where each sample splice ruptures. If 2 control bars are tested for one sample splice, the bar with the lower ultimate tensile strength shall be considered the control bar.

Testing to determine the minimum tensile strength, in conformance with the provisions in the ninth paragraph of Section 52-1.08, "Splicing," of the Standard Specifications, will not be required.

**Prejob Test Requirements for Ultimate Butt Splices**

Prior to use in the work, all ultimate butt splices shall conform to the following prejob test requirements:

A. Eight prejob sample splices for each bar size of each splice type including ultimate mechanical butt splices, ultimate complete joint penetration butt welded splices, and ultimate resistance butt welded splices, that will be used in the work, shall be fabricated by the Contractor. For deformation-dependent types of couplers, 8 sample prejob splices shall also be fabricated for each reinforcing bar size and deformation pattern that will be used in the work.

B. The sample splices shall be fabricated using the same splice materials, position, operators, location, and equipment, and following the same procedures as will be used to make the splices in the work.
C. At the option of the Contractor, operator qualification tests may be performed simultaneously with the preparation of prejob sample splices.
D. If different diameters of hoops are shown on the plans, prejob sample splices, as described above, will only be required for the smallest hoop diameter. In addition, these splices shall be fabricated using the same radius as shown on the plans for these hoops.
E. Unless otherwise directed in writing by the Engineer, 4 prejob sample splices and control bar sets shall be shipped to the Transportation Laboratory and the remaining 4 sets shall be tested by the Contractor's independent qualified testing laboratory.
F. Each group of 4 sets from a prejob test shall be securely bundled together and identified by location and contract number with weatherproof markings prior to shipment. Bundles containing fewer than 4 sets will not be tested by the Transportation Laboratory, nor shall they be tested by the independent laboratory.
G. All 8 sample splices from each prejob test shall conform to the provisions in "Ultimate Butt Splice Test Criteria" specified herein.
H. Prior to performing any tensile tests on prejob test sample splices, one of the 4 samples shall be tested for, and shall conform to, the provisions for total slip. Should this sample not meet these requirements, one retest, in which the 3 remaining samples are tested for total slip, will be allowed. All 3 of these remaining samples tested shall conform to the aforementioned slip requirements.
I. For each bundle of 4 sets, a Prejob Test Report shall be prepared by the independent testing laboratory performing the testing. The report shall 1) be signed by an engineer who represents the laboratory and is registered as a Civil Engineer in the State of California; 2) include, as a minimum, the following information for each set: contract number, bridge number, bar size, type of splice, length of mechanical splice, physical condition of test sample splice and control bar, any notable defects, limits of affected zone, total measured slip, location of visible necking area, ultimate strength of each splice, ultimate strength and 95 percent of this ultimate strength for each control bar, and a comparison between 95 percent of the ultimate strength of each control bar and the ultimate strength of its associated splice; and 3) be submitted to the QCM for review and approval, and then to the Engineer.
J. Test results for each bundle of 4 sets will be reported in writing to the Contractor within 10 working days after receipt of the bundle by the Transportation Laboratory. In the event that more than one bundle is received on the same day, 2 additional working days shall be allowed for providing test results for each additional bundle received. A test report will be made for each bundle received.
K. Should the Engineer fail to provide the test results within this time allowance and if, in the opinion of the Engineer,

the Contractor's controlling operation is delayed or interfered with by reason of the delay in providing the test results, the delay will be considered a right of way delay in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

**Production Test Requirements for Ultimate Butt Splices**

Production tests shall be performed for all ultimate butt splices used in the work. A production test shall consist of 4 sets of sample splices and control bars removed from each lot of completed splices, except when quality assurance tests are performed.

A lot of ultimate butt splices is defined as 1) 150, or fraction thereof, of the same type of ultimate mechanical butt splices used for each bar size and each bar deformation pattern that is used in the work or 2) 150, or fraction thereof, of ultimate complete joint penetration butt welded splices, or ultimate resistance butt welded splices for each bar size used in the work. If different diameters of hoop reinforcement are shown on the plans, separate lots shall be used for each different hoop diameter.

After all splices in a lot have been completed, the QCM shall notify the Engineer in writing that all couplers in this lot conform to the specifications and are ready for testing. The sample splices will either be selected by the Engineer at the job site or a fabrication facility, provided the facility is located within an 80-km radius of the jobsite.

At the option of the Contractor, sample splices for spiral reinforcement may be either 1) removed from the completed lot, or 2) prepared in the same manner as specified herein for ultimate prejob sample splices and control bars.

After notification has been received, the Engineer will randomly select the 4 sample splices to be removed from the lot and place tamper-proof markings or seals on them. The Contractor or QCM shall select the adjacent control bar for each sample splice bar, and the Engineer will place tamper-proof markings or seals on them. These ultimate production sample splices and control bars shall be removed by the Contractor, and tested by an independent qualified testing laboratory, in the presence of either the Engineer or the Engineer's authorized representative.

The Engineer or the Engineer's authorized representative will be at the independent qualified testing laboratory within a maximum of 5 working days after receiving written notification that the samples are at the laboratory and ready for testing. Should the Engineer or the Engineer's authorized representative fail to be at the laboratory within this time allowance, and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of this action, the delay will be considered a right of way delay in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

A sample splice or control bar from any set will be rejected if any tamper-proof marking or seal is disturbed prior to testing.

The 4 sets from each production test shall be securely bundled together and identified with a completed sample identification card prior to shipment to the independent laboratory. The card will be furnished by the Engineer. Bundles of samples containing fewer than 4 sets of splices shall not be tested.

A Production Test Report for all testing performed on each lot shall be prepared by the independent testing laboratory performing the testing and submitted to the QCM for review and approval. The report shall be signed by an engineer who represents the laboratory and is registered as a Civil Engineer in the State of California. The report shall include, as a minimum, the following information for each set: contract number, bridge number, lot number and location, bar size, type of splice, length of mechanical splice, physical condition of test sample splice and control bar, any notable defects, limits of affected zone, total measured slip, location of visible necking area, ultimate strength of each splice, ultimate strength and 95 percent of this ultimate strength for each control bar, and a comparison between 95 percent of the ultimate strength of each control bar and the ultimate strength of its associated splice.

The QCM must review, approve, and forward each Production Test Report to the Engineer for review before any splices represented by the report are encased in concrete. The Engineer shall have 3 working days to review each Production Test Report and respond in writing after a complete report has been received. Should the Contractor elect to encase any splices prior to receiving notification from the Engineer, it is expressly understood that the Contractor will not be relieved of the Contractor's responsibility for incorporating material in the work that conforms to the requirements of the plans and specifications. Any material not conforming to these requirements will be subject to rejection. Should the Contractor elect to wait to encase any splices pending notification by the Engineer, and should the Engineer fail to complete the review and provide notification within this time allowance, and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in notification, the delay will be considered a right of way delay in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

Prior to performing any tensile tests on production test sample splices, one of the 4 samples shall be tested for, and shall conform to, the provisions for total slip. Should this sample not meet these requirements, one retest, in which the 3 remaining samples are tested for total slip, will be allowed. Should any of the 3 remaining samples not conform to these requirements, all splices in the lot represented by this production test will be rejected.

If 3 or more sample splices from any production test conform to the provisions in "Ultimate Butt Splice Test Criteria"

specified herein, all splices in the lot represented by this production test will be considered acceptable.

Should only 2 sample splices from any production test conform to the provisions in "Ultimate Butt Splice Test Criteria" specified herein, one additional production test shall be performed on the same lot of splices. Should any of the 4 sample splices from this additional test fail to conform to these provisions, all splices in the lot represented by these production tests will be rejected.

If only one sample splice from any production test conforms to the provisions in "Ultimate Butt Splice Test Criteria" specified herein, all splices in the lot represented by this production test will be rejected.

If a production test for any lot fails, the Contractor will be required to repair or replace all reinforcing bars from which sample splices were removed, complete in place, before the Engineer selects any additional splices from this lot for further testing.

Whenever any lot of ultimate butt splices is rejected, additional ultimate butt splices shall not be used in the work until 1) the QCM performs a complete review of the Contractor's quality control process for these splices, 2) a written report is submitted to the Engineer describing the cause of failure for the splices in this lot and provisions for correcting these failures in future lots, and 3) the Engineer has provided the Contractor with written notification that the report is acceptable. The Engineer shall have 3 working days after receipt of the report to provide notification to the Contractor. Should the Engineer not provide notification within this time allowance, and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of this action, the delay will be considered a right of way delay in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

Production tests will not be required on any repaired splice from a lot, regardless of the type of prequalified ultimate mechanical butt splice used to make the repair.

Should an additional production test be required, the Engineer may select any repaired splice for use in the additional production test.

**Quality Assurance Test Requirements for Ultimate Butt Splices**

For the first production test performed, and for at least one, randomly selected by the Engineer, of every 5 additional production tests, or portion thereof, performed thereafter, the Contractor shall concurrently prepare 4 additional ultimate job control sample splices along with associated control bars. These ultimate job control samples shall be prepared in the same manner as specified herein for ultimate prejob sample splices and control bars.

Each time 4 additional ultimate job control sample splices are prepared, 2 of these job control sample splice and associated control bar sets and 2 of the production sample splice and associated control bar sets, together, shall conform to the requirements for ultimate production sample splices in "Production Test Requirements for Ultimate Butt Splices" specified herein.

The 2 remaining job control sample splice and associated control bar sets, along with the 2 remaining production sample splice and associated control bar sets shall be shipped, unless otherwise directed in writing by the Engineer, to the Transportation Laboratory for quality assurance testing. The 4 sets shall be securely bundled together and identified by location and contract number with weatherproof markings prior to shipment. Bundles containing fewer than 4 sets will not be tested.

Quality assurance testing will be performed in conformance with the requirements for ultimate production sample splices in "Production Test Requirements for Ultimate Butt Splices" specified herein.

Test results for each bundle of 4 sets will be reported in writing to the Contractor within 3 working days after receipt of the bundle by Transportation Laboratory. In the event that more than one bundle is received on the same day, 2 additional working days shall be allowed for providing test results for each additional bundle received. A test report will be made for each bundle received. Should the Contractor elect to encase any splices prior to receiving notification from the Engineer, it is expressly understood that the Contractor will not be relieved of the Contractor's responsibility for incorporating material in the work that conforms to the requirements of the plans and specifications. Any material not conforming to these requirements will be subject to rejection. Should the Contractor elect to wait to encase any splices pending notification by the Engineer, and should the Engineer fail to complete the review and provide notification within this time allowance, and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in notification, the delay will be considered a right of way delay in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

**MEASUREMENT AND PAYMENT**

Measurement and payment for reinforcement in structures shall conform to the provisions in Section 52-1.10, "Measurement," and Section 52-1.11, "Payment," of the Standard Specifications and these special provisions.

Full compensation for conforming to the provisions of "Ultimate Butt Splices," of these special provisions shall be considered as included in the contract prices paid for the various contract items of work involved and no additional compensation will be allowed therefor.

## 10-1.60 HEADED BAR REINFORCEMENT

Headed bar reinforcement, consisting of furnishing and friction welding or integrally forging heads onto one or both ends of bar reinforcement, shall conform to the requirements in ASTM Designation: A 970/A 970M including appendixes, the provisions of Section 52, "Reinforcement," of the Standard Specifications, the details shown on the plans, and these special provisions.

### GENERAL

Prior to performing any manufacturing, the Contractor shall submit to the Engineer the manufacturer's Quality Control (QC) manual for the fabrication of headed bar reinforcement. As a minimum, the QC manual shall include the following:

A. The pre-production procedures for the qualification of materials and equipment;
B. The methods and frequencies for performing QC procedures during production;
C. The calibration procedures and calibration frequency for all equipment;
D. A system for the identification and tracking of all friction welds. The system shall have provisions for permanently identifying each weld and the parameters used to perform it;
E. The welding procedure specification (WPS) for friction welded headed bar reinforcement; and
F. A system for marking headed bar reinforcement.

Quality Control is the responsibility of the Contractor. As a minimum, the Contractor shall perform inspection and testing prior to, during, and after welding or forging, and as necessary to ensure that materials and workmanship conform to the requirements of the specifications.

A daily production log for the manufacture of headed bar reinforcement shall be kept by the manufacturer for each production lot. The log shall clearly indicate the production lot numbers, the heats of bar material and head material used in the manufacture of each production lot, the number of bars in each production lot, welding or forging records, including tracking and production parameters for welds or forgings, and results of all tests performed.

A production lot of friction welded or integrally forged headed bar reinforcement is defined as 150 reinforcing bars, or fraction thereof, of the same bar size, with heads of the same size and type, produced from bar material of a single heat number and head material of a single heat number. A new production lot shall be started if the heat number of either the bar material or the head material changes before the maximum production lot size of 150 is reached.

The daily production log shall be submitted in writing to the Engineer within 7 days following the manufacture of any headed bar reinforcement.

The manufacturer shall furnish Certificates of Compliance accompanied by a copy of the mill test report to the Engineer in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for each shipment of headed bar reinforcement delivered to the job site.

Forging of heads or integrally forged headed bar reinforcement shall conform to the requirements in ASTM Designation: A 788.

Welding, welder qualifications, and inspection of welding shall conform to the requirements for friction welding in ANSI/AWS C6.1.

Welding or forging shall be performed at an established and permanent fabrication facility.

Equipment used to perform friction welding shall be fitted with an effective in-process monitoring system to record essential production parameters that describe the process of welding the head onto the bar reinforcement. As a minimum, the parameters to be recorded shall include friction welding force, forge force, rotational speed, friction upset distance and time, forge upset distance and time, and other elements of the production process. The data from this in-process monitoring shall be recorded and preserved by the manufacturer for a minimum of one year after manufacture of the friction welded headed bars and shall be provided to the Engineer upon request.

The Contractor may submit a request to the Engineer in writing, to use alternative head dimensions which are different from those specified in Table 1 of the ASTM Designation: A 970/A 970M. The alternative head dimensions shall be designed using the concrete compressive strength shown on the plans and shall be in conformance with these special provisions. Alternative head dimensions will not be considered for approval unless the Contractor can prove that the alternative heads have been successfully produced and have had at least 2 years of satisfactory service in conditions similar to this application. The Contractor shall furnish, at the Contractor's expense, documentation satisfactory to the Engineer that the alternative head dimensions are suitable for the intended application. The documentation shall include, but not be limited to, calculations and test reports showing the following:

A. The alternative head is capable of resisting the nominal tensile strength of the reinforcing bar when the bar reinforcement with the welded or forged head is embedded in concrete; and

B. Shear or bending forces do not cause premature failure of the alternative head or crushing failure of the concrete under the alternative head.

**ACCEPTANCE TESTS**

Acceptance tests shall be performed at the Contractor's expense, at the manufacturer's plant or at a qualified laboratory with traceability to the National Institute of Standards and Technology (NIST), and in the presence of the Engineer, unless otherwise directed in writing.

Test samples shall be randomly selected by the Engineer from each production lot of friction welded or integrally forged headed bar reinforcement, which is ready for shipment to the job site. The Engineer shall be notified in writing at least 7 days prior to conducting any tests.

A minimum of 3 samples of friction welded or integrally forged headed bar reinforcement from each production lot shall be tested. One tensile test shall be conducted on each sample.

Tensile tests shall conform to the requirements specified in Section 7 of ASTM Designation: A 970/A 970M, except that at rupture, there shall be visible signs of necking in the reinforcing bar at a minimum distance of one bar diameter away from the head to bar connection. If one of the test specimens fails to meet the specified requirements one retest shall be performed on one additional sample, selected by the Engineer, from the same production lot. If the additional test specimen, or if more than one of the original test specimens, fail to meet these requirements all friction welded or integrally forged headed bar reinforcement represented by the tests will be rejected in conformance with the provisions in Section 6-1.04, "Defective Materials," of the Standard Specifications.

All headed bar reinforcement of each bar size from each production lot to be shipped to the site shall be tagged in a manner that each production lot can be accurately identified at the job site. All unidentified headed bar reinforcement received at the job site will be rejected.

**MEASUREMENT AND PAYMENT**

Quantities of headed bar reinforcement will be measured as units determined from the number of friction welded or integrally forged heads shown on the plans or as directed by the Engineer.

The contract unit price paid for headed bar reinforcement shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in furnishing heads and friction welding or integrally forging heads onto bar reinforcement, including conformance with all testing requirements, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Bar reinforcement to be used in the manufacture of headed bar reinforcement will be measured and paid for as specified in Section 52, "Reinforcement," of the Standard Specifications, except that the lengths to be used in the computation of calculated masses of the bar reinforcement shall be the entire length of the completed headed bar, including heads.

Full compensation for placing the completed headed bar reinforcement into the work shall be considered as included in the contract price paid per kilogram for the bar reinforcement involved and no additional compensation will be allowed therefor.

## 10-1.61 SHOTCRETE

Shotcrete shall conform to the provisions in Section 51, "Concrete Structures," and Section 53, "Shotcrete," of the Standard Specifications and these special provisions.

Shotcrete operations shall completely encase all reinforcement and other obstructions shown on the plans. Exceptional care shall be taken to properly encase the reinforcement and other obstructions with shotcrete.

Except for finish coats, shotcrete shall be applied by the wet-mix process only.

Finish coats, applied by the dry-mix process, may be used only when approved by the Engineer.

Shotcrete shall have a minimum compressive strength of 22.5 MPa at 28 days or as shown on the plans, whichever is greater. No shotcrete work shall be performed prior to verification by the Engineer of the required compressive strength.

Splicing of reinforcing bars No. 22 or larger in shotcrete shall be by butt splicing only.

The Contractor shall be responsible for obtaining and testing all required preconstruction and production test cores. All coring and testing shall be at the Contractor's expense and performed in the presence of the Engineer, unless otherwise directed. The Engineer shall be notified a minimum of 24 hours prior to the Contractor performing any coring or testing operations.

All cores shall be obtained and tested for compressive strength in conformance with the requirements in ASTM Designation: C 42. Cores used for determining compressive strength shall not contain any bar reinforcement or other obstructions. The testing shall be performed at an independent testing facility approved by the Engineer. A copy of the test results shall be furnished to the Engineer within 5 days following completion of testing.

All test panels shall become the property of the Contractor and shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

**PRECONSTRUCTION REQUIREMENTS**

Prior to performing shotcrete work, the Contractor shall construct at least 2 preconstruction shotcrete test panels for each mixture being considered unless otherwise specified.

The nozzleperson shall have a minimum of 3000 hours experience as a nozzleperson on projects with a similar application.

At least 10 working days prior to constructing any shotcrete test panels, the Contractor shall submit to the Engineer for approval, a Quality Control Plan (QCP) for the proposed method of shotcrete placement. The plan shall include the following:

A. The number and qualifications of nozzlepersons available to place shotcrete, the number of nozzlepersons on-site at any time during the shotcrete placement, description of their work schedule, and the procedures for avoiding fatigue of any nozzleperson.
B. The proposed method of placing shotcrete, including, but not limited to, application rates, details of any proposed construction joints and their locations, and methods for achieving the required thickness and surface finish.
C. The procedure for curing shotcrete surfaces.
D. The description of a debris containment system, to be used during the cleaning of bar reinforcing steel and concrete and placing of shotcrete, as required to provide for public safety.

The Engineer shall have 10 working days to review and approve the QCP submittal after a complete plan has been received. No construction of shotcrete test panels shall be performed until the QCP is approved by the Engineer. Should the Engineer fail to complete the review within this time allowance, and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in approving the QCP, the delay will be considered a right of way delay in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

Preconstruction shotcrete test panels shall be constructed by the nozzlepersons and application crew scheduled to do the work, using equipment, materials, mixing proportions, ambient temperatures and procedures proposed for the work. The preconstruction shotcrete test panels shall conform to the following:

A. One shotcrete test panel, of the size determined by the Contractor, shall be unreinforced and shall have 3 cores taken from it and tested for compressive strength. The compressive strength shall be the average strength of the 3 cores, except that, if any core should show evidence of improper coring, the core shall be discarded and the compressive strength shall be the average strength of the remaining cores. The test panel shall be identified and submitted to the Engineer with the test results including a description of the mixture, proportions, and ambient temperature.
B. One shotcrete test panel shall have the same (1) thickness, (2) bar size and amount of bar reinforcement or other obstructions and (3) positioning of bar reinforcement or obstructions as the most heavily reinforced section of shotcrete to be placed. The test panel shall be square with the length of the sides equal to at least 3 times the thickness of the most heavily reinforced section of shotcrete to be placed, but not less than 750 mm. After a minimum 7 days of cure, the test panel shall be broken by the Contractor, in the presence of the Engineer, into pieces no larger than 250 mm in greatest dimension. The surfaces of the broken pieces shall be dense and free of laminations and sand pockets, and shall verify that the bar reinforcement or other obstructions are completely encased.
C. Both test panels shall be cured under conditions similar to the actual work.
D. At the option of the Contractor, cores to be used for determining the compressive strength may be taken from the reinforced test panel described above in lieu of making a separate unreinforced test panel as described above. The compressive strength shall be the average strength of the 3 cores, except that, if any core should show evidence of improper coring or contains bar reinforcement or other obstructions, the core shall be discarded and the compressive strength shall be the average strength of the remaining cores. If cores are taken from the reinforced test panel, the panel shall not be broken into pieces, as described above, until it has cured for a minimum of 14 days.

**PLACING**

An air blowpipe shall be used during shotcrete placement to remove rebound, overspray and other debris from the areas to receive shotcrete.

Construction joints shall be tapered, and shall conform to the provisions in Sections 51-1.13, "Bonding," of the Standard Specifications.

All overspray and rebound shall be removed prior to final set and before placement of shotcrete on adjacent surfaces.

Rebound or any other material which has already exited the nozzle shall not be reused.

Shotcrete shall be cured in conformance with the provisions of Section 90-7.03, "Curing Structures," of the Standard Specifications.

When a finish coat is to be used, all loose, uneven or excess material, glaze, and rebound shall be removed by brooming, scraping, or other means and the surface left scarified. Any surface deposits which take a final set shall be removed by abrasive blasting. Prior to placing the finish coat, the receiving surface shall be washed down with an air-water blast.

Shotcrete extending into the space shown on the plans for cast-in-place concrete shall be removed.

**TESTING AND ACCEPTANCE**

At least 3 production shotcrete test cores shall be taken from each 30 square meters or portion thereof of shotcrete placed each day. The cores shall be 76 mm in diameter. The location where cores are to be taken will be designated by the Engineer. Test cores shall be identified by the Contractor and a description of the core location and mixture, including proportions, shall be submitted to the Engineer with the test cores, immediately after coring. Cored holes shall be filled with mortar in conformance with the provisions in Section 51-1.135, "Mortar," of the Standard Specifications.

Upon receipt of the cores, the Engineer will perform a visual examination to determine acceptance, as described below. Within 48 hours after receipt, the Engineer will return the cores to the Contractor for compressive strength testing.

The compressive strength test shall be performed using the shotcrete production test cores described above. The compressive strength shall be the average strength of the 3 cores, except that, if any core should show evidence of improper coring, the core shall be discarded and the compressive strength shall be the average strength of the remaining cores.

The basis of acceptance for production shotcrete test cores shall be (1) that the core is dense and free of laminations and sand pockets, and shows that the reinforcement or other obstructions are completely encased and (2) the same as specified for test cylinders in the fourth and fifth paragraphs of Section 90-9.01, "General," of the Standard Specifications.

If any production test core shows signs of defective shotcrete as described in (1) above, the shotcrete represented by such test core will be rejected, unless the Contractor, at the Contractor's expense, obtains and submits evidence acceptable to the Engineer that the strength and quality of the shotcrete placed in the work are acceptable.

The surface finish of the shotcrete shall conform to the provisions of Section 51-1.18, "Surface Finishes," of the Standard Specifications.

**MEASUREMENT AND PAYMENT**

Full compensation for the Quality Control Plan, constructing and breaking test panels, furnishing and testing cores and patching cored holes shall be considered as included in the contract price paid per cubic meter for shotcrete and no additional compensation will be allowed therefor.

## 10-1.62 ISOLATION CASINGS

Isolation casings shall consist of galvanized corrugated metal pipe, with steel angles, steel top plate, concrete anchors and neoprene strip as shown on the plans and conforming to the provisions in Section 55, "Steel Structures," of the Standard Specifications and these special provisions.

Concrete anchorage devices shall conform to the provisions in Section 51, "Concrete Structures" of the Standard Specifications.

Isolation casings will be measured in conformance with the provisions in Section 55-4.01, "Measurement," of the Standard Specifications and these special provisions.

The contract price paid per kilogram for isolation casing shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in isolation casings, complete in place, including steel angles, steel top plate, neoprene strip, concrete anchors and isolation casing backfill as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

## 10-1.63 SIGN STRUCTURES

Sign structures and foundations for overhead signs shall conform to the provisions in Section 56-1, "Overhead Sign Structures," of the Standard Specifications and these special provisions.

Before commencing fabrication of sign structures, the Contractor shall submit 2 sets of working drawings to the Engineer in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. The working drawings shall include sign panel dimensions, span lengths, post heights, anchorage layouts, proposed splice locations, a snugging and tensioning pattern for anchor bolts and high strength bolted connections, and details for permanent steel anchor bolt templates. The working drawings shall be supplemented with a written quality control program that includes methods, equipment, and personnel necessary to satisfy the requirements specified herein and in the special provisions.

Working drawings shall be 559 mm x 864 mm or 279 mm x 432 mm in size and each drawing and calculation sheet

shall include the State assigned designations for the contract number, sign structure type and reference as shown on the contract plans, District-County-Route-Kilometer Post, and contract number.

The Engineer shall have 20 working days to review the sign structure working drawings after a complete submittal has been received. No fabrication or installation of sign structures shall be performed until the working drawings are approved in writing by the Engineer.

Should the Engineer fail to complete the review within the time allowance and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in reviewing the sign structure working drawings, the delay will be considered a right of way delay in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

A permanent steel template shall be used to maintain the proper anchor bolt spacing.

One top nut, one leveling nut, and 2 washers shall be provided for the upper threaded portion of each anchor bolt.

Surfaces of base plates which are to come in contact with concrete, grout, or washers and leveling nuts shall be flat to within 3 mm tolerance in 305 mm, and to within 5 mm tolerance overall. Faying surfaces of plates in high-strength bolted connections including flange surfaces of field splices, chord joints, and frame junctures, and contact surfaces of plates used for breakaway slip base assemblies shall be flat to within 2 mm tolerance in 305 mm, and within 3 mm tolerance overall.

Thermally cut holes made in tubular members of sign supports, other than holes in base and flange plates, shall initially be made a minimum of 2 mm undersized, and then be mechanically enlarged by reaming or grinding to the final required size and shape. All edges shall have a surface roughness of not greater than 6.35 μm. Round holes may be drilled to the exact final diameter. No holes shall be made in members unless the holes are shown on the plans or are approved in writing by the Engineer.

Steel members used for overhead sign structures shall receive nondestructive testing (NDT) in conformance with AWS D1.1 and the following:

A.

| Weld Location | Weld Type | Minimum Required NDT |
|---|---|---|
| Welds for butt joint welds in tubular sections, nontubular sections, and posts | CJP groove weld with backing ring | 100% UT or RT |
| Longitudinal seam welds* | PJP groove weld | 25% MT |
| | CJP groove weld | 100% UT or RT |
| Welds for base plate, flange plate, or end cap to post or mast arm | CJP groove weld | 25% UT or RT |
| | Fillet weld | 25% MT |
| * Longitudinal seam welds shall have 60% minimum penetration, except that within 150 mm of any circumferential weld, longitudinal seam welds shall be CJP groove welds. | | |

B. A written procedure approved by the Engineer shall be used when performing UT on material less than 8 mm thick. Contoured shoes shall be used when performing UT on round tubular sections under 1270 mm in diameter.

C. When less than 100 percent of a weld is specified for NDT, and if defects are found during this inspection, additional NDT shall be performed. This additional NDT shall be performed on 25 percent of the total weld for all similar welds, as determined by the Engineer, produced for sign structures in the project. If any portion of the additional weld inspected is found defective, 100 percent of all similar welds produced for sign structures in the project, as determined by the Engineer, shall be tested.

Circumferential welds and base plate to post welds may be repaired only one time without written permission from the Engineer.

Full compensation for furnishing anchor bolt templates and for testing of welds shall be considered as included in the contract price paid per kilogram for furnish sign structure and no additional compensation will be allowed therefor.

Metal (barrier mounted sign) will be measured and paid for by the kilogram in the same manner specified for metal (roadside sign) in Section 56-2 "Roadside Signs" of the Standard Specifications.

Metal (wall mounted sign) will be measured and paid for by the kilogram in the same manner specified for metal (roadside sign) in Section 56-2 "Roadside Signs" of the Standard Specifications.

**10-1.64 ROADSIDE SIGNS**

Roadside signs shall be installed at the locations shown on the plans or where designated by the Engineer and in conformance with the provisions in Section 56-2, "Roadside Signs," of the Standard Specifications and these special provisions.

Wood posts shall be pressure treated after fabrication in conformance with the provisions in Section 58, "Preservative Treatment of Lumber, Timber and Piling," of the Standard Specifications with creosote, creosote coal tar solution, creosote petroleum solution (50-50), pentachlorophenol in hydrocarbon solvent, copper naphthenate, ammoniacal copper arsenate, or ammoniacal copper zinc arsenate. In addition to the preservatives listed above, Southern yellow pine may also be pressure treated with chromated copper arsenate. When other than one of the creosote processes is used, blocks shall have a minimum retention of 6.4 $kg/m^3$, and need not be incised.

**10-1.65 INSTALL SIGN PANEL ON EXISTING FRAME**

Sign panels shall be installed on existing frames at the locations shown on the plans or where designated by the Engineer and in conformance with the provisions in Section 56-1.06, "Sign Panels and Fastening Hardware," of the Standard Specifications and these special provisions.

Existing sign panels, as shown on the plans, shall be removed and disposed of as provided in Section 15, "Existing Highway Facilities," of the Standard Specifications.

Installing sign panels on existing frames will be measured by the square meter and the quantity to be paid for will be the total area, in square meters, of sign panels installed in place.

The contract price paid per square meter for install sign panel on existing frame shall include full compensation for furnishing all labor, materials (except State-furnished sign panels and mounting bolts), tools, equipment, and incidentals, and for doing all the work involved in installing sign panels on existing frames, complete in place (including removing and disposing of existing sign panels), as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

**10-1.66 INSTALL MEDIAN MILEAGE PANEL**

Median mileage panels shall be installed at the locations shown on the plans or where directed by the Engineer, and in conformance with these special provisions.

Target plates will be furnished by the State as provided under "State-Furnished Materials" of these special provisions. Installation holes in target plates shall be drilled or punched by the Contractor, after determination of type of installation. Target plates shall have only the necessary holes for the specified installation indicated.

Appropriate letters and numerals shall be affixed to the target plates by the Contractor in conformance to the requirements in Section 82-1.04, "Marker Information," of the Standard Specifications.

Concrete anchorage devices for installing median mileage panels shall be cast-in-place or resin capsule type, conforming to the provisions of Section 75-1.03, "Miscellaneous Bridge Metal," and as shown on the plans.

Installing median mileage panels will be measured as units determined from actual count of median mileage panels in place.

The contract unit price paid for install median mileage panel shall include full compensation for furnishing all labor, (including the affixing of the appropriate letters and numerals to the target plates and providing traffic control necessary to allow accurate and safe determination of median mileage panel locations), materials (except State-furnished target plates), hardware, tools, equipment, and incidentals, and for doing all the work involved in installing median mileage panels, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

**10-1.67 CLEAN AND PAINT STRUCTURAL STEEL**

Exposed new metal surfaces, except where galvanized, shall be cleaned and painted in conformance with the provisions in Section 59-2, "Painting Structural Steel," and Section 91, "Paint," of the Standard Specifications and these special provisions.

Prior to performing any painting or paint removal, the Contractor shall submit to the Engineer, in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications, 3 copies of a separate Painting Quality Work Plan (PQWP) for each item of work for which painting or paint removal is to be performed. As a minimum, each PQWP shall include the following:

A. The name of each Contractor or subcontractor to be used.
B. One copy each of all current "SSPC: The Society for Protective Coatings" specifications or qualification procedures which are applicable to the painting or paint removal to be performed. These documents shall become the permanent property of the Department.
C. Proposed methods and equipment to be used for any paint application.
D. Proof of each of any required certifications, SSPC-QP 1, SSPC-QP 2, SSPC-QP 3.
    1. In lieu of certification in conformance with the requirements in SSPC-QP 1 for this project, the Contractor may submit written documentation showing conformance with the requirements in Section 3, "General Qualification Requirements," of SSPC-QP 1.

2. In lieu of certification in conformance with the requirements in SSPC-QP 3 for this project, the Contractor may submit written documentation showing conformance with the requirements in Section 3, " General Qualification Requirements," of SSPC-QP 3.

The Engineer shall have 2 weeks to review the PQWP submittal after a complete plan has been received. No painting or paint removal shall be performed until the PQWP for that work is reviewed by the Engineer. Should the Engineer fail to complete the review within this time allowance and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in reviewing the PQWP, the delay will be considered a right of way delay in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

**CLEANING**

Exposed new metal surfaces shall be dry blast cleaned in conformance with the requirements in Surface Preparation Specification No. 10, "Near White Blast Cleaning," of the "SSPC: The Society for Protective Coatings." Blast cleaning shall leave surfaces with a dense, uniform, angular anchor pattern of not less than 40 µm nor more than 86 µm as measured in conformance with the requirements in ASTM Designation: D 4417.

Mineral and slag abrasives used for blast cleaning steel shall conform to the requirements in Abrasive Specification No. 1, "Mineral and Slag Abrasives," of the "SSPC: The Society for Protective Coatings" and shall not contain hazardous material. Mineral and slag abrasives shall comply with the requirements for Class A, Grade 2 to 3 as defined therein.

A Certificate of Compliance conforming to the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications and a Material Safety Data Sheet shall be furnished prior to use for each shipment of blast cleaning material for steel.

**PAINTING**

Blast cleaned surfaces shall receive a single undercoat, and a final coat where specified, consisting of a waterborne inorganic zinc coating conforming to the requirements in AASHTO Designation M 300, Type II, except that: 1) the first 3 sentences of Section 4.7, "Primer Field Performance Requirements," and the entire Section 4.7.1 shall not apply, and 2) zinc dust shall be Type II in conformance with the requirements in ASTM Designation: D 520. The inorganic zinc coating shall be listed on the qualified products list which may be obtained from the Transportation Laboratory.

The color of the final application of inorganic zinc coating shall match Federal Standard 595B No. 36373.

Inorganic zinc coating shall be used within 12 hours of initial mixing.

Application of inorganic zinc coating shall conform to the provisions for applying zinc-rich coating in Section 59-2.13, "Application of Zinc-Rich Primer," of the Standard Specifications.

Inorganic zinc coating shall not be applied when the atmospheric or surface temperature is less than 7°C or more than 29°C, nor when the relative humidity exceeds 85 percent.

The single undercoat of inorganic zinc coating shall be applied to the required dry film thickness in 2 or more applications within 4 hours after blast cleaning.

The total dry film thickness of all applications of the inorganic zinc undercoat, including the surfaces of outside existing members within the grip under bolt heads, nuts and washers, shall be not less than 100 µm nor more than 200 µm, except that the total dry film thickness on each faying (contact) surface of high strength bolted connections shall be between 25 µm and the maximum allowable dry film thickness for Class B coatings as determined by certified testing in conformance with Appendix A of the "Specification for Structural Joints Using ASTM A325 or A490 Bolts" of the Research Council on Structural Connections (RCSC Specification). Unless otherwise stated, all inorganic zinc coatings used on faying surfaces shall meet the slip coefficient requirements for a Class B coating on blast-cleaned steel, as specified in the RCSC Specification. The Contractor shall provide results of certified testing showing the maximum allowable dry film thickness for the Class B coating from the qualifying tests for the coating he has chosen, and shall maintain the coating thickness on actual faying surfaces of the structure at or below this maximum allowable coating thickness.

Areas where mudcracking occurs in the inorganic zinc coating shall be blast cleaned and repainted with inorganic zinc coating to the specified thickness.

Dry spray, or overspray, as defined in the Steel Structures Painting Manual, Volume 1, "Good Painting Practice," of the "SSPC: The Society for Protective Coatings," shall be removed prior to application of subsequent coats or final acceptance. Removal of dry spray shall be by screening or other methods that minimize polishing of the inorganic zinc surface. The dry film thickness of the coating after removal of dry spray shall be in conformance with the provisions for applying the single undercoat, as specified herein.

The inorganic zinc coating shall be tested for adhesion and cure. The locations of the tests will be determined by the Engineer. The sequence of the testing operations shall be determined by the Contractor. The testing for adhesion and cure will be performed no sooner than 72 hours after application of the single undercoat of inorganic zinc coating. At the Contractor's expense, satisfactory access shall be provided to allow the Engineer to determine the location of the tests and to test the inorganic zinc coating cure. The inorganic zinc coating shall pass the following tests:

**Adhesion**

The inorganic zinc coating shall have a minimum adhesion to steel of 4 MPa when measured at no more than 6 locations per span on each girder using a self-aligning adhesion tester in conformance with the requirements in ASTM Designation: D 4541. The Contractor, at the Contractor's expense, shall: (1) verify compliance with the adhesion requirements, (2) furnish test results to the Engineer, and (3) repair the coating after testing.

**Cure**

The inorganic zinc coating, when properly cured, shall exhibit a solid, hard, and polished metal surface when firmly scraped with the knurled edge of a quarter. Inorganic zinc coating that is powdery, soft, or does not exhibit a polished metal surface, as determined by the Engineer, shall be repaired by the Contractor, at the Contractor's expense, by blast cleaning and repainting with inorganic zinc coating to the specified thickness.

The final coat of inorganic zinc coating shall be applied after testing for adhesion, testing for cure, and completion of all operations that may damage or discolor the steel surface, including correction of runs, sags, thin and excessively thick areas in the paint film, skips and holidays, dry spray, or areas of non-uniform appearance.

The area to receive the final coat of inorganic zinc coating shall be lightly roughened by abrasive blasting using an abrasive no larger than 600 µm. Abrasive blasting shall remove no more than 15 µm of inorganic zinc. The surface to be lightly roughened shall be free from moisture, dust, grease or deleterious material. The undercoated areas of the under surfaces of bottom flanges shall be protected from abrasive blast cleaning operations.

The final coat of inorganic zinc coating shall be applied to the required dry film thickness in one uniform application within 24 hours after light roughening. The dry film thickness of the final coat shall be not less than 25 µm nor more than 75 µm.

Except at bolted connections, the total dry film thickness of all applications of the single undercoat and final coat of inorganic zinc coating shall be not less than 125 µm nor more than 275 µm.

Finish coats will not be required.

## 10-1.68 REINFORCED CONCRETE PIPE

Reinforced concrete pipe shall conform to the provisions in Section 65, "Reinforced Concrete Pipe," of the Standard Specifications and these special provisions.

Where embankment will not be placed over the top of the pipe, a relative compaction of not less than 85 percent shall be required below the pipe spring line for pipe installed using Method 1 backfill in trench, as shown on Standard Plan A62D. Where the pipe is to be placed under the traveled way, a relative compaction of not less than 90 percent shall be required unless the minimum distance between the top of the pipe and the pavement surface is the greater of 1.2 m or one half of the outside diameter of the pipe.

Except as otherwise designated by classification on the plans or in the specifications, joints for culvert and drainage pipes shall conform to the plans or specifications for standard joints.

When reinforced concrete pipe is installed in conformance with the details shown on Revised Standard Plan A62DA, the fifth paragraph of Section 19-3.04, "Water Control and Foundation Treatment," of the Standard Specifications shall not apply.

When solid rock or other unyielding material is encountered at the planned elevation of the bottom of the bedding, the material below the bottom of the bedding shall be removed to a depth of 1/50 of the height of the embankment over the top of the culvert, but not less than 150 mm nor more than 300 mm. The resulting trench below the bottom of the bedding shall be backfilled with structure backfill material in conformance with the provisions in Section 19-3.06, "Structure Backfill," of the Standard Specifications.

The excavation and backfill below the planned elevation of the bottom of the bedding will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications.

The Outer Bedding shown on Revised Standard Plan A62DA shall not be compacted prior to placement of the pipe.

## 10-1.69 EDGE DRAIN

Edge drains shall conform to the provisions in Section 68-3, "Edge Drains," of the Standard Specifications.

**10-1.70 PREFABRICATED VERTICAL DRAIN**

Prefabricated vertical drains shall be furnished and installed as shown on the plans, as specified in these special provisions, and where designated by the Engineer.

Prefabricated vertical drains shall consist of fabricated vertical drain materials conforming to the following requirements:

A. Saturated test samples of the prefabricated vertical drain 0.6-m long, or 0.6-m plus the length of splice if splices are being tested, when suspended vertically shall support a 23 kg mass for a period of 5 minutes without distress or separation.
B. Prefabricated vertical drains shall have the following flow capacity characteristics when test samples are tested in conformance with the test procedure and sequence set forth in these special provisions.

    1. The pressure required to produce and maintain a flow of 3.8 L per minute for a period of 10 minutes, through the sidewalls and out the unsealed end of test samples, shall not exceed 8 kPa when the samples are immersed in water only.
    2. The pressure required to produce and maintain a flow of 3.8 L per minute for a period of 10 minutes, through the sidewalls and out the unsealed end of test samples, shall not exceed 100 kPa when the samples are embedded in a glassbead-aggregate soil matrix.

The test procedure to be used in determining flow capacity characteristics of prefabricated vertical drains shall consist of placing a 350 mm long test sample of the prefabricated vertical drain that has been sealed at one end in a test chamber, centered along its longitudinal axis, such that 300 mm of the sample is exposed to the flow within the chamber and such that the unsealed end of the sample extends out of the top of the chamber. Samples of spliced prefabricated vertical drain shall be placed in the test chamber with 300 mm of the splice exposed to flow within the chamber or, if the splice is less than 300 mm long, the spliced portion of the sample shall be placed in the top portion of the chamber. The inside diameter of the test chamber shall be at least 20 mm greater than the width of the test sample. Water shall be introduced into the test chamber through an inlet centered in the bottom of the chamber. Pressure shall be measured with a strain gage pressure tap installed in the test chamber at approximately mid-depth. Water used in determining flow capacity characteristics shall be potable tap water. Each test sample of spliced and unspliced prefabricated vertical drain shall first be tested for flow capacity when immersed in water only and then for flow capacity when embedded in a glassbead-aggregate soil matrix. The glassbead-aggregate soil matrix shall consist of inert glass beads and soil and shall conform to the following requirements:

A. Gradation:

| Sieve Sizes | Percentage Passing |
|---|---|
| 4.75-mm | 100 |
| 2.36-mm | 77 |
| 1.18-mm | 63 |
| 600-µm | 42 |
| 300-µm | 19 |
| 150-µm | 7 |
| 75-µm | 3 |
| 53-µm | 0 |

B. The material passing the 4.75-mm sieve and retained on the 300-µm sieve shall conform to the provisions in Section 90-2.02B, "Fine Aggregate," of the Standard Specifications. The material passing the 300-µm sieve and retained on the 53-µm sieve shall consist of inert glass beads.
C. The glass beads and soil shall be thoroughly mixed while damp, carefully installed around the test sample of prefabricated vertical drain in the test chamber and compacted by rodding.

Splices in prefabricated vertical drain will be permitted provided the splices are fabricated in a workmanlike manner approved by the Engineer, and the spliced wicks conform to the provisions in these special provisions.

The Contractor shall submit for testing a sample of the unspliced prefabricated vertical drain to be used and 3 samples of proposed splices to the Engineer at least 21 days prior to the installation of the prefabricated vertical drains. The sample of unspliced prefabricated vertical drain shall be at least 3 m long. Samples of spliced prefabricated vertical drain shall be long enough to include the splice plus 0.6-m of unspliced drain on either side of the splice. At the same time, the Contractor shall

submit full details of the sequence and method proposed for installation of the prefabricated vertical drains for the Engineer's review and approval. Approval by the Engineer of installation details and methods shall not relieve the Contractor of the responsibility to install prefabricated vertical drains in conformance with the plans and these special provisions.

Prior to installation of the prefabricated vertical drains, the Contractor shall demonstrate that the proposed equipment and methods will produce satisfactory installations of approved prefabricated vertical drains in conformance with the plans and these special provisions. For this purpose, trial prefabricated vertical drains shall be installed at those locations designated by the Engineer. Payment for trial prefabricated vertical drains will be made at the contract price per meter for prefabricated vertical drain. Payment will not be made for unsatisfactory installations of trial prefabricated vertical drain.

Prefabricated vertical drains shall be installed using a driving sleeve. The driving sleeve shall protect the prefabricated vertical drain from tears, cuts, and abrasions during installation and shall be retracted after each prefabricated vertical drain is installed. The cross-section of the driving sleeve shall be of a shape that will produce minimum disturbance of the soil surrounding the installed prefabricated vertical drain and shall not exceed 15,500 $mm^2$ in area. The tip of the driving sleeve shall cut through the filter fabric layer cleanly without tearing, gathering, folding or otherwise distressing or stressing the fabric.

Prefabricated vertical drains shall not be installed by jetting or impact methods.

Upon written request from the Contractor and when approved by the Engineer, augering or other methods may be used to loosen the soil and permeable material prior to installation of prefabricated vertical drains provided the augering does not penetrate more than 0.3-m into the underlying compressible native soil and does not tear, gather, fold or otherwise disturb or stress the filter fabric layer.

Equipment for installing prefabricated vertical drains shall be plumbed prior to installing each drain and shall not deviate from the vertical more than 30 mm in 3 m during installation of the prefabricated vertical drain. Prefabricated vertical drains that are out of proper location more than 150 mm or are damaged or improperly installed will be rejected. Rejected prefabricated vertical drains may be removed or abandoned in place, at the Contractor's option, except that rejected prefabricated vertical drains which interfere with installation of replacement prefabricated vertical drains, or other acceptable prefabricated vertical drains, shall be removed.

Prefabricated vertical drain locations shall be marked on the ground by the Contractor. The locations of the drainage wicks shall not vary by more than 150 mm from the locations shown on the plans.

Prefabricated vertical drains shall be installed from the working surface to the depth shown on the plans or designated by the Engineer.

The Contractor shall provide the Engineer with suitable means of determining the quantity of prefabricated vertical drain installed at each location and shall provide suitable means for the Engineer to determine the depth of the drain at any given time.

Prefabricated vertical drains shall be cut off neatly at the ground line at the location shown on the plans.

Prefabricated vertical drain will be measured by the meter. The length of prefabricated vertical drain to be paid for will be the length shown on the plans or designated by the Engineer. Prefabricated vertical drain placed in excess of such lengths will not be paid for.

The contract price paid per meter for prefabricated vertical drain shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in installing prefabricated vertical drains, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

### 10-1.71 MISCELLANEOUS FACILITIES

Pipe manholes, pipe risers, and concrete flared end sections shall conform to the provisions in Section 70, "Miscellaneous Facilities," of the Standard Specifications.

### 10-1.72 GRATED LINE DRAIN

This work shall consist of furnishing and installing precast grated line drain, with necessary fittings, coupling systems, frames, grates and associated items as shown on the plans and in conformance with these special provisions.

The interior surface of the grated line drain, below the level of the frame and grate and associated connections, shall be smooth. Grated line drain channel sections shall be manufactured of monolithic polymer concrete with no side extensions.

Monolithic polymer concrete shall be made from a composition of aggregate and polyester resin or vinylester resin and shall have the following properties when tested as follows:

| PROPERTY | ASTM TEST METHOD | VALUE |
|---|---|---|
| Tensile Strength, MPa | C 307 | 10 min. |

| | | |
|---|---|---|
| Compressive Strength, MPa | C 579 | 80 min. |
| Bending Strength, MPa | C 580 | 20 min. |
| Moisture Absorption, % | C 140 | 0.5 max. |
| Chemical Resistance | C 267 | Pass |
| Freeze/Thaw, number of cycles w/o weight loss | C 666 | 1600 min. |

The manufacturer of the grated line drain shall furnish the Engineer a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

Grated line drain frames and grates shall be manufactured of ductile iron conforming to the provisions in Section 75-1.02, "Miscellaneous Iron and Steel," of the Standard Specifications. The frames and grates need not be galvanized or coated with asphalt paint. Bolts, nuts, frame anchors, and other connecting hardware shall conform to the provisions in Section 75-1.02, "Miscellaneous Iron and Steel," of the Standard Specifications.

Frames and grates, when installed in conformance with the manufacturer's recommendations and these special provisions, shall withstand load testing conforming to the requirements in Federal Specification RR-F-621E for "Frames, Covers, Gratings, Steps, Manhole Sump and Catch Basin." Grates shall fit into the frames without rocking.

Frames shall be secured to the surrounding concrete backfill with steel anchoring rods as shown on the plans. Other methods may be used to secure the frame to the concrete backfill or grated line drain wall provided that a minimum pullout resistance of 10 kN per meter of length of grated line drain frame is maintained.

Grates and frames shall be one piece or the grates shall be removable. Removable grates shall be held in place by locking devices that are tamper resistant. Removable grates shall provide a minimum repetitive pullout resistance of 5 kN per meter of length after completion of 1000 hours of salt spray testing in conformance with the requirements in ASTM Designation: B 117. When a combination of one piece frame and grate and removable grates are used, the locations of the removable grates shall be shown on the plans.

Except for grates installed within designated pedestrian paths of travel, grates shall accept inflow of runoff through openings. The openings shall consist of a minimum of 60 percent of the total top surface area of the grate, with individual openings or slots having a dimension not greater than 50 mm measured in the direction of the grated line drain flow line. Grates installed within designated pedestrian paths of travel shall be certified as conforming to the requirements of the "Americans with Disabilities Act."

Grated line drains shall be installed in trenches excavated to the lines and grades established by the Engineer. The bottom of the trench shall be graded and prepared to provide a firm and uniform bearing throughout the entire length of the grated line drain.

Grated line drains shall be installed and jointed in conformance with the manufacturer's recommendations.

Grated line drains shall be installed to the lines and grades with sections closely jointed and secured to ensure that no separation of the line drains occurs during backfilling.

The frame or grate of the grated line drain shall not extend above the level of the surrounding concrete backfill.

Grated line drains shall be connected to new or existing drainage facilities as shown on the plans.

Excavation and backfill shall conform to the provisions in Section 19-3, "Structure Excavation and Backfill," of the Standard Specifications.

Backfill for the grated line drains shall be either minor concrete or Class 3 concrete conforming to the provisions in Section 90, "Portland Cement Concrete," of the Standard Specifications, except that minor concrete shall contain not less than 300 kg of cement per cubic meter.

Concrete backfill shall be placed in the trench as shown on the plans. Concrete backfill shall be placed against undisturbed material at the sides and bottom of the trench and in a manner that will prevent floating or shifting of the grated line drain and voids in, or segregation of, the concrete. Foreign material which falls into the trench, prior to or during placement of the concrete, shall be immediately removed. Where necessary, earth plugs shall be constructed and compacted at the ends of the planned concrete backfill to contain the concrete within the trench.

Concrete backfill shall be finished flush with the adjacent surfacing.

The surface of the concrete shall be textured with a broom or burlap drag to produce a durable skid-resistant surface.

The length the grated line drain to be paid for will be the length measured by the meter along the pavement surface as designated by the Engineer. No payment will be made for grated line drain placed in excess of the designated length.

The contract price paid per meter for grated line drain shall include full compensation for furnishing all labor, materials (including frames and grates), tools, equipment, and incidentals, and for doing all the work involved in installing grated line drains, complete in place, including excavation and backfill, connecting grated line drains to new or existing facilities, concrete collars, reinforcement, and other connecting devices, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

**10-1.73 SLOPE PROTECTION**

Slope protection shall be placed or constructed in conformance with the provisions in Section 72, "Slope Protection," of the Standard Specifications.

**10-1.74 SLOPE PAVING**

Slopes under the ends of bridges, where shown on the plans, shall be paved in conformance with the provisions in Section 72-6, "Slope Paving," of the Standard Specifications and these special provisions.

The slope paving shall be colored in conformance with the provisions in Section 72-6.03, "Materials," of the Standard Specifications.

Attention is directed to Section 51.135 "Mortar" of the Standard Specifications regarding material and placement.

Concrete for curbs will be paid for at the contract price per square meter for slope paving (split face pavers).

The location of construction joints shall be subject to the approval of the Engineer. Placement of slope paving shall be scheduled so that the work, including placement, finishing, and application of curing, is completed in any section bounded by permissible construction joints on the same day that the work is started in that section.

Prior to placing the permanent slope paving, the Contractor shall construct a test panel at least 1.2 m by 1.8 m at the site for approval by the Engineer. The test panel shall be constructed of the same materials as are proposed for the permanent work and shall be finished and cured as specified for the permanent work. Additional test panels shall be constructed as necessary until a panel is produced which conforms to the requirements herein, before constructing other slope paving.

The contract price paid per square meter for slope paving (split face pavers) shall include full compensation for furnishing all labor, materials (including bar reinforcing steel, reinforcing steel anchors, welded wire fabric), tools, equipment and incidentals, and for doing all the work involved in constructing the slope paving, complete in place (including excavation and backfill), as shown on the plans, as specified in these special provisions, and as directed by the Engineer.

**10-1.75 MISCELLANEOUS CONCRETE CONSTRUCTION**

Minor concrete (gutter), minor concrete (ditch lining), minor concrete (channel lining), and minor concrete (miscellaneous construction) shall conform to the provisions in Section 73, "Concrete Curbs and Sidewalks," of the Standard Specifications and these special provisions.

Curb ramp detectable warning surface shall conform to the details shown on the plans and shall not be constructed or installed on curb ramps with a slope that exceeds 6.67 percent. The finished surfaces of the detectable warning surface shall be free from blemishes.

Curb ramp detectable warning surface shall consist of raised truncated domes constructed or installed on curb ramps. Detectable warning surface, at the option of the Contractor, shall be either cast-in-place or stamped into the surface of the curb ramp, or shall be a prefabricated surface installed on the curb ramp. The color of the detectable warning surface shall be yellow conforming to Federal Standard No. 595B, Color No. 33538. Detectable warning surface, either cast-in-place or stamped into the surface of the curb ramp, shall be painted yellow in conformance with the provisions in Section 59-6, "Painting Concrete," of the Standard Specifications.

Prior to constructing curb ramps with a cast-in-place or stamped detectable warning surface, a test panel shall be constructed on the project site and shall be of a size not less than 600 mm by 600 mm. The test panel shall be constructed, finished and cured with the same materials, tools, equipment, and methods to be used in constructing the proposed permanent work. Additional test panels shall be constructed as necessary until a panel is produced which demonstrates, to the satisfaction of the Engineer, the ability of the selected procedure to produce a detectable warning surface that meets all of the specified requirements.

Full compensation for constructing or installing a curb ramp detectable warning surface shall be considered as included in the contract price paid per cubic meter for minor concrete (miscellaneous construction) and no separate payment will be made therefor.

Full compensation for repairing rock cobble shall be considered as included in the contract price paid per cubic meter for minor concrete (miscellaneous construction) and no separate payment will be made therefor.

The contract price paid per meter for minor concrete (gutter) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the minor concrete (gutter), complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract price paid per cubic meter for minor concrete (ditch lining) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in minor concrete (ditch lining), complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract price paid per cubic meter for minor concrete (channel lining) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in minor concrete (channel lining), complete in place, as shown on the plans, as specified in the Standard Specifications and these special

provisions, and as directed by the Engineer.

### 10-1.76 MISCELLANEOUS IRON AND STEEL

Miscellaneous iron and steel shall conform to the provisions in Section 75, "Miscellaneous Metal," of the Standard Specifications.

### 10-1.77 MISCELLANEOUS METAL (BRIDGE)

Miscellaneous metal (bridge) shall conform to the provisions for miscellaneous bridge metal in Section 75, "Miscellaneous Metal," of the Standard Specifications and these special provisions.

Miscellaneous metal (bridge) shall consist of the miscellaneous bridge metal items listed in Section 75-1.03, "Miscellaneous Bridge Metal," of the Standard Specifications.

Self-tapping screws used for sleeve connections shall be hex-head stainless steel, installed in holes drilled to fit the self-tapping screws, conforming to the requirements of ASTM Designation: A 276, Type 304.

At the Contractor's option, fiberglass pipes and fittings with the same diameter and minimum bend radius as those shown on the plans, may be substituted for welded steel pipe in deck drain systems.

Fiberglass pipe and fittings shall conform to the requirements in ASTM Designation: D 2996, and shall have a minimum short-term rupture strength of 207 MPa. The adhesive type recommended by the manufacturer shall be used for joining pipe and fittings. Fiberglass pipe not enclosed in a box girder cell or encased in concrete shall be manufactured from ultraviolet-resistant resin pigmented with concrete-gray color, or be coated with a concrete-gray resin-rich exterior coating. Paint shall not be used. Fiberglass pipe treated with ultraviolet protection shall withstand a minimum of 2500 hours of accelerated weathering when tested in conformance with the requirements in ASTM Designation: G 154. Lamps shall be UV-B (313 nm wavelength). The resting cycle shall be 4 hours of ultraviolet (UV) exposure at 60°C, and then 4 hour of condensate exposure at 50°C. After testing, the surface of the pipe shall exhibit no fiber exposure, crazing, or checking, and only a slight chalking or color change.

Support spacing for fiberglass pipe shall be the same as shown on the plans for welded steel pipe. Pipe supports shall have a width of not less than 38 mm.

A Certificate of Compliance for fiberglass pipe and fittings shall be furnished to the Engineer in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications. The Certificate of Compliance shall include all laboratory test results conforming to the provisions specified herein.

For drainage piping NPS 8 or smaller, which is: (1) enclosed in a box girder cell and exposed for a length not greater than 6 m within the cell, or (2) encased in concrete, the Contractor shall have the option of substituting polyvinyl chloride (PVC) plastic pipe and fittings, with the same diameter and minimum bend radius as shown on the plans, for welded steel pipe.

The PVC plastic pipe and fittings shall be Schedule 40 conforming to the requirements of ASTM Designations: D 1785. The maximum support spacing for PVC plastic pipe shall be 2 m.

Couplings used to connect PVC plastic pipe or fiberglass pipe to steel shall be threaded or flanged. The sleeve connections shown on the plans shall not be used for either PVC plastic pipe or fiberglass pipe.

If PVC plastic pipe or fiberglass pipe is substituted for welded steel pipe, the quantity of drainage piping will be computed on the basis of the dimensions and details shown on the plans, and no change in the quantities to be paid for will be made because of the use of PVC plastic pipe or fiberglass pipe.

Miscellaneous metal (deck drain) will be measured and paid for by the kilogram in the same manner specified for miscellaneous metal (bridge) in Sections 75-1.06, "Measurement," and 75-1.07, "Payment," of the Standard Specifications.

### 10-1.78 MISCELLANEOUS METAL (RESTRAINER-CABLE TYPE)

Miscellaneous metal (restrainer-cable type) shall conform to the provisions for bridge joint restrainer units in Section 75-1.035, "Bridge Joint Restrainer Units," of the Standard Specifications and these special provisions.

New concrete adjacent to restrainers shall be placed prior to installing restrainers.

Miscellaneous metal (restrainer-cable type) will be measured and paid for by the kilogram in the same manner specified for miscellaneous metal (restrainer) in Sections 75-1.06, "Measurement," and 75-1.07, "Payment," of the Standard Specifications.

### 10-1.79 CHAIN LINK FENCE

Chain link fence shall be Type 1.8 and shall conform to the provisions in Section 80, "Fences," of the Standard Specifications.

### 10-1.80 MARKERS AND DELINEATORS

Markers and delineators shall conform to the provisions in Section 82, "Markers and Delineators," of the Standard Specifications and these special provisions.

Markers and delineators on flexible posts shall conform to the provisions in "Prequalified and Tested Signing and Delineation Materials" of these special provisions. Flexible posts shall be made from a flexible white plastic which shall be resistant to impact, ultraviolet light, ozone, and hydrocarbons. Flexible posts shall resist stiffening with age and shall be free of burns, discoloration, contamination, and other objectionable marks or defects which affect appearance or serviceability.

Retroreflective sheeting for metal and flexible target plates shall be the retroreflective sheeting designated for channelizers, markers, and delineators conforming to the requirements in ASTM Designation: D 4956-95 and in conformance with the provisions in "Prequalified and Tested Signing and Delineation Materials" of these special provisions.

**10-1.81 METAL BEAM GUARD RAILING**

Metal beam guard railing shall be constructed in conformance with the provisions in Section 83-1, "Railings," of the Standard Specifications and these special provisions.

Attention is directed to "Order of Work" of these special provisions.

Line posts and blocks shall be wood.

Delete the ninth and eleventh paragraphs in Section 83-1.02B, "Metal Beam Guard Railing," of the Standard Specifications.

The grades and species of wood posts and blocks shall be No. 1 timbers (also known as No. 1 structural) Douglas fir or No. 1 timbers Southern yellow pine. Wood posts and blocks shall be graded in conformance with the provisions in Section 57-2, "Structural Timber," of the Standard Specifications, except allowances for shrinkage after mill cutting shall in no case exceed 5 percent of the American Lumber Standards minimum sizes, at the time of installation.

Wood posts and blocks shall be pressure treated after fabrication in conformance with the provisions in Section 58, "Preservative Treatment of Lumber, Timber and Piling," of the Standard Specifications with creosote, creosote coal tar solution, creosote petroleum solution (50-50), pentachlorophenol in hydrocarbon solvent, copper naphthenate, ammoniacal copper arsenate, or ammoniacal copper zinc arsenate. In addition to the preservatives listed above, Southern yellow pine may also be pressure treated with chromated copper arsenate. When other than one of the creosote processes is used, blocks shall have a minimum retention of 6.4 $Kg/m^3$, and need not be incised.

**TERMINAL SYSTEM (TYPE SRT)**

Terminal system (Type SRT) shall be furnished and installed as shown on the plans and in conformance with these special provisions.

Terminal system (Type SRT) shall be a SRT-350 Slotted Rail Terminal (8 post system) as manufactured by Trinity Industries, Inc., and shall include all the items detailed for terminal system (Type SRT) shown on the plans.

The 5 mm x 44 mm x 75 mm plate washer shown on the elevation view and in Section D-D at Wood Post No. 1 shall be omitted.

Arrangements have been made to insure that any successful bidder can obtain the SRT-350 Slotted Rail Terminal (8 post system) from the manufacturer, Trinity Industries, Inc., P.O. Box 99, 950 West 400S, Centerville, UT 84014, Telephone 1-800-772-7976. The price quoted by the manufacturer for the SRT-350 Slotted Rail Terminal (8 post system), FOB Centerville, Utah is $845.00, not including sales tax.

The above price will be firm for orders placed on or before July 31, 2002, provided delivery is accepted within 90 days after the order is placed.

The Contractor shall provide the Engineer with a Certificate of Compliance from the manufacturer in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications. The Certificate of Compliance shall certify that terminal systems (Type SRT) conform to the contract plans and specifications, conform to the prequalified design and material requirements and were manufactured in conformance with the approved quality control program.

The terminal system (Type SRT) shall be installed in conformance with the manufacturer's installation instructions and these requirements. The steel foundation tubes with soil plates attached, shall be, at the Contractor's option, either driven, with or without pilot holes, or placed in drilled holes. Space around the steel foundation tubes shall be backfilled with selected earth, free of rock, placed in layers approximately 100 mm thick and each layer shall be moistened and thoroughly compacted. Wood terminal posts shall be inserted into the steel foundation tubes by hand. Before the wood terminal posts are inserted, the inside surfaces of the steel foundation tubes to receive the wood posts shall be coated with a grease which will not melt or run at a temperature of 65°C or less. The edges of the wood terminal posts may be slightly rounded to facilitate insertion of the post into the steel foundation tubes.

Surplus excavated material remaining after the terminal system (Type SRT) has been constructed shall be disposed of in a uniform manner along the adjacent roadway where designated by the Engineer.

**TERMINAL SYSTEM (TYPE CAT)**

Terminal system (Type CAT) and terminal system (Type CAT) backup shall be furnished and installed as shown on the plans and in conformance with these special provisions.

Terminal system (Type CAT) shall be a CAT-350 Crash Cushion Attenuating Terminal as manufactured by Trinity Industries, Inc., and shall include items detailed for terminal system (Type CAT) shown on the plans.

Terminal system (Type CAT) backup shall consist of items detailed for terminal system (Type CAT) backup shown on the plans, and shall conform to the provisions in Section 83-1.02B, "Metal Beam Guard Railing," of the Standard Specifications.

Excluding the terminal system (Type CAT) backup, arrangements have been made to insure that any successful bidder can obtain the CAT-350 Crash Cushion Attenuating Terminal from the manufacturer, Trinity Industries, Inc., P.O. Box 99, 950 West 400S, Centerville, UT 84014, Telephone 1-800-772-7976. The price quoted by the manufacturer for the CAT-350 Crash Cushion Attenuating Terminal, FOB Centerville, Utah is $2,850.00, not including sales tax.

The above price will be firm for orders placed on or before July 31, 2003, provided delivery is accepted within 90 days after the order is placed.

The Contractor shall provide the Engineer with a Certificate of Compliance from the manufacturer in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications. The Certificate of Compliance shall certify that the terminal system (Type CAT) conforms with the contract plans and specifications, conforms to the prequalified design and material requirements, and was manufactured in conformance with the approved quality control program.

The terminal system (Type CAT) shall be installed in conformance with the manufacturer's installation instructions and these requirements. The steel foundation tubes with soil plates attached shall be, at the Contractor's option, either driven, with or without pilot holes, or placed in drilled holes. Space around the steel foundation tubes shall be backfilled with selected earth, free of rock, placed in layers approximately 100 mm thick and each layer shall be moistened and thoroughly compacted. Wood posts shall be inserted into the steel foundation tubes by hand. Before the wood posts are inserted, the inside surfaces of the steel foundation tubes to receive the wood posts shall be coated with a grease which will not melt or run at a temperature of 65°C or less. The edges of the wood posts may be slightly rounded to facilitate insertion of the post into the steel foundation tubes.

Surplus excavated material remaining after the terminal system (Type CAT) and backup have been constructed shall be disposed of in a uniform manner along the adjacent roadway where designated by the Engineer.

The contract unit price paid for terminal system (Type CAT) backup shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in furnishing and installing terminal system (Type CAT) backup, complete in place, including excavation, backfill, and disposal of surplus material, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

## 10-1.82 CABLE RAILING

Cable railing shall conform to the provisions in Section 83-1, "Railings," of the Standard Specifications.

## 10-1.83 CONCRETE BARRIER

Concrete barriers shall conform to the provisions in Section 83-2, "Barriers," of the Standard Specifications and these special provisions.

The provisions of the third paragraph in Section 83-2.02D(4), "Finishing," of the Standard Specifications shall not apply.

Concrete barrier markers shall conform to the provisions in "Prequalified and Tested Signing and Delineation Materials" of these special provisions. At those locations shown on the plans, concrete barrier markers shall be cemented to the barrier in conformance with the manufacturer's recommendations.

## 10-1.84 CRASH CUSHION (TYPE CAT)

Crash cushion (Type CAT) and crash cushion (Type CAT) backup shall be furnished and installed as shown on the plans and in conformance with these special provisions.

Crash cushion (Type CAT) shall be a CAT-350 Crash Cushion Attenuating Terminal as manufactured by Trinity Industries, Inc., and shall include all the items detailed for crash cushion (Type CAT) shown on the plans.

Crash cushion (Type CAT) backup shall consist of items detailed for crash cushion (Type CAT) backup shown on the plans and shall conform to the provisions in Section 83-1.02B, "Metal Beam Guard Railing," of the Standard Specifications.

Excluding the crash cushion (Type CAT) backup, arrangements have been made to insure that any successful bidder can obtain the CAT-350 Crash Cushion Attenuating Terminal from the manufacturer, Trinity Industries, Inc., P.O. Box 99, 950 West 400S, Centerville, UT 84014, Telephone 1-800-772-7976. The price quoted by the manufacturer for the CAT-350 Crash Cushion Attenuating Terminal, FOB Centerville, Utah is $2850, not including sales tax.

The above price will be firm for orders placed on or before July 1, 2002, provided delivery is accepted within 90 days after the order is placed.

The Contractor shall provide the Engineer with a Certificate of Compliance from the manufacturer in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications. The Certificate of Compliance shall certify that crash cushion (Type CAT) conforms with the contract plans and specifications, conforms to the prequalified design and material requirements, and was manufactured in conformance with the approved quality control program.

The crash cushion (Type CAT) shall be installed in conformance with the manufacturer's installation instructions and these requirements. The steel foundation tubes with soil plates attached, shall be, at the Contractor's option, either driven, with or without pilot holes, or placed in drilled holes. Space around the steel foundation tubes shall be backfilled with selected earth, free of rock, placed in layers approximately 100 mm thick and each layer shall be moistened and thoroughly compacted. Wood posts shall be inserted into the steel foundation tubes by hand. Before the wood posts are inserted, the inside surfaces of the steel foundation tubes to receive the wood posts shall be coated with a grease which will not melt or run at a temperature of 65°C or less. The edges of the wood posts may be slightly rounded to facilitate insertion of the post into the steel foundation tubes.

Surplus excavated material remaining after the crash cushion (Type CAT) and backup have been constructed shall be disposed of in a uniform manner along the adjacent roadway where designated by the Engineer.

Crash cushion (Type CAT) and crash cushion (Type CAT) backup will be measured as units determined from actual count in place in the completed work.

The contract unit prices paid for crash cushion (Type CAT) and for crash cushion (Type CAT) backup shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in furnishing and installing crash cushion (Type CAT) and crash cushion (Type CAT) backup, complete in place, including excavation, backfill, and disposal of surplus material, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

### 10-1.85 CRASH CUSHION (ADIEM)

Crash cushion shall be furnished and installed as shown on the plans and in conformance with the provisions in the Standard Specifications and these special provisions.

Crash cushion shall be an ADIEM II-350 as manufactured by Trinity Industries, Inc., and shall include the items detailed for crash cushion shown on the plans.

The successful bidder can obtain the crash cushion from the manufacturer, Trinity Industries, Inc., P.O. Box 99, 950 West 400S, Centerville, Utah 84014, telephone 1-800-772-7976.

The price quoted by the manufacturer for ADIEM II-350, FOB Centerville, Utah is $12,000, not including sales tax.

The above price will be firm for orders placed on or before July 31, 2003, provided delivery is accepted within 90 days after the order is placed.

The Contractor shall furnish the Engineer one copy of the manufacturer's plan and parts list.

The Contractor shall provide the Engineer with a Certificate of Compliance from the manufacturer in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications. The Certificate of Compliance shall certify that the crash cushion conforms to the contract plans and specifications, conforms to the prequalified design and material requirements, and was manufactured in conformance with the approved quality control program.

Crash cushion shall be installed in conformance with the manufacturer's installation instructions.

Surplus excavated material remaining after the crash cushion has been installed shall be disposed of in a uniform manner along the adjacent roadway where designated by the Engineer.

Crash cushion (ADIEM) will be measured by the unit as determined from actual count in place in the completed work.

The contract unit price paid for crash cushion (ADIEM) shall include full compensation for furnishing all labor, materials (including anchor bolts, nuts, washers, and marker panels), tools, equipment, and incidentals, and for doing all the work involved in furnishing and installing the ADIEM type crash cushion, complete in place, including structure excavation, structure backfill, and disposing of surplus material, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

### 10-1.86 CRASH CUSHION, SAND FILLED

Sand filled crash cushions shall be furnished and installed as shown on the plans and in conformance with these special provisions.

A sand filled crash cushion shall consist of a grouping of sand filled modules.

Crash cushions shall be installed at the following locations:

Between HOV Direct Connector and Northbound Rte. 57.

At the Contractor's option, modules for use in sand filled crash cushions shall be either Energite III Inertial Modules, Fitch Inertial Modules or TrafFix Sand Barrels manufactured after March 31, 1997, or equal:

A. Energite III and Fitch Inertial Modules, manufactured by Energy Absorption Systems, Inc., One East Wacker Drive, Chicago, IL 60601-2076. Telephone 1-312-467-6750, FAX 1-800-770-6755

   1. Distributor (North): Traffic Control Service, Inc., 8585 Thys Court, Sacramento, CA 95828. Telephone 1-800-884-8274, FAX 1-916-387-9734
   2. Distributor (South): Traffic Control Service, Inc., 1881 Betmor Lane, Anaheim, CA 92805. Telephone 1-800-222-8274, FAX 1-714-937-1070

B. TrafFix Sand Barrels, manufactured by TrafFix Devices, Inc., 220 Calle Pintoresco, San Clemente, CA 92672. Telephone 1-949 361-5663, FAX 1-949 361-9205

   1. Distributor (North): United Rentals, Inc., 1533 Berger Drive, San Jose, CA 95112. Telephone 1-408 287-4303, FAX 1-408 287-1929
   2. Distributor (North): Statewide Safety & Sign, Inc., P.O. Box 1440, Pismo Beach, CA 93448. Telephone 1-800-559-7080, FAX 1-805 929-5786

Modules contained in the crash cushion shall be of the same type at each location. The color of the modules shall be the standard yellow color as furnished by the vendor, with black lids. The exterior components of the modules shall be formulated or processed to resist deterioration from ambient ultraviolet rays. The modules shall exhibit good workmanship free from structural flaws and objectionable surface defects.

The Contractor shall provide the Engineer with a Certificate of Compliance from the manufacturer in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications. The Certificate of Compliance shall certify that the crash cushions comply with the contract plans and specifications, conform to the prequalified design and material requirements, and were manufactured in conformance with the approved quality control program.

Sand for filling the modules shall be clean washed concrete sand of commercial quality. At the time of placing in the modules, the sand shall contain not more than 7 percent water, as determined by California Test 226.

Modules placed on bridge decks shall be provided with positioning blocks fastened to the deck surface. Positioning blocks shall be shaped as segments of a ring and placed along the inner or outer periphery of the module wall. A minimum of 2 blocks, a minimum of one-sixth of a ring in length shall be provided for each module. Positioning blocks and fasteners shall be of a material that is corrosion and water resistant.

Module cylinders shall be filled with sand in conformance with the manufacturer's directions and to the sand capacity in kilograms for each module shown on the plans.

Lids shall be securely attached as recommended by the manufacturer.

A Type R or Type P marker panel shall be attached to the front of the crash cushion as shown on the plans, when the closest point of the crash cushion array is within 3.6 m of the traveled way. The marker panel, when required, shall be firmly fastened to the crash cushion with commercial quality hardware or by other methods approved by the Engineer.

Sand filled crash cushions, regardless of the number of modules required in each sand filled crash cushion, will be measured and paid for by the unit as crash cushion, sand filled. The quantity to be paid for will be determined from actual count of the units in place in the completed work.

The contract unit price paid for crash cushion, sand filled shall include full compensation for furnishing all labor, materials (including sand and marker panels), tools, equipment, and incidentals, and for doing all the work involved in furnishing and installing crash cushions, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

## 10-1.87 THERMOPLASTIC TRAFFIC STRIPE AND PAVEMENT MARKING

Thermoplastic traffic stripes (traffic lines) and pavement markings shall be applied in conformance with the provisions in Section 84, "Traffic Stripes and Pavement Markings," of the Standard Specifications and these special provisions.

Where striping joins existing striping, as shown on the plans, the Contractor shall begin and end the transition from the existing striping pattern into or from the new striping pattern a sufficient distance to ensure continuity of the striping pattern.

Thermoplastic material shall conform to the requirements in State Specification 8010-19A.

Thermoplastic material for traffic stripes shall be applied at a minimum thickness of 2.03 mm.

At the option of the Contractor, permanent traffic striping and pavement marking tape conforming to the provisions in "Prequalified and Tested Signing and Delineation Materials" of these special provisions may be placed instead of the thermoplastic traffic stripes and pavement markings specified herein. Permanent tape, if used, shall be installed in conformance with the manufacturer's specifications. If permanent tape is placed instead of thermoplastic traffic stripes and pavement markings, the tape will be measured and paid for by the meter as thermoplastic traffic stripe and by the square meter as thermoplastic pavement marking.

### 10-1.88 PAVEMENT MARKERS

Pavement markers shall be placed in conformance with the provisions in Section 85, "Pavement Markers," of the Standard Specifications and these special provisions.

Attention is directed to "Traffic Control System For Lane Closure" of these special provisions regarding the use of moving lane closures during placement of pavement markers with bituminous adhesive.

Retroreflective pavement markers shall comply with the specific intensity provisions for reflectance after abrading the lens surface in conformance with the "Steel Wool Abrasion Procedure" specified for pavement markers placed in pavement recesses in Section 85-1.05, "Retroreflective Pavement Markers," of the Standard Specifications.

## SECTION 10-2. HIGHWAY PLANTING AND IRRIGATION SYSTEMS

### 10-2.01 GENERAL

The work performed in connection with highway planting and irrigation systems shall conform to the provisions in Section 20, "Erosion Control and Highway Planting," of the Standard Specifications and these special provisions.

The Contractor shall notify the Engineer not less than 72 hours prior to requiring initial access to the existing irrigation controllers. When the Engineer determines that access to the controllers is required at other times, arrangements will be made to provide this access.

When fluctuations of water pressure and water supply are encountered during normal working hours, plants shall be watered at other times, as often, and in sufficient amounts as conditions may require to keep the soil and plant roots moist during the life of the contract.

Full compensation for watering plants outside normal working hours shall be considered as included in the contract lump sum prices paid for highway planting and plant establishment work and no additional compensation will be allowed therefor.

#### PROGRESS INSPECTIONS

Progress inspections will be performed by the Engineer for completed highway planting and irrigation system work at designated stages during the life of the contract.

Progress inspections will not relieve the Contractor of responsibility for installation in conformance with the special provisions, plans and Standard Specifications. Work within an area shall not progress beyond each stage until the inspection has been completed, corrective work has been performed, and the work is approved, unless otherwise permitted by the Engineer.

The requirements for progress inspections will not preclude additional inspections of work by the Engineer at other times during the life of the contract.

The Contractor shall notify the Engineer, in writing, at least 4 working days prior to completion of the work for each stage of an area and shall allow a minimum of 3 working days for the inspection.

Progress inspections will be performed at the following stages of work:

A. During pressure testing of the pipelines on the supply side of control valves.
B. During testing of low voltage conductors.
C. Before planting begins and after completion of the work specified for planting in Section 20-4.03, "Preparing Planting Areas," of the Standard Specifications.
D. Before plant establishment work begins and after completion of the work specified for planting in Section 20-4.05, "Planting," of the Standard Specifications.
E. At intervals of one month during the plant establishment period.

#### COST BREAK-DOWN

The Contractor shall furnish the Engineer a cost break-down for the contract lump sum items of highway planting and irrigation system. Cost break-down tables shall be submitted to the Engineer for approval within 15 working days after the contract has been approved. Cost break-down tables shall be approved, in writing, by the Engineer before any partial

payment will be made for the applicable items of highway planting and irrigation system involved.

Cost break-downs shall be completed and furnished in the format shown in the samples of the cost break-downs included in this section. Line item descriptions of work shown in the samples are the minimum to be submitted. Additional line item descriptions of work may be designated by the Contractor. If the Contractor elects to designate additional line item descriptions of work, the quantity, value and amount for those line items shall be completed in the same manner as for the unit descriptions shown in the samples. The line items and quantities given in the samples are to show the manner of preparing the cost break-downs to be furnished by the Contractor.

The Contractor shall determine the quantities required to complete the work shown on the plans. The quantities and their values shall be included in the cost break-downs submitted to the Engineer for approval. The Contractor shall be responsible for the accuracy of the quantities and values used in the cost break-downs submitted for approval.

The sum of the amounts for the line items of work listed in each cost break-down table for highway planting and for irrigation system work shall be equal to the contract lump sum price bid for Highway Planting and Irrigation System, respectively. Overhead and profit, shall be included in each individual line item of work listed in a cost break-down table.

No adjustment in compensation will be made in the contract lump sum prices paid for highway planting and irrigation system due to differences between the quantities shown in the cost break-downs furnished by the Contractor and the quantities required to complete the work as shown on the plans and as specified in these special provisions.

Individual line item values in the approved cost break-down tables will be used to determine partial payments during the progress of the work and as the basis for calculating an adjustment in compensation for the contract lump sum items of highway planting and irrigation system due to changes in line items of work ordered by the Engineer. When the total of ordered changes to line items of work increases or decreases the lump sum price bid for either Highway Planting or Irrigation System by more than 25 percent, the adjustment in compensation for the applicable lump sum item will be determined in the same manner specified for increases and decreases in the total pay quantity of an item of work in Section 4-1.03B, "Increased or Decreased Quantities," of the Standard Specifications.

**HIGHWAY PLANTING COST BREAK-DOWN**

**Contract No. 07-1257U4**

| UNIT DESCRIPTION | UNIT | APPROXIMATE QUANTITY | VALUE | AMOUNT |
|---|---|---|---|---|
| ROADSIDE CLEARING | LS | LUMP SUM | | |
| PLANT (GROUP A) | EA | 68 | | |
| COMMERCIAL FERTILIZER (SLOW RELEASE) | KG | 71 | | |
| PREPARE HOLE (SOIL AMENDMENT) | KG | 3 | | |
| | | | | |
| | | | | |
| | | | | |

**TOTAL** _____

**IRRIGATION SYSTEM COST BREAK-DOWN**

**Contract No. 07-1257U4**

| UNIT DESCRIPTION | UNIT | APPROXIMATE QUANTITY | VALUE | AMOUNT |
|---|---|---|---|---|
| CHECK & TEST AND REMOVE EXISTING IRRIGATION FACILITIES | LS | LUMP SUM | | |
| CONTROL AND NEUTRAL CONDUCTORS | LS | LUMP SUM | | |
| 25 mm REMOTE CONTROL VALVE | EA | 5 | | |
| 20 mm PLASTIC PIPE (SUPPLY LINE) | m | 100 | | |
| 25 mm PLASTIC PIPE (SUPPLY LINE) | m | 130 | | |
| 40 mm PLASTIC PIPE (SUPPLY LINE) | m | 30 | | |
| 50 mm PLASTIC PIPE (SUPPLY LINE) | m | 250 | | |
| 65 mm PLASTIC PIPE (SUPPLY LINE) | m | 20 | | |
| SPRINKLER (TYPE C-3) | EA | 22 | | |
| 40 mm FILTER ASSEMBLY UNIT | EA | 5 | | |
| 40 mm BALL VALVE | EA | 5 | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

**TOTAL** _____

## 10-2.02 EXISTING HIGHWAY PLANTING

In addition to the provisions in Section 20 of the Standard Specifications, work performed in connection with existing highway planting shall be in conformance with the provisions in Section 15, "Existing Highway Facilities," of the Standard Specifications and these special provisions.

Replacement planting shall conform to the requirements specified under "Preservation of Property" of these special provisions.

### MAINTAIN EXISTING PLANTS

Existing plants shall be maintained as directed by the Engineer. Maintaining existing plants will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

## 10-2.03 EXISTING HIGHWAY IRRIGATION FACILITIES

The work performed in connection with the various existing highway irrigation system facilities shall conform to the provisions in Section 15, "Existing Highway Facilities," of the Standard Specifications and these special provisions.

Water shall be maintained in conformance with the provisions in Section 20-5.025, "Maintain Existing Water Supply," of the Standard Specifications.

### CHECK AND TEST EXISTING IRRIGATION FACILITIES

Existing irrigation facilities that are to remain and that are within those areas where clearing and grubbing or earthwork operations are to be performed, shall be checked for missing or damaged components and proper operation prior to performing clearing and grubbing or earthwork operations. Existing irrigation facilities outside of work areas that are affected by the construction work shall also be checked for proper operation.

A written list of existing irrigation system deficiencies shall be submitted to the Engineer within 5 working days after checking the existing facilities.

Deficiencies found during checking of the existing facilities shall be corrected as directed by the Engineer. Corrective work ordered by the Engineer will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

When existing irrigation facilities are checked, existing backflow preventers to remain shall be tested for proper operation in conformance with the provisions in Section 20-5.03J, "Check and Test Backflow Preventers," of the Standard Specifications.`

Existing backflow preventers shall be retested annually after the satisfactory completion of the previous test or 10 days prior to completion of the plant establishment period, whichever occurs first.

Existing backflow preventers shall be tested in conformance with the provisions in "Irrigation Systems" of these special provisions.

Length of watering cycles for use of potable water from water meters for checking or testing existing irrigation facilities shall be as determined by the Engineer.

Repairs to the existing irrigation facilities ordered by the Engineer after checking and testing the facilities, and further repairs required thereafter as ordered by the Engineer, except as otherwise provided under "Existing Highway Irrigation Facilities" of these special provisions, will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

### REMOVE EXISTING IRRIGATION FACILITIES

Existing irrigation facilities where shown on the plans to be removed, shall be removed. Facilities that are more than 150 mm below finished grade.

Immediately after disconnecting an existing irrigation facility to be removed or abandoned from an existing facility to remain, the remaining facility shall be capped or plugged, or shall be connected to a new or existing irrigation facility.

Facilities to be removed shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

## 10-2.04 HIGHWAY PLANTING

The work performed in connection with highway planting shall conform to the provisions in Section 20-4, "Highway Planting," of the Standard Specifications and these special provisions.

## HIGHWAY PLANTING MATERIALS

### Commercial Fertilizer (Slow Release)

Commercial fertilizer (slow release) shall be a pelleted or granular form, shall be slow or controlled release with a nutrient release over an 8- to 12-month period, and shall fall within the following guaranteed chemical analysis range:

| Ingredient | Percentage |
|---|---|
| Nitrogen | 16-21 |
| Phosphoric Acid | 6-8 |
| Water Soluble Potash | 4-10 |

## ROADSIDE CLEARING

Prior to preparing planting areas or commencing irrigation trenching operations for planting areas, trash and debris shall be removed from these areas and a distance of 3 m beyond the edges of those areas. In addition to removing trash and debris, the project area shall be cleared as specified herein:

After the initial roadside clearing is complete, additional roadside clearing work shall be performed as necessary to maintain the areas, as specified above, in a neat appearance until the start of the plant establishment period. This work shall include the following:

A. Trash and debris shall be removed.
B. Rodents shall be controlled.
C. Weeds in plant basins, including basin walls, shall be removed by hand pulling, after the plants have been planted.

Roadside clearing work shall not include work required to be performed as clearing and grubbing as specified in Section 16, "Clearing and Grubbing," of the Standard Specifications.

## PESTICIDES

Pesticides used to control weeds shall conform to the provisions in Section 20-4.026, "Pesticides," of the Standard Specifications. Except as otherwise provided in these special provisions, pesticide use shall be limited to the following materials:

Glyphosate
Oxadiazon - 50 percent WP (Preemergent)

Glyphosate shall be used to kill stolon type weeds.

Oxadiazon shall be of the emulsifiable concentration or wettable powder type.

A minimum of 100 days shall elapse between applications of preemergents.

If the Contractor elects to request the use of other pesticides on this project, the request shall be submitted, in writing, to the Engineer not less than 15 days prior to the intended use of the other pesticides. Except for the pesticides listed in these special provisions, no pesticides shall be used or applied without prior written approval of the Engineer.

## PREPARING PLANTING AREAS

Plants adjacent to drainage ditches shall be located so that after construction of the basins, no portion of the basin walls shall be less than the minimum distance shown on the plans for each plant involved.

## PREPARE HOLES

Holes for plants shall be excavated to the minimum dimensions shown on the plans.

Backfill material for plant holes shall be a mixture of soil and other materials shown on the Plant List. Backfill material shall be thoroughly mixed and uniformly distributed throughout the entire depth of the plant hole without clods and lumps.

## PLANTING

Commercial fertilizer shall be applied or placed at the time of planting and at the rates shown on the plans.

Mulch will not be required in the plant basins as shown on the Standard Plan details for Basins Type I, II and III, when mulch is not shown on the Plant List for the plants involved.

A granular preemergent shall be applied within 1m strip between edge of shoulder and erosion control.

Attention is directed to "Irrigation Systems Functional Test" of these special provisions regarding functional tests of the irrigation systems. Planting shall not be performed in an area until the functional test has been completed for the irrigation system serving that area.

pesticides shall be considered as included in the contract unit prices paid for the various items of plants involved and no separate payment will be made therefor.

**PLANT ESTABLISHMENT WORK**

The plant establishment period shall be Type 2 and shall be not less than 120 working days.

Attention is directed to "Relief From Maintenance and Responsibility" in these special provisions regarding relief from maintenance and protection.

Weeds within plant basins, including basin walls and ground cover, shall be controlled by hand pulling.

Previously installed filters shall be removed, cleaned and reinstalled at least 15 days prior to the completion of the plant establishment period.

The final inspection shall be performed in conformance with the provisions in Section 5-1.13, "Final Inspection," of the Standard Specifications and shall be completed a minimum of 20 working days before the estimated completion of the contract.

**10-2.05 IRRIGATION SYSTEMS**

Irrigation systems shall be furnished and installed in conformance with the provisions in Section 20-5, "Irrigation Systems," of the Standard Specifications, except materials containing asbestos fibers shall not be used.

Attention is directed to the provisions in "Obstructions" of these special provisions, regarding work over or adjacent to existing underground facilities. Excavation for proposed irrigation facilities shall not be started until the existing underground facilities have been located.

Pipe supply lines shall be pressure tested in conformance with the provisions in Section 20-5.03H, "Pressure Testing," of the Standard Specifications, except the pipe (supply line) on the discharge side of the control valve shall be tested by Method B as specified in Section 20-5.03H(2), "Method B," of the Standard Specifications.

Only pipeline trenches and excavation pits for supply lines being supplied from one water service point shall be open at one time. After pressure testing is complete, trenches and pits excavated for pipe supply lines, being supplied from one water service point, shall be backfilled prior to commencing excavations for pipe supply lines being supplied from another water service point.

**VALVE BOXES**

Valve boxes shall conform to the provisions in Section 20-2.24, "Valve Boxes," of the Standard Specifications, except as otherwise provided herein.

Valve boxes shall be precast portland cement concrete.

Covers for concrete valve boxes shall be cast iron or steel. Cast iron and steel covers shall be hinged with brass hinge pins for valve boxes containing valves smaller than 50 mm.

Valve boxes shall be identified on the top surface of the covers by labels containing the appropriate abbreviation for the irrigation facility contained in the valve box as shown on the plans. Valve boxes that contain remote control valves shall be identified by the appropriate letters and numbers (controller and station numbers). Labels for valve boxes shall conform to the provisions in Section 20-5.03F, "Valves and Valve Boxes," of the Standard Specifications.

Label material shall be polyurethane.

**ELECTRIC AUTOMATIC IRRIGATION COMPONENTS**

**Electric Remote Control Valves**

Electric remote control valves shall conform to the provisions in Section 20-2.23, "Control Valves," of the Standard Specifications and the following:

A. Valves shall be glass filled nylon.
B. Valves shall be angle pattern (bottom inlet) or straight pattern (side inlet) as shown on the plans.

**Pull Boxes**

Pull box installations shall conform to the provisions in Section 20-5.027I, "Conductors, Electrical Conduits and Pull Boxes," of the Standard Specifications.

**Conductors**

Low voltage, as used in this section "Conductors," shall mean 36 V or less.

Low voltage control and neutral conductors in pull boxes and valve boxes, at irrigation controller terminals, and at splices shall be marked as follows:

A. Conductor terminations and splices shall be marked with adhesive backed paper markers or adhesive cloth wrap-around markers, with clear, heat-shrinkable sleeves sealed over the markers.
B. Non-spliced conductors in pull boxes and valve boxes shall be marked with clip-on, "C" shaped, white extruded polyvinyl chloride sleeves. Marker sleeves shall have black, indented legends of uniform depth with transparent overlays over the legends and "chevron" cuts for alignment of 2 or more sleeves.

Markers for the control conductors shall be identified with the appropriate number or letter designations of irrigation controllers and station numbers. Markers for neutral conductors shall be identified with the appropriate number or letter designations of the irrigation controllers.

New control and neutral conductors that are to replace existing control and neutral conductors shall be the same size and color as the existing control and neutral conductors being connected to.

The color of low voltage neutral and control conductor insulation, except for the striped portions, shall be homogeneous throughout the entire thickness of the insulation.

Insulation for conductors may be UL listed polyethylene conforming to UL44 test standards with a minimum insulation thickness of 1.05 mm for wire sizes 10AWG and smaller.

At the option of the Contractor, other types of splice sealing materials and methods may be used provided other materials and methods have been approved in writing by the Engineer prior to installation of the connectors.

**IRRIGATION SYSTEMS FUNCTIONAL TEST**

Functional tests for the associated automatic irrigation systems shall conform to the provisions in Section 20-5.027J, "Testing," of the Standard Specifications and these special provisions.

Tests shall demonstrate to the Engineer, through one complete cycle of the irrigation controllers in the automatic mode, that the associated automatic components of the irrigation systems operate properly. If automatic components of the irrigation systems fail a functional test, these components shall be repaired at the Contractor's expense and the testing repeated until satisfactory operation is obtained.

Associated automatic components shall include, but not be limited to remote control valves.

Upon completion of work on an irrigation system, including correction of deficiencies and satisfactory functional tests for the systems involved, the plants to be planted in the area watered by the irrigation system may be planted provided the planting areas have been prepared as specified in these special provisions.

**PIPE**

**Plastic Pipe**

Plastic pipe supply lines shall be polyvinyl chloride (PVC) 1120 or 1220 pressure rated pipe with the minimum pressure rating (PR) shown on the plans.

Plastic pipe supply lines shall have solvent cemented type joints. Primers shall be used on the solvent cemented type joints.

Plastic pipe supply lines (main) shall have a minimum cover of 0.45 m.

Plastic pipe supply lines downstream from the remote control valves for Type C sprinklers shall have a minimum cover of 150 mm.

Fittings for plastic pipe supply lines with a pressure rating (PR) of 315 shall be Schedule 80.

**RECLAIMED WATER SUPPLY LINES**

New and exposed reclaimed water supply lines shall be marked with a permanently affixed purple warning tape bearing the continuous wording "CAUTION RECLAIMED WATER." The tape shall be wrapped around the supply lines in a manner that produces a uniform and smooth fit, free of irregularities.

At the Contractor's option, purple colored polyvinyl chloride (PVC) supply lines may be used for reclaimed water supply lines in place of standard polyvinyl chloride (PVC) supply line with affixed purple warning tape. Purple colored polyvinyl chloride (PVC) supply lines shall conform to the following:

A. Pipe shall be made of polyvinyl chloride (PVC) 1120 with the minimum pressure ratings (PR) shown on the plans.
B. Pipe shall conform to the requirements in one of the following Standards: ASTM Designation: D 1785, ASTM

Designation: D 3139 and ASTM Designation: D 2241 or ASTM Designation: D 2672.

C. Pipe shall have permanent wording "CAUTION RECLAIMED WATER" in 2 rows, approximately 180 degrees apart, in the longitudinal direction of the pipe. The warning message shall be repeated every 600 mm continuously along the pipe.

**SPRINKLERS**

Sprinklers shall conform to the type, pattern, material, and operating characteristics listed in the "Sprinkler Schedule" shown on the plans.

Flexible risers shall be ultraviolet (UV) resistant, brown in color and shall conform to the details shown on the plans.

**FILTER ASSEMBLY UNIT**

A filter assembly unit shall consist of a filter housing, a reusable filter cartridge, fittings, pipe, and valve box as shown on the plans.

Filter assembly units shall withstand a cold water working pressure of 1034 kPa.

Pressure loss through the filter assembly units shall not exceed the following:

| FILTER ELEMENT SIZE (Millimeters) | MAX FLOW RATE (Liters Per Minute) | PRESSURE LOSS AT MAX FLOW (kPa) |
|---|---|---|
| 40 | 132 | 16 |

Filter housings shall be manufactured of reinforced polypropylene plastic.

Filter cartridges shall be threaded plastic rings attached to one another to produce a reusable cylindrical form filter. Filters shall be capable of 130 µm size mesh filtration.

**BALL VALVES**

Ball valves shall be polyvinyl chloride (PVC) and shall be capable of withstanding a cold-water working pressure of 1034.22 Kpa. The pressure seats shall be teflon coated. The valve shall have threaded unions.

The contract unit price paid for 40 mm ball valve shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all work involved in ball valves, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

**FINAL IRRIGATION SYSTEM CHECK**

A final check of existing and new irrigation facilities shall be performed not more than 20 working days prior to acceptance of the contract.

The length of watering cycles using potable water measured by water meters for the final check of irrigation facilities will be determined by the Engineer.

Remote control valves connected to existing irrigation controllers shall be checked for automatic performance when the controllers are in automatic mode.

Unsatisfactory performance of irrigation facilities installed or modified by the Contractor shall be repaired and rechecked at the Contractor's expense until satisfactory performance is obtained, as determined by the Engineer.

Repair or replacement of existing irrigation facilities due to unsatisfactory performance shall conform to the provisions in "Existing Highway Irrigation Facilities" of these special provisions.

Nothing in this section "Final Irrigation System Check" shall relieve the Contractor of full responsibility for making good or repairing defective work or materials found before the formal written acceptance of the entire contract by the Director.

Full compensation for checking the irrigation systems prior to the acceptance of the contract shall be considered as included in the contract lump sum price paid for plant establishment work and no additional compensation will be allowed therefor.

## SECTION 10-3. SIGNALS, LIGHTING AND ELECTRICAL SYSTEMS

### 10-3.01 DESCRIPTION

Modifying traffic signals, lighting and sign illumination, ramp metering systems, collector metering systems, traffic monitoring stations, and various electrical systems for communication equipment and communication system routing, described in Section 10-3, shall conform to all rules and regulations of the Federal Communications Commission and the provisions in Section 86, "Signals, Lighting and Electrical Systems," of the Standard Specifications and these special

provisions.

Locations of traffic monitoring station (TMS), collector metering system, and ramp metering installations are shown below:

Traffic monitoring station - Location 2714- (Relocate ) - KP 36.2 - Westbound Route 60, East of Lemon Avenue
Location 2163 - KP 38.8 - Westbound Route 60, West of Grand Avenue
Location 2363 - KP 6.4 - Southbound Route 57, North of Pathfinder Road

Lighting equipment is included in the following structures:

Communication conduit is included in the following structure:

Golden Springs Drive Undercrossing - KP 7.2 - Bridge No. 53-2149

Traffic signal work is to be performed at the following locations:

A. Location 1 - Westbound Route 60 at Brea Canyon Road.
B. Location 2 - Eastbound Route 60 at Grand Avenue.

Closed circuit television camera system (CCTV) work is to be performed at the following locations:

A. CCTV Camera (Relocate - Location PO226) - KP 36.2 - Westbound Route 60, East of Lemon Avenue
B. CCTV Camera (Location PO247) - KP 39.7 - Eastbound Route 60 at Grand Avenue
C. Camera (Location OR043) - KP 6.9 - Eastbound Route 60 to Southbound Route 57 Connector

Video Node work is to be performed at the following location:

Video Node (Location PO247) - KP 39.7 - Eastbound Route 60 at Grand Avenue

Cable Node work is to be performed at the following location:

Cable Node (Relocate - Location PO237) - KP 38.1 - Northbound Route 57 to Eastbound Route 60

Highway Advisory Radio (HAR) work is to be performed at the following location:

HAR (Location OR043) - KP 6.9 - Eastbound Route 60 to Southbound Route 57 Connector

The Contractor shall confirm equipment placement with the Engineer before installing any equipment.

**10-3.02 ABBREVIATIONS AND GLOSSARY**

The following Abbreviations and Glossary apply to Section 10-3 of these special provisions.

**Abbreviations:**

| | |
|---|---|
| **&** | And |
| **#** | number |
| **ADM:** | Add Drop Multiplexer. |
| **AFC:** | Automated Frequency Control. |
| **AGC:** | Automatic gain control. |
| **S:** | Alarm Indication Signal. |
| **AISI:** | American Iron and Steel Institute. |
| **AMI:** | Alternate Mark Inversion (a data transmission protocol.) |
| **APD:** | Avalanche Photo diode. |
| **APL:** | Average picture level. |
| **APS:** | Automatic Protection Switch. |
| **AVC** | Automatic vehicle classification system |

| | |
|---|---|
| **AWG** | American wire gauge |
| **AWM:** | Appliance Wiring Material. |
| **B8ZS:** | Bipolar 8 Zero Suppression(data transmission protocol) |
| **BER:** | Bit error rate. |
| **BERTS:** | Bit Error Rate Test Set. |
| **BITS:** | Building Integrated Timing Supply. |
| **BNC:** | Bayonet Navy Connector. |
| **bps:** | Bits per second. |
| **BPV:** | Bipolar Violation. |
| **CCD:** | Charge-Coupled Device. |
| **CCK:** | Camera Control Key pad. |
| **CCR:** | Camera Control Receiver |
| **CCT:** | Camera Control Transmitter. |
| **CCTV:** | Closed Circuit Television. |
| **cfm:** | Cubic feet per minute. |
| **CFR:** | Code of Federal Regulations. |
| **CIDH:** | Cast In Drilled Hole. |
| **CMIP:** | Configuration Management Information Protocol. |
| **CMISE:** | Common Management Information Service Entity. |
| **CMP:** | Configuration Management Plan. |
| **CMS:** | Changeable Message Sign. |
| **CODEC:** | Coder - Decoder. |
| **COMM** | Communication |
| **CPU:** | Central Processing Unit. |
| **CRT:** | Cathode Ray Tube. |
| **CTRL** | Controller |
| **DACCS** | Digital access and cross connection system |
| **D4:** | 4th version of the D-signal format for time division multiplexers. |
| **dB:** | Decibel. |
| **dBm:** | Decibel referred to milliwatt. |
| **dBrn:** | Decibel above reference noise. |
| **DCD:** | Data carrier detect |
| **DCE:** | Data communication equipment. |
| **DTE:** | Data Circuit Terminating Equipment. |
| **DEMARC** | Demarcation |
| **DEMUX** | Demultiplexer |
| **DCS:** | Digital Cross-Connect System. |
| **DS-1:** | Digital Signal Level 1. Digital Transmission Rate - 1.544 megabits per second. |
| **DS-3:** | Digital Signal Level 3. Digital Transmission Rate - 44.876 megabits per second. |
| **DWP:** | LA Dept. of Water and Power |
| **EIA:** | Electronics Industries Association. |
| **EMT:** | Electrical Metallic Tubing. |
| **ESF:** | Extended Superframe or Extended Superframe Format (4). |
| **E/O** | east of |
| **FCC** | Federal Communications Commission |
| **F/O or FO:** | Fiber optic. |
| **FDF** | Fiber Distribution Frame |

| | |
|---|---|
| **FDU:** | Fiber Distribution Unit. |
| **FRP:** | Fiberglass Reinforced Plastic. |
| **FXS:** | Foreign Exchange Subscriber. |
| **GFCI:** | Ground Fault Circuit Interrupter. |
| **GUI** | Graphical User Interface. |
| **HAR:** | Highway Advisory Radio. |
| **HVAC:** | Heating Ventilation and Air Conditioning. |
| **Hz:** | Hertz. |
| **IRE:** | IRE is a SMPTE Standard video reference level. |
| **ITUR** | International Telecommunications Union Radio |
| **JKFD:** | Jackfield |
| **KP** | Kilometer Post |
| **LA** | Los Angeles |
| **M13:** | Multiplexer, 28 DS-1 circuits to 1 DS-3 circuit. |
| **MHz:** | Megahertz. |
| **MMFO:** | Multimode fiber optics |
| **MUX:** | Multiplexer |
| **NEMA:** | National Electrical Manufacturers Association. |
| **NHD** | North Hollywood |
| **nm:** | nanometer. |
| **NMS:** | Network Management System. |
| **NRZ:** | Non-return to Zero. |
| **NTSC:** | National Television Standards Committee. |
| **OC:** | Optical Channel. |
| **OD:** | Outside Diameter. |
| **OEM** | Original Equipment Manufacturer. |
| **OSHA:** | Occupational Safety and Health Administration. |
| **OW** | Order wire (Multiple voice circuit) |
| **P** | Pair |
| **P22** | Pair 22 American Wire Gauge |
| **PAC BELL** | Pacific Bell telephone Company |
| **p-p:** | Peak to Peak. |
| **PC:** | Personal Computer. |
| **PCMS:** | Pasadena City Municipal Services |
| **PDA** | Power distribution assembly |
| **PIN:** | P-type, intrinsic, N-type. |
| **PR** | Pair |
| **PRBS:** | Pseudo-Random Bit Sequence pattern. |
| **QRSS:** | Quasi-Random Signal Source. |
| **REA:** | United States Rural Electrification Administration. |
| **RETMA:** | Radio-Electronics-Television Manufacturers Association (Former name of EIA.) |
| **RF:** | Radio Frequency. |
| **RG:** | Regulatory Guide. |
| **RMS:** | Ramp Metering System. |
| **RMS:** | Root-mean-square. |
| **RTS:** | Request to send. |
| **SF:** | Superframe Format (D4). |
| **SM:** | Singlemode. |
| **SMFO:** | Singlemode Fiber Optic. |

| | |
|---|---|
| **SONET:** | Synchronous Optical Network. |
| **SSOVP:** | Solid State Over-voltage Protector. |
| **SSPC:** | Steel Structures Painting Council. |
| **ST:** | Type of Connector. |
| **TDM:** | Time Division Multiplexer. |
| **THHN:** | Heat Resistant thermoplastic with Nylon Jacket Conductor. |
| **THWN:** | Moisture and Heat Resistant Thermoplastic with Nylon Jacket Conductor. |
| **TIA:** | Telecommunications Industries Association. |
| **TL-1:** | Transaction Language 1. |
| **TLP:** | Transmission Level Point. |
| **TMC:** | Traffic Management Center. |
| **TSG:** | Test Signal Generator. |
| **TSI:** | Time Slot Interchange. |
| **UNC:** | Unified National Coarse. |
| **UNIX:** | Specific operating system found in real-time applications. |
| **UV:** | Ultraviolet. |
| **V:** | Volt. |
| **V(ac)** | V, Alternating Current. |
| **VID:** | Video Identification and Date/Time Display. |
| **VSK:** | Video switch keypad. |
| **VSM:** | Video switch matrix. |
| **VT-1.5:** | Virtual Tributary-Level 1.5 (1.728 Mb/s.). |
| **VT:** | Virtual Tributary. |
| **W:** | Watt. |
| **WFM:** | Waveform Monitor. |
| **WTO:** | Wire Transit Only. |
| **X.11, X.25:** | specific protocol standards generated by the International Telecommunications Union (formerly CCITT.) |
| **XHHW:** | Moisture and Heat Resistant Cross Linked Synthetic Polymer Conductor. |

**Glossary:**

**Breakout.--**The cable "breakout" is produced by (1) removing the jacket just beyond the last tie-wrap point, (2) exposing 0.9 m to 1.8 m of the cable buffers, aramid strength yarn and central fiberglass strength member, and (3) cutting the aramid yarn, central strength member and the buffer tubes to expose the individual glass fibers for splicing or connection to the appropriate device.

**Cable Storage Cabinet.--**A cabinet for holding excess cable slack for protection. The cable storage cabinet allows the user flexibility in equipment location and the ability to pull cable back for re-splicing.

**Channel.--**(1) An information path between a discrete input and a discrete output. (2) One single input to a multiplexer or output from a demultiplexer.

**Closed Circuit Television Assembly.**--Camera, lens, environmental enclosure, and necessary connectors and cables.

**Connector.--**A mechanical device used to provide a means for attaching to and decoupling from a transmitter, receiver, or another fiber (such as on a patch panel).

**Connectorized.--**A term that describes a fiber to which a connector has been affixed.

**Connector Module Housing (CMH).--**A patch panel used in the FDF to terminate singlemode fibers with most common connector types. It may include a jumper storage shelf and a hinged door.

**Couplers.--**Couplers are devices which mate two fiber optic connectors to facilitate the transition of optical light signals from one connector into another. Couplers may also be referred to as: adapters, feed-throughs, and barrels. They are normally located within FDF's mounted in panels. They may also be used unmounted, to join two simplex fiber runs.

**Fiber Distribution Frame (FDF).--**A rack mounted system that is usually installed in the TMC that consists of a standard equipment rack, fiber routing guides, horizontal jumper troughs, fiber distribution units (FDU), connector module housings (CMH), and splice module housings (SMH).

The FDF serves as the "home" for the passive fiber optic components from cable breakout, for connection by jumpers, to the electronics.

**Fiber Distribution Unit (FDU).--**An enclosure containing both a Connector Module Housing (CMH) and a Splice Module Housing enclosure.

**Field Cabinet.**--A roadside cabinet used for housing controllers or communications equipment.

**Interconnection.**--An electronic, fiber optic or electrical connection between controller unit, located inside a controller cabinet, and other components housed in other enclosures.

**Jumper.--**A short fiber optic cable that has connectors installed on both ends, and is typically used for connection within a FDF.

**Light Source.--**A portable piece of fiber optic test equipment that, in conjunction with a power meter, is used to perform end-to-end attenuation testing. It contains a stabilized light source operating at the designed wavelength of the system under test.

**Link.--**A passive section of the system, the ends of which are to be connected to active components. A link may include splices and couplers. For example, a video link may be from a F/O transmitter to a video multiplexer (MUX).

**Mux/Demux.**--Multiplexer/demultiplexer.

**Optical Time Domain Reflectometer (OTDR).--**Fiber optic test equipment (similar in appearance to an oscilloscope) that is used to measure the total amount of power loss between two points and the corresponding distance. It provides a visual and printed display of the relative location of system components such as fiber sections, splices and connectors and as the losses that are attributed to each component or defect in the fiber.

**Patchcord.--**A short jumper.

**Pigtail.--**Relatively short length of fiber optic cable that has a connector installed on only one end.

**Power Meter.--**A portable piece of fiber optic test equipment that, in conjunction with a light source, is used to perform end-to-end attenuation testing. It contains a detector that is sensitive to light at the designed wavelength of the system under test. Its display indicates the amount of power injected by the light source that arrives at the receiving end of the link.

**Segment.--**A section of F/O cable that is not connected to any active device and may or may not have splices per the design.

**Splice Closure.--**Normally installed in a splice vault, a splice closure is an environmentally sealed container used to organize and protect splice trays. The container allows splitting or routing of fiber cables from multiple locations.

**Splice Module Housing (SMH).--**The SMH stores splice trays as well as pigtails and short cable lengths.

**Splice Tray.--**A container used to organize and protect spliced fibers.

**Splice Vault.--**A splice vault is used to house splice closures.

**10-3.03 COST BREAK-DOWN**

Cost break-downs shall conform to the provisions in Section 86-1.03, "Cost Break-Down," of the Standard Specifications and these special provisions.

The Engineer shall be furnished a cost break-down for each contract lump sum item of work described in this Section 10-3.

The cost break-down shall be submitted to the Engineer for approval within 15 days after the contract has been approved. The cost break-down shall be approved, in writing, by the Engineer before any partial payment for the items of electrical work will be made.

The cost breakdown shall include the following items in addition to those listed in the Standard Specifications:

A. Telephone bridges
B. Terminal blocks - each type
C. Video node controller cabinet enclosure
D. Video transmitters
E. Video receivers
F Fiber optic data modems
G. Fiber distribution units

**10-3.04 EQUIPMENT LIST AND DRAWINGS**

A maintenance manual shall be furnished for all installed controller units, CCTV cameras, video transmitters, video receivers and auxiliary equipment. The maintenance manual and operation manual may be combined into one manual. The maintenance manual or combined maintenance and operation manual shall be submitted at the time the controllers are delivered for testing or, if ordered by the Engineer, prior to purchase. The maintenance manual shall include, but need not be limited to, the following items:

A. Specifications
B. Design characteristics
C. General operation theory
D. Function of all controls
E. Trouble shooting procedure (diagnostic routine)
F. Block circuit diagram
G. Geographical layout of components
H. Schematic diagrams
I. List of replaceable component parts with stock numbers

**Field Cabinets**- Each field cabinet which is connected to the communication system routing in this contract shall be supplied with the following documentation, and stored in a re-sealable water-resistant folder mounted on the inside of the field cabinet door:

Traffic monitoring station (TMS)
- A copy of the wiring diagram for the communications elements at that site
- A copy of the twisted pair assignment tables
- A copy of the system schematic diagrams
- A copy of element reference table

CCTV Camera
- A copy of the wiring diagram for the communications elements at that site
- A copy of the fiber assignment tables
- A copy of the twisted pair assignment tables
- A copy of the system schematic diagrams
- A copy of the element reference table

Video node
- A copy of the wiring diagram for the communications elements at that site
- A copy of the video channel assignment table
- A copy of the fiber assignment tables

A copy of the twisted pair assignment tables
A copy of the system schematic diagrams
A copy of the element reference table

Relocated cable node

Contractor shall update the following existing documentation with the newly added circuits to the relocated cable node:

A copy of the wiring diagram for the communications elements at that site
A copy of the data node circuit assignment tables
A copy of the fiber assignment tables
A copy of the twisted pair assignment tables
A copy of the system schematic diagrams
A copy of the element reference table

Highway advisory radio (HAR)

A copy of the wiring diagram for the communications elements at that site
A copy of the fiber assignment tables
A copy of the system schematic diagrams
A copy of the element reference table

Additional information may be supplied by the Engineer to be used to produce the documentation listed above by adding the related information that applies to this project.

Full compensation for the maintenance manual and field cabinet documentation shall be considered as included in the contract lump sum price paid for system testing, and no separate payment will be made therefor.

## 10-3.05 MAINTAINING EXISTING AND TEMPORARY ELECTRICAL SYSTEMS

Traffic signal and lighting, lighting and sign illumination, traffic monitoring station, and ramp metering system shutdowns shall be limited to periods between the hours of 9:00 a.m. and 3:00 p.m. except that the normal lighting schedule shall be maintained on weekends and on designated holidays as defined under " Maintaining Traffic" of these special provisions.

Attention is directed to Section 7-1.11, "Preservation of Property," of the Standard Specifications and these special provisions.

The Contractor shall obtain written approval from the Engineer, not less than 72 hours prior to any system cutover, testing, disconnection or disruption of service from the existing individual electrical systems for communication equipment, communication system routing, traffic signal and lighting, lighting and sign illumination, ramp metering system, and traffic monitoring station.

An individual electrical system for communication equipment, communication system routing, ramp metering system (RMS) and traffic (count) monitoring system (TMS) shall be considered to be "offline" for the duration of time that it is disconnected from AC power and disrupted from active communications with the District Transportation Management Center (TMC), such that the equipment cannot be controlled through the exercise of remote control commands from the TMC.

### TRAFFIC SIGNAL AND LIGHTING, LIGHTING AND SIGN ILLUMINATION, TRAFFIC MONITORING STATION, AND RAMP METERING SYSTEM RESTRICTIONS

Except as otherwise provided in these special provisions or as directed by the Engineer, electrical systems for traffic signal and lighting, lighting and sign illumination, traffic monitoring station, and ramp metering systems shall be subjected to the following restrictions:

No traffic signal and lighting, lighting and sign illumination, ramp metering system or traffic monitoring station controller shall be disconnected or disrupted between the hours of 6:00 a.m. and 9:00 a.m., and from 3:00 p.m. to 7:00 p.m., Monday through Friday.

No traffic signal and lighting, lighting and sign illumination, ramp metering system or traffic monitoring station controller shall be disconnected from its electrical power for more than 15 minutes in any 24 hour period without prior written approval from the Engineer.

No more than five individual Model 170 Controller locations, each with its own unique controller I.D. number, as indicated on the plans, shall be subject to disruption at any time during the system cutover.

**MAINTAINING EXISTING COMMUNICATION SYSTEM ELEMENTS**

Existing communication system elements, including, but not limited to, communication equipment, such as highway advisory radio, closed circuit television camera, changeable message sign, ramp metering system and traffic monitoring station, and communication system routing, such as various communication conduits, cables, pull boxes, and splice vaults, are located within the project limits and may conflict with construction operations. In areas where trenching operations are to be performed, the Contractor shall notify the Engineer a minimum of 72 hours, prior to starting any work and obtain as-built plans and specifications for the area. The Engineer will advise the District Office of Intelligent Transportation System (ITS) of the Contractor's scheduled work.

The Contractor and the Engineer shall jointly conduct a pre-construction check of the existing communication system elements. The Engineer will determine the exact location of all existing communication systems elements including, but not limited to, highway advisory radio, closed circuit television camera, changeable message sign, ramp metering system, traffic monitoring station, splice vaults, conduits and pull boxes of various types, prior to the Contractor beginning any trenching operations. The Engineer will maintain the records of the pre-construction check of the existing communication system elements.

Existing communication system elements shall remain in place and shall be protected from damage.

The Contractor shall obtain written approval from the Engineer not less than 72 hours prior to any disconnection, or disruption, of service from the existing communication systems elements.

The Contractor shall use hand tools to perform any work involved in excavating, relocating, repairing, replacing and removing existing communication system elements. If any part of the existing communication system elements is damaged or failed by the Contractor's operations, the Engineer shall be notified immediately and the damaged communication system elements shall be repaired or replaced, at the Contractor's expense, within 2 working days. Replaced communication system elements shall be new, or of equal or better quality than the damaged communication system elements. The Engineer shall approve replacement methods and replaced elements in advance and in writing. After repair or replacement of such elements is complete, the Contractor shall demonstrate to the Engineer that the repaired or replaced elements operate in the manner identical to that prior to the damage. Should the Contractor fail to perform the required repair or replacement work, as determined by the Engineer, the cost of performing such repairs or replacement work shall be deducted from any money due or to become due to the Contractor and all electrical related construction on this project shall be suspended until all repairs and replacement works have been completed.

Removing, relocating, repairing and replacing the existing communication system elements, including post-construction testing, ordered only by the Engineer, and further repairs required thereafter as ordered only by the Engineer, except as otherwise provided under "Existing Highway Facilities" of these special provisions, will be paid for as extra work in "Maintain Existing Communication System Elements" and as provided in Section 4-1.03D of the Standard Specifications.

Full compensation for pre-construction check of the existing communication system elements shall be considered as included in the contract lump sum prices paid for system testing and no additional compensation will be allowed therefor.

## 10-3.06 COMMUNICATION SYSTEM ROUTING

Communication system routing consists of, but not limited to, communication conduits, fiber optic cables, and twisted pair cables, of various types and sizes, communication pull boxes and splice vaults.

Prototype equipment is not acceptable. All new equipment shall be current standard production units and shall have been in production for a minimum of six months. Rebuilt or reconditioned equipment will not be allowed.

All rack mounted equipment and card cage assemblies shall have metal filler plates to cover any unused channel slots or card slots.

Before working on the existing communication system routing, the Contractor shall perform the jointly conducted pre-construction check with the Engineer according to "Maintaining Existing and Temporary Electrical Systems," elsewhere in these special provisions, and shall submit a test plan, in accordance with manufacturer's specifications, for approval in advance by the Engineer, also as described elsewhere in these special provisions.

The test plan is also to verify that all existing equipment is functional before construction and to record the working condition of those equipment.

The Contractor may arrange, at the Contractors expenses, to have a technician, qualified to work on existing communication equipment and employed by the communication equipment manufacturer or his representative, present at the time the communication equipment is installed or modified.

Except for testing and verification of the condition of the existing communication system routing before and after the works on the existing communication system routing, the scope of the Contractor's work shall be as shown on the plans.

## 10-3.07 STANDARDS AND POSTS

The sign mounting hardware shall be installed at the locations shown on the plans.

The sign panels will be State-furnished in conformance with the provisions in "Materials" of these special provisions.

Type 1 standards shall be assembled and set with the handhole on the downstream side of the pole in relation to traffic or as shown on the plans.

**10-3.08 CONDUIT**

Conduit to be installed underground, including conduit for power conductors, in jacking runs, masonry walls and sidewalks, from pull boxes and splice vaults to cabinets and junction boxes, and in or on structures shall be Type 1 unless otherwise specified and shall not be exposed in any areas. The Contractor shall install pull ropes in all empty conduits and innerducts. Detector termination conduits shall be Type 1.

Type 3 conduit shall be used for communication trunk line, including runs in elevated concrete slabs, except as shown on plans, and shall not be exposed in any areas.

Conduit shall be installed by the methods shown on the plans except as specified in these special provisions as directed by the Engineer. A flat, woven, lubricated, polyester tape with a minimum tensile strength of 80 kN minimum shall be placed in all conduits. At least 1.2 m of tape shall be extended beyond termination.

The conduit in a foundation and between a foundation and the nearest pull box shall be Type 1.

Conduit sizes shown on the plans and specified in the Standard Specifications and these special provisions are referenced to metallic type conduit. When rigid non-metallic conduit is required or allowed, the nominal equivalent industry size shall be used as shown in the following table:

| Size Designation for Metallic Type Conduit | Equivalent Size for Rigid Non-metallic Conduit |
|---|---|
| 21 | 20 |
| 27 | 25 |
| 41 | 40 |
| 53 | 50 |
| 63 | 65 |
| 78 | 75 |
| 103 | 100 |

When a standard coupling cannot be used for joining Type 1 conduit, a UL listed threaded union coupling conforming to the provisions in Section 86-2.05C, "Installation," of the Standard Specifications, shall be used.

When Type 3 communication conduit is placed in a trench, after the bedding material is placed and the conduit is installed, the trench shall be backfilled with slurry cement backfill conforming to the requirements in Section 19-3.062 of the standard Specification, except the maximum size of aggregate shall be 10 mm (pea gravel) containing not less than 150 kg of Portland cement per cubic meter and commercial quality cement sand, to not less than 50 mm above the conduit before additional backfill material is placed.

In those areas where a jacking pit in a paved shoulder is necessary to jack conduit across a roadway and the work has not been completed in a work shift the Contractor shall backfill the pit or cover the excavation with steel plates to make it safe for traffic. Surface of pit shall have no more than 10-mm gap after each completed work shift. When the work has been completed in a particular jacking area. The structural section must be restored to its original condition.

When conduit is placed in a trench under paved shoulders, after the bedding material is placed and conduit installed, the trench shall be backfilled with cement slurry backfill as specified above to within 30 mm of existing shoulder surface.

Conduits located within the same trench shall have not less than 50-mm separation.

Trenches shall be less than or equal to 200-mm width.

The Contractor's attention is directed to "Aerially Deposited Lead" elsewhere in these special provisions.

Immediately prior to installing conductors, cables and innerducts, all conduits shall be blown out with compressed air until all foreign material is removed. After conductors have been installed, the ends of conduits terminating in various pull boxes and splice vaults, service equipment enclosures, and various controller cabinets shall be sealed with an approved type of sealing compound.

At those locations where conduit is required to be installed under pavement and existing underground facilities require special precautions in conformance with the provisions in "Obstructions" of these special provisions, conduit shall be placed by the "Trenching in Pavement Method" in conformance with the provisions in Section 86-2.05C, "Installation," of the Standard Specifications.

Conduit shall not be installed by trenching along the pavement of freeway lanes except in those section of the highway where there is insufficient clearance to locate a longitudinal trench off the traveled way, or where obstructions off the traveled way would necessitate bends in the conduits in excess of those allowed.

Where conduits are shown on the plans to be installed parallel and adjacent to each other, they shall be installed together in a common trench as shown on the conduit installation details.—Power conduits placed in the same trench as communication conduits shall not terminate in communication pull boxes or splice vaults.

Communication conduits shall not terminate in power pull boxes.

Trenching shall not be allowed across freeway lanes, connectors and ramps.

**COMMUNICATION CONDUIT**

Communication conduit shall conform to the provisions specified above under "Conduit" and the following.

Conduit shall enter splice vault and communication pull boxes through knockouts. Conduits entering the ends of these boxes shall be vertically and horizontally aligned with the conduits at the opposite end of the box. Conduit ends shall not extend beyond the interior wall face of splice vault and pull boxes. The space around conduits through end walls of splice vault and communication pull boxes shall be filled with Portland cement mortar conforming to the provisions in Section 51-1.135, "Mortar," of the Standard Specifications. In no case shall a conduit body or pull box be used in lieu of a specified bend to change the direction of the communication conduit run, except where specified.

No bends shall be placed in a section of conduit in excess of those indicated in the plans without the approval of the Engineer. The total degrees of bending in a section of conduit between splice vaults and communication pull boxes shall not exceed a total of 180 degrees, except where specified otherwise.

Changes in indicated conduit bends may be made in order to suit field conditions, as long as the change reduces the degree of the bend or increases the radius of the bend. In no case shall the angle of the bend be increased without the approval of the Engineer.

Minimum bending radius for Size 53 communication conduit shall be 610 mm and minimum bending radius for Size 103 communication conduit shall be 1220 mm. Bends of greater than 22 degrees shall be factory bends and bends greater than 45 degrees shall galvanized rigid steel with any necessary adapters.

Deflections from the indicated communication conduit routing to avoid obstructions shall not exceed 83.3 mm/m. Conduit from the typical trench sections shall not deflect by more than 83.3 mm/m from the alignment preceding or following pull boxes and splice vault.

The total sum of bend radius for the communication conduit between consecutive communication pull boxes or splice vault shall not exceed 360 degrees.

Where edge drains are in the path of conduit routing the Contractor must first locate the edge drains and install the conduit maintaining a minimum depth. In the event an edge drain is damaged by the Contractor's work, the Contractor will be responsible for a full repair at his cost.

Adjacent to over crossings or bridge foundations, the Contractor shall trench and install conduit in the shoulder as close as possible to the edge of traveled way so that a minimum of 1.5 m from the outside face of footing or pile cap is maintained.

**COMMUNICATION CONDUIT (BRIDGE)**

At the locations shown on the plans, where communication conduit is to be installed on bridges, fiberglass conduit shall be used and shall conform to the details shown on the plans, and to these special provisions. Communication conduit (bridge) shall include excavation, installation of the fiberglass conduit, and placing sand and slurry cement backfill.

Excavation and slurry cement backfill shall conform to Section 19-3, "Structure Excavation and Backfill," of the Standard Specifications. The slurry cement backfill shall reach initial set prior to placing of reinforced concrete for the approach slab.

**Measurement.--**Communication conduit (bridge) will be measured by the meter.

**FIBERGLASS CONDUIT**

**General:** Fiberglass conduit and components shall comply with the specifications in ANSI/NEMA Standards Publication TC-14A or TC-14B. All fiberglass conduit components shall be free of defects including delaminations, foreign inclusions, etc. All fiberglass conduit components shall be nominally uniform (as commercially practical) in color, density, and physical properties. Fiberglass conduit shall be straight and the ends shall be cut square and true.

The Contractor shall purchase all fiberglass conduits and other fiberglass conduit system components from the same manufacturer to insure component compatibility.

**Conduit Sizes:** Fiberglass conduit shall be supplied in 6-m minimum lengths.

**System Components:** Fiberglass conduit components shall include compatible fittings, adapters, expansion joints, and factory bends at nominal radii of 1.3 m for Size 103 conduit.

**Material:** All fiberglass conduit system components shall be produced from heat cured, corrosion resistant epoxy resin and continuous fiberglass roving. All materials shall be manufactured for use at temperatures from -40°C to 110°C. All

fiberglass conduit components shall be manufactured using a homogeneously dispersed UV inhibitor. When exposed to direct diurnal sunlight, the UV inhibitor shall prevent the degradation of all physical material properties, except for surface cosmetic appearance. Materials shall contain no halogens above trace levels and shall be fire resistant.

**Joining Method:** Joints shall be watertight and withstand a minimum 4450 N of pullout tension.

**Stiffness:** For all sizes of fiberglass conduit, under a load of 1.3 kN/m of conduit, the deflection of the inside diameter shall not exceed 5 percent.

**Impact Resistance:** The minimum impact resistance values for the fiberglass conduit shall be as follows when measured as described in ASTM Designation: D2444-70, using a 9 kg tup "B" with a 50 mm radius nose:

| | |
|---|---|
| Size 103 conduit | 108 N/m. |

**CONCRETE SUPPORTS (BRIDGE)**

Wrapping tape for pipe in contact with the earth shall be a pressure sensitive polyvinyl chloride or polyethylene tape with a minimum thickness of 1.27 mm.

Steel anchor bolts, pipe clamps, nuts and bolts, and other fittings shall be suitable for the type and size of the supply lines or casing and shall conform to the provisions in Section 75-1.03, "Miscellaneous Bridge Metal," of the Standard Specifications.

Concrete pipe supports shall consist of either a precast or cast-in-place concrete pipe cradle, galvanized steel pipe clamp, 2 anchor bolts and, where shown on the plans, a stainless steel pipe protection shield.

Concrete pipe supports and pipe stops shall conform to the dimensions shown on the plans and shall be constructed of commercial quality concrete with a cement content not less than 350 kg of portland cement per cubic meter and commercial quality wire mesh. The concrete for pipe supports and pipe stops shall be moist cured for not less than 3 days.

Epoxy adhesive shall conform to the provisions in Section 95-1, "General," of the Standard Specifications and at the option of the Contractor, shall conform to the provisions in Section 95-2.03, "Epoxy Resin Adhesive for Bonding New Concrete to Old Concrete," or in Section 95-2.04, "Rapid Set Epoxy Adhesive for Pavement Markers," or in Section 95-2.05, "Standard Set Epoxy Adhesive for Pavement Markers," of the Standard Specifications.

Full compensation for furnishing and installing mechanical expansion bolt anchors, steel brackets and other fittings, concrete supports, pipe wrapping tape, epoxy-adhesives, and conduit expansion fittings shall be considered as included in the contract price paid per meter of communication conduit (bridge) involved and no additional compensation will be allowed therefor.

## 10-3.09 WARNING TAPE

Warning tape shall be furnished and installed in the trench, over new conduits to receive reinstalled or new fiber optic cables, as shown on the plans. The warning tape shall consist of 100-mm wide bright orange pigmented polyolefin film with a bold printed message of approximately 19-mm black characters on one side. The message shall be: "CAUTION: BURIED FIBER OPTIC CABLE - CALTRANS (213) 897-0340," repeated at approximately 910 mm intervals.

The warning tape shall not delaminate nor shall the message smear when wet. The tape and the printed message shall be resistant to insects and shall not degrade when exposed to alkalis, acids and other corrosive elements commonly found in soil. It shall have a minimum of 356 N tensile strength and a minimum of 700 percent elongation before breakage.

Warning tape shall be Condux International, Inc.; Allen System, Inc.; Reef Industries, Inc. or equal.

Full compensation for warning tape shall be considered as included in the contract price paid per meter for the various sizes and types of conduit involved and no separate payment will be made therefor.

## 10-3.10 COLORED CEMENT BACKFILL

The slurry cement backfill for the installation of communication conduits that will contain fiber optic cable shall be a medium to dark, red or orange color to clearly distinguish the concrete backfill from other concrete and soil. The concrete shall be pigmented by the addition of commercial quality cement pigment to the concrete mix. The red or orange concrete pigment shall be LM Scofield Company; Orange Chromix Colorant; Davis Colors; or equal.

For trenches in pavement areas, only the top 100-mm of slurry cement backfill will be required to be pigmented concrete. At the option of the Contractor, the full depth may have the pigment.

Full compensation for furnishing and incorporating the cement pigment to achieve the color required shall be considered as included in the contract price paid per meter for the various sizes and types of conduit involved and no separate payment will be made therefor.

### 10-3.11 FIBER UNDERGROUND WARNING SIGN

Any communication conduit installed in soil where conduit can not be seen from above ground for more than 30 m must have a warning sign. The signs must be placed within 5 m of conduit at minimum 60-m intervals.

The signs shall say "FIBER UNDERGROUND CALL 213-897-4698 CALTRANS ITS DEPT." The dimensions of the signs shall be at a minimum of 130 mm x 170 mm x 2 mm and made of galvanized sheet metal or aluminum sheet. The sign colors shall be white lettering with black background. The signs shall be bolted to right of way fence at a height of 1.5 m. In the event the right of way fence is not within 5 m from conduit installation, than contractor shall install signs on a metal post, see A73B in the standard plans.

Full compensation for furnishing fiber underground warning sign shall be considered as included in the price or prices paid for the conduit involved and no separate payment will be made.

### 10-3.12 SIZE 25 AND 32 INNERDUCT

Wherever fiber optic cable is used, innerduct shall be installed to provide protection for the fiber optic cable. A separate innerduct shall be installed for each fiber optic cable along the communication mainline as shown on the plans.

All innerduct shall be 25 mm for size 25 and 32 mm for size 32, smooth, ribbed or corrugated high tensile polyethylene duct. Innerduct shall have the following characteristics:

Inner diameter grater than or equal to 25 mm for size 25 and 32 mm for size 32, nominal.
Environmental stress crack resistance in excess of 2000 hours at - 100˚C, no failures.
Cold impact resistance to -76˚C not brittle until -100˚C.
Minimum tensile strength of 2670 N for finished product.
Minimum crush strength of 2900 N.
Coefficient of friction shall be less than 0.4 un-lubricated on nonmetallic conduit and with common polyethylene cable jackets.

Different innerduct within the same conduit shall be different colors, and shall be consistent throughout the project. The colors shall be yellow for fiber optic cables used for video/data and contrasting colors approved by the Engineer for video distribution and data distribution. The exterior of the innerduct shall be marked with sequential measurement markings each meter.

Innerduct shall be installed using the manufacturer's recommended practices. A manufacturer recommended lubricant shall be applied between the innerduct and the conduit during installation to reduce friction. Innerduct shall be installed using a cable pulling lubricant recommended by the innerduct manufacture and a non-abrasive pull tape conforming to the provisions described under "Conduit" elsewhere in these special provisions. If innerduct is to be installed with adjacent cables in the same conduit, the innerduct and the cable shall be installed together in one operation. Innerduct shall be installed in continuous runs between communication pull boxes and splice vaults without splices or joints.

All ends shall be smoothed to prevent scraping of the cable. A dynamometer shall be used to record installation tension and a tension-limiting device shall be used to prevent exceeding the maximum pulling tension during installation. A fusible link shall be used to limit the pulling tension. One link shall be placed in series with every element rated for less than the maximum pulling tension of that element. The innerduct shall not be stressed beyond the minimum-bending radius allowed by either the innerduct or fiber optic cable manufacturer.

The tension shall be set to the manufacturer's maximum limit. The maximum pulling tension shall be recorded for each innerduct run.

Immediately prior to installing cables, innerduct shall be blown out with compressed air until all foreign material is removed. After cables have been installed, the ends of innerduct shall be sealed with an approved type of sealing compound.

### 10-3.13 PULL BOXES

Grout shall not be placed in the bottom of pull boxes.

Additional pull boxes for communication system routing shall not be installed without the Engineer's written approval. All pull boxes for communication system routing shall be installed in the unpaved area immediately adjacent to the paved shoulder or behind guardrail or to be determined by the Engineer. Communication conduit shall be directed from the shoulder to the boxes with 15-degree (maximum) sweeps. Dikes shall be replaced in kind, as necessary.

Full compensation for replacing the dikes shall be considered as included in the contract price paid per meter for the various sizes and types of conduit involved and no additional compensation will be allowed therefor.

#### COMMUNICATION PULL BOXES

Communication pull boxes and covers shall have a vertical proof-load strength of 111 kN. The 111 kN load shall be

distributed through a 229-mm x 229-mm x 51-mm steel plate according to Federal Specification RR-F-621e. This load shall be placed anywhere on the box and cover for a period of one minute without causing any cracks or permanent deformations.

The communication pull boxes shall be reinforced with a galvanized Z-bar welded frame and cover similar to that shown on the plans for No. 6(T) boxes. Frames shall be anchored to the boxes by means of 6-mm x 57-mm long concrete anchors. Six concrete anchors shall be provided for each communication pull box, one placed in each corner and one placed near the middle of each of the longer sides.

Hold down screws shall be 9-mm hex flange cap screws of Type 316 stainless steel. The nut shall be zinc plated carbon steel and shall be made vibration resistant with a wedge ramp at the root of the thread. The nut shall be spot welded to the underside of, or fabricated with, the galvanized Z-bar pull box frame.

Steel covers shall be countersunk approximately 6-mm to accommodate the bolt head. The bolt head shall not extend more than 3-mm above the top of the cover when tightened down. A 6 -mm tapped hole and brass-bonding screw shall be provided.

Communication pull boxes shall have " CALTRANS COMMUNICATION" marking on the steel cover.

The opening of communication pull boxes shall have the following dimensions.

| Pull Box Type | Width (±25 mm) | Length (±25 mm) |
|---|---|---|
| Communication | 432 mm | 762 mm |

Concrete placed around and under communication pull boxes as shown on the plans shall contain a minimum of 325 kg of cement per cubic yard.

After the installation of communication pull boxes, the steel covers shall be installed and kept bolted down during periods when work is not actively in progress at the pull box. When placing the steel cover for the final time, the cover and the Z-bar frame shall be cleaned of all debris and securely tightened down.

Communication pull boxes shown on the plans in the shoulder are shown for general location only. The exact location shall be outside the paved shoulder and shall be determined by the Engineer.

Communication pull boxes will be measured as units determined from actual count in place. Communication pull boxes to be paid for, as units shall be those units designated on the plans or ordered by the Engineer. Additional communication pull boxes shall not be installed without the Engineer written approval.

**10-3.14 SPLICE VAULT**

Splice vault shall be 1520 mm (L) x 760 mm (W) x 760 mm (D) nominal inside dimensions and shall conform to Section 86-2.06, "Pull Boxes," of the Standard Specifications. Covers shall be in one or two sections. Hold down bolts or cap screws and nuts shall be of brass, stainless steel or other non-corroding metal material. Each cover portion shall have inset lifting pull slots. Cover marking shall be "CALTRANS COMMUNICATION" on each cover section. Enclosures, covers and extensions shall be concrete gray color. Vault and covers may be constructed of reinforced Portland cement concrete or of non-PCC material.

Non-PCC vault and covers shall be of sufficient rigidity that when a 445 N concentrated force is applied perpendicularly to the midpoint of one of the long sides at the top while the opposite long side is supported by a rigid surface, it shall be possible to remove the cover without the use of tools. When a vertical force of 6675 N is applied, through a 13-mm by 75-mm by 150-mm steel plate, to a non-PCC cover in place on a splice vault, the cover shall not fail and shall not deflect more than 6-mm.

Splice vault shall be installed as detailed and where shown on the plans. Splice vault and cover shall have an AASHTO HS 20-44 rating where shown on the plans., except in the area protected from vehicular traffic, as directed by the Engineer, may be rated for AASHTO H5 loads (25 percent of HS 20-44):

a. Behind structures, retaining walls, barrier railing or guard railing.
b. In sidewalk areas.
c. In other areas protected from vehicular traffic as directed by the Engineer.

Splice vault shall be installed 24-mm above grade in unpaved area.

Splice vaults shown on the plans in the shoulder are shown for general location only, exact location shall be directed by the Engineer.

Metallic or non-metallic cable racks shall be installed on the interior of both sides of the splice vault. The rack shall be capable of supporting a load of 445 N, minimum, per rack arm. Racks shall be supplied in lengths appropriate to the box in which they will be placed. Rack arms shall not be less than 150 mm in length. All metallic cable racks shall be fabricated from ASTM Designation: A36 steel plate and shall be hot-dip galvanized after fabrication. Steel plate, hardware and galvanizing shall be in accordance with the requirements of Section 75, "Miscellaneous Metal," of the Standard

Specifications. Metallic cable racks shall be bonded and grounded.

**10-3.15 CONDUCTORS AND WIRING**

Splices shall be insulated by "Method B".

The minimum insulation thickness, at any point, for Type USE, RHH or RHW wire shall be 1.0 mm for conductor sizes No. 14 to No. 10, inclusive, and 1.3 mm for No. 8 to No. 2, inclusive. The minimum insulation thickness, at any point, for Type THW and TW wires shall be 0.69 mm for conductor sizes No. 14 to No. 10, inclusive, 1.02 mm for No. 8, and 1.37 mm for No. 6 to No. 2, inclusive.

Full compensation for power cables of the sizes shown on the plans shall be considered as included in the contract price paid for the items involved and no additional compensation will be allowed therefor.

Twisted pair cables and fiber optic cables are provided for elsewhere in these special provisions.

**TELEPHONE CABLE**

Telephone cable shall consist of four No. 18 AWG conductors with braided copper shield and outer jacket. Each conductor shall have a minimum of 16 tinned copper strands. Conductor insulation shall be rubber or thermoplastic rated for 600 Volts. Insulation of the four conductors shall be color coded with one each of the following colors: Black, white, red, and green. Jacket shall be neoprene, polyethylene, and polyvinyl chloride with a nominal thickness of 0.89 millimeters.

The telephone cable shall be terminated on terminal boards in the ramp metering controller cabinets with the shield bonded to the ground bus. Approximately 1 m of cable shall be neatly coiled in the telephone demarcation cabinets. The telephone cable shall be run from controller cabinets to telephone demarcation boxes without splices.

Full compensation for power cables and telephone cables of the sizes shown on the plans shall be considered as included in the contract lump sum price paid for the items involved and no additional compensation will be allowed therefor.

**10-3.16 TWISTED PAIR CABLE**

Twisted pair cable shall be supplied in the configurations shown on the plans and specified in these special provisions.

The twisted pair cable shall meet the requirements of REA Specification PE-39 and the following:

Conductors shall consist of a solid wire of plain annealed high conductivity copper, smoothly drawn, circular in section, uniform in quality, free from defects and having a conductor size of number 22 AWG. Each conductor shall be insulated with a colored, high-density polyethylene jacket.

Insulated conductors shall be uniformly twisted to form pairs. The twisted length of the pairs shall vary to minimize cross talk. A non-hygroscopic dielectric tape shall be wrapped around the insulated pairs. A laid up core shall be wrapped with aluminum tape and bonded with an overlap to provide 100 percent shielding. A black, high molecular weight, medium or low density, polyethylene jacket shall be extruded over the shield. Filling compound materials used in the cable shall not support galvanic action.

The cables shall be color-coded using the REA standard color code.

**Packing.**--The cable shall be supplied on reels. Each reel shall be transported to the site using cable reel trailers and shall have the following information clearly labeled on it:

Customer
Customer order number
Reel number
Destination
Ship date
Manufactured date
Manufacturer's name
Cable code
Length of cable
Manufacturers Test Data

Cable shall be transported to the project site using cable reel trailers. Care shall be taken at all times to avoid scraping, denting, or otherwise damaging the cable before, during, or after installation. The Contractor without additional compensation shall replace damaged cable.

**Installation.**--Cable shall be installed in duct in the field in accordance with the plans. Duct ends shall have all rough ends smoothed to prevent scraping the cable. A manufacturer recommended lubricant should be applied to the cable to reduce friction between the cable and the duct. Mechanical aids and pulling cable or ropes shall be used as required. Personnel shall be stationed at each cabinet, splice vault and pull box through which the cable is to be pulled to observe and

lubricate the cable. All exposed cable ends shall be protected from moisture ingress.

The cable shall not be stressed beyond the manufacturer's minimum bending radius at any time. A dynamometer shall be used to measure installation tension and a tension-limiting device shall be used to prevent exceeding the manufacturer's maximum pulling tension specification during installation. The tension limit shall be set at or below the manufacturer's maximum limit. The maximum measured pulling tension shall be recorded for each run of cable.

A single loop of cable, with a minimum length of 3.0 m, shall be provided at each pull box in accordance with the plans. Cable shall be trained to the splice vault wall opposite any power cables, tied with nylon ties and labeled with vinyl marking bands.

A minimum of 12 m of slack shall be provided for each unspliced cable at each splice vault.

Following installation of the cable in the duct, all duct entrances at pull boxes, vaults and cabinets shall be sealed with duct sealing compound to prevent the ingress of moisture, foreign materials, and rodents. The cables shall be spliced, maintaining the pair count and REA color code. Cable markers shall be used to identify the cable and pair-count. All field splices shall be made in twisted pair splice closures located in the splice vaults. The cable shall be securely fastened in place within pull boxes, vaults and cabinets.

**Testing.**--The Contractor is responsible for all testing and documentation required establishing approval and acceptance of the cable, its installation and in operation during the system integration testing. The following identifies the specific quality control requirements for this specification.

Cables shall be tested at the factory to ensure the cable complies with the manufacturer's specifications. The Contractor shall record the reel number from which the cable came, the identification of the pairs measured, and the results of continuity and insulation tests. Half of the twisted wire pairs in each reel of cable shall be tested for insulation breakdown and continuity prior to installation in ducts.

As a post-installation check, the Contractor shall measure the continuity and insulation resistance of the cable pairs in each length of cable after installation. The Contractor shall measure these parameters on each pair and record and submit the results to the Engineer.

The Contractor shall carry out system integration testing to ensure that the twisted-pair cables perform as specified when used in operation with equipment installed under these special provisions and plans.

**REMOVAL AND REINSTALLATION OF EXISTING TWISTED PAIR CABLES (6P22)**

Existing twisted pair cables (6P22) from existing communication pull box at Station 375+47 to existing communication pull box at 375+22 shall be removed and coiled in existing pull box at Station 375+22. Existing twisted pair cables coiled in existing pull box at Station 375+22 shall be installed in new conduit as shown on the plans.

Full compensation for removing, coiling and reinstalling existing twisted pair cables shall be considered as included in the contract unit price paid for twisted pair cables and no additional compensation will be allowed therefor.

## 10-3.17 TERMINAL BLOCK

The protected terminal blocks shall have replaceable protector modules and be installed in equipment cabinets.

**Terminal Blocks - 6, 12 and 50 Pair.--**Terminal blocks shall terminate twisted-pair communications cables and each pair shall terminate on distinct terminals using either punch-down or compression, screw-down terminals. Each terminal block shall terminate either 6 pairs, 12 pairs or 50 pairs as shown on the plans. The terminal blocks shall include solid state, over-voltage protection consistent with REA Telecommunications Bulletin 344-2, or Bellcore TR-TSY-000299.

The terminals shall terminate wire sizes from No. 22 AWG to No. 18 AWG, and have a current rating of not less than 2 A. Terminal blocks installed in field equipment cabinets, including but not limited to traffic monitoring stations, traffic signals, and CCTV camera locations, shall be 12-pair protected terminal blocks. Terminal blocks shall be installed at data nodes, video nodes and cable nodes, and shall be protected premises entry type, and use an AT&T, 4C-S, 5-pin plug-in type protector or equivalent.

Terminal blocks shall be systematically arranged inside the cabinet to allow termination of cables. The terminal block and the station-protection modules shall be properly installed along the lower side of the equipment cabinet, opposite the power terminations.

Each pair of the incoming twisted-pair communications cables shall be properly terminated inside the equipment cabinet as indicated in the schematics and twisted-pair splice tables. Terminations shall be made sequentially and no more than one wire from the communications cable shall be connected to one terminal and marked properly to show the pair number.

All cable cores shall be labeled with cable markers at each end for proper core identification.

**Terminal Protector.--**The terminal protector incorporated in the terminal blocks shall be field installable and replaceable solid state over-voltage protection (SSOVP) module. The SSOVP shall have tin-alloy plated outside plant, central office and grounding pins. The SSOVP will operate in the 300 V(dc) surge range with a response time of less than 20 nanoseconds.

The solid state over-voltage protection (SSOVP) module is a 5-pin unit that will be installed in a C-310 style terminal block. The SSOVP will have an on-state voltage of less than 5 V at 100 A within 10 microseconds.

Full compensation for terminal blocks shall be considered as included in the contract lump sum price paid for the items requiring terminal blocks and no additional compensation will be allowed therefor.

## 10-3.18 TWISTED PAIR SPLICE CLOSURE

Twisted-pair splice closures shall come in two sizes: 305 mm and 610 mm. The closures shall be installed inside communications pull boxes or splice vaults for every drop from the twisted-pair trunk cable to an equipment location and at mid-span splices as shown on the plans and shall conform to the following.

The twisted-pair splice closure shall consist of a neoprene sleeve, and shall be secured with hose clamps.

The twisted-pair splice closure shall have external dimensions not exceeding 610 mm in length by 76 mm in diameter. In the pull boxes, the length shall be limited to 305 mm. The twisted-pair splice closure shall consist of a neoprene sleeve, and shall be secured with hose clamps. The closure shall protect the cable splices from water and mechanical damage and shall be resistant to salt corrosion. All material of the twisted-pair splice closure and associated mounting accessories shall be non-reactive and the completed assembly shall not support galvanic cell action. The twisted-pair splice closure shall be waterproof, encapsulated with re-enterable material, and shall be sealed with a gasket. Wire connections shall be of the insulation displacement type with water blocking gel, (3-M Scotchlocks, AMP Pica-bonds, or equivalent). The manufacturer's instructions shall be explicitly followed during installation of the twisted-pair splice closure.

The closure shall be mounted securely inside the communications pull box or vault as shown on the plans. The closure shall be properly grounded and the cable sheaths bonded using bonding clamps. The trunk cables shall be identified as "IN" or "OUT" depending upon their location relative to the splice (toward the communications node or away from the communications node). A tape collar shall be placed around the two trunk cables and the drop cable at the location required by the splice closure. The splice closure shall be fitted to the splice and the hose clamps tightened over the cables.

Each pair of the drop cable shall be properly spliced to the designated pair in the trunk cable as indicated in the twisted-pair splice tables. The splice conductors shall be securely crimped onto the wires, using manufacturer approved installation tools.

The closures shall be provided along with a splice kit, which shall contain all hardware items. Hardware shall include, but not be limited to, vinyl tape, bonding clamps, splice connectors, No. 14 AWG, insulated wire, spacer tapes, and terminal lugs.

Continuity shall be tested and confirmed prior to final assembly of the splice closure. After installing, splicing, and terminating the twisted-pair communication cables the Contractor shall test the cables for grounds, shorts, splits, and opens. The Contractor shall measure and record the loop resistance from the adjacent data node for all pairs at each terminal location. This resistance shall not exceed 34 Ω per 305 m; the Contractor shall record all data and shall correct any problems per manufacturer’s instruction. The Contractor shall record all data for review by the Engineer.

### REMOVAL AND DISPOSAL OF EXISTING TWISTED PAIR SPLICE CLOSURES

Existing twisted pair splice closures at Station 367+45 shall be removed and disposed at Contractor's expense.

Full compensation for removing, and disposing of existing twisted pair splice closures at Station 367+45 shall be considered as included in the contract unit price paid for twisted pair splice closures and no additional compensation will be allowed therefor.

## 10-3.19 FIBER OPTIC CABLE

Fiber optic cable shall conform to the details shown on the plans and these special provisions.

### DEFINITIONS

The following definitions shall apply to these special provisions:

A. Active Component Link Loss Budget.—The active component link loss budget is the difference between the average transmitter launch power (in dBm) and the receiver maximum sensitivity (in dBm).
B. Backbone.—Fiber cable that provides connections between the TMC and hubs, as well as between equipment rooms or buildings, and between hubs. The term is used interchangeably with "trunk" cable.
C. Connector.—A mechanical device used to align and join two fibers together to provide a means for attaching to and

decoupling from a transmitter, receiver, or another fiber (patch panel).

D. Connectorized.--The termination point of a fiber after connectors have been affixed.

E. Connector Module Housing (CMH).--A patch panel used to terminate singlemode fibers with most common connector types. It may include a jumper storage shelf and a hinged door.

F. Couplers.--Devices which mate fiber optic connectors to facilitate the transition of optical light signals from one connector into another. They are normally located within FDUs, mounted in panels. They may also be used unmounted, to join two simplex fiber runs.

G. Distribution Cable.--Fiber cable that provides connections between hubs. Drop cables are typically spliced into a distribution cable.

H. Drop Cable.--Fiber cable that provides connections between a distribution cable to a field element. Typically these run from a splice vault to a splice tray within a field cabinet. Drop cables are usually short in length (less than 20m) and are of the same construction as outside plant cable. The term “breakout cable” is used interchangeably with drop cable.

I. End-to-End Loss.--The maximum permissible end-to-end system attenuation is the total loss in a given link. This loss could be the actual measured loss, or calculated using typical (or specified) values. A designer should use typical values to calculate the end-to-end loss for a proposed link. This number will determine the amount of optical power (in dB) needed to meet the System Performance Margin.

J. Fan Out Termination.--Permits the branching of fibers contained in an optical cable into individual cables and can be done at field locations; thus, allowing the cables to be connectorized or terminated per system requirements. A kit provides pull-out protection for individual bare fibers to support termination. It provides three layers of protection consisting of a Teflon inner tube, a dielectric strength member, and an outer protective PVC jacket. Fan out terminations shall not be used for more than 6 fibers. Using a patch panel would be appropriate.

K. Fiber Distribution Frame (FDF).--A rack mounted system that is usually installed in hubs or the Transportation Management Center (TMC), that may consist of a standard equipment rack, fiber routing guides, horizontal jumper troughs and Fiber Distribution Units (FDU). The FDF serves as the termination and interconnection of passive fiber optic components from cable breakout, for connection by jumpers, to the equipment.

L. Fiber Distribution Unit (FDU).--An enclosure or rack mountable unit containing both a patch panel with couplers and splice tray(s). The unit’s patch panel and splice trays may be integrated or separated by a partition.

M. F/O.--Fiber optic.

N. FOIP.--Fiber optic inside plant cable.

O. FOOP.--Fiber optic outside plant cable.

P. FOTP.--Fiber optic test procedure(s) as defined by TIA/EIA standards.

Q. Jumper.--A short cable, typically one meter or less, with connectors on each end, used to join two CMH couplers or a CMH to active electronic components.

R. Light Source.--Portable fiber optic test equipment that, when coupled with a power meter, is used to perform end-to-end attenuation testing. It contains a stabilized light source operating at the wavelength of the system under test.

S. Link.--A passive section of the system, the ends of which are connectorized. A link may include splices and couplers. For example, a video link may be from a F/O transmitter to a video multiplexer (MUX).

T. Loose Tube Cable.--Type of cable construction in which fibers are placed in buffer tubes to isolate them from outside forces (stress). A flooding compound or material is applied to the interstitial cable core to prevent water migration and penetration. This type of cable is primarily for outdoor applications.

U. Mid-span Access Method.--Description of a procedure in which fibers from a single buffer tube are accessed and spliced to an adjoining cable without cutting the unused fibers in the buffer tube, or disturbing the remaining buffer tubes in the cable.

V. MMFO.--Multimode Fiber Optic Cable.

W. Optical Time Domain Reflectometer (OTDR).--Fiber optic test equipment similar in appearance to an oscilloscope that is used to measure the total amount of power loss in a F/O cable between two points. It provides a visual and printed display of the losses associated with system components such as fiber, splices and connectors.

X. Optical Attenuator.--An optical element that reduces the intensity of a signal passing through it.

Y. Patchcord.--A term used interchangeably with "jumper".

Z. Patch Panel.--A precision drilled metal frame containing couplers used to mate two fiber optic connectors.

AA. Pigtail.--A short optical fiber permanently attached to a source, detector, or other fiber optic device.

AB. Power Meter.--Portable fiber optic test equipment that, when coupled with a light source, is used to perform end-to-end attenuation testing. It contains a detector that is sensitive to light at the designed wavelength of the system under test. Its display indicates the amount of optical power being received at the end of the link.

AC. Riser Cable.--NEC approved cable installed in a riser (a vertical shaft in a building connecting floors).

AD. Segment.--A section of F/O cable that is not connected to any active device and may or may not have splices per the design.

AE. SMFO.--Singlemode Fiber Optic Cable.
AF. Splice.--The permanent joining of two fiber ends using a fusion splicer.
AG. Splice Closure.--A environmentally sealed container used to organize and protect splice trays. The container allows splitting or routing of fiber cables from multiple locations. Normally installed in a splice vault.
AH. Splice Module Housing (SMH).--A unit that stores splice trays as well as pigtails and short cable lengths. The unit allows splitting or routing of fiber cables to or from multiple locations.
AI. Splice Tray.--A container used to organize and protect spliced fibers.
AJ. Splice Vault.--An underground container used to house excess cable and/or splice closures.
AK. System Performance Margin.--A calculation of the overall "End to End" permissible attenuation from the fiber optic transmitter (source) to the fiber optic receiver (detector). The system performance margin should be at least 6 dB. This includes the difference between the active component link loss budget, the passive cable attenuation (total fiber loss) and the total connector/splice loss.
AL. Tight Buffered, Non-Breakout Cable (Tight Buffer Cable).--Type of cable construction where each glass fiber is tightly buffered (directly coated) with a protective thermoplastic coating to 900 µm (compared to 250 µm for loose tube fibers).

**FIBER OPTIC OUTSIDE PLANT CABLE**

**General**

Each fiber optic outside plant cable (FOOP) for this project shall be all dielectric, gel filled or water-blocking material, duct type, with loose buffer tubes and shall conform to these special provisions. Cables with singlemode fibers shall contain singlemode (SM) dual-window (1310 nm and 1550 nm) fibers. The optical fibers shall be contained within loose buffer tubes. The loose buffer tubes shall be stranded around an all dielectric central member. Aramid yarn and/or fiberglass shall be used as a primary strength member, and a polyethylene outside jacket shall provide for overall protection.

All fiber optic (F/O) cable on this project shall be from the same manufacturer, who is regularly engaged in the production of this material.

The cable shall be qualified as compliant with RUS Federal Rule 7CFR1755.900.

| CABLE TYPE | DESCRIPTION |
|---|---|
| A | 2SMFO |
| D | 8MFO |
| E | 12SMFO |
| G | 36SMFO |
| H | 48SMFO |
| J | 72SMFO |

**Fiber Characteristics**

Each optical fiber shall be glass and consist of a doped silica core surrounded by concentric silica cladding. All fibers in the buffer tube shall be usable fibers, and shall be sufficiently free of surface imperfections and occlusions to meet the optical, mechanical, and environmental requirements of these specifications. The required fiber grade shall reflect the maximum individual fiber attenuation, to guarantee the required performance of each and every fiber in the cable.

The coating shall be a dual layered, UV cured acrylate. The coating shall be mechanically or chemically strippable without damaging the fiber.

The cable shall comply with the optical and mechanical requirements over an operating temperature range of -40°C to +70°C. The cable shall be tested in accordance with EIA-455-3A (FOTP-3), "Procedure to Measure Temperature Cycling Effects on Optical Fiber, Optical Cable, and Other Passive Fiber Optic Components." The change in attenuation at extreme operational temperatures (-40°C to +70°C) for singlemode fiber shall not be greater than 0.20 dB/km, with 80 percent of the measured values no greater than 0.10 dB/km.Singlemode fibers within the finished cable shall meet the requirements in the following table:

| Fiber Characteristics Table | | |
|---|---|---|
| Parameters | Multimode | Singlemode |
| Type | Graded index | Step Index |
| Core diameter | 50 µm ± 3.0 µm | 8.3 µm (nominal) |
| Cladding diameter | 125 µm ± 2.0 µm | 125 µm ±1.0 µm |
| Core to Cladding Offset | < 3.0 µm | ≤0.8 µm |
| Coating Diameter | 250 µm ± 15 µm | 250 µm ±15 µm |
| Cladding Non-circularity defined as: [1-(min. cladding dia ÷max. cladding dia.)] x 100 | < 2.0% | ≤1.0% |
| Proof/Tensile Test | 345 Mpa, min. | 345 Mpa, min. |
| Attenuation: -40(C) to +70(C)<br>@850 nm<br>@1300 nm (MM)/1310 nm (SM)<br>@1550 nm | <br>< 3.75dB/km<br>< 1.0 dB/km<br>N/A | <br>N/A<br>≤0.4 dB/km<br>≤0.3 dB/km |
| Attenuation at the Water Peak | N/A | ≤2.1 dB/km @ 1383 ±3 nm |
| Bandwidth: | | |
| @ 850 nm | > 300MHz x km | N/A |
| @1,300 nm (MM)/1310 nm (SM) | >1,000 MHz x km | N/A |
| Chromatic Dispersion:<br>Zero Dispersion Wavelength<br>Zero Dispersion Slope | <br>N/A<br>N/A | <br>1301.5 to 1321.5 nm<br>≤0.092 ps/(nm2*km) |
| Maximum Dispersion: | N/A | ≤3.3 ps/(nm*km) for 1285 – 1330 nm<br><18 ps/(nm*km) for 1550 nm |
| Cut-Off Wavelength | N/A | <1260 nm |
| Numerical Aperture (measured in Accordance with EIA-455-47) | .20 ± 0.02 | N/A |
| Mode Field Diameter (Petermann II) | N/A | 9.3 ±0.5 µm at 1310 nm<br>10.5 ±1.0 µm at 1550 nm |

**Color Coding**

In buffer tubes containing multiple fibers, each fiber shall be distinguishable from others in the same tube by means of color-coding according to the following:

1. Blue (BL)
2. Orange (OR)
3. Green (GR)
4. Brown (BR)
5. Slate (SL)
6. White (WT)
7. Red (RD)
8. Black (BK)
9. Yellow (YL)
10. Violet (VL)
11. Rose (RS)
12. Aqua (AQ)

Buffer tubes containing fibers shall also be color-coded with distinct and recognizable colors according to the same table listed above for fibers.

These colors shall be targeted in accordance with the Munsell color shades and shall meet EIA/TIA-598 "Color Coding of Fiber Optic Cables."

The color formulation shall be compatible with the fiber coating and the buffer tube filling compound, and be heat stable. It shall not fade or smear or be susceptible to migration and it shall not affect the transmission characteristics of the optical fibers and shall not cause fibers to stick together.

**Cable Construction**

The fiber optic cable shall consist of, but not be limited to, the following components:

1. Buffer tubes
2. Central member
3. Filler rods
4. Stranding
5. Core and cable flooding
6. Tensile strength member
7. Ripcord
8. Outer jacket

1. Buffer Tubes

Clearance shall be provided in the loose buffer tubes between the fibers and the inside of the tube to allow for expansion without constraining the fiber. The fibers shall be loose or suspended within the tubes. The fibers shall not adhere to the inside of the buffer tube. Each buffer tube shall contain a maximum of 12 fibers.

The loose buffer tubes shall be extruded from a material having a coefficient of friction sufficiently low to allow free movement of the fibers. The material shall be tough and abrasion resistant to provide mechanical and environmental protection of the fibers, yet designed to permit safe intentional "scoring" and breakout, without damaging or degrading the internal fibers.

Buffer tube filling compound shall be a homogeneous hydrocarbon-based gel with anti-oxidant additives and used to prevent water intrusion and migration. The filling compound shall be non-toxic and dermatologically safe to exposed skin. It shall be chemically and mechanically compatible with all cable components, non-nutritive to fungus, non-hygroscopic and electrically non-conductive. The filling compound shall be free from dirt and foreign matter and shall be readily removable with conventional nontoxic solvents.

Buffer tubes shall be stranded around a central member by a method, such as the reverse oscillation stranding process, that will prevent stress on the fibers when the cable jacket is placed under strain.

2. Central Member

The central member which functions as an anti-buckling element shall be a glass reinforced plastic rod with similar expansion and contraction characteristics as the optical fibers and buffer tubes. To ensure the proper spacing between buffer tubes during stranding, a symmetrical linear overcoat of polyethylene may be applied to the central member to achieve the optimum diameter.

3. Filler Rods

Fillers may be included in the cable to maintain the symmetry of the cable cross-section. Filler rods shall be solid medium or high-density polyethylene. The diameter of filler rods shall be the same as the outer diameter of the buffer tubes.

4. Stranding

Completed buffer tubes shall be stranded around the overcoated central member using stranding methods, lay lengths and positioning such that the cable shall meet mechanical, environmental and performance specifications. A polyester binding shall be applied over the stranded buffer tubes to hold them in place. Binders shall be applied with sufficient tension to secure the buffer tubes to the central member without crushing the buffer tubes. The binders shall be non-hygroscopic, non-wicking (or rendered so by the flooding compound), and dielectric with low shrinkage.

5. Core and Cable Flooding

The cable core interstices shall contain a water blocking material, to prevent water ingress and migration. The water blocking material shall be either a polyolefin based compound which fills the cable core interstices, or an absorbent polymer, which fills voids and swells to block the ingress of water. The flooding compound or material shall be homogeneous, non-hygroscopic, electrically non-conductive, and non-nutritive to fungus. The compound or material shall also be nontoxic, dermatologically safe and compatible with all other cable components.

6. Tensile Strength Member

Tensile strength shall be provided by high tensile strength aramid yarns and/or fiberglass which shall be helically stranded evenly around the cable core and shall not adhere to other cable components.

7. Ripcord

The cable shall contain at least one ripcord under the jacket for easy sheath removal.

8. Outer Jacket

The jacket shall be free of holes, splits, and blisters and shall be medium or high density polyethylene (PE), or medium density cross-linked polyethylene with minimum nominal jacket thickness of 1 mm ± 0.076 mm. Jacketing material shall be applied directly over the tensile strength members and water blocking material and shall not adhere to the aramid strength material. The polyethylene shall contain carbon black to provide ultraviolet light protection and shall not promote the growth of fungus.

The jacket or sheath shall be marked with the manufacturer's name, the words "Optical Cable", the number of fibers, "SM", year of manufacture, and sequential measurement markings every meter. The actual length of the cable shall be within -0/+1 percent of the length marking. The marking shall be in a contrasting color to the cable jacket. The height of the marking shall be 2.5 mm ±0.2 mm.

**General Cable Performance Specifications**

The F/O cable shall withstand water penetration when tested with a one meter static head or equivalent continuous pressure applied at one end of a one meter length of filled cable for one hour. No water shall leak through the open cable end. Testing shall be done in accordance with EIA-455-82 (FOTP-82), "Fluid Penetration Test for Fluid-Blocked Fiber Optic Cable."

A representative sample of cable shall be tested in accordance with EIA/TIA-455-81 (FOTP-81), "Compound Flow (Drip) Test for Filled Fiber Optic Cable". No preconditioning period shall be conducted. The cable shall exhibit no flow (drip or leak) at 70 80°C as defined in the test method.

Crush resistance of the finished F/O cables shall be 220 N/mm applied uniformly over the length of the cable without showing evidence of cracking or splitting when tested in accordance with EIA-455-41 (FOTP-41), "Compressive Loading Resistance of Fiber Optic Cables". The average increase in attenuation for the fibers shall be ≤0.10 dB at 1550 nm (singlemode) for a cable subjected to this load. The cable shall not exhibit any measurable increase in attenuation after removal of load. Testing shall be in accordance with EIA-455-41 (FOTP-41), except that the load shall be applied at the rate of 3 mm to 20 mm per minute and maintained for 10 minutes.

The cable shall withstand 25 cycles of mechanical flexing at a rate of 30 ±1 cycles/minute. The average increase in attenuation for the fibers shall be ≤0.20 dB at 1550 nm (singlemode) at the completion of the test. Outer cable jacket cracking or splitting observed under 10x magnification shall constitute failure. The test shall be conducted in accordance with EIA-455-104 (FOTP-104), "Fiber Optic Cable Cyclic Flexing Test," with the sheave diameter a maximum of 20 times the outside diameter of the cable. The cable shall be tested in accordance with Test Conditions I and II of (FOTP-104).

The cable shall withstand 20 impact cycles, with a total impact energy of 5.9 N•m. Impact testing shall be conducted in accordance with TIA/EIA-455-25B (FOTP-25) "Impact Testing of Fiber Optic Cables and Cable Assemblies." The average increase in attenuation for the fibers shall be <0.20 dB at 1550 nm for singlemode fiber. The cable shall not exhibit evidence of cracking or splitting.

The finished cable shall withstand a tensile load of 2700 N without exhibiting an average increase in attenuation of greater than 0.20 dB (singlemode). The test shall be conducted in accordance with EIA-455-33 (FOTP-33), "Fiber Optic Cable Tensile Loading and Bending Test." The load shall be applied for one-half hour in Test Condition II of the EIA-455-33 (FOTP-33) procedure.

**Packaging and Shipping Requirements**

Documentation of compliance to the required specifications shall be provided to the Engineer prior to ordering the material.

Attention is directed to "Fiber Optic Testing," elsewhere in these special provisions.

The completed cable shall be packaged for shipment on reels. The cable shall be wrapped in a weather and temperature resistant covering. Both ends of the cable shall be sealed to prevent the ingress of moisture.

Each end of the cable shall be securely fastened to the reel to prevent the cable from coming loose during transit. Four m of cable length on each end of the cable shall be accessible for testing.

Each cable reel shall have a durable weatherproof label or tag showing the manufacturer's name, the cable type, the actual length of cable on the reel, the Contractor's name, the contract number, and the reel number. A shipping record shall also be included in a weatherproof envelope showing the above information and also include the date of manufacture, cable characteristics (size, attenuation, bandwidth, etc.), factory test results, cable identification number and any other pertinent information.

The minimum hub diameter of the reel shall be at least thirty times the diameter of the cable. The F/O cable shall be in one continuous length per reel with no factory splices in the fiber. Each reel shall be marked to indicate the direction the reel should be rolled to prevent loosening of the cable.

Installation procedures and technical support information shall be furnished at the time of delivery.

**LABELING**

**General**

The Contractor shall label all fiber optic cabling in a permanent consistent manner. All tags shall be of a material designed for long term permanent labeling of fiber optic cables and shall be marked with permanent ink on non-metal types, or embossed lettering on metal tags. Metal tags shall be constructed of stainless steel. Non-metal label materials shall be approved by the Engineer. Labels shall be affixed to the cable per the manufacturer's recommendations and shall not be affixed in a manner which will cause damage to the fiber. Handwritten labels shall not be allowed.

**Label Identification**

1. Labeling of Cables

Labeling of the backbone, distribution and drop fiber optic cables shall conform to the following unique identification code elements:

| UNIQUE IDENTIFICATION CODE ELEMENTS for Backbone, Distribution or Drop Cables | | |
|---|---|---|
| DESCRIPTION | CODE | NUMBER OF CHARACTERS |
| District | District number | 2 |
| Cable Type | Fiber:<br>S: Singlemode<br>Copper:<br>T: 18 AWG, U: 19 AWG,<br>V: 20AWG, W: 22AWG<br>X: 24 AWG | 1 |
| Cable fiber (or copper pairs) Count | Number of fibers or conductor pairs (Examples: 144 fibers; or 100 TWP) | 3 |
| Route Number | Hwy. Rte (Example: 005) | 3 |
| Begin Function | T: TMC; H: HUB; V: Video Node;<br>D: Data Node; C: Cable Node;<br>M: CCTV Camera; N: CMS;<br>P: Traffic Signal; Z: Ramp Meter;<br>U: Traffic Monitoring/Count Station/Vehicle Count Station (VDS, TOS);<br>S: Splice Vault | 1 |
| Begin Function Number | Unique ID number corresponds to Begin Function (Example: H02 [Hub 02]) | 2 |
| End Function | T: TMC; H: HUB; V: Video Node;<br>D: Data Node; C: Cable Node;<br>M: CCTV Camera; N: CMS;<br>P: Traffic Signal; Z: Ramp Meter;<br>U: Traffic Monitoring/Count Station;<br>S: Splice Vault | 1 |
| End Function Number | Unique ID number corresponds to Begin Function (Example: H03 [Hub 03]) | 2 |
| Unique Identifier | XX: If two or more cables of the same count are in the same run | 2 |
| TOTAL | | 17 |

Each cable shall display one unique identification, regardless of where the cable is viewed. The begin function and end function correspond to the end points of each cable. The order of the begin and end function follow a hierarchy as listed below, where the lowest number corresponding to the begin/end function is listed first.

| List of Hierarchy | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** |
| TMC | HUB | Video Node (VN) | Data Node (DN) | Cable Node | CCTV Camera | CMS | Traffic Signal | Ramp Meter | Traffic Monitoring/ Count Station | Splice Vault |

This scheme will work as follows: A cable between the TMC and a HUB will always have the TMC listed as the start function and the HUB as the end function. Between a CMS and a Splice Vault, the start function will always be listed as the CMS, and so on. If a cable is connected between HUBs, for example HUB-01 and HUB-03, the lowest number, in this case HUB-01, will be listed as the start function and HUB-03 as the end function.

A. Example 1: 08S060010H02H0302

This cable is located in District 8, identified as a singlemode fiber optic cable containing 60 fibers, installed along highway Route 10, beginning in Hub 2, and ending in Hub 3, with unique ID of number 2. The implication for the unique ID is that there may be another 60 fiber optic cable between those hubs. This is an example for a backbone cable.

B. Example 2: 11S048008H01S04

This cable is located in District 11, identified as a singlemode fiber optic cable containing 48 fibers, installed along highway Route 8, beginning in Hub 1, and ending in Splice Vault 04. In this case, no additional digits are necessary for a unique ID. This is an example for a distribution cable.

C. Example 3: 11S006163N03S04

This cable is located in District 11, identified as a singlemode fiber optic cable containing 6 fibers, installed along highway Route 163, beginning at CMS-03, and ending in Splice Vault 04. In this case, no additional digits are necessary for a unique ID. This is an example for a drop cable.

2. Labeling of Jumpers and Pigtails

Labeling of the jumpers and pigtails shall conform to the following unique identification code elements:

| UNIQUE IDENTIFICATION CODE ELEMENTS for JUMPERS (active component to FDU) and PIGTAILS (to connector # on patch panel) | | |
|---|---|---|
| DESCRIPTION | CODE | NUMBER OF CHARACTERS |
| Hub Identifier | Hub, TMC, VN or DN ID Numbers or Alphanumeric or both | 2 |
| From (Source) Device | MU: Multiplexer<br>FD: FDU (Fiber Distribution Unit)<br>RP: Repeater | 2 |
| From (Source) Device Identifier | Numbers or Alphanumeric or both | 2 |
| Transmitter or Receiver | T or R | 1 |
| To (Destination) Device | MU: Multiplexer<br>FD: FDU (Fiber Distribution Unit)<br>RP: Repeater | 2 |
| To (Destination) Device Identifier | Numbers or Alphanumeric or both | 2 |
| Connector Identifier | Connector ID | 2 |
| TOTAL | | 13 |

A. Example 1: 01MU01TFD0203.

This pigtail is located in Hub 1, from multiplexer 01, transmitting to FDU 02 to patch panel position (connector) 03.

B. Example 2: 02MUA1TFD0B08.

This jumper is located in Hub 2, from multiplexer A1, transmitting to FDU B, to patch panel position (connector) 08.

**Label Placement**

1. Cables

All cables shall be clearly labeled with the unique identification code element method described elsewhere in these special provisions, at all terminations, even if no connections or splices are made, and at all splice vault entrance and exit points.

2. Cable to Cable Splices

All cable jackets entering the splice closure shall be labeled in accordance with the identification method described elsewhere in these special provisions.

3. Cable to Fiber Distribution Units

The cable jackets shall be clearly labeled at entry to the FDU in accordance with the unique identification code element method described elsewhere in these special provisions. In addition, each fiber shall be labeled with the Fiber ID and pigtails shall be labeled at the connector with the Fiber ID. The FDU shall be clearly labeled with the Cable ID on the face of the FDU. If multiple cables are connected to the FDU, each block of connectors relating to each individual cable shall be clearly identified by a single label with the Cable ID. Individual connections shall be clearly marked on the face of the FDU in the designated area with the Fiber ID.

4. Fiber

Fiber labels shall be placed next to the connectors of the individual fibers.

5. Patch Panels

The cable jackets shall be clearly labeled at entry to the Patch Panel in accordance with the unique identification code element method described elsewhere in these special provisions. In addition, each fiber shall be labeled with the Fiber ID and pigtails shall be labeled at the connector with the Fiber ID. The Patch panel shall be clearly labeled with the Cable ID on the face of the Panel. If multiple cables are connected to the Patch Panel, each block of connectors relating to each individual cable shall be clearly identified by a single label with the Cable ID. Individual connections shall be clearly marked on the face of the Panel in the designated area with the Fiber ID.

6. Jumpers

Equipment to FDU jumpers shall be labeled as to the equipment type connected and shall be labeled at both ends. FDU to FDU jumpers shall be labeled at each end in accordance with the unique identification code element method described elsewhere in these special provisions.

7. Pigtails

Pigtails shall be labeled at the connector in accordance with the unique identification code element method described elsewhere in these special provisions.

8. Copper Cable Labels

All twisted-pair communications cables shall be clearly labeled in a in accordance with the unique identification code element method described elsewhere in these special provisions.

**CABLE INSTALLATION**

Installation procedures shall be in conformance with the procedures specified by the cable manufacturer for the specific cable being installed. The contractor shall submit the manufacturer's recommended procedures for pulling fiber optic cable at least 20 working days prior to installing cable. Mechanical aids may be used provided that a tension measuring device, and a break-away swivel are placed in tension to the end of the cable. The tension in the cable shall not exceed 2225 N or the manufacturer's recommended pulling tension, whichever is less.

During cable installation, the bend radius shall be maintained at a minimum of twenty times the outside diameter. The cable grips for installing the fiber optic cable shall have a ball bearing swivel to prevent the cable from twisting during installation.

F/O cable shall be installed using a cable pulling lubricant recommended by the F/O cable and/or the innerduct manufacturer, and a pull tape conforming to the provisions described under "conduit" elsewhere in these special provisions.

Contractor's personnel shall be stationed at each splice vault and pull box through which the cable is to be pulled to lubricate and prevent kinking or other damage.

F/O cable shall be installed without splices except where specifically allowed on the plans. If splice locations are not shown on the plans, splicing shall be limited to one cable splice every 6 km. Any midspan access splice or FDU termination shall involve only those fibers being spliced as shown on the plans. Cable splices shall be located in splice closures, installed in splice vaults shown on the plans. A minimum of 20 m of slack shall be provided for each F/O cable at each splice vault. Slack shall be divided equally on each side of the F/O splice closure.

Unless shown or provided otherwise, only F/O cable shall be installed in each innerduct. Pulling a separate F/O cable into a spare duct to replace damaged fiber will not be allowed.

At the Contractor's option, the fiber may be installed using the air blown method. If integral innerduct is used, the duct splice points or any temporary splices of innerduct used for installation must withstand a static air pressure of 758 kPa.

The fiber installation equipment must incorporate a mechanical drive unit or pusher, which feeds cable into the pressurized innerduct to provide a sufficient push force on the cable, which is coupled with the drag force created by the high-speed airflow. The unit must be equipped with controls to regulate the flow rate of compressed air entering the duct and any hydraulic or pneumatic pressure applied to the cable. It must accommodate longitudinally ribbed, or smooth wall ducts from nominal 16 mm to 51 mm inner diameter. Mid assist or cascading of equipment must be for the installation of long cable runs. The equipment must incorporate safety shutoff valves to disable the system in the event of sudden changes in pneumatic or hydraulic pressure.

The equipment must not require the use of a piston or any other air capturing device to impose a pulling force at the front end of the cable, which also significantly restricts the free flow of air through the inner duct. It must incorporate the use of a counting device to determine the speed of the cable during installation and the length of the cable installed.

**SPLICING**

Field splices shall be done either in splice vaults or cabinets as shown on the plans. All splices in splice vaults shall be done in splice trays, housed in splice closures. All splices in cabinets shall be done in splice trays housed in FDU's.

Unless otherwise specified, fiber splices shall be the fusion type. The mean splice loss shall not exceed 0.07 dB per splice. The mean splice loss shall be obtained by measuring the loss through the splice in both directions and then averaging the resultant values.

All splices shall be protected with a metal reinforced thermal shrink sleeve.

The mid-span access method shall be used to access the individual fibers in a cable for splicing to another cable as shown on the plans. Cable manufacturers recommended procedures and approved tools shall be used when performing a mid-span access. Only the fibers to be spliced may be cut. All measures shall be taken to avoid damaging buffer tubes and individual fibers not being used in the mid-span access.

The individual fibers shall be looped one full turn within the splice tray to avoid micro bending. A 45 mm minimum bend radius shall be maintained during installation and after final assembly in the optical fiber splice tray. Each bare fiber shall be individually restrained in a splice tray. The optical fibers in buffer tubes and the placement of the bare optical fibers in the splice tray shall be such that there is no discernable tensile force on the optical fiber.

The Contractor will be allowed to splice a total of 30 percent of all fibers to repair any damage done during mid-span access splicing without penalty. The Contractor will be assessed a penalty of $300.00 for each additional and unplanned splice. Any single fiber may not have more than 3 unplanned splices. If any fiber requires more than 3 unplanned splices, the entire length of F/O cable must be replaced at the Contractor's expense.

**SPLICE CLOSURES**

The F/O field splices shall be enclosed in splice closures which shall be complete with splice organizer trays, brackets, clips, cable ties, seals and sealant, as needed. The splice closure shall be suitable for a direct burial or pull box application. Manufacturer's installation instructions shall be supplied to the Engineer prior to the installation of any splice closures. Location of the splice closures shall be where a splice is required as shown on the plans, designated by the Engineer, or described in these special provisions.

The splice closure shall conform to the following specifications:

A. Non-filled thermoplastic case
B. Rodent proof, water proof, re-enterable and moisture proof
C. Expandable from 2 cables per end to 8 cables per end by using adapter plates
D. Cable entry ports shall accommodate 10 mm to 25-mm diameter cables
E. Multiple grounding straps
F. Accommodate up to 8 splice trays
G. Suitable for "butt" or "through" cable entry configurations

H. Place no stress on finished splices within the splice trays

The splice closure shall be bolted to the side wall of the splice vault.

The Contractor shall verify the quality of each splice prior to sealing the splice closure. The splice closure shall not be sealed until link testing is performed and is approved by the Engineer.

**SPLICE TRAYS**

Splice trays must accommodate a minimum of 12 fusion splices and must allow for a minimum bend radius of 45 mm. Individual fibers must be looped one full turn within the splice tray to allow for future splicing. No stress is to be applied on the fiber when it is located in its final position. Buffer tubes must be secured near the entrance of the splice tray to reduce the chance that an inadvertent tug on the pigtail will damage the fiber. The splice tray cover may be transparent.

Splice trays in the splice closure shall conform to the following:

A. Accommodate up to 24 fusion splices
B. Place no stress on completed splices within the tray
C. Stackable with a snap-on hinge cover
D. Buffer tubes securable with channel straps
E. Must be able to accommodate a fusion splice with the addition of an alternative splice holder
F. Must be labeled after splicing is completed.

Only one single splice tray may be secured by a bolt through the center of the tray in the fiber termination unit. Multiple trays must be securely held in place as per the manufacturer's recommendation.

**PASSIVE CABLE ASSEMBLIES AND COMPONENTS**

The F/O cable assemblies and components shall be compatible components, designed for the purpose intended, and manufactured by a company regularly engaged in the production of material for the fiber optic industry. All components or assemblies shall be best quality, non-corroding, with a design life of at least 20 years.

The cable assemblies and components manufacturer shall be ISO9001 registered.

**FIBER OPTIC CABLE TERMINATIONS**

**General**

The cable shall continue within the conduit to the designated termination point for cable termination. All components shall be the size and type required for the specified fiber. Fiber optic cable terminations may take place in several locations such as TMC, hubs, data nodes, cable nodes, TMS cabinets, camera sites, etc.

**Cable Termination**

At the FDU, the cable jacket of the FOIP or outside plant cable, shall be removed exposing the aramid yarn, filler rods, and buffer tubes. The exposed length of the buffer tubes shall be at least the length recommended by the FDU manufacturer which allows the tubes to be secured to the splice trays. Each buffer tube shall be secured to the splice tray in which it is to be spliced. The remainder of the tubes shall be removed to expose sufficient length of the fibers in order to properly install on the splice tray, as described in "Splicing," elsewhere in these special provisions

The cable shall then be spliced and secured with tie wraps and routed to its appropriate fiber distribution frame/unit (FDF/U) as shown on the plans.

When applicable, moisture-blocking gel shall be removed from the exposed buffer tubes and fibers. The transition from the buffer tube to the bundle of jacketed fibers shall be treated by an accepted procedure for sleeve tubing, shrink tube and silicone blocking of the transition to prevent future gel leak. Manufacturer directions shall be followed to ensure that throughout the specified temperature range gel will not flow from the end of the buffer tube. The individual fibers shall be stripped and prepared for splicing.

Factory terminated pigtails shall then be spliced and placed in the splice tray.

All fibers inside a fiber optic cable entering an Fiber Distribution Unit (FDU), such as at a TMC or hub, shall be terminated and labeled. Attention is directed to "Fiber Distribution Unit" elsewhere in these special provisions.

A transition shall then be made, with flexible tubing, to isolate each fiber to protect the individual coated fibers. The final transition from bundle to individual fiber tube shall be secured with an adhesive heat shrink sleeve. Refer to Fan-Out Termination, elsewhere in these special provisions.

**Distribution Interconnect Package**

Distribution involves connecting the fibers to locations shown on the plans. The distribution interconnect package consists of FDFs and FDUs with connector panels, couplers, splice trays, fiber optic pigtails and cable assemblies with connectors. The distribution interconnect package shall be assembled and tested by a company that is regularly engaged in the assembly of these packages. Attention is directed to "Fiber Optic Testing" elsewhere in these special provisions. All distribution components shall be products of the same manufacturers, who are regularly engaged in the production of these components, and the respective manufacturers shall have quality assurance programs.

**Fiber Optic Cable Assemblies and Pigtails**

1. General

Cable assemblies (jumpers and pigtails) shall be products of the same manufacturer. The cable used for cable assemblies shall be made of fiber meeting the performance requirements of these special provisions for the F/O cable being connected.

2. Pigtails

Pigtails shall be of simplex (one fiber) construction, in 900-µm tight buffer form, surrounded by aramid for strength, with a PVC jacket with manufacturer identification information, and a nominal outer jacket diameter of 3 mm. Singlemode simplex cable jackets shall be yellow in color. All pigtails shall be factory terminated and tested and at least one meter in length.

3. Jumpers

Jumpers may be of simplex or duplex design. Duplex jumpers shall be of duplex round cable construction, and shall not have zipcord (siamese) construction. All jumpers shall be at least 2 m in length, sufficient to avoid stress and allow orderly routing.

The outer jacket of duplex jumpers shall be colored according to the singlemode color (yellow) specified above. The two inner simplex jackets shall be contrasting colors to provide easy visual identification for polarity.

4. Connectors

Connectors shall be of the ceramic ferrule ST type for SM. Indoor ST connector body housings shall be either nickel - plated zinc or glass reinforced polymer construction. Outdoor ST connector body housing shall be glass reinforced polymer.

The associated coupler shall be of the same material as the connector housing.

All F/O connectors shall be the 2.5 mm connector ferrule type with Zirconia Ceramic material with a PC (Physical Contact) pre-radiused tip.

The ST connector operating temperature range shall be -40$^{o}$C to +70$^{o}$C. Insertion loss shall not exceed 0.4 dB for singlemode, and the return reflection loss on singlemode connectors shall be at least -35 dB. Connection durability shall be less than a 0.2 dB change per 500 mating cycles per EIA-455-21A (FOTP-21). All terminations shall provide a minimum 222 N pull out strength. Factory test results shall be documented and submitted to the Engineer prior to installing any of the connectors. Singlemode connectors shall have a yellow color on the body and/or boot that renders them easily identifiable.

Field terminations shall be limited to splicing of adjoining cable ends and/or cables to ST pigtails.

All connectors shall be factory-installed and tested. There shall be no installation of connectors in the field.

All unmated connectors shall have protective caps installed.

**Fan-Out Termination**

A fan out termination shall be required as shown on the plans designated by the Engineer or described in these special provisions.

For fiber counts of less than 6 fibers, a fan out termination may be used to terminate the incoming fiber optic cable. The connector return loss shall be no greater than -40 dB.

The fan out termination shall consist of a splice connector and the appropriate number of fiber optic pigtails, which will be fusion spliced to the incoming fibers.

The pigtail shall be contained in a housing that will provide strain relief between the incoming fiber optic cable plant jacket, buffer tubes, fibers and pigtail jacket material.

Each fiber shall be spliced to a pigtail with a factory installed and polished ST connector, as specified elsewhere in these special provisions. The splices shall then be encapsulated in a weather-proof housing. Each connector shall have a weatherproof cap to protect it from the elements. The pigtail shall be of simplex (one fiber) construction, in a 900-µm tight buffer form, surrounded by Aramid yarn for strength. The buffer shall have a PVC jacket with manufacturer identification information, and a nominal outer jacket diameter of 3 mm. Singlemode simplex cable jackets shall be yellow in color. All pigtails shall be at least two meter in length.

Each pigtail shall be labeled, as specified elsewhere in these special provisions, and secured onto the cable using clear

heat shrink tubing.

**FIBER DISTRIBUTION UNIT**

The fiber distribution unit (FDU) shall consist of an EIA 482 mm rack, a compartment for termination and distribution cable tray and a compartment for a splice drawer.

The FDU shall not exceed 250 mm in height and 380 mm in depth

The Contractor shall furnish and install all components to terminate the incoming fiber optic communication cables:

| FDU Type | Accommodates Termination of |
|---|---|
| B | 12 SMFO fibers |
| C | 24 SMFO fibers |
| D | 36 SMFO fibers |
| E | 48SMFO fibers |
| G | 72SMFO fibers |

The fiber distribution unit shall include a patch panel to terminate the appropriate number of singlemode fibers with ST type connector feed through couplers.

The termination and distribution cable trays shall accommodate 12, 24, 36, 48 and 72 singlemode optical fiber cables. The termination and distribution cable trays shall have sufficient tray areas for excess optical fiber storage with provisions to assure that the optical fibers do not exceed a 51-mm bend radius. The termination and distribution cable trays shall include a designation strip for identification of the 12, 24, 36, 48 and 72 singlemode optical fibers. Each splice drawer shall include two splice trays with each splice tray capable of accommodating 12, 24, 36, 48 and 72 fusion type splices. Each splice drawer shall allow for storage of excess lengths of the optical fibers of fiber optic cables. Each fiber distribution unit shall be provided with cable clamps to secure fiber optic cables to the chassis.

Strain relief shall be provided for the incoming fiber optic cable. Cable accesses shall have rubber grommets or similar material to prevent the cable from coming in contact with bear metal. All fibers shall be terminated and individually identified in the FDU and on the patch panel.

The patch panel shall be hinged or have coupler plates to provide easy access and maintenance. Brackets shall be provided to spool the incoming fiber a minimum of two turns, each turn shall not be less than 300 mm, before separating out individual fibers to the splice tray.

**Installation.--**The Contractor shall install sufficient quantity of fiber distribution units to terminate all fibers in the largest cable as shown in the Plans. The fiber distribution shall be mounted in equipment racks as shown on the plans. At each fiber distribution unit, the Contractor shall terminate the optical fibers of the fiber optic cable. The optical fibers shall be fusion spliced to each of the single mode optical fiber cables assemblies within the splice tray(s).

The optical fibers shall be of appropriate lengths to allow for future splicing with the splice drawer and shall be appropriately identified (tagged). All splices shall be fusion type and shall be arranged within the splice trays of the fiber distribution unit in accordance with the organizational design of the splice trays. Appropriate protective coating shall be applied to all fusion splices.

**Payment.--**Full compensation for fiber distribution unit shall be considered as included in the contract prices paid for the item requiring fiber distribution unit and no separate payment will be made therefor.

**FIBER OPTIC TESTING**

**General**

Testing shall include the tests on elements of the passive fiber optic components: (1) at the factory, (2) after delivery to the project site but prior to installation, (3) after installation but prior to connection to any other portion of the system. The Contractor shall provide all personnel, equipment, instrumentation and materials necessary to perform all testing. The Engineer shall be notified two working days prior to all field tests. The notification shall include the exact location or portion of the system to be tested.

Documentation of all test results shall be provided to the Engineer within 2 working days after the test involved.

A minimum of 15 working days prior to arrival of the cable at the site, the Contractor shall provide detailed test procedures for all field testing for the Engineer's review and approval. The procedures shall include the tests involved and how the tests are to be conducted. Included in the test procedures shall be the model, manufacturer, configuration, calibration and alignment procedures for all proposed test equipment.

**Factory Testing**

Documentation of compliance with the fiber specifications as listed in the Fiber Characteristics Table shall be supplied by the original equipment manufacturer. Before shipment, but while on the shipping reel, 100 percent of all fibers shall be tested for attenuation. Copies of the results shall be (1) maintained on file by the manufacturer with a file identification number for a minimum of seven years, (2) attached to the cable reel in a waterproof pouch, and (3) submitted to the Contractor and to the Engineer.

**Arrival On Site**

The cable and reel shall be physically inspected on delivery and 100 percent of the fibers shall be attenuation tested to confirm that the cable meets requirements. The failure of any single fiber in the cable to comply with these special provisions, is cause for rejection of the entire reel. Test results shall be recorded, dated, compared and filed with the copy accompanying the shipping reel in a weather proof envelope. Attenuation deviations from the shipping records of greater than five percent shall be brought to the attention of the Engineer. The cable shall not be installed until completion of this test sequence and the Engineer provides written approval. Copies of traces and test results shall be submitted to the Engineer. If the test results are unsatisfactory, the reel of F/O cable shall be considered unacceptable and all records corresponding to that reel of cable shall be marked accordingly. The unsatisfactory reels of cable shall be replaced with new reels of cable at the Contractor's expense. The new reels of cable shall then be tested to demonstrate acceptability. Copies of the test results shall be submitted to the Engineer.

**After Cable Installation**

Index matching gel shall not be allowed in connectors during testing. After the fiber optic cable has been pulled but before breakout and termination, 100 percent of all the fibers shall be tested with an OTDR for attenuation. Test results shall be recorded, dated, compared and filed with the previous copies of these tests. Copies of traces and test results shall be submitted to the Engineer. If the OTDR test results are unsatisfactory, the F/O cable segment of cable shall be unacceptable. The unsatisfactory segment of cable shall be replaced with a new segment, without additional splices, at the Contractor's expense. The new segment of cable then shall be tested to demonstrate acceptability. Copies of the test results shall be submitted to the Engineer.

**System Cable Verification At Completion**

1. Power Meter and Light Source

At the conclusion of the OTDR testing, 100 percent of the fiber links shall be tested end to end with a power meter and light source, in accordance with EIA Optical Test Procedure 171 and in the same wavelengths specified for the OTDR tests. These tests shall be conducted in one direction. As shown in Appendix A, the Insertion Loss (1C) shall be calculated. Test results shall be recorded, compared, and filed with the other recordings of the same links. Test results shall be submitted to the Engineer. These values shall be recorded in the Cable Verification Worksheet in Appendix A.

2. OTDR Testing

Once the passive cabling system has been installed and is ready for activation, 100 percent of the fibers shall be tested with the OTDR for attenuation at wavelengths of both 1310 nm and 1550 nm. OTDR testing shall be performed in both directions (bidirectional), on all fibers. Test results shall be generated from software of the test equipment, recorded, dated, compared and filed with previous copies. A hard copy printout and a electronic copy on a DOS based 89 mm diskette of traces and test results shall be submitted to the Engineer. The average of the two losses shall be calculated, and recorded in the Cable Verification Worksheet in Appendix A. The OTDR shall be capable of recording and displaying anomalies of at least 0.02 dB. All connector losses must be displayed on the OTDR traces.

3. Cable Verification Worksheet

The Cable Verification Worksheet shown in Appendix A shall be completed for all links in the fiber optic system, using the data gathered during cable verification. The completed worksheets shall be included as part of the system documentation.

4. Test Failures

If the link loss, measured from the power meter and light source, exceeds the calculated link loss, or the actual location of the fiber ends does not agree with the expected location of the fiber ends (as would occur with a broken fiber), the fiber optic link will not be accepted. The unsatisfactory segments of cable, or splices shall be replaced with a new segment of cable or splice at the Contractor's expense. The OTDR testing, power meter and light source testing and Cable Verification Worksheet shall be completed for the repaired link to determine acceptability. Copies of the test results shall be submitted to

the Engineer. The removal and replacement of a segment of cable shall be interpreted as the removal and replacement of a single contiguous length of cable connecting two splices and two connectors. The removal of a small section containing the failure, and therefore introducing new unplanned splices, will not be allowed.

**Passive Component Package Testing and Documentation**

All components in the passive component package (FDUs, pigtails, jumpers, couplers, and splice trays) shall be from a manufacturer who is ISO9001 registered.

In developing the passive component package, each connector termination (pigtail, or jumper) shall be tested for insertion attenuation loss using an optical power meter and source. In addition, all singlemode terminations shall be tested for return reflection loss. These values shall meet the loss requirements specified earlier and shall be recorded on a tag attached to the pigtail or jumper.

Once an assembly is complete, the manufacturer shall visually verify all tagging of loss values is complete. As a final quality control measure, the manufacturer shall do an "end to end" optical power meter/light source test from pigtail end to end to the terminating point assure continuity and overall attenuation loss valued.

The final test results shall be recorded, along with previous individual component values, on a special form assigned to each FDU. The completed form shall be dated and signed by the Manufacturer's Quality Control supervisor. One copy of this form will be attached in a plastic envelope to the assembled FDU unit. Copies will be provided separately to the Contractor and to the Engineer, and shall also be maintained on file by the manufacturer or supplier.

The assembled and completed FDU unit shall then be protectively packaged for shipment to the Contractor for installation.

**Fiber Optic System Performance Margin Design Criteria**

The installed system performance margin shall be at least 6 dB for every link. If the design system performance margin is less than 6 dB, the Engineer shall be notified and informed of the Contractor's plan to meet that requirement.

**Active Component Testing**

The transmitters and receivers shall be tested with a power meter and light source, to record the transmitter average output power (dBm) and receiver sensitivity (dBm). These values shall be recorded in the Fiber System Performance Margin Calculations Worksheet in Appendix B, section C, number 6.

**APPENDIX A**

**Cable Verification Worksheet**
*End-to-End Attenuation (Power Meter and Light Source) Testing and OTDR Testing*

Contract No. _____ Contractor: _____

Operator: _____ Date: _____

Link Number: _____ Fiber Number: _____

Test Wavelength (Circle one): 1310 nm 1550 nm

Expected Location of fiber ends: End 1: _____ End 2: _____

Power Meter and Light Source Test Results:

| | | | |
|---|---|---|---|
| Power In: | _____ | dBm | 1A |
| Output Power: | _____ | dBm | 1B |
| Insertion Loss [1A - 1B]: | _____ | dB | 1C |

OTDR Test Results:

| | | | |
|---|---|---|---|
| Forward Loss: | _____ | dB | 2A |
| Reverse Loss: | _____ | dB | 2B |
| Average Loss [(2A + 2B)/2]: | _____ | dB | 2C |

---

To Be Completed by Caltrans:
Resident Engineer's Signature: _____
Cable Link Accepted: _____

**APPENDIX B**
**Fiber System Performance Margin Calculations Worksheet**

**A. Calculate the Passive Cable Attenuation**

| | | |
|---|---|---|
| 1. Calculate Fiber Loss at Operating Wavelength: _____ nm | Cable Distance (times)<br>Individual Fiber Loss (equal)<br>@ 1310 nm (0.4 dB/km)<br>@ 1550 nm (0.3 dB/km) | _____ km x ___ dB/km = |
| | **Total Fiber Loss:** | _____ dB |

**B. Calculate the Total Connector/Splice Loss**

| | | |
|---|---|---|
| 2. Calculate Connectors/couplers Loss:<br>(exclude Tx and Rx connectors) | Individual Connector Loss (times) Number of Connector Pairs (equal)<br>**Total Connector Loss:** | 0.4 dB x ____ =<br>_____ dB |
| 3. Calculate Splice Loss: | Individual Splice Loss (times) Number of Splices (equal)<br>**Total Splice Loss:** | 0.1 dB x ____ =<br>_____ dB |
| 4. Calculate Other Components Loss: | **Total Components:** | _____ dB |
| 5. Calculate Total Losses: | Total Connector Loss (plus)<br>Total Splice Loss (plus)<br>Total Components (equal) | + dB<br>+ dB<br>+ dB = |
| | **Total Connector/Splice Loss:** | _____ dB |

**C. Calculate Active Component Link Loss Budget**

| | | |
|---|---|---|
| System Wavelength:<br>Fiber Type:<br>Average Transmitter Output (Launch Power): | | _____ nm<br>singlemode<br>_____ dBm |
| Receiver MAX Sensitivity ($10^9$ BER) (minus)<br>Receiver MIN Sensitivity (equal) | **Receiver Dynamic Range:** | _____ dBm<br>- _____ dBm =<br>_____ dB |
| 6. Calculate Active Component Link Loss Budget: | Average Transmitter Output (Launch Power) (minus)<br>Receiver MAX Sensitivity (equal) | _____ dBm<br>- _____ dBm = |
| | **Active Component Link Loss Budget:** | _____ dB |

**D. Verify Performance**

| | | |
|---|---|---|
| 7. Calculate System Performance Margin to Verify Adequate Power: | Active Component Link Loss Budget **[C]** (minus)<br>Passive Cable Attenuation **[A]** (minus)<br>Total Connector/Splice Lost **[B]** (equal) | _____ dB<br>- _____ dB<br>- _____ dB = |
| | **System Performance Margin:** | _____ dB |

**REMOVAL AND REINSTALLATION OF EXISTING FIBER OPTIC AND TWISTED PAIR CABLES (12 SMFO, 36 SMFO AND 50P22)**

Existing fiber optic cables (12 SMFO and 36 SMFO) and twisted pair cables (50P22) from existing splice vault at Station 363+20 to existing pull box at Station 360+65 shall be removed and coiled in existing pull box at Station 360+65. Existing fiber optic and twisted pair cables coiled in existing pull box at Station 360+65 shall be installed in new conduit as shown on the plans

Full compensation for removing, coiling and reinstalling existing fiber optic cables shall be considered as included in the contract unit price paid for fiber optic cable and no additional compensation will be-allowed therefor.

## 10-3.20 BONDING AND GROUNDING

Bonding and grounding shall conform to the provisions in Section 86-2.10, "Bonding and Grounding," of the Standard Specifications and these special provisions.

Bonding jumpers in standards with handholes and traffic pull box lid covers shall be attached by a UL listed lug using 4.5-mm diameter or larger brass or bronze bolts and shall run to the conduit or bonding wire in the adjacent pull box. The grounding jumper shall be visible after the standard has been installed and the mortar pad and cap have been placed on the foundation.

Standards without handholes shall have bonding accomplished by jumpers attached to UL listed ground clamps on each anchor bolt.

For slip base standards or slip base inserts, bonding shall be accomplished by jumpers attached to UL listed ground clamps on each anchor bolt, or a UL listed lug attached to the bottom slip base plate with a 4.5-mm diameter or larger brass or bronze bolt.

Equipment bonding and grounding conductors are required in conduits, except when the conduits contain combinations of loop lead-in cable, fiber optic cable, or signal interconnect cable. A No. 8 minimum, bare copper wire shall run continuously in circuits, except for series lighting circuits, where No. 6 bare copper wire shall run continuously. The bonding wire size shall be increased to match the circuit breaker size in conformance with the Code, or shall be as shown on the plans. Conduits to be installed for future conductors, may omit the copper wire.

Bonding of metallic conduits in metal pull boxes shall be by means of bonding bushings and bonding jumpers connected to the bonding wire running in the conduit system.

## 10-3.21 SERVICE

Continuous welding of exterior seams in service equipment enclosures is not required.

Circuit breakers shall be the cable-in/cable-out type, mounted on non-energized clips. All circuit breakers shall be mounted vertically with the up position of the handle being the "ON" position.

Each service shall be provided with up to 2 main circuit breakers which shall disconnect ungrounded service entrance conductors. Where the "Main" circuit breaker consists of 2 circuit breakers as shown on the plans or required in the special provisions, each of the circuit breakers shall have a minimum interrupting capacity of 10 000 A, rms.

An engraved phenolic nameplate shall be installed with stainless steel rivets on the exterior of the front panel indicating the identification number and the service address of the service cabinet enclosure. Character size shall be a minimum of 5 mm in height.

Service conduit between the serving utility owned power pole and service equipment enclosure shall not be installed until service location has been verified by the serving utility.

Where a new service is to be installed, the Contractor shall notify the Engineer in writing at least 5 working days prior to the date service is required.

Full compensation for Type III-BF and III-CF service equipment enclosure shall be considered as included in the contract price paid for the items involved and no additional compensation will be allowed therefor.

## 10-3.22 NUMBERING ELECTRICAL EQUIPMENT

Reflective numbers and edge sealer will be State-furnished in conformance with the provisions in "Materials" of these special provisions.

The numbers and edge sealer shall be placed on the equipment where designated by the Engineer.

Where new numbers are to be placed on existing or relocated equipment, the existing numbers shall be removed.

Reflective numbers shall be applied to a clean surface. Only the edges of the numbers shall be treated with edge sealer.

Five-digit, self-adhesive equipment numbers shall be placed for all electroliers, and service equipment enclosures. On service enclosures, the numbers shall be placed on the front door.

### 10-3.23 MODEL 334-TV CONTROLLER ASSEMBLIES

Model 334-TV controller assemblies for closed circuit television camera and video node shall be furnished by the Contractor and shall conform to the provisions in Section 86-3.03, "Model 170 and Model 2070 Controller Assemblies," of the Standard Specifications and these special provisions.

The Contractor shall arrange to have a signal technician, qualified to work on the controller unit and employed by the controller unit manufacturer, or the manufacturer's representative, present at the time the equipment is turned on.

The Contractor shall construct each controller cabinet foundation as shown on the plans for Model 334-TV cabinets (including furnishing and installing anchor bolts), shall install the controller cabinet on the foundation, and shall make field wiring connections to the terminal blocks in the controller cabinet.

Foundations for Type 1 housing shall conform to the details on Standard Plan ES-3C for Model 334 cabinets.

Full compensation for Model 334-TV Controller assemblies shall be considered as included in the contract price paid for the items involved and no additional compensation will be allowed therefor.

### 10-3.24 STATE-FURNISHED MODEL 170 CONTROLLER ASSEMBLIES

The Model 170 controller assemblies, including controller unit, completely wired controller cabinet and inductive loop detector sensor units, but without anchor bolts, for collector metering system and traffic monitoring stations will be State-furnished as provided under "Materials" of these special provisions.

The Contractor shall construct the controller cabinet foundation as shown on the plans for Model 334 cabinets (including furnishing and installing anchor bolts), shall install the controller cabinet on the foundation, and shall make field wiring connections to the terminal blocks in the controller cabinet.

A listing of field conductor terminations, in the State-furnished controller cabinet, will be furnished free of charge to the Contractor at the site of the work.

State forces will maintain the controller assemblies. The Contractor's responsibility for controller assemblies shall be limited to conforming to the provisions in Section 6-1.02, "State-Furnished Materials," of the Standard Specifications.

### 10-3.25 VEHICLE SIGNAL FACES AND SIGNAL HEADS

Lamps for vehicular traffic signal units will be State-furnished in conformance with the provisions in "Materials" of these special provisions.

### 10-3.26 DETECTORS

Loop detector sensor units, will be State-furnished in conformance with the provisions in "Materials" of these special provisions.

Loop wire shall be Type 2.

Loop detector lead-in cable shall be Type B.

Slots shall be filled with hot-melt rubberized asphalt sealant.

Detector loops shall be Type E. For Type E detector loops, sides of the slot shall be vertical and the minimum radius of the slot entering and leaving the circular part of the loop shall be 40 mm. Depth of slots of circular loops shall not exceed the depth of pavement as shown on the Standard plans and shall be a maximum of 20 mm. Loop wire for circular loops shall be Type 2. Slots of circular loops shall be filled with hot melt rubberized asphalt sealant. Detector loops shall be installed only after pavement stripping is completed.

The depth of loop sealant above the top of the uppermost loop wire in the sawed slots shall be as shown on the Standard plans. The saw cut depth shall have a maximum as shown in the Standard plans.

Slots in portland cement concrete shall be filled with hot-melt rubberized asphalt sealant, or shall be filled with an epoxy sealant conforming to the provisions in Section 95-2.09, "Epoxy Sealant for Inductive Loops (State Specification 8040-06)," of the Standard Specifications.

#### PREFORMED INDUCTIVE LOOPS

Preformed inductive loops shall be Type E.

The loop shall be 1.8 m square unless otherwise shown. The loop shall consist of 4 turns of No. 16, or larger, wire with Type THWN or TFFN insulation.

The loop wires shall be encased in Size 10, minimum, Schedule 40 or Schedule 80 PVC or polypropylene conduit. The conduit shall be sealed to prevent the entrance of water and the movement of wires within the conduit.

The loop wires from the preformed loop to the adjacent pull box shall be twisted together into a pair (at least 7 turns per meter) and encased in Schedule 40 or Schedule 80 PVC or polypropylene conduit between the preformed loop and the adjacent pull box or detector handhole. The lead-in conduit shall be sealed to prevent the entrance of water at the pull box or handhole end.

In new roadways, the preformed loops and lead-in conduits shall be placed in the base course, with the top of the conduit flush with the top of the base, and then covered with asphalt concrete or portland cement concrete pavement. Preformed loops and lead-in conduits shall be protected from damage prior to and during pavement placement.

In new reinforced concrete structure decks, the preformed loops shall be secured to the top of the uppermost layer of reinforcing steel using nylon wire ties. The loop shall be held parallel to the structure deck by using PVC or polypropylene spacers where necessary. Conduit for lead-in conductors shall be placed between the uppermost 2 layers of reinforcing steel.

Preformed inductive loops shall not be installed in existing structure decks.

A. Slots in asphalt concrete pavement shall be filled with hot-melt rubberized asphalt sealant.
B. Slots in portland cement concrete pavement shall be filled with hot melt rubberized asphalt sealant.

Full compensation for detector loops shall be considered as included in the contract lump sum price paid for the various items of work requiring detector loops and no additional compensation will be allowed therefor.

### 10-3.27 LUMINAIRES

Ballasts shall be the lag regulator type.

### 10-3.28 PHOTOELECTRIC CONTROLS

Contactors shall be the mechanical armature type.

### 10-3.29 EXTINGUISHABLE MESSAGE SIGN

Each extinguishable message sign shall be an internally illuminated weathertight and dust tight unit which will produce a clearly visible message only when internally illuminated and shall conform to these special provisions.

The design of each sign shall be as shown on the plans. Minor details of construction shown are typical and may be modified subject to approval by the Engineer.

Six sets of shop drawings shall be submitted to the Engineer for review prior to performing work on the signs.

#### HOUSING

The housing shall be ruggedly constructed, shall be rigid, weathertight, dust tight and corrosion resistant, and shall be made of durable materials.

Provisions shall be made for ease of maintenance of components.

Sign panels and housing window shall be made of acrylic plastic which, including painted portions, shall be highly resistant to crazing, staining, discoloration, creep, warping, and the long range deleterious effects of vehicle fumes, direct sunlight, heat (up to 90°C), water, oils and aging.

The housing skin shall be made of Type 5052-H32 aluminum alloy sheet with clad finish. The housing reinforcing and miscellaneous parts shall be made of suitable gages and types of aluminum, except external fasteners, machine screw parts, lock washers, hinge pins, and other mechanical parts, which shall be made of Type 316 stainless steel.

Interior metal parts shall be made of suitable gages and types of plated steel or aluminum, except fasteners, machine screw parts, lock washers and other miscellaneous parts shall be made of corrosion resistant metals other than aluminum.

The separable hinge for mounting the reflector shall be brass as shown on the plans or shall be stainless steel.

Gaskets shall be uniform and even textured, and shall be highly resistant to stiffening and setting and the long range deleterious effects of vehicle fumes, direct sunlight, heat (up to 70°C), water, oils and aging.

Terminal strips shall be used for input, output and tie point connections and shall be of the molded phenolic, barrier type.

#### BALLASTS, CONTROL RELAYS AND TERMINAL BLOCKS

Ballast inductors shall meet the requirements in ANSI Standard: C82.1, "Fluorescent Lamp Ballasts."

The inductors shall have the inductance noted on the plans (±10 percent), losses not exceeding 15 percent of lamp watts at rated current of inductor and a maximum current crest factor of 1.5 at rated current of inductor. The maximum temperature rise of the inductor coils shall be limited to 40°C above an ambient temperature of 40°C.

Heater transformers shall produce the rated secondary voltage (±10 percent) at full load and at one-third load. The maximum temperature rise of the transformer coils shall not exceed 40°C above an ambient temperature of 40°C.

Inductors and transformers shall have cores made of a suitable grade of silicon steel lamination material and shall have thorough resin impregnation.

Each mounting chassis shall be fabricated of 3 mm, Type 5052-H32 aluminum alloy sheet. Units shall be mounted on the chassis with plated brass or steel hardware, except for lock washers which shall be beryllium copper, externally toothed.

Capacitors shall be rated 660 V (ac), 60 Hz, for operation down to -20°C with capacity as shown on the plans and shall be oil filled, paper type, hermetically sealed with solder lug terminals. Capacitance shall be within ±10 percent of rating at 25°C. Each capacitor shall withstand a limited direct current, 15-second breakdown test at 25°C of 3000 V (ac) from each terminal to case. Minimum insulation leakage resistance from terminal to terminal, in megohms, shall be not less than 1500 divided by capacitance in microfarads.

Each magnetic control relay shall be of the heavy-duty, power type with 120-V (ac) coil and double-pole, double–throw contacts with a minimum rating of 2 A at 480 V (ac), 60 Hz. The coil shall consume not more than 10 VA with sealed armature.

The relay coil shall be designed to provide reliable service under the following conditions:

A. Maximum operating voltage: 10 percent over rated volts.
B. Ambient temperature: 60°C.

The relay coil shall meet NEMA requirements for temperature rise and voltage breakdown.

Maximum dimensions of the relay shall be: mounting base, 63.5 mm by 102 mm; overall height, 63.5 mm.

Fuseholders shall be the panel mounting type rated at 250 V (ac), complete with a 10.3-mm diameter by 38-mm length, slow blowing, cartridge type fuse.

Surge limiting and ballast resistors shall be ceramic coated, 20-watt, wirewound units. Resistor leads shall have plastic insulation rated 600 V (ac), for operation at 200°C.

Wiring connections from components shall be terminated on 2 molded phenolic, barrier type, terminal block assemblies rated at 15 A, 600 V (ac). Terminal designations shall be marked as indicated on the plans.

**LAMPHOLDERS AND LAMPS**

Lampholders shall have silver plated contacts.

Lamps shall be the extra-high output, rapid-start type with T-12 bulb of the length shown on the plans, cool-white color and plated contacts for operation up to 1500 mA.

**CONDUCTORS AND WIRING**

Ballast and sign conductors shall be No. 16 stranded copper wire and shall be labeled by UL as 105°C appliance wiring material (AWM) for use at 600 V (ac). Ballast conductors shall be secured with easily removable, spring cross straps (not clamped, cabled or served) on the underside of the chassis. Color coding and terminal markings shall be as shown on the plans.

Lead ends shall be fitted with spade lugs.

**LUG DISCONNECT**

Each plug disconnect shall consist of molded nylon plug and receptacle housings containing plug pins and individual sockets designed to be crimped to conductors and snapped into the housings. Housings shall have integral, molded, polarizing and locking devices. Minimum UL electrical rating shall be 10 A, 600 V (ac). Pins and sockets shall be tin plated phosphor bronze secured to conductors using a ratchet type precision crimping tool.

**TESTING**

Tests shall verify that the following conditions exist:

A. Transformer output voltage: 480 V (ac) ± 10 percent.
B. Sign input current (daytime level): 4 A maximum.
C. Lamp current each (daytime level): 1.4 A ± 15 percent (nighttime level) 30 mA ± 15 percent.
D. Cathode filament voltage: 3.6 V (ac) ± 10 percent and shall be supplied from a steady (non-flashing) source.

**SIGN OPERATION**

The sign shall operate as follows:

A. During daytime, the lamps shall operate at full rated brightness.
B. During nighttime, the lamps shall be dimmed to approximately one-thirty-fifth of daytime brightness.
C. Starting and flashing shall be positive, without flickering, during daytime and nighttime levels.

**10-3.30 COMMUNICATION EQUIPMENT**

**GENERAL**

Communication equipment consist of, but not limited to, various field element sites such as highway advisory radio, closed circuit television camera, changeable message sign, fiber optic video node, data node, cable node, ramp metering system, and traffic monitoring / count station, at various locations, the San Gabriel HUB building, and the District Traffic Management Center (TMC).

Prototype equipment is not acceptable. All equipment shall be current standard production units and shall have been in production for a minimum of six months. Rebuilt or reconditioned equipment will not be allowed.

All equipment racks shall be industrial grade and conform to EIA standard RS-310-D.

All rack mounted equipment and card cage assemblies shall have metal filler plates to cover any unused channel slots or card slots.

Before working on the existing communication equipment, the Contractor shall perform the jointly conducted pre-construction check with the Engineer according to "Maintaining Existing and Temporary Electrical Systems," elsewhere in these special provisions, and shall submit a test plan, in accordance with manufacturer's specifications, for approval in advance by the Engineer, also as described elsewhere in these special provisions.

The test plan is also to verify that all existing communication equipment is functional before construction and to record the working condition of those equipment.

The Contractor may arrange, at the Contractors expenses, to have a technician, qualified to work on existing communication equipment and employed by the communication equipment manufacturer or his representative, present at the time the communication equipment is installed or modified.

Except for testing and verification of the condition of the existing communication equipment before and after the works on the existing communication equipment, the scope of the Contractor's work shall be as shown on the plans.

**EQUIPMENT AT SAN GABRIEL VALLEY HUB**

The San Gabriel Valley (SGV) Hub communication building is located at Route 10/Route 605 Separation.

Equipment at the San Gabriel Valley Hub shall consist of furnishing and installing a video demultiplexer matching the video multiplexer unit installed at video node location P0247 and connecting wires and cables and incidentals required to make the equipment at the San Gabriel Valley Hub fully operational.

The Contractor's attention is directed to "Video demultiplexer" as described under "Video multiplexer and demultiplexer" elsewhere in these special provisions.

**RELOCATE CABLE NODE (LOCATION P0237)**

Relocate cable node location PO237 shall consist of relocating the existing Type 334-TV cabinet, cable node assembly, including six-25 pair terminal blocks, fiber distribution units (FDU's), and other equipment housed in the existing Type 334-TV cabinet, to a new Type 334 cabinet foundation, and connecting conduits, wires, cables, and incidentals required to make the relocated cable node fully operational, as shown on the plans and as directed by the Engineer.

**10-3.31 CLOSED CIRCUIT TELEVISION SYSTEM LOCATION**

Closed circuit television (CCTV) cameras at various locations (OR043 and PO247), and relocated CCTV camera (P0226) shall consist of providing electrical service and installing Type 334-TV cabinet, CCTV camera assembly, which includes pan and tilt unit, digital signal processing (DSP) color video camera unit, camera lens, camera housing, camera control receiver (CCR), camera control circuits and accessories, CCTV enclosed wiring, which includes enclosed cables for video and camera control, connectors, video coaxial cables, camera pole, fiber optic data modem, video transmitter and other equipment, as shown on the plans and as directed by the Engineer, to provide a fully functional site at locations as shown on the plans.

A CCTV camera location that coincides with a video node may omit the video transmitter in the CCTV cabinet by routing the video coaxial cable to the video multiplexer in the video node as shown on the plans.

The closed circuit television Type 334-TV cabinet and control equipment shall consist of a Type 334-TV cabinet, a fiber distribution unit, a fiber optic data modem, a video transmitter, and a camera control receiver, as described elsewhere in these special provisions and as shown on plans.

Before installation, the Contractor shall test to verify that all new CCTV equipment functions in accordance with manufacturer's specifications. After installation, all new and relocated CCTV camera location equipment shall be tested at each individual site as described elsewhere in these special provisions.

**CLOSED CIRCUIT TELEVISION CAMERA POLE**

Closed circuit television (CCTV) camera pole shall conform to the provisions in Section 86-2.04, "Standards, Steel Pedestals and Posts," of the Standard Specifications and these special provisions.

The CCTV camera pole shall be made from sheet steel, shall have a minimum yield of 331 MPa and shall be hot-dip galvanized after fabrication in accordance with the provisions in Section 75-1.05, "Galvanizing," of the Standard Specifications. The pole shall be fabricated to the dimensions and with all the accessories as shown in the plans.

The horizontal plane of the pan and tilt base plate shall be perpendicular to the vertical plane of the CCTV camera pole. The CCTV camera pole shall be erected plumb. The vertical axis of the erected CCTV camera pole shall be within 76 mm of the theoretical vertical axis when measured without the action of sunlight or wind.

A junction box of a type and configuration set forth elsewhere in the plans and these special provisions shall be typically installed on the camera pole, approximately 150 mm from the top of the pole, as shown on the plans and described elsewhere in these special provisions.

Full compensation for camera pole shall be considered as included in the contract lump sum price paid for the items requiring camera pole and no additional compensation will be allowed therefor.

**CAMERA CONTROL RECEIVER**

The camera control receiver (CCR) shall include all auxiliary equipment required to interface with the communication subsystem, outdoor pan and tilt units, and the closed circuit television (CCTV) camera assemblies.

The CCR shall receive commands from the existing camera control transmitter (CCT) in the traffic management center (TMC) and decode them into the switch closures that are used to operate and orient a CCTV camera. In addition, the CCR shall generate outputs to control ancillary equipment and operations as defined elsewhere in these special provisions. The CCR shall be connected to the CCT by cable, providing a circuit equipped with fiber optic data modems (FODM). These modems may be internal or external to the CCR. The CCR shall be fully compatible with the existing Javelin Model JO1400R CCT and Javelin Model JO4100DT camera control keyboard located in the TMC and shall be completely interchangeable with COHU Series ER3490 and shall be compatible with a CHOHU ER3490K cable, or equal and as approved by the Engineer.

The command messages addressed to the CCR shall cause an immediate response. In response to command messages, the state of the control relays shall be engaged for a specific period of time and returned automatically to a neutral state. If the action is to continue, an additional command from the transmitter shall be required. This shall provide a fail-safe mode of operation should communications be interrupted between the CCR and the existing CCT in the TMC.

The specific length of time that any command remains latched shall be determined by the operational impact of that command, system and component requirements. Commands for camera movement and adjustment, such as, pan, tilt, iris and lens control shall use shorter latching times on the order of milliseconds, compared to external contact closures that shall latch for periods of seconds to minutes. The manufacturer shall provide documented evidence that the chosen time intervals for the latched commands do not negatively affect the operation of the camera, lens, or the pan and tilt unit.

One set of dry contacts shall be permanently latched until a second command is received by the CCR. This function will be used to turn on communications equipment at selected sites. This communications equipment will remain operational until disengaged by the operator.

The CCR and modem shall provide an EIA-232 compatible interface. If the modem is internal to the CCR, all communication and control signals between the modem and CCR shall appear at the EIA-232 interface. In addition, it shall be possible to communicate with the CCR by way of the EIA-232 interface and exercise all CCR functions.

The CCR shall be designed for continuous operation in outdoor weather conditions when installed in Type 334-TV, or equivalent, cabinets.

The CCR communication protocol shall be fully compatible with the existing CCT communication protocol and shall provide the following:

Signaling rate of 9600 bps shall be used to communicate with the existing CCT in the TMC.

Ability to configure the transmission rate of the equipment to 9600 bps.

A unique address shall be used to identify and accept commands sent from the camera control transmitter. This unique address shall be included in all signals sent from the CCR to the CCT.

Parity checks on each byte and any additional cyclic redundancy codes (CRC) or checksums required to ensure that random or fortuitous noise is not interpreted by the CCR as a valid message from the existing CCT in the TMC.

The CCR shall only transmit to the existing CCT in the TMC only in response to a valid poll or command message which contains a unique address for the CCR.

Transmissions to different CCRs shall share a single communication channel without interference or erroneous operation.

The CCR shall provide acknowledgment of all correct messages.

Unique commands shall be provided to exercise all functions of the CCR.

The Contractor shall provide the Engineer with detailed descriptions of the CCR communication protocol and interface specifications and a license agreement to develop devices to interface with the existing CCT.

The CCR shall provide the following functions:

The CCR shall receive and decode signals from the existing CCT in the TMC and activate pan, tilt, zoom, focus, iris and auxiliary functions at the remote camera site in the camera and pan, tilt unit. The CCR shall provide both local automatic and remote manual iris adjustment and shall provide control for automatic or manual shutter speed with the selections made by commands initiated from the existing CCT in the TMC.

The CCR shall provide the capability to locally store and activate a minimum of 15 camera preset positions. The preset information shall be digitally stored at the CCR. Presets shall be assignable and activated from the existing CCT in the TMC. In the event of a power failure preset settings shall be maintained. The CCR or CCT shall be able to re-calculate the preset values should the pan/tilt unit be replaced.

The CCR shall provide the capability of transmitting positioning feedback information from the pan, tilt, and zoom potentiometers to the existing CCT in the TMC using an eight bit, or equivalent, digital format. The positioning feedback information shall only be transmitted when a command requesting positioning feedback is received from the existing CCT in the TMC.

The CCR shall include the capability to process and implement a minimum of three auxiliary control signals. For example, auxiliary control signals may provide needed control of heaters, washers and wipers on cameras, etc. At least two of the auxiliary control signals shall be latching. At least three inputs capable of sensing a dry contact closure shall also be provided.

The CCR shall provide local control functions for pan, tilt, zoom, focus, and other operations. These control functions shall be performed from a portable unit communicating through a serial port on the CCR. A switch shall be provided to defeat remote commands from the existing CCT in the TMC and allow the activation of all local control functions.

The failure of a single CCR unit or its associated modem shall not cause any other units to become inoperative or damage to its associated camera.

If communications to the CCR are interrupted, the CCR shall cause the camera to remain in the current position or move it to a preset position as a user option.

The Contractor shall provide a certification from the original equipment manufacturer that the CCR (using a fiber optic data modem) will interface and operate over singlemode fiber optic cable as required by these special provisions when it is correctly connected to existing pan and tilt units and zoom lenses. In addition, the CCR shall meet the following requirements:

**Electrical**.--The CCR shall operate from a 120 V(ac) ±10 percent, at 60 Hz ±5 percent, power source and incorporate an internal, regulated power supply. The maximum power consumption shall be 45 W. Protection from power brown outs, current surges or voltage spikes of up to 1000 V shall be provided. The lens driver circuit shall provide power at the appropriate voltage for zoom, focus and iris controls, listed elsewhere in these special provisions. The pan and tilt driver circuit shall provide power at the appropriate voltages to control the movement of the pan and tilt.

**Physical.**--The CCR shall be supplied in a durable enclosure suitable for mounting in an EIA 482 mm. The maximum dimensions of the CCR shall be 200 mm (H) x 480 mm (W) x 355 mm (D).

The CCR shall be fully operational over an ambient temperature range of -23°C to +50°C with relative humidity from 5 to 90 percent. The CCR enclosure shall have all necessary bulkhead connectors for access to all required external cables.

The Contractor shall perform a functional test to verify that the CCR to be placed in the cabinet works in accordance with these special provisions before installing the CCR. The CCR shall be installed as shown on the plans. The Contractor shall confirm equipment placement with the Engineer before installing any equipment.

The Contractor shall test the camera control system for the following functions:

After installing all equipment at each CCTV site, the Contractor shall confirm the operation of the camera control receiver and modem using test equipment and other necessary equipment that emulates all the functions of the CCT and fiber optic data modems, and shall document all results.

After installing all camera control receivers and fiber optic data modems and the communication system, the Contractor shall demonstrate the operation of the camera control system, assign all system parameters using test equipment that emulates all the functions of the camera control keypad, camera control transmitter, and fiber optic data modem from the TMC, and shall keep test equipment in operation until witnessed and approved by the Engineer.

Test equipment that emulates all the functions of the camera control transmitter and fiber optic data modem shall address all camera control receivers and shall operate all remote control functions, including pan and tilt, zoom, focus, set up, and recall a minimum of ten preset positions per remote CCR address. The response to the test equipment signals shall appear to be immediate.

Full compensation for the camera control receiver shall be considered as included in the contract lump sum price paid for the items requiring camera control receiver and no additional compensation will be allowed therefor.

**FIBER OPTIC DATA MODEM**

The fiber optic data modem (FODM) shall be used as an RS-232C interface between field equipment and a data node via optical link. Modems shall be stand-alone units securely fastened on a rack-mounted shelf. LED indicators shall be provided for transmitter status (on/off) and received optical power above the receiver sensitivity. The FODM shall be a "drop and insert" or "drop and repeat" type with dual optics for dual fiber daisy chain or redundant loop poll response networks. The unit shall provide DB25 DCE port for the serial interface and shall regenerate signals received on the second optical port. The FODM optical receive port shall operate correctly at full transmitter launch power applied via a short jumper. Power consumption shall not exceed 6 W.

The modem shall meet the following requirements

| | |
|---|---|
| Electrical Signaling: | Per EIA RS-232 with full handshake control signals |
| Electrical Power: | Stand-alone version: 115 V(ac) □10%, 60 Hz. |
| Bit Error Rate: | 1 in $10^9$ within optical budget. |
| Operating Mode: | Asynchronous, half duplex or full duplex. |
| Input/Output Logic Level: | I: +3.75 to +12 V.<br>O: - 3.75 to –12 V. |
| Input/Output Impedance: | Per RS-232 |
| System Bandwidth: | DC to 19.2 kbps minimum |
| Optical Wavelength: | 1310 nm. |
| Loss Budget: | Singlemode: 13 dB |
| Connectors Optical: | ST |
| Connectors Electrical (Data): | DB25 female |
| Mechanical Size: | 135 mm x 90 mm x 38 mm for module |
| Temperature Range: | -20□C to +70□C |
| Storage Temperature: | -40□C to +85□C |

The FODM shall include local and remote loopback diagnostic functions. LED indicators shall show the presence of unit power and TX data and RX data on each of the fiber optic ports. If the unit included anti-streaming technology it shall be switch defeatable.

The FODMs shall be tested as follows:

Each optical modem shall be functionally tested by looping back the optical transmit connector to the optical receive connector using a variable optical attenuator with measured optical loss of 13 dB at 1300 nm. A test set shall be connected to the modem and set for RS-232 communication testing. A fifteen-minute test after burn-in shall be error free.

After performing the fifteen minute bit error rate test (BERT), at least two modems shall be tested for receiver dynamic range. To do this the optical attenuation shall be increased to the point at which the data test just begins to register bit errors. The optical receive power into the modem shall be measured and recorded. The optical attenuation shall be then decreased until the data test once again registers errors. At no time shall the optical power into the receiver exceed the manufacturer's specified saturation level. The optical receive level shall once again be measured and recorded. These minimum and maximum receive levels define the modem receiver's dynamic range and shall meet or exceed manufacturers specifications.

One pair of modems shall be interconnected using optical jumpers and attenuators with a loss of 13 dB in each direction. The RS-232 interface shall be looped back on one modem and a test set connected to the RS-232 interface of the other modem. A bit error rate of less than one in $10^9$ shall be demonstrated.

Full compensation for fiber optic cable modem (FODM) shall be considered as included in the contract lump sum price paid for the items requiring fiber optic cable modem (FODM) and no additional compensation will be allowed therefor.

**FIBER OPTIC AUDIO MODEM**

The fiber optic cable modem (FOAM) shall provide the interface between the HAR Voice recorder and the FXS voice channel card of the D4 channel bank at the Data Node. The modem units shall comply with the requirements of the Federal Communications Commission rules and regulations part 68 for direct connection to a common carrier telephone line.

The FOAM shall operate in either a master or slave configuration. Master FOAM, located at Data Node shall transmit voice, sourcing from the TMC, to the receiving FOAM at the HAR site. The FOAM at each field element shall be stand-alone type and shall be securely fastened. LED indicators shall be provided for transmitter status (on/off) and received optical power above the receiver sensitivity.

The modem shall meet the following requirements:

| | |
|---|---|
| Audio Signaling:<br>Audio Bandwidth:<br>Input / Output:<br>Impedance:<br>Signal-To-Noise Ratio (SNR): | Balanced, simplex<br>20 Hz – 20 kHz<br>2.2 volts pk-pk<br>600 Ohms<br>60 dB |
| Electrical Power: | 12 V @ 250 mA |
| Optical Output: | -16 dBm |
| Optical Sensitivity Input: | -33 dBm |
| Optical Wavelength: | Singlemode, 1300 nm. |
| Loss Budget: | 16 dB |
| Connectors Optical: | ST |
| Connectors Electrical: | Terminal block with screw terminals |
| Mechanical Size: | 17.8 x 12.5 x 5.1 cm |
| Operating Temperature: | -40□C to +70□C |
| Storage Temperature: | -40□C to +85□C |

The FOAMs shall be tested as follows:

Each optical modem shall be functionally tested by looping back the optical transmit connector to the optical receive connector using a variable optical attenuator with measured optical loss of 15 dB at 1300 nm. An audio test set shall be connected to the audio input of the transmitting FOAM and set for 1 kHz audio tone, starting @ 0 dB. Monitor the audio output level. Verify the linearity of the audio tone dB level

Reverse the test connection at both ends of the FOAMs and repeat the test procedure.

At no time shall the optical power into the receiver exceed the manufacturer's specified saturation level. The optical receive level shall once again be measured and recorded. These minimum and maximum receive levels define the modem receiver's dynamic range and shall meet or exceed manufacturers specifications.

Full compensation for fiber optic cable modem (FOAM) shall be considered as included in the contract lump sum price paid for the items requiring fiber optic cable modem (FOAM) and no additional compensation will be allowed therefor.

**CLOSED CIRCUIT TELEVISION WIRING**

The CCTV wiring shall be installed between the camera assembly, pan and tilt unit and the camera control receiver, and shall consist of enclosed cables. The CCTV wiring shall be compatible with the camera assembly, pan and tilt unit and the camera control receiver.

CCTV wiring and connectors shall be configured to make the CCTV sub-system completely operational.

A bonding wire shall be provided between the control receiver and the Type 334-TV cabinet.

All cables shall be:

Installed without damaging the conductors or insulation.
Installed without kinks.
Handled in accordance with manufacturers specifications and recommended bending radius.
Run continuously between terminations without splices.
Installed with sufficient slack for equipment movement.
Neatly tagged at both terminations to indicate source, destination and function.

All cables, cable assemblies and connectors shall meet all National Electrical Code standards with regards to voltage, current and environmental ratings. Specifications of all cables, cable assemblies, and connectors with strain relief backshells intended for use by the Contractor shall be submitted to the Engineer as part of the shop drawings for review and approval. The Contractor shall test the cables for continuity prior to and after installation. Cables shall be installed as shown on the plan sheet "Electrical Diagram for CCTV and Pan/Tilt Unit."

Full compensation for CCTV wiring shall be considered as included in the contract lump sum price paid for the items requiring CCTV wiring and no additional compensation will be allowed therefor.

## ENCLOSED CAMERA CONTROL CABLES

The enclosed camera control cables shall connect the camera control receiver to the camera control receiver located in the Type 334-TV cabinet and shall be compatible with a COHU ER3490K cable, or equal, as shown on the plan sheet E-84, "Electrical Diagram for CCTV and Pan/Tilt Unit", and as approved by the Engineer.

Each conductor in the cables shall be insulated with a polypropylene jacket, color coded for positive identification, have a resistance of 23.4 Ω/km at 20°C or less and be stranded.

Each conductor pair, in the twisted pair cables, shall be shielded with an aluminum-polyester tape wrap with a copper drain wire.

Each cable shall have an overall PVC jacket of no less than 1.14 mm thickness.

The RG-6A/U coaxial cable shall be compatible to Comm/Scope No. F59SSEF, Alpha 9006A, Manhattan M4204, or equal, and as approved by the Engineer.

Full compensation for enclosed camera control cables shall be considered as included in the contract lump sum price paid for the items requiring enclosed camera control cables and no additional compensation will be allowed therefor.

## MODEL 334-TV CABINET

Model 334-TV cabinet shall include a Model 170-based controller, power distribution assembly, thermostatically controlled fan, door locks, EIA standard 482 mm equipment racks, all necessary mounting hardware and wiring, foundation and anchor bolts and other equipment as shown on the plans and specified in these special provisions. The Model 170-based controller is specified elsewhere in these special provisions.

The Contractor shall install a power distribution assembly at the bottom of the 482 mm equipment rack, inside the Model 334-TV cabinet, in accordance with the plans. The power distribution assembly shall consist of the following: one 30 A, 120 or 240 V minimum, single pole main breaker; three 15 A, 120 V minimum, single pole secondary breakers; eight standard duplex 120 V(ac) receptacles; and one duplex, three prong, NEMA Type 5-15R grounded utility type outlet with ground fault interrupter. The power distribution assembly shall protect the electronic equipment powered by the assembly from power transients. Over voltage protection shall be provided for the power distribution assembly and shall contain as a minimum, a surge arrestor which shall reduce the effect of power line voltage transients and be rated as follows:

| | |
|---|---|
| Recurrent peak voltage | 212 V |
| Energy rating (maximum) | 50 J |
| Power dissipation, average | 0.85 W |
| Peak current for pulses less than 6 µs | 2,000 A |
| Standby current for 60 Hz sinusoidal | 1 mA or less |

The Contractor shall install a thermostatically controlled fan in the Model 334-TV cabinet. The fan shall provide shall provide 150 cfm of ventilation. The fan shall be activated when the temperature inside the cabinet exceeds 24°C and shut off when the temperature is less than 18°C. All vents shall be filtered.

The Contractor shall provide prime power to the cabinet and perform all internal wiring in accordance with these special provisions and plans.

The Contractor shall provide all necessary mounting hardware and wiring to install and commission the equipment in new, relocated and existing cabinets as shown on the plans. The Contractor shall test all cabinet assemblies and demonstrate the correct function of all controls in the presence of the Engineer.

The Contractor shall construct each Model 334-TV cabinet foundation as shown on the plans, including furnishing and installing anchor bolts, and shall make all field wiring connections to the cabinet.

All cabinet assemblies shall be tested to demonstrate the correct function of all controls in the presence of the Engineer.

Full compensation for Model 334-TV cabinet shall be considered as included in the contract lump sum price paid for the items requiring Model 334-TV cabinet and no additional compensation will be allowed therefor.

## VIDEO TRANSMITTER

The video transmitter shall accept any NTSC baseband video signal and convert it to an optical signal suitable for launching into singlemode fiber.

The video interface to the video transmitter shall be a nickel plated, bulkhead female BNC-style connector with a gold plated contact. The video transmitter shall accept a composite video signal at a level of 1.0 V peak to peak between sync tip and reference white, as measured on an oscilloscope. The transmitter shall operate as specified when the peak-to-peak value of the signal varies between 0.71 and 1.4 V. The nominal input impedance shall be 75 Ω and the return loss shall be at least 30 dB in compliance with EIA RS 250 medium haul for an unbalanced connection.

The video signal shall modulate the optical source to produce a frequency modulated optical signal. The optical emitter shall have a center wavelength in the range of 1300 nm to 1330 nm at 25˚C. The transmitter shall interface to fiber with a ST style compatible connector. The video transmitter launch power shall be defined as the power launched by the transmitter into at least 1 m of the singlemode fiber optic cable, installed for CCTV camera locations. The video transmitter launch power shall be at least 18 dB greater than the video receiver sensitivity. The optical modulation bandwidth required by the video transmitter for specified video link performance shall be 60 MHz, minimum**.**

The video transmitter shall include all mounting hardware necessary to mount it in the EIA standard 482 mm equipment rack in each cabinet. The size and mounting arrangements shall be consistent with the space allocated in the cabinet layout plans. It shall be mounted in a manner which allows easy access to all connections and indicators. It may be mounted in a video transmitter mainframe supplied and installed in accordance with these special provisions and plans.

The video transmitter shall operate over a temperature range of 0°C to 50°C. Power shall be supplied from existing 120 V(ac) ±15 percent, 60 Hz ±5 percent power receptacle inside the cabinet reserved for communications equipment. The video transmitter shall include a power supply, which may be external to the remainder to the video transmitter components. The power supply shall supply all voltages required by the video transmitter for operation, and a panel indicator visible from the front that shows DC power on shall be provided.

The Contractor shall perform pre-installation testing to verify that the video transmitter and video receiver are compatible, meet manufacturers specifications and the requirements of these special provisions.

The video transmitters shall be installed at the cabinet locations and shown on the cabinet layouts as shown on the plans. The Contractor shall coordinate the physical space required by the video transmitters with the allocated space.

Prior to installation, the operation of all equipment shall be verified using the same type of fiber it is to be installed with. The fiber optic path for each video link shall have been tested and verified in accordance with these special provisions and plans prior to the video transmitter installation.

The Contractor shall connect the correct optical pigtail to the optical connector on the video transmitters. The Contractor shall neatly train all pigtails together when routing them along the same path and the support rails in the equipment racks. No cables shall be installed with a bend radius less than the manufacturer's minimum recommended bending radius.

The Contractor is responsible for all testing and documentation required for approval and acceptance of the production, installation and operation at these materials and equipment. All indicators shall be verified to function correctly.

The Contractor shall input a video test signal into the video transmitter and use a variable optical attenuator to set the optical power at the receiver to the video receiver sensitivity level. The optical signal shall then be connected to the video receiver with a monitor connected to its output. The Engineer shall then qualitatively assess the monitor output. The signal-to-noise and signal-to-low frequency noise shall be measured and recorded.

Attention is directed to "System Testing and Documentation," elsewhere in these special provisions regarding testing the single video transmitters.

Full compensation for video transmitter shall be considered as included in the contract lump sum price paid for the items requiring video transmitter and no additional compensation will be allowed therefor.

**VIDEO RECEIVER**

The video receiver shall be connected to the video transmitter by optical fiber to form a video link having a center wavelength in the range of 1300 nm to 1330 nm at 25˚C. The video link is to provide point-to-point transmission and reception of a full motion NTSC baseband video signal using an optical fiber as the transmission medium.

The video receiver shall receive the optical signal launched into the singlemode optical fiber by the corresponding video transmitter. The optical interface to the receiver shall be a ST-style connector. The video receiver shall use a PIN photo diode or an avalanche photo diode to convert the optical signal into an electrical signal. The receiver sensitivity shall be defined as the minimum optical power required to operate at the minimum video link performance specifications. The video receiver shall have an optical dynamic range of at least 10 dB. If the saturation level of the receiver is not greater than the received signal level plus one dB, attenuators shall be installed between the fiber and the transmitter to attenuate the received signal level. The video output interface from the video receiver shall be a nickel-plated, bulkhead female BNC-type connector with a gold plated contact.

The baseband video signal output from the video receiver, while it is receiving an optical signal from the video transmitter at an average power level equal to the video receiver sensitivity shall meet the following performance specifications defined and measured in accordance with EIA-250 medium haul for end-to-end modified performance:

Output signal level per RIA 250.
Amplitude vs. frequency characteristic.
Chrominance to luminance gain inequality.
Chrominance to luminance delay inequality.
Field time waveform distortion.
Line time waveform distortion.
Insertion gain variation.
Differential gain.
Differential phase -- less than or equal to 5 degrees.
Signal-to-noise ratio -- equal to or better than 50 dB weighted.
Signal-to-low frequency noise ratio.

The video receiver installation shall include all mounting hardware necessary to mount it in the EIA standard 482 mm equipment rack in each cabinet. The size and mounting arrangements shall be consistent with the space allocated in the cabinet layout plans. It shall be mounted in a manner that allows easy access to all connections and indicators. It may be mounted in a video receiver mainframe supplied and installed in accordance with these special provisions and plans.

The video receiver shall operate over a temperature range of 0°C to 50°C. Power shall be supplied from an existing 120 V(ac) ±15 percent, 60 Hz ±5 percent, power receptacle inside the cabinet reserved for communications equipment. The video receiver shall include a power supply, which may be external to the video receiver. The power supply shall supply all voltages required by the video receiver for operation, and panel indicators visible from the front of the receiver that show DC power on and received optical signal present.

Prior to installing any equipment in the field cabinets, the Contractor shall verify that the video transmitter and video receiver are compatible, meet manufacturers specifications and the requirements of these special provisions.

The video receivers shall be installed at the cabinet locations identified in the plans. The Contractor shall coordinate the physical space required by the video receivers with the allocated space.

Prior to installation, the operation of all equipment shall be verified using the same type of fiber the equipment is to be installed with. The fiber optic path for each video link shall have been tested and verified in accordance with these special provisions and plans prior to the video receiver installation.

Optical attenuators shall be provided in as such that the optical power received at the video receiver is the maximum possible within the dynamic range.

The Contractor shall connect the correct optical pigtail to the optical connector on the video receivers. The Contractor shall neatly train all pigtails together when routing them along the same path and the support rails in the equipment racks. No cables shall be installed with a bend radius less than the manufacturer's minimum recommended bending radius.

The Contractor shall connect the video receiver power supply to one of the existing receptacles reserved for communications equipment in the cabinet.

The Contractor is responsible for all testing and documentation required for approval and acceptance of the production, installation and operation of this equipment. All indicators shall be verified to function correctly.

Attention is directed to "System Testing and Documentation" elsewhere in these special provisions regarding testing the single video receivers.

Full compensation for video receiver shall be considered as included in the contract lump sum price paid for the items requiring video receiver and no additional compensation will be allowed therefor.

## CLOSED CIRCUIT TELEVISION CAMERA ASSEMBLY

The closed circuit television (CCTV) camera assembly shall consist of a Digital Signal Processing (DSP) color video camera unit, camera lens, enclosed camera control cables and connectors, and camera housing. The CCTV camera assembly shall be protected from brown outs and voltage spikes up to 1000 V.

The Contractor shall verify that the units work in accordance with manufacturer's specifications before installation. All CCTV camera assembly equipment shall also be tested after installation as described elsewhere in these special provisions.

Full compensation for closed circuit television (CCTV) camera assembly shall be considered as included in the contract lump sum price paid for the items requiring closed circuit television (CCTV) camera assembly and no additional compensation will be allowed therefor.

**Closed circuit television digital signal processing color video camera unit.--**The CCTV digital signal processing

(DSP) color video camera unit shall operate reliably under a full range of environmental and lighting conditions and shall provide clear and usable images. All cameras supplied on this project shall be fully interchangeable and meet the following specifications.

All DSP color video cameras shall be of solid state design, and shall meet the following requirements:

**Performance.--**The following are the performance specifications for the camera:

| | |
|---|---|
| Optical device | Color CD interline transfer |
| Optical device size | 13 mm |
| Pixels | 682 (horizon.) x 492 (vertical) min. |
| Horizontal resolution | 430 television lines minimum |
| Minimum usable illumination | 1 lx (measured with fl.4 lens) |
| Scanning system | 525 lines 2:1 interlace.<br>No interlace jitter or line pairing on the viewing monitor shall be discernible |
| Back focus adjustment | Required |
| Frame frequency | 30 frames per second |
| Width to height aspect ratio | 4:3. |

The system shall be capable of providing clear, low-bloom and low-lag video pictures under all conditions from bright sunlight to night time scene illumination.

White Balance:

Auto: Color quality shall be maintained by a continuous through the lens automatic white balance system for color temperatures from 2850K to greater than 5100K with less than 10 IRE units unbalance.

Set: Allows user to set white as preferred. For instance, the camera could be focused on an Off White scene and Set to white balance. The camera will then automatically track color temperature changes, biasing the auto white balance on the Off White instead of the factory defined white.

Lock: Locks the white balance at the current levels.
Indoor: Sets the White to be consistent with 3200K
Outdoor: Sets the White to be consistent with 5100K
Fluorescent: Sets the White to be consistent with Fluorescent Lighting

**Electrical Specifications.--**The following are the electrical specifications for the camera:

| | |
|---|---|
| Operating voltage | 115 VA. @ 50/60 Hz. (±10%) |
| Heater Power Input Requirements: | 115 V(ac) @ 50/60 Hz. (±10%) |
| Power Consumption: | 7 W with Heater Off; 12 W with Heater On |
| Video output signal | Standard NETS color TV |
| Motorized-Iris connector | Required |
| Gamma: | 0.45 |
| Sensitivity (3200K):<br>Full Video, AGE off, iris @ f/1.6, shutter @ 1/60:<br>80% Video, AGE on:, Iris @ f/1.6, shutter @ 1/60 :<br>30% Video, AGE on, Iris @ f/1.6, shutter @ 1/60:<br>30% Video, AGE on, 1/4-second integration: | 110 lug scene illumination (8.5 lug faceplate illume.)<br>10 lug scene illumination (0.8 lug faceplate illume)<br>2 lug scene illumination (0.16 lug faceplate illume)<br>0.125 lug scene illume. (0.01 lug faceplate illume)<br>Note 1: Scene Illumination is based on 100% reflectance. |
| Video output connector | Standard NBC bulkhead on rear of camera |
| Imager: | Interline transfer micro-lens CD with mosaic-type color compensating filter. |
| Image Area | 3.6 mm (H) x 2.7 mm (V) [Format] |
| Resolution: | 460 horizontal; 350 vertical- NETS |
| Digital Zoom Range: | Digital Zoom Range: 1X (Off) through 8X |
| Effective Digital Focal Length: | 85.8mm to 686.4mm |
| Horizontal Angle of View: | 48.94 to 2.51 At 8X Digital: to 0.31 |
| Minimum Focus Distance: | 0.7 at max. wide; 29.5 at max tele |
| Auto Focus: | Selectable Auto/Manual. Minimum Scene Illumination for Reliable Auto Focus, 30% video |
| Zoom & Focus Presets: | 64 preset positions (Note: recalling a preset position puts camera into manual focus mode) |
| Long Term Integration Range: | Provides manual selection of integration duration for enhanced sensitivity. Integration times are 1/4 second, 1/8 second, 1/15 second, 1/30 second. Frame Store video output provides continuous video output, updated at the integration rate. |
| Signal to noise ratio | 56 dB (HPF: 200 kHz; LPF: 6 MHz; Weighted, Minimum Camera Gain, Lens Capped) |
| Synchronization | Internal Crystal sync or line lock |
| Video output level | 1.0 V p-p (75 Ω composite), unbalanced, NTSC |
| Gain control | Automatic |
| Automatic white balance: | Required |

The Contractor shall provide the camera with a suitable power supply that operates with an AC input voltage.

The camera shall have automatic gain control (AGC) from 0 to 16 dB in order to be able to handle the range of lighting extremes from very low light night scenes to full sunlight conditions. If the AGC control is switchable, the Contractor shall set the AGC to the "on" position.

The camera shall be equipped with an electronic shutter with adjustable speeds. Manual Shutter: Selectable shutter speeds of 1/60, 1/100; 1/250; 1/500; 1/1,000; 1/2,000; 1/4,000; 1/10,000 second. Auto Shutter: Automatically controls shutter speed between 1/60 and 1/10,000 second to maintain correct video level output. Auto Iris: Iris automatically adjusts to compensate for changes in scene illumination to maintain constant video level output within sensitivity specifications. Manual Iris: In the manual iris mode the iris opens and closes in steps.

The Contractor shall set the shutter speed of the camera at 1/60th of a second.

**Physical Specifications.--**The following are the physical specifications for the camera:

| | |
|---|---|
| Lens mount | C type |
| Camera mount | 6 mm - 20 UNC (minimum of two located on bottom) |
| Maximum weight | 0.73 kg without lens |
| Maximum dimensions | 70 mm (H) x 70 mm (W) x 216 mm (D) (body) |

**Environmental Specifications.--**The following are the environmental specifications for the camera:

| | |
|---|---|
| Operating temperature | 10°C to 50°C |
| Storage temperature | -40°C to 60°C |
| Operating humidity | 20 to 80% non-condensing |
| Storage humidity | 20 to 90% non-condensing |

**Shock and Vibration Specifications.--**The following are the shock and vibration specifications for the camera:

| | |
|---|---|
| Shock | 15 g |
| Vibration | 5-60 Hz with 2.0 mm total excursion, and 5 g rms vibration from 60-1000 Hz. |

The CCTV camera shall not incur any physical damage after a shock, return to normal operation immediately and operate within the specified vibration.

**Installation.--**The Contractor shall install and fully adjust the camera with the associated lens, power supplies, housings, and all necessary cabling, etc., to make the assembly completely operational.

The Contractor shall firmly attach the camera to the housing enclosure. The Contractor shall exercise care to tighten the camera mount within the torque limits specified by the camera manufacturer.

The Contractor shall properly terminate all of the electrical cables to the camera and firmly attach them.

The Contractor shall dress and secure the electrical cables inside the housing and cabinet so that they do not interfere with the closing of the cabinet, with the fan or with any other moving part.

The camera shall be mounted in the housing within 6 mm of the optical window. This distance is measured with the lens attached and adjusted to its maximum physical length.

The Contractor shall mount the camera in the housing enclosure such that the lens is centered in the optical window.

The Contractor shall adjust the back-focus adjustment on the camera such that the lens focus is properly set and maintained over the zoom range. This adjustment shall be made such that when the zoom is adjusted from long range (telephoto) to wide angle that no refocusing is necessary.

The Contractor shall provide five copies of the operation and maintenance manuals for the camera.

**Closed circuit television camera lens.--**The CCTV camera lens shall work properly in conjunction with the camera as well as all of the other video system components. It shall operate reliably and produce clear images when properly adjusted and meet the following specifications.

The CCTV camera lens shall be an integral component of the specified camera. The lens shall be factory assembled, back-focused, and adjusted during manufacturing of the camera. Separate camera and lens combinations shall not be accepted. The lens shall provide an adjustable focal range of 22X, 3.9 mm to 85.8 mm @ minimum F1.6. The camera lens shall provide auto iris with manual iris over-ride capabilities.

**Performance.--**The following are the performance specifications for the lens:

| | |
|---|---|
| Format | 13 mm, minimum |
| Mount | C |
| Zoom magnification range | 10:1 |
| Zoom focal length range | 7.5 mm to 75 mm, or 8 mm to 80 mm |
| Aperture range | F1.2 to F560, minimum |
| Iris type | Motorized iris |

**Electrical Specifications.--**The following are the electrical specifications for the lens:

| | |
|---|---|
| Operating voltage | ±12 V(dc) |
| Iris position without power | Closed |

When the camera is pointed at a very bright object and/or when the camera and lens is first turned on, the image produced by the lens and camera combination should not optically "oscillate" (i.e., produce an image that alternates from too light to too dark) or otherwise be unstable. The lens and camera combination should react to temporary overload situations (such as described above) in a smooth and rapid fashion and with minimum overshoot.

The motorized-iris cable shall be strain relieved or sufficiently rugged such that the cable will not fail at the point where it leaves the lens assembly.

**Optical Specifications.--**The following are the optical specifications for the lens:

When the power is removed from the lens, the lens iris shall automatically close.

The lens shall incorporate an integral variable-density filter.

The lens shall include mechanical and/or electrical means to protect the motors from over running in the extreme position.

**Environmental Specifications.--**The following are the environmental specifications for the lens:

| | |
|---|---|
| Operating temperature | –10°C to +50°C (min. range). |
| Storage temperature | –40°C to 60°C |
| Operating humidity | 20 to 80% non-condensing |
| Storage humidity | 20 to 90% non-condensing |

**Shock/Vibration Specifications.--**The following are the shock and vibration specifications for the lens:

The lens shall be constructed such that it is able to withstand the vibration that it will be subjected to when mounted in the camera housing in all locations specified.

The auto-iris function shall not be affected by normal vibration.

The focus and zoom mechanism shall not be affected by normal vibration.

The lens shall be constructed such that it is able to withstand the shock that occurs during shipment and normal installation.

**Presets.--**The lens shall be supplied with zoom and focus preset position.

**Installation.--**The Contractor shall adjust the back-focus adjustment on the camera such that the lens focus is properly set and maintained when adjusting the focal length from zoom to wide angle. The Contractor shall make this adjustment with the lens iris at full open position. This adjustment shall be made such that when the zoom is adjusted from long range (telephoto) to wide angle, no refocusing is necessary.

The Contractor shall properly terminate the motorized iris electrical cable and connect it between the lens and the camera body.

The Contractor shall provide operation and maintenance manuals for the lens as described under "System Testing and Documentation" elsewhere in these special provisions.

**Camera housing.--**The camera housing shall house the camera and CCTV camera lens. It shall protect the camera and CCTV camera lens from rain, dust, wind and other elements. It shall offer ease of accessibility for maintenance, have a sufficiently large interior dimension to house the camera and lens, offer a means of securing the camera and lens and allow for entry of required cables to make an operational system. The camera housing shall be mounted to the pan and tilt unit specified elsewhere in these special provisions.

The contractor shall furnish and install a corrosion resistant and tamperproof sealed and pressurized housing with five pounds psi dry nitrogen with Schraeder purge fitting and 137.9K Pascals relief valve for each camera. The size of the housing shall be 90 mm diameter or smaller.

The camera housing shall include a loss of pressure sensor that will trigger an alarm message which will be inserted in the video output signal.

The camera/lens/housing shall be assembled, tested and configured only by the camera manufacturer at the camera manufacturer facility. The camera shall have been adjusted for color balance and lens tracking/focus, and all configurable items shall have been properly set per specifications. Each camera/lens/housing delivered to the project site shall be accompanied with a written certification of assembly and configuration from the camera manufacturer. This certification

shall serve as the manufacturer documentation that the assembly and configuration of the camera/lens/housing equipment were performed. A sample certification document shall be furnished as part of the materials submittal data.

The enclosure shall be constructed from 6061-T6 standard aluminum tubing with a wall thickness of 5 mm ±2 mm. Internal components shall be mounted to a rail assembly. A copper plated spring-steel ring shall be used to ensure electrical bonding of the rail assembly and components to the camera housing. The housing exterior shall be finished by pre-treatment with a conversion coating and baked enamel paint.

The camera enclosure shall be designed to withstand the effects of sand, dust, and hose-directed water. All connections shall be watertight.

A gas-tight connector shall be used at the rear plate of the housing. Wiring to the connector shall be sealed with silicon or potting compound.

The internal humidity of the housing shall be less than 10 percent, when sealed and pressurized. Desiccant packs shall be securely placed inside the housing to absorb any residual moisture and maintain internal humidity at 10 percent or less.

The viewing window shall be constructed in such a way that unrestricted camera views can be obtained at all camera and lens positions.

A sun shield shall be provided to shield the entire housing from direct sunlight. It shall be constructed in such a way as to allow the free passage of air between the housing and the shield, but shall not form a sail to place an excessive load on the pan/tilt unit in high winds.

Each housing shall be provided with an internal 115 V(ac), 5 W low temperature heater with its own thermostat control.

**Mechanical specifications.--**

| | |
|---|---|
| Weight: | 1.9 kg |
| Length (less connectors): | 300 mm |
| Housing Diameter: | 90 mm |
| Height (Including mounting base) | 130 mm |
| Mounting: | 4 mounting 6.35 mm 20 UNC on enclosure bottom of base. Platform mount with adjustment fore & aft |
| Interior Dimensions | Suitable for camera, lens & wiring |
| Pressure valve | Schraeder type with pressure relief |

The housing shall protect the camera and lens assembly from dirt, rain and other adverse environmental conditions.

The housing shall be purge pressurized by the Contractor during installation. The pressure shall be between 48 kPa to 69 kPa (7 to 10 psi) and the pressurizing gas shall be dry nitrogen.

The interior of the housing unit shall provide an adjustable camera sled for mounting the camera and lens assembly.

If cameras of low centerline profile are used, then the contractor shall provide a means of elevating the camera for proper lens clearance. The Contractor shall position the lens in the center of the housing window.

The housing enclosure shall include a sun shield or shroud. The purpose of the sun shroud shall be to protect the housing enclosure from the direct rays of the sun and to reduce the internal temperatures of the enclosure by at least 10°F. The sun shroud shall be made specifically for the model of housing enclosure that is selected.

Contractor shall provide any adapter plates required to mount positioning system to pole.

**Shock/Vibration specifications.--**

| | |
|---|---|
| Shock | 15 g |
| Vibration | 5-60 Hz with 2.08 mm total excursion, and 5 gs rms vibration from 60-1000 Hz. |

The camera housing shall not incur any physical damage after a shock, return to normal operation immediately and operate within the specified vibration.

**Electrical specifications.--**

| | |
|---|---|
| Power requirements | 120 V(ac) ± 15%, 60 Hz ± 5% |
| Power consumption | Less than 170 W |

| | |
|---|---|
| Heater Operation | Thermostatically controlled turn-on for internal temp < 4°C. |
| Elect. Connector | Single sealed multi-pin for all video, power and control cabling |

**Environmental specifications.--**

| | |
|---|---|
| Ambient Temperature Limits (Operating): | -40°C to 60°C (-40°F to 140°F) |
| Ambient Temperature Limits (Storage): | -30°C to 70°C (-22°F to 157°F) |
| Humidity: | Up to 100% relative humidity (per MIL-E-5400T, paragraph 3.2.24.4) |
| Other: | Withstands exposure to sand, dust, fungus, and salt atmosphere per MIL-E-5400T, paragraph 3.2.24.7, 3.2.24.8, and 3.2.24.9. |

**Installation.--**Upon completion of the installation by the Contractor, the Engineer shall verify proper installation of the housing and camera/lens assembly.

**Pan and tilt unit.--** The pan and tilt unit will consist of the pan and tilt unit itself along with any electrical or communication interfaces required to perform the functions specified. The pan and tilt unit shall operate reliably over extended periods of time with little or no maintenance, be environment and weather-resistant under a full range of environmental conditions, and provide repeatable day-to-day operation. The pan and tilt unit will be compatible with the COHU 3855-1000/PED series, or equal, and as approved in writing by the Engineer.

**Performance.--**The pan and tilt unit shall meet the following performance specifications:

| | |
|---|---|
| Load Rating | Greater than 36.3 kgs |
| Braking: Pan and Tilt | Mechanical or Electrical to limit coasting |
| Overload Protection | Motors: Impedance protected |
| Construction | Corrosion resistant steel or aluminum |
| Angular Travel | Pan: At least 350 degrees<br>Tilt: At least +30 degrees to -90 degrees |
| Motor Reversal | Instantaneous |

The pan and tilt unit with camera assembly mounted shall be able to withstand a wind load of 145 km/h.

**Electrical specifications.--**The pan and tilt unit shall meet the following specifications:

| | |
|---|---|
| Power requirements | 120 V(ac) ± 15%, 60 Hz ± 5% |
| Power consumption | less than 100 W |
| Duty cycle | Pan: continuous<br>Tilt: intermittent |
| Pan/Tilt position preset | Enables preset position to a predetermined Azimuth, elevation and lens position |
| Motor type | High Speed Stepper |
| Variable speed | Motor Technology |

**Physical specifications.--**The pan and tilt unit shall meet the following physical specifications:

| | |
|---|---|
| Size | Less than 406 mm H x 356 mm W x 203 mm D |
| Weight | Less than 25 kg |
| | |
| Pan Speed | Greater than or equal to 6 degrees/second |

| | |
|---|---|
| Tilt Speed | Greater than or equal to 3 degrees/second |
| Gears | Hardened steel |
| Mounting (Base) | 178 mm + 3 mm |
| Camera Mount | Compatible with camera housing |
| Bearings on Rotating Surfaces | Heavy duty roller type |
| Overload Protection | Provided - internal |

**Shock/Vibration specifications.--**The pan and tilt unit shall meet the following vibration specifications:

| | |
|---|---|
| Shock | 15g |
| Vibration | 5-60 Hz with 2.08 mm total excursion, and 5 gs rms vibration from 60-1000 Hz |

The pan and tilt unit shall not incur any physical damage after a shock, shall return to normal operation immediately and shall operate within the specified vibration.

**Environmental specifications.--**The pan and tilt unit shall meet the following environmental specifications:

| | |
|---|---|
| Operating temperature | -23˚C to + 60˚C |
| Finish | Weather resistant paint or polyurethane |
| Seals | "O" ring or gaskets for all weather protection of Pan and Tilt Unit and cables. |

**Pan and tilt stops.--**The pan and tilt unit shall have pan and tilt stops. The setting shall be determined by the Engineer. Pan and tilt stops shall have both mechanical and electrical stops.

**Installation.--**The Engineer will notify the Contractor of the pan and tilt stops for the pan and tilt unit for the Contractor to set, prior to installation check. Installation check shall be done by the Contractor in the presence of the Engineer. The operation of the pan and tilt unit will be performed at the Type 334-TV cabinet adjacent to the camera pole where the camera is mounted. The Contractor shall furnish a color video monitor, for testing only, to view the actual camera image. The Engineer shall direct adjustments for pan and tilt presets and pan and tilt stops, to be made by the Contractor. Upon completion of the installation, the Engineer shall verify operation of the pan and tilt unit.

### 10-3.32 RELOCATE CLOSED CIRCUIT TELEVISION CAMERA (LOCATION P0266)

Relocate closed circuit television (CCTV) camera at location PO226 shall consist of relocating existing camera assembly, including camera pole, camera lens, camera housing, DSP color video camera unit, pan and tilt unit, and relocating existing Type 334-TV cabinet, including camera control receiver, modem and video transmitter, as shown on the plans, and as directed by the Engineer.

### 10-3.33 VIDEO NODE (LOCATION P0247)

Video node location PO247 shall consist of Type 334-TV cabinet, video multiplexer, video transmitter, video receivers, fiber distribution units and other equipment housed in Type 334-TV cabinet, on a new Type 334 cabinet foundation, connecting conduits, wires, cables, and incidentals required to make the video node fully operational, as shown on the plans and as directed by the Engineer.

#### VIDEO MULTIPLEXER AND DEMULTIPLEXER

The video multiplexer shall consist of FM (Frequency Modulation) video modulators, a RF (Radio Frequency) combiner and splitter, and a singlemode fiber optic transmitter. The demultiplexer shall consist of FM video demodulators, RF splitter, and a fiber optic receiver. The video multiplexer and demultiplexer shall be connected by singlemode optical fiber to form video link. A video link shall provide point-to-point transmission of at least 16 full motion, NTSC baseband video signals.

The video multiplexer and demultiplexer shall mount in an EIA 482 mm equipment rack, either as separately mountable sub-units or as a card cage. The equipment shall include all necessary hardware mounting and adapters. The video multiplexer and the demultiplexer, including power supply, shall each occupy no more than 445-mm of rack space and shall be fully configured for not less than 16 video channels as shown on plans. A single video card shall be installed for each video channel. The single video cards shall be interchangeable, or directly swapped with one another, without the need of

any network management software.

Each system component described below shall be mounted on one or more PC boards. In addition, one PC board may support two or more functional components or the partial function of a component with the exception of the power supply, which shall be mounted on a separate PC board or boards. All electronic components shall be mounted on PC boards. The PC boards shall be easily replaceable without requiring special tools.

All specifications for the video multiplexer and demultiplexer equipment shall be met over an operating temperature range from 0°C to 50°C. The power supply for the video multiplexer and demultiplexer equipment shall be powered from a 120 V(ac), 60 Hz power receptacle located in the Type 334-TV cabinet as shown on the plans.

**FM Video Modulator.--**The FM video modulator shall accept any NTSC baseband video signal and convert it to a frequency-modulated electrical signal suitable for mixing or combining with other electrical signals to produce a composite broadband signal to the optical transmitter. The video modulator shall be capable of modulating the input video signal using an FM scheme, onto any one of 16 frequencies in the range of 50 to 550 MHz. The output frequency of the modulator shall be remotely selectable.

Each modulator shall consist of either plug-in modules that fit into the multiplexer card cage or 482 mm rack mountable units. The video inputs to the modulator shall be nickel plated, female BNC connectors with a gold plated contact. The nominal input impedance shall be 75 Ω and the return loss shall be at least 30 dB. Each modulator shall operate as specified with a 0.7 V to 1.4 V peak-to-peak composite input video signal. The modulator shall continue to operate satisfactorily with an input level of 0.5 V to 2.0 V.

After selection of the appropriate output frequency, any video modulator shall be interchangeable with any other video modulator in the subsystem. A female BNC bulkhead connector of the same design as the video input connector, or a female F bulkhead connector shall be installed at the rear of the module to deliver the modulated signal output. Either type of connector shall be designed to interface with 75 Ω coaxial cable.

Test points shall be provided on the front panel of the video modulator to allow in-service measurement of relevant signals without causing any disturbances in the output of the video modulator. Indicators shall be provided on the front panel of the video modulator to allow operator verification of the correct performance of the video modulator.

**RF Combiner and Splitter.--** The RF combiner and splitter shall be capable of combining the outputs of 16 video modulators. It shall operate over the frequency range of 5 to 600 MHz. In addition, it shall provide attenuation of each input that is uniform across all inputs within ±1 dB. The RF combiner and splitter shall provide a high degree of isolation between each input with the worst case isolation being 30 dB at 550 MHz.

The RF combiner and splitter shall provide a return loss of greater than 20 dB at all taps. It shall have an input and output impedance of 75 Ω and shall be constructed with female F bulkhead connectors. All unused RF combiner and splitter inputs and outputs shall be terminated with 75 Ω resistive loads.

**Fiber Optic Transmitter.--**The fiber optic transmitter shall accept the output from the RF combiner and splitter in the configuration of various video modulators in quantities as shown in the plans. The bandwidth of the input of the fiber optic transmitter shall be 5 to 550 MHz. The fiber optic transmitter shall use a laser with center wavelength of 1300 nm to 1330 nm at 24°C, with the spectral width not to exceed 10 nm. The laser shall operate at 1310 nm and shall provide an optical launch power of 0 dBm. The combined electrical signal from the modulators shall modulate the laser and be coupled into a singlemode optical fiber. The transmitter launch power shall be defined as the power launched by the laser into one meter of step-index optical fiber having a mode field diameter of 10 µm. The transmitter launch power shall be at least 20 dB greater than the receiver sensitivity and greater than –8 dBm.

A female BNC bulkhead connector shall be installed at the rear of the module to accept the input signal from the RF combiner and splitter. Either type of RF connector shall be designed to interface with 75 Ω coaxial cable. The fiber optic transmitter shall use a ST style compatible connector and be compatible with the fiber optic cable Type ST connector mating connector on the fiber optic cable specified in these special provisions.

Test points shall be provided on the front panel of the fiber optic transmitter to allow in-service measurement of relevant signals without causing any disturbances in the output of the fiber optic transmitter.

Indicators shall be provided on the front panel of the video modulator to allow operator verification of the correct performance of the fiber optic transmitter. The video transmitter shall be capable of interfacing with and operating over fiber optic cable as specified elsewhere in these special provisions.

**Fiber Optic Receiver.--** The fiber optic receiver shall receive the optical signal launched into a singlemode optical fiber by the transmitter and output an electrical signal suitable for splitting and demodulating. The fiber optic receiver shall employ an avalanche photo diode (APD) as the input-sensing device. The receiver shall be designed to operate in accordance with the above indicated special provisions with an optical input power range of –8 dBm to –20 dBm. The fiber

optic receiver shall provide sufficient RF output power to directly drive, or feed a wide band RF line amplifier to drive, a minimum of 16 video demodulators to at least middle range of the demodulators required input power levels. The input power level to any of the video demodulators shall not be effected by loading changes to the other video demodulators feed by the fiber optic receiver.

The fiber optic receiver shall be equipped with an AGC system that shall maintain an RF signal output level consistent with the requirements of the video demodulator under varying optical power input conditions. A front panel control shall be provided to allow operator override and adjustment of the AGC system within ±5 dB of the nominal output level.

The fiber optic receiver shall be compatible with the fiber optic cable specified in these special provisions. The fiber optic receiver shall be equipped with a Type ST connector compatible with the mating connector on the fiber optic cable. A female BNC bulkhead connector shall be installed at the rear of the module to deliver the output signal. Either type of connector shall be designed to interface with 75 Ω coaxial cable.

Test points shall be provided on the front panel of the fiber optic receiver to allow in-service measurement of relevant signals without causing any disturbances in the output of the fiber optic receiver.

Indicators shall be provided on the front panel of the fiber optic receiver to allow operator verification of the correct performance of the fiber optic receiver.

**Video Demodulator.--**The video demodulators shall consist of either plug-in modules that fit into the demultiplexer card cage or 482 mm rack mountable units. The demodulators shall convert the RF signal output of the fiber optic receiver, with a bandwidth of 50 to 550 MHz, to an electrical baseband NTSC video signals.

The video demodulator shall be capable of demodulating any one of 16 frequencies in the range of 50 to 550 MHz comprising the input RF signal. The frequency to be demodulated shall be selectable by the operator. The video demodulator shall provide as an output one baseband video signal as specified by the RS-170 Standard. After selection of the appropriate frequency, any video demodulator shall be interchangeable with any other video demodulator in the subsystem.

A female BNC bulkhead connector shall be installed at the rear of the video demodulator to accept the RF input signal. The connector shall be designed to interface with 75 Ω cable. A female BNC bulkhead connector shall be installed at the rear of the video modulator to deliver the output video signal. The female BNC connector shall be nickel plated except for the center contact which shall be gold plated. The female BNC bulkhead connector shall be designed to interface with a 75 Ω coaxial cable.

Test points shall be provided on the front panel of the video demodulator to allow in-service measurement of relevant signals without causing any disturbances in the output of the video demodulator.

Indicators shall be provided on the front panel of the video demodulator to allow operator verification of the correct performance of the video demodulator.

**Rack Frame and Power Supply.--**The rack frame and power supply shall contain all of the various modules of the video multiplexer and video demultiplexer. The rack frame and power supply shall provide power to all of the modules contained therein and shall operate from input power supply of 120 V(ac) ±15 percent, 60 Hz ±5 percent. The rack frame and power supply shall be suitable for installation in an EIA standard 482-mm equipment rack.

Modules not designed to be contained in the rack frame and power supply shall be suitable for installation directly into an EIA standard 482-mm equipment rack and shall be powered directly from a power supply of 120 V(ac) ±15 percent, 60 Hz ±5 percent.

**Fiber optic Attenuator.--**The fiber optic attenuator shall be suitable for installation at the receiver end of the optical signal path. The value of each fiber optic attenuator shall be such that, for each optical signal path into which a fiber optic attenuator is inserted, the optical power level delivered to the respective fiber optic receiver is at least three dBm above the minimum level required and does not exceed the maximum level acceptable by the fiber optic receiver. Fiber optic attenuators shall be provided if the saturation level of the receiver minus the received signal level is greater than one dB.

**Installation.--**All components of the video multiplexer and demultiplexer shall be installed at the locations and in the quantities as shown in the plans. Installation shall include all required interface cable types as specified in these special provisions. All blank module slots in rack frame and power supply assemblies shall be filled with a plate of similar construction and finish consistent with those of the modules. The filler plate shall be field removable without requiring special tooling or any disassembly of the system. The system shall provide the ability to remove and replace any module in the system without requiring that the power supply be turned off and without disturbing the operation of any other modules in the same rack frame and power supply assembly. All modules shall be labeled on the front panel to identify the video signal or fiber passing through the module. The labeling technique shall be such that all labels are neat and legible and shall be removable and replaceable to allow for substitution of modules in the event of failure.

**Testing.--**The Contractor shall test all modules and components prior to installation in accordance with the manufacturer's test procedures in the presence of the Engineer and shall furnish documentation demonstrating the compliance of all modules of these special provisions.

**RS232 PORT EXPANDER.**

The RS232 Port expander shall operate with any combination of 8 DTEs or DCES, and for synchronous or asynchronous up to 19.2 kbps.

The RS232 Port expander shall unit shall feature:

RTS/DCD or data contention.
DCE/DTE switch for main and each sub-channel.
Automatic disabling of sub-channel in event of streaming.
Individual sub-channel manual disable switches.
Internal or external clocks.
1U height for minimal rack space.
Cascadeability.

The RS232 port expander shall be able to enable up to 8modems or terminals to share a master modem (RS232 port expander), a multiplexer or a computer port in a multi point environment. It shall operate at seven selectable data rates up to 19.2 kbps, synchronously or asynchronously.

The RS232 port expander shall feature or be able to:

Support for three clocks.
Internal.
External from the main channel.
External from DCE connected to sub-channel 1.
Power supply of –48 V DC (default 115 / 230 VAC switchable).
Buffer that shall be able to switch-select for equipment which must provide clock to multiple sub-channels.

Information shall be broadcasted by the main channel to all sub-channels in parallel. Sub-channel shall transmit to the main channel by activating RTS/DCD or by data transition. If the RTS/DCD or data of a sub-channel is active, the sub-channel's transmit data and or control signals shall connect to the main channel. When RTS/DCD drops or data transmission ceases, the control circuitry shall switch to monitor or other channels.

A sub-channel shall disconnect after it drops RTS/DCD or transmits 16 idle bits.

In the event of streaming a sub-channel shall be able to be disabled by automatic circuitry if it remains active for a preset time. The automatic disable shall reset whenever the sub-channel RTS/DCD drops, or 16 idle bits are transmitted (data contention). Front panel indication shall be provided for each sub-channel disabled by automatic circuitry.

The sub-channel shall be manually disabled from the front panel as an alternative.

RS232 port expander shall be mountable on a standard 480 mm rack and shall be compatible with the RAD RSD-10 Digital Sharing Device.

## 10-3.34 HIGHWAY ADVISORY RADIO SYSTEM

**Description.--**The highway advisory radio (HAR) system shall consist of AM broadcast band radio equipment for a fixed location.

The outside of each equipment packing container shall be marked with the Caltrans contract number and the make, model number, serial number, and installed operating frequencies of the unit within.

Test methods followed by the State for evaluation of supplied equipment will follow EIA recommendations where applicable.

Prototype equipment is not acceptable. Only equipment previously manufactured and sold for at least 6 months prior to the advertising date will be acceptable.

Any semiconductor devices or components utilized in the radio equipment which are not available from a minimum of two manufacturers shall have five such devices or components provided for each device utilized in the radio equipment.

All manuals, warranties, and licenses shall be submitted with the unit(s) for acceptance.

All equipment shall be warranted against defects and any failures which may occur through normal use for one year from the date the equipment is placed in service.

Proper contact protection shall be placed at all high voltage connections to prevent accidental contact with operators and operator's tools and equipment.

The HAR system may consist of equipment from multiple manufacturers but shall be integrated to be fully functional.

The HAR system shall be designed to operate in conformance with CFR Title 47, Section 90.242 of the FCC rules and regulations.

Enclosures for all radio, electrical, and mechanical equipment shall be designed to be card rack mounted inside a Type 334-TV cabinet enclosure as specified in these special provisions. Card rack mountable equipment shall be provided with slotted mounting holes and shall be compatible with an EIA-310-D rack.

The equipment shall be designed and installed in such a way as to be easily accessible for maintenance.

**Transmitters.--**The transmitters shall be the type accepted or type approved for travelers information stations (TIS) service and shall operate in a range of from 530 kHz to 1710 kHz.

Each transmitter shall have the capability of remote and local control. The ability to broadcast live messages from the transmitter site and the ability to record and broadcast from the Transportation Management Center (TMC) shall be provided.

Adjustment of RF power output shall be made by using an easily accessible control and shall be continuously adjustable over the transmitter output power range specified herein.

Built-in, switchable meters shall indicate relative percentage of modulation and forward and reflected RF output power levels.

A provision for automatic station identification using stored, digitized audio shall be provided every 30 minutes while transmitting.

Operating temperature range shall be from -30˚C. to 60˚C. Operating humidity range shall be from 20 percent relative at 30˚C. to 95 percent relative at 50˚C.

The HAR shall deliver a 2 mV per meter signal, minimum, at a distance of 1.5 km (0.93 miles) from the transmitter antenna with a maximum transmitter output of 10 watts.

The transmitter shall withstand an overload mismatched output (including an open or short circuit) for a period of 5 minutes at 10 watts output without overheating or component failure. The transmitter shall automatically resume normal operation when the mismatched output load is removed.

The transmitter RF power output level shall be rated at 30 watts, maximum. The transmitter output level shall be adjusted from a minimum of 2 watts to no more than 12 watts. A warning label shall be securely attached to the transmitter next to the adjacent output control and shall read as follows, "DO NOT EXCEED 10 WATTS".

The transmitter shall be equipped with a high stability oven controlled crystal oscillator. The oscillator shall be of the stress compensated (SC) cut crystal type and meet the following specifications:

| Oscillator | |
|---|---|
| Temperature: | $+5x10^{-8}$over -24°C. to 70°C. |
| Aging: | $5x10^{-10}$/day, $1x10^{-7}$/year |
| Frequency vs. supply: | $2x10^{-9}$/percent |
| Short-term: (Allan Variance) | $1x10^{-11}$/second |
| Warm-up @25°C: (Relative to 2 hours after turn-on following 24 off) | $1x10^{-7}$ in 7 minutes<br>$3x10^{-8}$ in 10 minutes |
| Output: | >$0.5V^{RMS}$ into 50 ohms(7 dBm) |
| Harmonics/subs: | -20 dBc (for sine out) |
| ssb Noise/Hz (Typical, degrades 6 dB per octave above 12 MHz): | -115 dBc at 10 Hz<br>-148 dBc at 10 kHz |
| Supply: | 12 V(dc) + 5% |
| Input power: | <3.5 watt at turn-on years<br><1.7 watt stabilized at 25°C. |
| Frequency Adjust: (Mechanical) | Range for 10 years aging, settable to $5x10^{-9}$ nominal |
| Electrical tuning: | Not included |
| Size: | 51 mm x 51 mm x 25.4 mm |
| Base: | Pins for PC Mounting |

**Transmitter Station.--**The transmitter station shall include the amplitude modulation (AM) transmitter and antenna system, digital recorder system, lightning protection, controls, dual tone multi-frequency (DTMF) telephone handset, back-

up system, conduit, wiring and other hardware required for proper operation. The transmitter station shall be housed in a Model 334 cabinet enclosure.

**Coupler Unit.--**The coupling unit shall:

a) isolate the transmitter from high voltage through the use of high-pass capacitors and fuses.
b) compensate for antenna system impedance mismatch through the use of multi-tap toroidal transformers.
c) include an internal voltage standing wave ratio (VSWR) meter and include controls for correcting load impedance and reactance.

**HAR power and back-up equipment.--**Equipment necessary for operation and backup of the HAR shall be included as part of the system and shall conform to the following:

**Primary Power Input Provisions.--**Operation shall be from 117+10 percent V(ac), 60 +3Hz single phase, at a power input not to exceed 100 watts, continuous.

The primary input power shall be controlled by a circuit breaker mounted on the front panel labeled "AC POWER".

An AC power light indicator shall be provided on the front panel.

**Main Power Back-up.--**In the event of AC power loss, the HAR system shall automatically switch to a battery back-up system and continue to operate without degradation of performance for a period of not less than 12 hours.

The battery back-up system shall utilize a battery charger and gel cell batteries. The battery back-up system shall maintain the batteries without overcharging. The batteries shall not emit any corrosive, toxic or explosive gasses.

The HAR system shall resume normal operation after AC power has been restored.

Indicator lights shall be provided to show when the unit is operating on AC power, or when it is operating on battery back-up. A voltmeter shall show the condition of the battery back-up system.

A front panel switch labeled "DC POWER" shall activate DC operation for the HAR system.

Fuse protection shall be provided on the battery charger and on the front panel for DC load.

The battery charger shall be designed for floating service and have an adjustable output voltage. The battery charger shall be the complete shut off type (fully automatic) and shall bring completely discharged batteries to a fully charged condition within 12 hours. The battery charger shall be designed to operate in unventilated area.

When the HAR is operating on battery back-up, the system shall automatically disconnect the HAR, to protect the batteries from damage caused by too deep a discharge. The disconnect threshold shall be adjustable over the range of either 20.0 to 24.0 V(dc) for a 24 V system or 10 to 12 V(dc) for a 12 V system.

The batteries shall not discharge to less than 10 V(dc) for a 12 V system, or 20 V(dc) for a 24-V system, when supplying 4.0 amperes for a period of 30 hours at 30˚C. They shall be organized as a group of two 12 V batteries and mounted on a wooden frame at the bottom of the controller cabinet enclosure.

The batteries shall be easily accessible and removable from the cabinet for service or replacement using connectors that do not require the use of hand tools. If 2 connectors are identical, and used for different purposes, they shall be clearly marked or polarized differently to ensure proper installation after repair or replacement of component parts. When the battery back-up system is disconnected from the cabinet, the station shall be capable of continued operation solely on AC power without having to connect, jump, or bypass any other device. Only relay, contact, and switch type devices shall be used to make a clean procedure of removal.

**HAR operation control equipment.--**Equipment necessary for local and remote control of the HAR operations shall be included as part of the system and shall comply with the following:

**Local Control Facilities.--**Local operator control of all essential features of the highway advisory radio station shall be accomplished both by the use of a standard dual tone multi-frequency (DTMF) telephone and by necessary discrete front panel controls.

**Remote Control Facilities.--**A telephone line interface shall be provided (prior to cut-over) so that the HAR may be connected to and controlled through a voice-grade dial-up telephone line, leased telephone line, or cellular telephone line with appropriate interface. The telephone line interface shall have a standard RJ-11 connector.

The HAR Remote Control Facility shall be fully functional and operational when it is cut-over to the cable-based communications infrastructure. Remote access shall occur from the TMC to the HAR transmitter via the cable-based communications infrastructure.

The HAR shall be equipped with a telephone line interface so that it will be possible to access, monitor, and control the

message being transmitted. The audio for the monitor function shall be obtained by demodulating the transmitter audio.

**HAR message storage and management equipment.--**Equipment necessary for storage and management of messages shall be included as part of the HAR and shall comply with the following.

**Message Management.--**The HAR shall be able to receive a live or recorded message from a remote location via the cable-based communication infrastructure, cellular telephone line and from the operator at the station location. This feature shall not require the use of hand tools.

The message shall be stored in a solid-state recorder and player, with the ability for selecting and checking the message prior to transmission.

**Solid State Recorder and Player.--**Non-volatile solid-state memory shall be used for message storage. Magnetic media is not acceptable.

A DTMF decoder shall be provided for programming and control of the recorder using a standard DTMF telephone. This function shall be possible, both remotely, via the telephone line interface, and at the station location. The DTMF tones shall not be recorded on the message.

Memory storage capacity shall be provided for a minimum of 250 different messages, with a minimum of 860 seconds total recording time. The length of each message shall be continuously variable up to the total recording time available.

The recorder shall have the flexibility for messages to be selected and organized into a minimum of 20 different message play lists with a minimum total of 100 different messages contained within the 20 play lists.

An internal clock shall be provided to select and control message play-back by day, hour, and minute.

The system shall allow the recording of a message while another message is being broadcast.

Recording features shall include:

Monitor off-air RF output of transmitter.
Recording message.
Playback of recorded message.
Erasing of message.
Set time spacing between messages.
Set play list sequence.
Hear play list sequence.
Set recording source input (dynamic microphone, cassette player (auxiliary audio input), and control telephone).
Set recording speed.
Set background source materials message.
Set alternate audio source.
Set clock time and day of the week (clock time shall be in military time and day of week shall be from 1 to 7, where 1 is Sunday).
Set message schedules.
Hear message schedules.
Cancel message schedules.
Set play list number.
Hear play list number.
Cancel play list number.
Stop record.
Set remote record security code.

The functions of recording and editing shall be accessible remotely or locally.

The recorder shall be able to be configured in the message repeater mode using DTMF tones.

Frequency response shall be from 200 to 10,000 Hz.

**Memory Power and Back-up.--**The recorder shall operate on 24 V(dc)+5 percent at a total power consumption not to exceed 10 watts from the source. The recorder memory back-up shall operate on 8 to 24 V(dc).

In the event of AC power loss to the digital recorder, the memory power back-up shall automatically maintain messages in the memory for up to two weeks.

**HAR transient and lightening protection.--**The transient and lightning (T/L) protection shall be provided for the power line, telephone line, and antenna system.

The T/L protection for the power line shall provide as a minimum protection the following:

| | |
|---|---|
| Number of AC outlets | 5 |
| Turn-on voltage: | 200 V |
| Energy rating (minimum): IEEE 8/20 waveform | 700 joules |
| Peak Current (minimum) | 20,000 amperes |
| Stand-by current (maximum), for 60 Hz: | 1 mA |

The T/L protection for the telephone line shall provide as a minimum protection the following:

| | |
|---|---|
| Clamping voltage: | 200 V+ 10% |
| Energy rating (minimum) | 400 joules |
| Series resistance (max.): | 30 ohms |
| Response time (maximum): | 1 nanosecond |

The T/L (lightning arrestor) protection for the antenna system shall provide as a minimum protection the following:

| | |
|---|---|
| Clamping voltage: | 90 V + 10% |
| RF power (minimum): | 35 watts |
| Frequency range: | 500 kHz to 2 MHz |
| VSWR (maximum): | 1.2 to 1 |
| Insertion loss (maximum): | 0.2 dB |
| Surge current (minimum): IEEE 8/20 waveform | 17,000 amperes |
| Response time (maximum): | 5 nanosecond |

**Antenna.--**The antenna shall be a center-loaded vertical whip type with loading coil.

The antenna shall be mounted on a fiberglass pole as shown on the plans. The length of the antenna shall be tuned for the selected frequency and shall not be less than 3.05 meters and not more than 7.62 meters. The top of the antenna shall extend 14.93 meters above ground level.

The antenna shall be anodized aluminum with a tuning tip. The tip shall be adjustable for precise tuning and shall be made of stainless steel tubing Type 316, Heat 150907.

The antenna shall be the weather resistant type and shall operate within a temperature range of-40˚C. to 85˚C. It shall withstand wind velocities of 129 kilometers per hour without any discernible damage while remaining functional.

The maximum weight of the complete antenna including lower base, loading coil form, mid tip pipe and adjustable stainless steel tip shall not exceed 5.4 kilograms. The lower base of the antenna shall be aluminum Type 6063-T832 with No. 215 R1 gold anodized finish.

The loading coil shall be a continuous filament glass fabric. Epoxy G-11 and the coil shall be made of enameled close wound copper wire.

The antenna mounts shall be the "high impact thermoplastic split" type and shall provide 360-degree support to the antenna. All other mounting hardware shall be stainless steel or cadmium- plated.

Attention is directed to the requirements for fiberglass highway advisory radio (HAR) standard, elsewhere in these special provisions.

**Ground system.--**The ground system shall be the ground rod type as shown on the plans and described in these special provisions.

**12.2 Meter Ground Rod.--**The ground rod system shall consist of a 12.2 meter ground rod placed in a 152 mm minimum, vertically drilled hole. The hole shall be backfilled with bentonite slurry.

The ground rod shall be a UL listed ground electrode designed for the purpose. The Contractor shall provide the Engineer a certificate of compliance from the manufacturer in accordance with the provisions of Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for the ground rod and bentonite backfill material. The certificate of compliance shall be provided to the Engineer for approval, prior to ordering or shipping the material.

The ground rod shall be a 53.975-mm outside diameter hollow tube of Type K copper, with nominal 2.11-mm wall

thickness, 12.2 m in length. A rod formed from two 6.1-m sections and joined with an outside threaded copper coupler will be acceptable. The top end of the rod shall have a shop welded ground connection with a 4/0 gage, minimum, copper pigtail. The ends of the rod shall have press-on end caps.

The breather and weep holes on the top and bottom of the rod, as shown on the plans, shall be protected with tape until the installation of the rod. The Contractor shall remove the tapes and provide them to the Engineer before installation.

The drilled hole shall be backfilled with 100 percent bentonite clay slurry and consolidated around the rod. The bentonite slurry shall be placed in the presence of the Engineer. Two working days notice shall be provided to the Engineer prior to backfilling.

The bentonite backfill material shall be a natural volcanic, non-corrosive form of bentonite clay grout. The backfill material shall be capable of absorbing 53 liters of water per 22.68 kilograms to obtain an optimal 30-percent-solids density. The pH value shall be 8-10 with maximum resistivity of 3 ohms at 30 percent solids density.

The ground rod shall be connected to a surge arrestor ground lug. The ground wire splice to the pigtail shall be made by a UL listed exothermic (Cadweld, or similar) connection method. Soldering, brazing, or field welding will not be acceptable.

The ground rod shall be filled with non-hazardous Calsolyte to enhance grounding performance. The filler shall hygroscopically extract moisture from the air to activate the electrolytic process, improving ground performance. The ground rod system shall be 100 percent self-activating and maintenance free. No additions of chemicals or water solutions shall be required.

**Protective Pull Box.--**The protective pull box shall be made of reinforced concrete with lift holes and a vented cast iron grate cover to permit air circulation into the "breather" holes of the ground rod.

**HAR installation.--**HAR equipment shall be installed at the locations shown on the plans.

The installation shall be under the immediate supervision of a person holding a general class radio telephone operators license.

**Service manuals.--**The Contractor shall provide 2 service manuals which will contain the following described sections.

**Introduction.--**Each manual shall contain a general information section which shall include the following items:

A list of applicable sub-assemblies that comprise the specified equipment.
Overall description of the equipment design features, performance, and applications.
Equipment specifications summary.
Equipment installation instructions, if applicable.

**Theory of Operation Section.--**Each manual shall contain equipment theory of operation section which shall include the following items:

Theory of operation of the standard equipment, with unique or unusual circuitry described in detail.
Theory of operation reflecting any modifications to the standard equipment.

**Maintenance Section.--**Each manual shall contain an equipment maintenance section which shall include the following items:

Recommended test equipment and fixtures, or minimum operational and performance requirements for appropriate test equipment.
Troubleshooting information and charts.
Removal and installation procedures for replacing assemblies and subassemblies, if not obvious or if improper sequencing of steps may result in component damage.
Component level circuit schematics of each circuit board, assembly and sub-assembly units depicting waveforms, AC and DC voltage levels and recommended adjustments for peak equipment performance.

**Replacement Parts Section.--**Each manual shall contain an equipment replacement parts section which shall include a component parts list(s) including electrical parts, mechanical parts, and assemblies. All semiconductors shall be identified by the supplier's numbers and, as applicable, by JEDEC numbers.

**Diagram Section.--**Each manual shall contain an equipment diagram section which shall include the following items:

Schematic diagram(s) identifying all circuit components and showing normal test voltages and levels.
An overall functional block diagram.
Detailed interconnecting diagram(s) showing wiring between modules, circuit boards, and major components.
Pictorial circuit board layout diagram(s) showing both component placement and printed wiring detail.
Diagram(s) showing location of circuit boards and other subassemblies.
Exploded view diagram(s) of complex mechanical assemblies.

**Physical Requirements.--**Each manual shall conform to the following physical requirements:

All pages, including latest revisions, shall be securely fastened together between protective covers (loose-leaf ring binding is acceptable).
No page shall be subject to fading from exposure to any normal source of ambient lighting (ozalid reproduced pages are not acceptable).
The cover or first pages shall be marked in any manner to show the Caltrans Contract number and advertising and bid opening dates.

**Arrestor Enclosure.--**The arrestor enclosure shall be a NEMA Type 3R with hinged cover, with dimensions of 381 mm x 305 mm x 152 mm and shall have provisions for padlocking. A 102 mm x 102 mm x 3 mm and/or 203 mm x 102 mm x 3.2 mm aluminum plate shall be installed vertically, facing the door, in the enclosure. The Contractor shall terminate the ground conductor(s) with an aluminum-copper NEMA one and/or three bolt hold tongue. The ground conductor(s) and lightning arrestor shall be mounted on the aluminum plate.

**Antenna Coaxial Cable (ACC).--**Type ACC shall consist of an RG-8/U single foil single braid flexible coaxial cable with a bare copper center conductor, Cellular Polyethylene dielectric, 97 percent tinned copper braid, and 100 percent shield coverage and shall conform to the following requirements:

| Electrical Characteristics | |
|---|---|
| Capacitance | 26 pF/0.305 meters (nominal) |
| Impedance | 50 ohms (nominal) |
| Velocity of propagation | 78% (nominal) |
| DC loop resistance | 1.2 ohms per 0.305 meters (nominal) @20°C. |

| Attenuation at 20°C. | |
|---|---|
| Frequency (MHz) | Nominal dB/30.5 meters |
| 10.0 | 0.50 |
| 50.0 | 1.2 |
| 100.0 | 1.6 |
| 200.0 | 2.4 |

| Physical Dimensions | |
|---|---|
| | Nominal O.D. (mm) |
| Center conductor | 2.6 |
| Dielectric | 7.2 |
| Outer jacket | 10.3 |

| Electrical Characteristics | |
|---|---|
| Impedance: | 50 ohms (nominal) |
| Frequency range: | 0 -300 MHz |
| Voltage rating: | 500 V peak |

| Mechanical | |
|---|---|
| Mating: | Standard Size: 5/4-24 threaded coupling. Push-on mates with any standard size threaded receptacle. |
| Method of attachment: | Clamp and Crimp. |
| Composition: | Bodies-Brass or die cast zinc Contacts-brass, silver |

| | |
|---|---|
| | plated Insulators-TFC, copolymer of styrene, polystyrene, micafilled phenolic and/or, PBT polester or equal Plating-ASTRO plate and silver. Other metal parts-Brass. |

| Environmental | |
|---|---|
| Temperature | -55˚C to + 165˚C |
| Moisture | Weather resistant design. |

**Antenna feeding cable (AFC).--**The AFC shall consist of a No. 12 AWG solid copper conductor. The AFC shall have a length necessary to connect the lightning arrestor and the antenna without causing stress to the cable and shall be terminated with a UG plug and a reducing adapter as specified elsewhere in these special provisions.

After installing the AFC between the arrestor enclosure and the antenna, the Contractor shall seal the 38.1 mm nipple near the top of the fiberglass pole.

**Coaxial cable connectors (for Type ACC and AFC).--**Coaxial cable connectors for attaching Type ACC and AFC including the reducing adapter shall be UG Standard and meet the following requirements:

**Ground System Testing.--**The Contractor shall take certified measurements before and after the installation of the ground system.

The testing shall utilize an earth resistance meter and be conducted in accordance with IEEE Standard 3-point fall of potential methods.

The Contractor shall provide all test equipment and take and document resistivity measurements on the grounding system as specified elsewhere in these special provisions and submit them to the Engineer for approval.

**Cable Testing.--**The antenna coaxial cable (ACC) will be tested by the Engineer. Those cables found to have faults shall be replaced. The testing will utilize a time domain reflectometer.

A fault in a length of cable is defined as any of the following:

1. A return loss measurement indicating that there is a short in the cable.
2. A return loss measurement indicating a cut or open circuit in the cable.
3. A visual inspection which reveals exposure or damage to the cable shielding.

**HAR Testing.--**After all HAR equipment has been installed, the Contractor shall test the HAR.

Minimum test equipment required for testing the HAR shall consist of:

1. Dummy load, 50 ohms.
2. Power meter.
3. Communications monitor.
4. Field strength meter.

The Contractor shall tune the HAR with the impedance matching network of the coupling unit by adjusting the stainless steep tip of the antenna.

The HAR shall be considered tuned when the system's voltage standing wave ratio (VSWR) is at the lowest possible value as directed by the Engineer.

After the HAR has been tuned, the Contractor shall record and transmit a test message with the output power level of the transmitter set at approximate 10 watts or lower. Modulation shall be adjusted between 85 to 95 percent as specified by the FCC for the standard AM broadcast band.

The Contractor shall make actual on-the-air field strength measurements. A sufficient number of points shall be selected in order to determine the distance at which the attenuated field of 2 mV/m exists, as measured with a calibrated standard field strength meter. This may be done in a 5 to 8 radial directions facilitating a plot of a 2 mV/m at a distance of 1.5 km from the HAR antenna. If the measured field exceeds 2 mV/m at a distance of 1.5 km, the transmitter output power shall be decreased accordingly and if the measured field is less than 2 mV/m at the same distance then the power may be increased as directed by the Engineer. This test sequence shall be executed for both daytime operations and nighttime operations.

At the completion of all HAR testing, the Contractor shall submit a written report of all measurements to the Engineer for approval. The report shall include a map, with scale, showing a 2 mV/m contour based on the actual on-the-air field strength measurements. The VSWR, percent modulation, and transmitter output power measurements shall be tabulated.

## 10-3.35 INTERFACE TO TRAFFIC ELEMENTS

The communication system routing shall interface to traffic elements as shown on the plans. These elements are the traffic monitoring stations and ramp metering systems. The following equipment shall be supplied by the Contractor at each of the new traffic elements, including CCTV cameras:

FDU
FODM
Interface cable
Video transmitter for CCTV camera locations

**Interface cable.--**Interface cable shall consist of six No. 22, stranded tinned copper conductors. Each conductor shall be insulated with 0.25 mm, minimum nominal thickness, color polypropylene material. Conductors shall be twisted pairs. Each pair shall be wrapped with an aluminum polyester shield and shall have a No. 22 or larger, stranded, tinned copper drain wire inside the shielded pair.

The cable jacket shall be polyvinyl chloride, rated for a minimum of 300 V and 60°C, and shall have a nominal wall thickness of one mm, minimum.

The cable shall be one meter long with a connector for termination to the Model 170 controller and a DB25 male termination to the fiber optic data modem.

The connector at the Model 170 controller shall meet the following requirements:

| Amphenol or equivalent | |
|---|---|
| Part | Number |
| Shield | 201378-2 |
| Block | 201298-1 |
| Guide Pin | 200390-4 |
| Socket | 200389-4 |

The cable shall have the following pin configuration:

| Model 170 Controller | |
|---|---|
| Pin No. | Function |
| N | DC Ground |
| H | DCD |
| L | Rx Data |
| K | Tx Data |
| J | RTS |
| M | CTS |

Full compensation for interface to traffic elements shall be considered as included in the contract lump sum price paid for the items requiring interface to traffic elements and no additional compensation will be allowed therefor.

## 10-3.36 SYSTEM TESTING AND DOCUMENTATION

The system testing and documentation shall cover pre-installation testing, sub-system testing, fiber optic cable testing, video link testing, acceptance testing, physical inspection, functional testing, performance testing, final acceptance and system documentation that is required to validate the operational performance of the communications system and described elsewhere in these special provisions.

### SYSTEM TESTING

**Test Plan.--**The Contractor shall develop and submit within 60 working days to the Engineer an installation and test plan for approval, which details the method of installation and all testing for all material, equipment, and cable and the associated schedule of activities, based on these special provisions, plans, the manufacturer's recommended test procedures, and industry standard practices. Five copies of the test plan shall be submitted to the Engineer for approval. The Engineer will review then approves or disapproves the plan within four weeks. If the Engineer rejects the test plan the Contractor shall submit a revised test plan within 20 working days for review and approval by the Engineer. No testing shall be

performed until the Contractor's test plan has been approved by the Engineer. The tests shall demonstrate that the design and production of material and equipment meet the requirements of these special provisions and plans. All test results, including results of failed test or re-tests, shall be submitted and delivered to the Engineer and a copy placed with the equipment at the site. All test equipment shall be supplied by the Contractor.

The Contractor shall notify the Engineer of his intent to proceed with functional and sub-system testing 48 hours prior to commencement of each test. Full environmental conditions shall be tested as part of the functional tests for field equipment. Sub-system testing and inspections shall include visual inspection for damaged in correct installation, adjustments and alignment, and measurement of parameters and operating conditions.

**Pre-Installation Testing.--**Pre-installation testing shall include testing of all material, equipment and cable in a laboratory environment prior to delivery to the site. Use of laboratory facilities, including an environmental simulation chamber, shall be arranged by the Contractor. The tests shall either be conducted at the equipment manufacturer's premises or at a laboratory arranged by the Contractor.

All material, except test equipment and special tools, shall be bench tested in accordance with the following paragraphs, which include those items described elsewhere requiring pre-installation testing for each individual item where applicable.

All active equipment shall be connected to normal operating power, energized and subjected to normal operating conditions for a continuous period of time in the laboratory of not less than 48 hours.

Functional testing shall be performed by the manufacturer on all material prior to delivery to the site. The functional tests shall be performed in accordance with an approved test plan. Any material or equipment which fails to meet the requirements of the contract shall be repaired or replaced and the test shall be repeated until satisfactory. All functional test results, including results of failed tests or re-tests, shall be submitted and delivered with all material and equipment delivered to the site.

Full performance test shall be performed by the manufacturer or by the Contractor on not less than 5 percent or at least one unit of material selected at random from the normal production run. The full performance test shall be performed in accordance with a test plan developed by the Contractor and approved by the Engineer.

**Sub-system Testing.--**Sub-system testing shall encompass the testing of all material, equipment and cable after installation, but prior to acceptance tests. These tests shall be done in accordance with the performance testing called under each individual item in these special provisions.

Equipment and hardware shall be installed in accordance with the plans and special provisions. All material, equipment and cable shall be tested after installation at the site. Sub-system testing and inspections shall include visual inspection for damaged or incorrect installation, adjustments and alignment, and measurement of parameters and operating conditions. The Contractor shall notify the Engineer of his intent to proceed with sub-system testing 48 hours prior to commencement of each test.

Installation documentation and test results shall be provided for all material, equipment and cable prior to commencement of acceptance tests. Installation documentation shall be in accordance with these special provisions and shall include the following as appropriate:

Model, part number and serial number for all material and equipment.
Test equipment model number, serial number, settings, and date of last calibration.
All strap and switch settings.
Record of all adjustments and levels.
Alignment measurements.
Identification of interconnections.
All factory, laboratory and site test results.

**Fiber Optic Cable Testing.--**Attention is directed to "Fiber Optic Testing" elsewhere in these special provisions.

**Video Link Testing.--**The video link testing shall be conducted after the Contractor submits a test plan and receives approval from the Engineer, based on these special provisions, plans and the manufacture's recommended test procedures for the equipment involved. Measurements shall be made from the baseband- in to baseband-out connections. A video communications link shall include a video transmitter at the CCTV camera controller cabinet, a video receiver at the video node controller cabinet, interconnecting optical fiber, connectors and power supplies. The video link is to provide point-to-point transmission and reception of a full motion NTSC baseband video signal using an optical fiber as the transmission medium. Video system performance tests for any particular video link shall be performed after the associated camera has been installed and tested. Video link testing shall be conducted between each pair of a CCTV camera location and the associated video node, as shown on the plans and as directed by the Engineer.

Each video link in the communications system shall be tested with a video test signal at the video transmitter input. The Contractor shall perform all level adjustments and alignments required on the video link in order for it to operate in accordance with these special provisions. If any video link fails to meet the performance requirements, the Contractor shall take all steps necessary to restore the failed link to the required performance.

Each video link in the communications system shall be tested for qualitative performance with its associated camera turned on and connected to the BNC connector of the video link transmitter. The Contractor shall measure and record the received optical power at the optical connector of the video receiver from the video transmitter under test using a 90 percent APL (average picture level) flat field input to the transmitter. The Contractor shall measure, record and tabulate a video receiver's dynamic range at the optical connector of the video receiver from the video transmitter under test using a 90 percent APL (average picture level) flat field input to the video transmitter. To do this the measured optical attenuation of the fiber being used shall be increased to the point at which the video test set just begins to show a 3 dB degradation of the video signal to noise ratio in accordance with EIA 250 video test procedures. The optical receive power into the video receiver shall be measured and recorded. Then the optical attenuation shall be decreased until the video test set once again shows degradation of the video and registers errors. At no time shall the optical power into the receiver exceed the manufacturer's specified saturation level. The optical receive level shall once again be measured and recorded. These minimum and maximum receive levels define the video receiver's dynamic range and shall meet or exceed the specifications as specified elsewhere under these special provisions. This measurement shall be repeated for each video link. The video test set shall be approved by the Engineer. The Contractor shall measure and record the baseband video output level from the video receiver under test. This measurement shall be repeated for each video link.

The output video signal shall be connected to a video display monitor. The observed picture on the video display monitor shall be assessed for qualitative performance. All qualitative comments shall be recorded for each camera. The Contractor shall measure, record and tabulate the video receiver's dynamic range at the optical connector of the video demultiplexer's video receiver from the video multiplexer's video transmitter under test. To do this the measured optical attenuation of the fiber being used shall be increased to the point at which the video test set just begins to show a 3 dB degradation of the video signal to noise ratio in accordance with EIA 250 video test procedures. The optical receive power into the video receiver shall be measured and recorded. Then the optical attenuation shall be decreased until the video test set once again shows degradation of the video and registers errors. At no time shall the optical power into the video receiver exceed the manufacturer's specified saturation level. The optical receive level shall once again be measured and recorded. These minimum and maximum receive level define the video receiver's dynamic range and shall meet or exceed the specifications as specified elsewhere under these special provisions. This measurement shall be repeated for each video link. The video test set shall be approved by the Engineer. The Contractor shall measure, record and demonstrate that the performance meets or exceed the specified EIA RS-250 requirements listed below:

Differential gain.
Differential phase.
Chrominance to luminance delay inequality.
Amplitude vs. frequency characteristics.
Frequency response characteristic.
Signal to noise ratio.
Signal to low frequency noise.
Signal to periodic noise.
Output signal level.

**Data Link Testing.--**The data link testing shall be conducted after the Contractor submits a test plan and receives approval from the Engineer, based on these special provisions, plans and the manufacture's recommended test procedures for the equipment involved. Data link testing is for the alignment and testing of the data system. The activities shall include verification of all data circuits in the low speed data links, high speed data ring network and in the integrated data system. The Contractor shall adjust levels required for the data system to operate.

Data link tests shall be conducted in one phase:

**Data link performance.--**Data link performance tests shall consist of functional tests conducted between the existing D4 channel bank multiplex at the 3 existing data nodes and each system element as shown in the plans. The audio channel shall be verified in both directions using telephone instruments. The signaling system shall be verified in both directions. In addition for circuits using 4WTO channel cards for modems, bit error rate (BER) tests shall be conducted using appropriate model 400, 1200 BPS modem or ITU compatible high speed modem, and a bit error rate test set (BERTS) shall be used to verify error free transmission for five minutes at the bit rate to be employed in the system. Records of all tests shall be delivered to the Engineer. Circuits shall be fully tested to the channel card manufacturer's specifications. Modem

manufacturer required channel specifications shall be measured. In addition, end-to-end bit error rate tests (BERTS) shall be conducted using the type modem to be employed on the link at the bit rate to be employed. The bit error rate tests (BERTS shall be with the modem at the equipment site(s) configured in a loop back and with the test setup at the node. BER tests shall be a minimum of 3 hours for each circuit exactly and fully configured for operation in accordance with these Special Provisions and the Plans including required bridges.

All circuits shall provide an error rate less than $1 \times 10^{-6}$.

**Acceptance Testing.--**The acceptance testing shall be conducted in accordance with the approved test plan. The acceptance testing shall include conducting acceptance tests and subsequent retest, and documentation of the test results.

Final acceptance tests shall be conducted after the site and sub-system test results have been reviewed and accepted by the Engineer. These tests include the complete system in normal operations. The test plan shall address the full testing requirements of the specifications. The test plan shall detail all tests to be performed, the test results which are expected and the test schedule. The acceptance test plan shall include the following major test and acceptance categories:

Physical inspection.
Functional tests.
Performance tests.

The Contractor shall test the communications system according to the approved acceptance test plan and shall provide all test equipment, labor and ancillary items required to perform the testing. The test equipment shall be certified to be calibrated to the manufacturer's specifications. The model and part numbers and date of last calibration of all test equipment shall be included with the test results.

Acceptance testing shall not commence until all material required by these special provisions and plans are delivered, installed, and aligned and all production test and site test documentation and results have been approved by the Engineer.

All acceptance test results shall be fully documented and such documentation provided as a condition of acceptance.

**Physical Inspection.--**The Contractor shall provide documentation to prove delivery of all material, equipment, cable and documentation. If any material or documentation is outstanding or have been replaced under pre-acceptance warranty a physical inspection and documentation shall be provided for this material. The physical inspection shall consist of inspecting all installed material to ensure workmanship satisfies the specified requirements.

**Functional Tests.--**The Contractor shall test all system functions to demonstrate that all circuits (video, data, and voice), cameras, camera control and all equipment satisfies the functional requirements of the specifications.

This testing shall include subjective testing of each camera image and verification of camera control from the camera control receiver. The connectivity of each data channel shall be demonstrated. The Contractor shall document all functional test results. In the event that any aspect of the functional tests are determined by the Engineer to have failed, the Contractor all cease all acceptance testing and determine the cause of the failure and make repairs to the satisfaction of the Engineer. Acceptance testing shall, at the discretion of the Engineer, be repeated beginning from the start of functional tests.

**Performance Tests.--**The Contractor shall conduct operational performance tests on the following:

All video links from the camera to the video node and cable nodes.
All data circuits operational from the data nodes to the system elements located in the field equipment.

Video tests shall satisfy the end-to-end performance requirements under normal operating conditions. Video tests shall be measured with the camera video output transmitting a video signal at the input of the video display monitors. The Contractor shall test the video sub-system and record the results.

The video signal to noise shall be measured according to EIA-250. The video signal to noise ratio shall be measured and recorded with both the camera providing the video input reference and with suitable video test equipment providing the video reference signal. When the source is the test equipment, the video signal to noise ratio shall be greater than 47 dB.

Adjustments shall be calculated to account for any deviation in output level of the camera resulting from the variable light conditions, the automatic iris and associated automatic gain control. The resulting video signal to noise ratio shall be recorded.

The video signal to low frequency noise ratio shall be measured according to EIA-250. The resulting video signal to low frequency noise ratio shall be greater than 39 dB. If an AGC circuit does not allow measurement as per EIA-250, the Contractor shall submit an alternative test plan for approval.

The video signal to periodic noise ratio shall be measured according to EIA-250. The resulting video signal to periodic

noise ratio shall be greater than 52 dB.

Data tests shall be performed on all operational and voice data circuits using appropriate test equipment for the measurement of the following parameters:

End-to-end bit error rate tests shall be run from the data nodes and cable node to each remote drop of each data circuit A data test set shall be used at both the cable node and the remote modems to insert an asynchronous pseudo-random pattern using 8 data bits, 1 start bit, 1 stop bit and even parity. The data test set at the remote modem must hold RTS high for the duration of the data test. The data rate of the test sets shall be set to rate as employed in the system.

A 15 minute test on each drop of each multi-point circuit shall be error free in both directions. One drop of each circuit as chosen by the Engineer shall be tested for 72 hours. The average bit error rate in both directions shall be less than $1 \times 10^{-6}$ at 9600 bps.

The round-trip propagation delay for each model 170-based controller circuit shall be measured by using a loop back connector on the slave modem furthest from the master. The loop back connector shall connect pin 2 to 3, 8 to 4, and 6 to 20 of the DB-25 connector. A data test set capable of measuring delay shall be used at the data node. The test shall be repeated 3 times and the average value calculated.

Pulse-width distortion shall be defined as the difference between the data pulse width into a data channel port at the communications building port and the pulse width out of the EIA-232C port of an interconnected drop modem.

Distortion shall be tested between the cable node and the selected field modem for each data circuit. The signal shall not have a gross span-stop distortion greater than 20 percent at any data interface measured as per EIA-404-A.

If any circuit or element fails to satisfy the specified performance requirements the Contractor shall determine the cause and correct the failure to the satisfaction of the Engineer. The full performance tests shall be repeated under operating conditions as determined by the Engineer.

**SYSTEM DOCUMENTATION**

The Contractor shall submit a draft copy of all documentation for review and approval prior to production of documentation. The Engineer will review and approve or reject the draft documentation within four weeks of receipt.

The Contractor shall modify the documentation if required and submit provisional documentation. The Engineer will approve or reject the provisional documentation within three weeks of receipt. The Contractor shall arrange for re-submission in a timely manner to meet the schedule in the case that the documents are rejected.

Draft documentation shall be submitted eight weeks prior to the start of installation. The draft documentation shall show the general approach in preparing the final manuals.

Upon approval of the draft documentation provisional documentation shall be supplied three weeks prior to the start of site testing. The provisional documentation shall be of the same format as the final manuals but with temporary insertion for items, which cannot be finalized until the system is completed tested and accepted. Final documentation shall be submitted no later than four weeks after completion of the acceptance tests and shall incorporate all comments made during the approval stages. The Contractor shall be responsible for all delay caused by non-compliance to the specified requirements.

Final documentation shall be approved prior to its production. Ten copies of all final documents shall be delivered. The copies shall be 215 mm x 279 mm (8.5 x 11 inch) paper and bound in three-ring hard-covered binders complete with dividers. System documentation shall be arranged in an operation and maintenance (O & M) manual format providing all the information necessary to operate, maintain and repair the equipment, excluding the HAR equipment, and cable to the lowest module or component level. The operation and maintenance manual shall as a minimum consist of the following sub-section as described below:

**Master Items Index.**--This shall be the first section of the O & M manual. The section shall describe the purpose of each manual and brief description to the directory of the manual. It shall also reference equipment manuals as required for additional and support material.

**Technical Data.** --This section shall contain an overall description of the associated new equipment and cables with illustrative block diagrams. This section shall identify all new equipment and cables in the system stating the exact module and option number that are employed in the system. Technical data specification and settings for every type of new equipment or cable shall be provided. Any modification that has been done on the equipment shall be clearly described.

**Theory of Operation.** --The manual shall contain a functional description of each new element of the system, explaining how each function is being achieved separately and how each element works together to form the complete system.

**Operations.**--The manual shall describe how to operate each particular type of new equipment. Equipment layout, layout of controls, displays, operating procedures and all other information required to correctly operate each new functional unit shall be provided. Procedures shall also be provided for initial tune-up of the new equipment and adjustment and checkout required to ensure that the new equipment is functioning within the performance requirements. Warning of special procedures shall be given. The functions and setting of all parameters shall be explained.

**Corrective Maintenance.**--The manual shall include fault diagnostic and repair procedures to permit the location and correction of faults to the level of each replaceable module. Procedures shall include alignment and testing of the equipment following repair, the test equipment, tools, diagnostic software required and the test set up.

**Preventative Maintenance**--The manual shall include procedures for preventative maintenance in order to maintain the performance parameters of the new equipment and cables within the requirements of the specifications.

**Parts List.**--The manual shall include a list of all replaceable parts with exact parts description and number and a directory of recommended suppliers with correspondence address, telephone and fax numbers.

**Test Results.**--This section shall include a copy of the results for all the tests that have been conducted for the contract.

**Manuals.--**Ten complete sets of operation and maintenance manuals shall be provided. The manuals shall, as a minimum, include the following:

A. Complete and accurate Block Diagrams.
B. Complete installation and turn-on procedures.
C. Complete performance specifications (functional, electrical, mechanical, and environmental) identified by a universal part number such as JEDEC, RETMA, or EIA.
D. Complete stage-by-stage explanation and trouble-shooting procedures.
E. Complete stage-by-stage explanation of operation.

System schematic drawings shall be provided to identify the type of new equipment at each location and the function of all new equipment. The drawings shall also show how the system is interconnected. A comprehensive list of cabling and wiring shall be provided to clearly identify the interconnection and labeling of all equipment in the field.

**FINAL ACCEPTANCE**

The final acceptance of the system will not occur until all of the following conditions have been met as follows:

Physical, functional, and full performance acceptance tests have been completed and the results are approved by the Engineer.
All documentation has been completed and submitted to the Engineer.
All connections that were changed to perform acceptance tests are restored and tested.

## 10-3.37 DISPOSING OF ELECTRICAL EQUIPMENT

Ballasts and mercury lamps shall be disposed of in conformance with California Department of Health Services Regulations set forth in Title 22, Division 4, Chapter 30, of the California Code of Regulations.

Ballasts that contain polychlorinated biphenyl (PCB) are designated as extremely hazardous wastes and mercury lamps are designated as hazardous wastes under Title 22, Chapter 30, Article 9, Section 66680, of the California Code of Regulations.

The following electrical materials on the project are known to contain polychlorinated biphenyl (PCB):

A. Ballasts
B. Mercury lamps

When 25 or more mercury lamps, in combination, are to be disposed of, the lamps shall be treated as recyclable hazardous waste and shall be recycled within the State of California in conformance with Title 22, Chapter 30, Article 12, of the California Code of Regulations by a currently certified recycler such as, but not limited to, the following:

A. Exceltrans Inc., P.O. Box 866, Benicia, CA 94510, Telephone (707) 745-8907.
B. Roberts Enterprises, 2021 South Myrtle Avenue, Monrovia, CA 91016, Telephone (818) 303-2053.

The recyclable hazardous waste shall be packaged and then shipped via a currently certified hauler in conformance with Title 22, Chapter 30, Article 12, of the California Code of Regulations and other applicable local, State, and Federal regulations.

The Engineer shall be furnished with a statement noting which certified hauler and which certified recycler is proposed for utilization, together with a copy of the recycler's interim status document or a copy of the variance letter from the Department of Health Services. The statement shall be furnished within 15 calendar days after the contract has been approved by the Attorney General.

The State assumes generator responsibility for these wastes. The Engineer will prepare the Hazardous Waste Manifest for Shipment.

Full compensation for hauling, stockpiling, and disposing of ballasts and mercury lamps shall be considered as included in the contract lump sum price paid for modify lighting and sign illumination and no additional compensation will be allowed therefor.

After removal, hauling and disposing of electrical material containing polychlorinated biphenyl (PCB) will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

**10-3.38 PAYMENT**

The contract lump sum price or prices paid for signal and lighting (Modify) shall include highway lighting at intersections in connection with signals only.

Other roadway lighting on the project shall be considered as included in the contract lump sum price paid for lighting and sign illumination (Modify).

The contract price paid per meter for conduit of various sizes, types and installation methods listed in the Engineer's Estimate or the lump sum price paid for the various items of work requiring conduit of various sizes, types and installation methods as shown on the plans, shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, for finding all edge drains in the path of conduit routing and for doing all the work involved in installing the conduit, complete in place, including all trenching and backfill material required and pull boxes not otherwise paid for, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract price paid per meter for communication conduit (bridge) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in installing fiberglass conduit in the bridge structure, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract price paid per meter for Sizes 25 and 32 innerducts shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in Sizes 25 and 32 innerducts, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract unit price paid for pull boxes of various sizes and types listed in the Engineer's Estimate or the lump sum price paid for the various items of work requiring pull boxes of various sizes and types as shown on the plans, shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in the installation of pull boxes, complete in place, including No. 6 and communication pull boxes, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract unit price paid for splice vault shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in splice vault, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract price paid per linear meter for fiber optic cable of various sizes and types listed in the Engineer's Estimate, or the lump sum price paid for the various items of work requiring fiber optic cable of various sizes and types, as shown on the plans, shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in fiber optic cable of the types and sizes involved, complete in place, including break out cables, connectors, cable tray and splicing, fiber optic testing, marking and labeling fiber optic cable assemblies, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract unit price paid for fiber optic splice closure shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in fiber optic splice closure, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract price paid per linear meter for twisted pair cable of the sizes listed in the Engineer's Estimate shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in twisted pair cable of the sizes involved, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract unit price paid for twisted pair splice closure shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in twisted pair splice closure, sizes 305 mm and 610 mm, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract lump sum price paid for closed circuit television camera at various locations shall include full compensation for furnishing all labor, materials, tools, equipment, wiring and incidentals, and for doing all the work involved in closed circuit television camera at various locations, complete in place, including ancillary or incidental items required to provide fully functional site at each location, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract lump sum price paid for relocate closed circuit television camera (location P0226) shall include full compensation for furnishing all labor, materials, tools, equipment, wiring and incidentals, and for doing all the work involved in relocate closed circuit television camera (location P0226), complete in place, including ancillary or incidental items required to provide a fully functional site at the new location, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract lump sum price paid for equipment at the San Gabriel Valley Hub shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in the equipment at the San Gabriel Valley hub, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract lump sum price for relocate cable node (location P0237) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in relocate cable node (location P0237), complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract lump sum price paid for video node shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals required to provide fully equipped and operating system, and for doing all the work involved in installing video node, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract lump sum price paid for highway advisory radio shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in the installation of the highway advisory radio, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract lump sum price paid for system testing and documentation shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in system testing and documentation, as specified in the Standard Specification, and these special provisions, and as directed by the Engineer.

Full compensation for arranging for a qualified technician employed by the various communication equipment manufacturers or their representatives, for the purpose of system turn-on, shall be considered as included in the contract price paid for the items involved and no additional compensation will be allowed therefor.

## SECTION 10-4. SEWERS

### 10-4.01 GENERAL

This work shall consist of removing and abandoning existing sewer facilities and constructing new sewer facilities complete in place in accordance with these special provisions and as directed by the Engineer.

All work and materials shall conform to the details shown on the plans, the Standard Specifications, and the Standard Specifications for Public Works Construction of the Joint Cooperative Committee of the APWA-AGC, 1997 Edition, Parts 2 and 3, the Amendments to the Standard Specifications for Public Works Construction, 1997 Edition and Standard Drawings for Construction as adopted by the County Sanitation Districts of Los Angeles, dated September 1997, herein referred to as SSPWC.

The sewers are owned and operated by the City of Industry (Golden Spring Drive, Old Brea Canyon Road), The County Sanitation Districts of Los Angeles and the City of Diamond Bar (Old Brea Canyon Road). The Contractor shall notify the owner 2 working days before work is begun on any existing sewer facility. In addition, the Contractor shall notify the Engineer and the County Sanitation District Representative at (310) 638-1161 to provide a project representative, not less than 48 hours prior to beginning any work on the sewers owned and operated by the County Sanitation Districts.

In case of conflict between any requirements set forth in these special provisions and any provisions of the SSPWC, the requirements set forth in these special provisions shall govern.

### 10-4.02 MAINTENANCE OF FLOWS

The existing City of Industry, County of Sanitation Districts of Los Angeles and City of Diamond Bar sanitary sewer

system must continue to collect all incoming wastewater at all times. All work included in this Specification shall be performed in such a manner that all wastewater flow from existing, not to be abandoned, buildings and residences be maintained at all times except for short periods of shut down as specified elsewhere in these special provisions. A temporary shut down of wastewater flow from existing buildings may be allowed if the Contractor submits a detailed schedule including dates, times of day for the stoppage and the specific buildings affected, to the Engineers for review and approval 30 days prior to the proposed shut down. A shut down may not exceed two continuous hours. If approval is given by the Engineer, the Contractor shall notify the Owner and residents of each affected building both 10 working days preceding the shut down of the exact date and times of day. Should the Contractor's sequence of work or method of construction be such that outages of longer duration are necessary, temporary pumping, piping and bypasses as covered in "Temporary Sewer System" of these special provisions, shall be installed and maintained and removed after use by the Contractor at his expense. When temporary facilities are to be utilized, a detailed construction plan and schedule of events, including sizes and capacities of all piping and equipment, shall be submitted to the Engineer for review and approval 30 days preceding their proposed use.

**10-4.03 EXISTING SEWER FACILITIES**

When the new facilities interfere with the existing flow of sewage, the Contractor shall provide satisfactory bypass facilities at his expense as covered in "Temporary Sewer System" of these special provisions. Existing manholes shall be adjusted to grade, removed or abandoned, and existing sewer pipes shall be removed or abandoned, as shown on the plans and in accordance with the provisions in Section 15, "Existing Highway Facilities," of the Standard Specifications.

**ABANDON SEWER LINES AND FACILITIES**

Existing sewer lines shown on the plans to be abandoned, shall be abandoned in place or, at the option of the Contractor, the sewer lines shall be removed and disposed of. All resulting openings into existing structures, that are to remain in place, shall be plugged with commercial quality concrete containing not less than 300 kg of cement per cubic meter.

Abandoning sewer lines in place shall conform to the following:

Sewer lines that intersect the side slopes shall be removed to a depth of not less than one meter measured normal to the plane of the finished side slope, before being abandoned.

The ends of sewer lines shall be securely closed by a 150 mm thick tight fitting plug or wall of commercial quality concrete.

Sewer lines shall not be abandoned until their use is no longer required. The Contractor shall notify the Engineer in advance of any intended sewer abandonment.

Full compensation for plugs, pipe removal, structure excavation and backfill shall be considered as included in the contract price paid per meter for abandon sewer, and no separate payment will be made therefor.

**REMOVE SEWER MANHOLE, AND SEWER PIPE**

Existing sewer manhole and sewer pipe box culverts, inlets, headwalls and endwalls, where any portion of these structures is within one meter of the grading plane in excavation areas, or within 0.3-m of original ground in embankment areas, or where shown on the plans to be removed, shall be completely removed and disposed of outside the highway right of way. Disposal shall conform to the provisions in Section 7-1.13, "Disposal of Materials Outside the Highway Right of Way," of the Standard Specifications.

Frames and grates shall be removed and disposed of.

**10-4.04 TEMPORARY SEWER SYSTEM**

The Contractor shall provide all necessary equipment, manpower, and resources to provide a safe and reliable temporary sewer system on a 24 hour basis during construction and testing. The temporary sewer shall be designed to divert the entire domestic wastewater flow which can consist of rags, towels, sheets, grease, food waste, fecal material, etc.

The Contractor shall reconnect any active side sewers encountered during replacement of the existing sewer main by the end of each working day.

The Contractor shall be responsible for any damage and cost of repair caused to private or public property from the failure or problems of the temporary sewer system installation or operation. The Contractor shall remove the temporary sewer system at the completion of the project to the satisfaction of the Engineer.

**10-4.05 PIPING AND APPURTENANCES**

**CONTRACTOR SUBMITTALS**

A. Manufacturer's Data. Complete with material grade, and class for all pipe, fittings, and couplings and for all joints, and appurtenances and such other data as may be requested by the Engineer shall be submitted for approval. Detailed catalog and engineering data sheets shall be submitted for all components such as flexible couplings, rubber gaskets, and joints, and a proposed schedule for delivering and installing the piping shall be included. Expansion joint submittal shall include a leak-proof certificate and expansion joint's preset dimension for each installation.

B. Installation Procedure. The installation drawings shall be supplemented with a set of written procedures for performing the field piping installation. The procedures shall cover in detail the preparation and making of the push-on joints and couplings.

C. Testing Procedures. Procedures for testing the piping, and arrangements for obtaining and disposing of water for the tests shall be fully described. The equipment for testing shall be itemized. Details of bulkheads, flanges, or caps for the testing of the pipe shall be included with the submittals.

D. Manufacturer's warranties and guarantees for materials or equipment as listed in the product data paragraph shall be delivered to the Engineer at the job site prior to acceptance of the contract.

**PRODUCT HANDLING, DELIVERY AND STORAGE**

A. General. Handle pipe at all times with equipment designed to prevent damage to the pipe materials. Pipe shall only be handled with wide canvas or rubber covered slings. Do not allow bare cables, chains, hooks, or metal bars to come in contact with the pipe. Pipe slings used during handling and tie-down straps used during transit shall be minimum 4-inch wide flat fiber or plastic straps. During transit and storage place pipes on saddles or on a support system approved by Engineer to prevent damage to barrel and bell.

B. Shipping. During shipment, carefully pad all chains, cables and hold-down equipment where in contact with the pipe.

C. Unloading. Unload pipes from trucks with care using slings as indicated above. Do not allow pipe to fall from trucks. Always use a crane or fork lift to unload pipe.

D. Gaskets. Store gaskets in containers or wrappers which will protect the gaskets from ozone and other atmospheric deterioration. Deliver gaskets, gasket lubricants, bolts, and jointing materials in separate, clearly marked boxes.

**PRODUCTS GENERAL**

A. General Requirements. All pipe, fittings, couplings, and appurtenant items shall be new, free from defects or contamination, and wherever possible, shall be the standard product of the manufacturer. They shall be furnished in strength or thickness classes as specified or shown. Unless otherwise indicated the size shown shall be the nominal pipe diameter.

B. Length. All pipe shall be furnished in standard lengths, unless indicated otherwise.

**10-4.06 MATERIALS**

All pipe shall be clearly marked with type, class, and thickness. Lettering shall be legible and permanent under normal conditions of handling and storage. If the quality of the pipe is such that more than 25 percent of any lot delivered to the jobsite becomes subject to rejection, as determined by the Engineer, then the entire lot shall be rejected and removed from jobsite, at the expense of the Contractor.

**CONCRETE AND GROUT.--**Concrete materials shall conform to the provisions in Section 90, "Portland Cement Concrete," and Section 51, "Concrete Structures," of the Standard Specifications and to applicable provisions of SSPWC.

A. Grout. Except in high watertable locations, precast concrete manhole rings shall be joined with a minimum thickness of 12.7 mm of portland cement grout.

B. Manhole Bases. Construct manhole bases to the form and dimensions indicated. Bases shall be formed and poured on

gravel subbase of the same thickness as the sewer on which it is being built. The portion of the base above the invert elevation of the sewer pipe shall be formed to provide a smooth channel section. The manhole base shall be poured as one monolithic pour.

**REINFORCEMENT.--**Reinforcement shall conform to the provisions in Section 52, “Reinforcement,” of the Standard Specifications.

**MISCELLANEOUS IRON AND STEEL.--**Miscellaneous iron and steel items shall conform to the provisions in "Miscellaneous Iron and Steel," of these special provisions.

**SEWER MANHOLES.—**New manholes for sewers shall be constructed in accordance with the details shown on the plans.

All manhole frame and covers shall be cast iron conforming to ASTM A48, Class 30 and to the details shown on the plans.

Concrete for sewer manhole facilities shall be Class 2 as per Section 90, "Portland Cement Concrete," of the Standard Specifications unless otherwise shown on the plans.

The inside bottoms of existing manholes, where new connections are made, and of new manholes shall be shaped to provide channels conforming to the size and shape of the lower portion of the inlets and outlets of the manholes. The channels shall vary uniformly in size and shape from inlet to outlet.

In no case shall the bell of a pipe be built into the wall of a manhole.

All concrete shall be cured for a period of not less than 10 days after being placed and shall be protected from damage.

The upper step of the sewer structures shall be placed not more than 152 mm below the bottom of the cover frame, and it shall project not more than 76 mm inside the structure. The ends of the steel steps projecting outside the manhole, when such steps are above a point 305 mm below the existing ground surface, shall be bent down against the manhole. The line of steps shall always be placed on the side of the sewer structure which is clear of openings, except that in the case of drop manholes, the steps shall not be directly opposite the drop. Ladder rungs shall be grouted in the precast concrete walls. Rungs shall be uniformly spaced at 305 mm and be vertically aligned.

The cover or grating of a manhole shall not be grouted to final grade until the final elevation of the pavement, gutter, ditch, or sidewalk in which it is to be placed has been established, and until permission thereafter is given by the Engineer to grout the cover or grating in place. Covers shall be seated properly to prevent rocking.

In the event any pipe enters the manhole through the precast concrete units, the Contractor shall make the necessary cut through the manhole wall and steel mesh. The steel shall be cut flush with the face of the concrete and shall be cut in such a manner that it will not loosen the reinforcement in the manhole wall.

The ends of all pipes shall be trimmed flush with the inside walls.

Rubber gaskets or flexible plastic gaskets may be used in tongue and groove joints of precast units. Joints between precast manhole units used for sanitary sewers shall be rubber gasketed. All other joints and all openings cut through the walls shall be grouted and watertight.

If gaskets are used, handling of the precast units after the gasket has been affixed shall be done carefully to avoid disturbing or damaging the gasket or contaminating it with foreign material. Care shall be exercised to attain proper alignment before the joints are entirely forced home. During insertion of the tongue or spigot, the units shall be partially supported to minimize unequal lateral pressure on the gasket and to maintain concentricity until the gasket is properly positioned.

Rigid pipes connecting to sanitary sewer manholes shall be provided with a flexible joint at a distance from the face of the manhole of not more than 1 1/2 times the nominal pipe diameter or 457.2 mm, whichever is greater.

Backfilling around the work will not be allowed until the concrete or mortar has thoroughly set.

Catch basin, grate inlet, and drop inlet connections to the sewer shall be so placed that the connecting pipe may be easily rodded over its entire length. After the connections are made, the Contractor shall rod all inlet and outlet pipes. All connections that cannot be successfully rodded shall be removed and new connections made.

Backfilling of manholes shall be done in accordance with the provisions of Section 19, "Earthwork," of the Standard Specifications.

Manholes shall be constructed on a compacted or undisturbed level foundation. A grout pad shall be placed to attain full bearing for precast units if deemed necessary by the Engineer. Upon final acceptance of the work, manholes and other drainage structures shall be open, clean, and free draining.

When connecting a sewer pipe to an existing manhole, the connection shall be in accordance with the requirements for new construction. Special care shall be taken not to damage (crack) the concrete manhole base. If the contractor damages the concrete base, as determined by the Engineer, the contractor shall at his own expense remove and discard the damaged concrete base and form a new concrete base in accordance with the requirements for new construction.

All manhole rings, tops, and cones shall be reinforced designed for AASHTO H-20 highway loading, and shall conform to the standard plans, the requirements of ASTM C-478, and the following requirements:

A. Rings. All manhole rings shall be centrifugally spun or compactly vibrated in forms.

B. Tops. All manhole tops and cones shall be compactly vibrated in forms.

C. Gasket Seals. Where installed in high watertable locations gasket seals shall be provided at mating joints of precast concrete sections. Size gaskets to suit joint dimensions and surface conditions to assure watertight completed installation. Use either compressible closed-cell neoprene rods with compatible bonding agent or non-bituminous joint sealing compressible gaskets.

Precast concrete sections shall be inspected when delivered to the job site. Cracked or defective sections shall be rejected and removed from the job site. Precast materials such as the Eccentric Cone, and Riser Sections shall conform to ASTM C478. The cone and riser sections shall have Rubber Gasketed Joints conforming to ASTM C443. Manhole waterstops shall be manufactured of elastomeric plastic. The waterstops shall be corrosion, acid and alkali resistant and suitable for use in wastewater. The waterstop shall be used when grouting sewer line penetrations of existing manholes or installation in new manholes as shown on the plans.

**WATERTIGHT CAULKING.--**Watertight caulking for pipe penetrations occurring in precast manhole assemblies, shall be polyurethane sealant meeting or exceeding requirements of Standard Specifications Polyurethane Sealant contained in Section 51-1.12F(3) Materials and Installation; (a) type A and AL seal, of the Standard Specifications for flow-type sealant, and like material having equal characteristics which also provides non-sag properties for use in overhead or sloping joints.

A. Back-Up Performed Joint Filler. Use closed cell polyethylene foam or equal impervious, compatible, compressible foam material recommended for retaining sealant depth in expansion joints while curing. Use no bitumen or oil saturated material.

B. Bond Breakers, where required, shall be polyethylene tape or equal as recommended by sealant manufacturer to prevent adherence of sealant to back-up material.

**PENETRATIONS.--**Pipes penetrating precast structures shall be cast-in-place, or grouted in place with non-shrink grout. Tightly caulk cold joints between pipe and grout or pipe and concrete at the interior (waterbearing) surface with specified material to provide a leak-free installation when complete.

**EXTRA STRENGTH VITRIFIED CLAY SEWER PIPE AND FITTINGS.--**Clay bell and spigot sewer pipe and fittings shall conform to the specifications for extra strength, unglazed vitrified clay pipe of ASTM Designation: C700-96. All vitrified clay pipe shall be first quality bell and spigot type.

The ends of the pipe shall be so formed that, when the pipes are laid together and jointed, the pipe will form a continuous line with a smooth interior surface.

Clay sewer pipe shall conform to the absorption requirements of ASTM Designation: C700.

Ells, tees, reducing tees, wyes, couplings, increases, crosses, transitions and end caps shall be of the same type and class of materials as the pipe, or of material having equal physical and chemical properties.

All vitrified clay pipe and fittings shall be furnished with compression joints such as "Wedge-Lock", "Speed-Seal", or equal. The joint on the spigot and bell ends of the pipe shall be factory-made of plasticized compound, bonded to the pipe and molded and cured to a uniform hardness and compressibility to form a tight compression coupling when assembled. The joints shall conform to ASTM C425.

**PIPE TO MANHOLE FLEXIBLE COUPLINGS.--**The joint shall consist of a flexible connector designed to produce a positive watertight connection for pipes entering precast manholes and other concrete structures as shown on the plans.

The connector shall be in accordance with ASTM C 923M(ASTM C 923) so that a positive seal is made between the connector and the manhole wall and between the connector and the pipe. The seal between the connector and the manhole wall may be made by either mechanical means or by casting the connector integrally with the manhole wall. The seal between the connector and the pipe may be made by mechanical means or by compression of the resilient material against the outside of the pipe.

The connector shall withstand 70 kPa (7.1 m)(10 psi (23 feet)) of hydrostatic pressure and be capable of sustaining an

axial deflection of at least 7 degrees in any direction. The test methods and requirements shall be in accordance with ASTM C 923M(ASTM C 923), Section 7.

The gaskets shall be manufactured from a synthetic elastomer and shall contain not less than 50 percent by volume of first-grade synthetic rubber. All rubber gaskets shall be either molded or extruded and cured in such a manner that any cross-section shall be dense, homogeneous and free of porosity blisters, pitting, and other imperfections. The gaskets shall comply with the physical requirements prescribed by ASTM C 923M(ASTM C 923) (Table 1) when tested in accordance with the referenced ASTM, except that the chemical resistance will be tested in accordance with Section 210-2.3.3 of the Standard Specifications of the Public Works Construction. Metal components shall be fabricated from AISI Type 316 stainless steel for all bands and the nut and bolt shall be AISI Type 305 stainless steel. Gaskets shall conform with the installation time requirements in Section 208-1.2 of the Standard Specifications for Public Works Construction.

A performance test of the connector to be used shall be made at least once when the manhole producer begins using a pipe to manhole connector system. The test methods and requirements shall be made in accordance with ASTM C 923M(ASTM C 923), Section 7. The connector shall be marked clearly by the manufacturer with his trade name and size designation or part number. This shall be visible on the gasket when installed in the manhole.

The flexible connector shall be installed in accordance with the specific instructions of the manufacturer. The manhole manufacturer shall provide installation instructions to the Contractor. The connector shall have all foreign matter removed and shall be inspected by the Contractor to ensure that there are no defects in the rubber or splice.

**BANDED RUBBER COUPLINGS.--**Banded rubber coupling used to connect new pipe to existing pipe shall be band seal adjustable repair couplings (or equal) completed by a flexible coupling consisting of a neoprene gasket and stainless steel shear ring.

**TRACER TAPE.--** The pipe shall be marked with warning tape. Warning tape shall be 150 mm wide, green plastic coated metallic tape with the words “CAUTION BURIED SEWER LINE BELOW” printed on each side. The tape shall be a minimum of 0.14 mm thick and have an aluminum foil center. Minimum tensile strength shall be 35 Mpa.

**10-4.07 EXCAVATION AND BACKFILL**

Excavation and backfill shall conform to the provisions in Sections 7-1.11, “Preservation of Property, and 19-3, "Structure Excavation and Backfill," of the Standard Specifications and as specified in Section 306 of SSPWC and the following special provisions. Pipeline construction shall be coordinated with the roadway earthwork to prevent damage to the pipeline. Where roadway excavation and embankment work may damage pipeline, Contractor shall prepare the rough pavement subgrade before installing the pipeline.

The pipe shall be installed in a trench excavated to the lines and grades shown on the plans and designated by the Engineer. The bottom of the trench shall be graded and prepared to provide a firm and uniform bearing throughout the entire length of the pipe barrel. The width of the trench shall not be less than 457 millimeter nor more than 914 millimeter greater than the outside diameter of the barrel of the pipe to be laid therein. Where shoring is required, this width shall be increased by the thickness of the shoring.

Pipe may be laid out in open trenches or in sections of open trenches connected by tunnels, as permitted by the Engineer.

Suitable excavation shall be made to receive the bell of the pipe and the joint shall not bear upon the bottom of the trench. All adjustment to line and grade shall be made by scraping away or filling in with sand, gravel, or granular material under the barrel of the pipe, and not by wedging or blocking.

Special care shall be taken to have all fire hydrants and gate valves on water mains kept accessible at all times. The Contractor shall not obstruct the drainage of any street or alley, and shall use all proper means to provide for the free passage of surface water along the gutters into storm water inlets. He shall provide channels where necessary, suitable to the Engineer. The Contractor shall cooperate with the owners and tenants of the private property through which the right-of-way extends. The Contractor shall be liable for all damages suffered by the owners or tenants resulting from his negligence or lack of cooperation.

Excavate to approximate bottoms and trim to lines and elevations in a manner specified under Embedment. Embedment starts at final trimmed trench elevation and ends at 305 millimeter above the top of the pipe or component. Backfill starts 305 millimeter above pipe or component. Use manual methods of compaction of embedment and backfill materials in areas adjacent to buried construction and utilities to avoid damage or unscheduled service interruption. Limit trench width or embankment conditions to preclude excessive earth loads on installed piping system.

All supports required by the Trench Excavation Safety Plans shall be removed after construction is completed, unless otherwise directed by the Engineer, and shall be withdrawn in a manner that will prevent the caving of the sides of the excavation. All openings caused by the removal of supports shall be filled with suitable material property compacted.

Trim rough trench to subgrade and provide embedment as indicated on the plans for full width of the trench. Shape bedding to provide full length barrel support and to prevent point loading at pipe joints. Carefully place bedding under pipe

haunches. No ponding and jetting shall be allowed.

Hand-grade base to proper grade ahead of pipe laying. Base shall provide a firm, unyielding support along entire pipe length. Grade the top of the base to the bottom of the pipe ahead of pipe laying for the full width of the trench.

Excavate bell holes at each joint to permit proper assembly and inspection of entire joint.

Particular attention must be given to the area of the pipe bedding from the flow line to the centerline of the pipe to ensure that firm support is obtained to prevent any lateral movement of the pipe during the final backfilling of the pipe zone.

Backfill the area of the pipe bedding from the bottom of the trench to the springline of the pipe with trench bedding material. The material around the pipe shall be placed in 10.2-mm layers and thoroughly tamped with approved tamping sticks supplemented by "walking in" and slicing with a shovel. Backfill the area of the pipe zone from the springline to a point 305 mm above the top outside surface of the barrel of the pipe with trench bedding and backfill material as shown on the plans.

### 10-4.08 PIPE INSTALLATION

Prior to lowering pipe and fittings into trench, clean and visually inspect for apparent defects. Remove defective pipe from the site promptly. Pipe shall be protected against impact shocks during handling and shall not be allowed to free fall. Pipe damaged before placement shall not be used, and shall be replaced by new pipe. Carefully lower all pipe, fittings, etc. into the trench with suitable tools or equipment in such a manner as to prevent damage to the pipe, lining, coating, fitting or other appurtenances. Prior to and during laying of pipe, maintain excavations dry and clear of water and extraneous materials.

Install piping in accordance with the requirements of the pipe manufacturer procedures and the provisions specified herein. The interior of pipe, fittings, and couplings shall be clean and free from contamination when installed and effective means shall be taken to prevent the entrance of foreign matter during progress of the work.

Prior to installation, accurately determine all dimensions essential to the correct location of the pipe, or to the avoidance of obstructions or conflict with other improvements, Make all required changes from the nominal locations shown on the plans and obtain Engineer's approval of the changes.

Unless otherwise authorized by the Engineer, the laying of the pipe in finished trenches shall be commenced at the lowest point of the project, with the spigot ends abutting and pointing in the direction of the flow. The joints shall be carefully centered so that when laid to proper grade and alignment as designated on the plans, they will form a sewer with a uniform invert.

All pipes and fittings shall be laid accurately to the lines and grades given by the Engineer, with joints closed and even, abutting all around. Special care shall be taken that there is no sagging of the spigot end in the hub and that a true surface is given to the invert throughout the entire length of the sewer.

In order to relieve the bell of the load and provide ample space for making the joints, the foundation for the pipe shall be free of all grade irregularities and bell holes shall be provided for all sizes of pipe. Care should be taken not to disturb the joints already laid.

Where existing sewer pipe is embedded in an underground concrete structure, provide joints within the specified distances of exterior surface of the structure as shown on the plans, capable of absorbing movement without leakage.

Clean and lubricate elastomer joints prior to assembly. Check recessed gaskets with feeler gages. If any previous length of pipe is moved or disturbed so as to break any joint, the joint shall be repaired or pipe replaced as determined by the Engineer.

Whenever the work ceases for any reason, the end of the pipe shall be securely closed with a tight fitting plug or cover to prevent the admission of foreign matter. Plugs shall be commercially manufactured products. Do not remove plugs unless or until the trench is dry.

All joints shall be cleaned and then sealed with the type of materials specified or required by the Engineer. Sealing materials shall be sufficiently protected from the air and sun to prevent deterioration.

All joints shall be carefully cleaned on the inside. Stoppers for pipes and branches left unconnected shall be made of the same material as the pipe or of resilient joint material conforming to the requirements of ASTM Designation: C 425. After placing the stopper, it shall be covered with a layer of sealant. The sealant shall be sufficiently fluid to insure free flow around the stopper.

The new main sewer alignments shall be marked with tracer tape 0.61 m below finished grade, centered above the pipe. The wording on the tape shall be carefully placed to prevent tearing or damaging the tape.

The pipe shall be laid in a trench excavated to the lines and grades designated on the plans and as directed by the Engineer. The bottom of the trench shall be graded and prepared to provide a firm and uniform bearing throughout the entire length of the pipe barrel. When bell-end pipe is used, suitable excavation shall be made so the bell portion of the pipe will not bear on the bottom of the trench. All adjustment to line and grade shall be made by scraping away or filling in with bedding (Sand equivalent of 30) under the body of the pipe, and not by wedging or blocking. Trenches shall not be left open farther than 60 m in advance of pipe laying operations or 60 m to the rear thereof, unless otherwise permitted by the

Engineer.

Pipe may be laid in open trenches or in sections of open trenches connected by tunnels, as permitted by the Engineer. The length of the tunnel shall not exceed the depth of cut, except that if the depth of the cut is over 6.10 meters, the pipe may be laid in a continuous tunnel. Tunnels shall be driven from shafts at the locations of manholes or at other locations approved by the Engineer. Tunnels shall have a height of not less than above the top of the sewer to allow proper workmanship. When bell-end pipe is used, suitable excavation shall be made so the bell portion of the pipe will not bear on the bottom of the tunnel. Continuous tunnels shall be completely backfilled as soon as the sewer pipe is laid and the joint material has properly set. The backfilling may be done by air-blown methods provided the required compaction as specified in Section 19-3.06, "Structure Backfill," of the Standard Specifications is obtained, or it shall be rammed with proper tools until compacted to the required amount.

All supports required by the Trench Excavation Safety Plans shall be removed after construction is completed, unless otherwise directed by the Engineer, and shall be withdrawn is a manner that will prevent the caving of the sides of the excavation. All openings caused by the removal of supports shall be filled with suitable material properly compacted.

Furnish all pipelines joining concrete structures with a flexible joint as shown on the plans.

Install vitrified clay pipe in accordance with the plans and ASTM C12. Overexcavate the trench for VCP pipe to a depth of 102 mm below the bottom of the pipe, fill to the proper grade with coarse sand, and tamp thoroughly. After pipe is laid, backfill the trench with sand to 305 mm above the top of the pipe.

### 10-4.09 FLUSHING WORK

Provide temporary and permanent piping, equipment, and materials required for flushing work. Coordinate cleaning of connections to existing systems with the Engineer.

If equipment and piping systems are not properly cleaned and flushed, pay for resultant damage, necessary cleaning and flushing of systems to which connection was made, and subsequent inspection at no additional cost to the State.

Clean out settled debris and dirt in the manholes after the flushing operation.

Dispose of flushing water per governing codes and regulations and as directed by the Engineer. The Contractor shall provide the necessary equipment and manpower to properly dispose of the flushing water as directed by the Engineer.

### 10-4.10 CLEANING GRAVITY LINES

All new sanitary sewer lines and at least 150 m downstream to the closest manhole shall be cleaned by means of a pneumatic sewer cleaning ball and/or hydroflushing as directed by the Engineer. The sewer ball shall be of the Wayne type or approved equal. The sewer ball shall be the appropriate size to fit flush with the inside diameter of the sewer main to be cleaned. The cleaning ball shall be introduced into the sewer at the uppermost manhole and passed down grade by a line with a sufficient head of water to carry the ball slowly along the inside of the pipe. Where sewer balls will not pass through the sewer, the cleaning ball shall be removed and the obstruction removed.

The Contractor shall be required to remove all debris collected during the cleaning operation.

After cleaning the sewer main the Contractor shall thread a 6.35 mm nylon rope through the pipeline from manhole to manhole. Three (3) meters of slack shall be left in each manhole and the rope shall be securely attached to the manhole.

### 10-4.11 GENERAL SEWER PIPEING SYSTEMS TESTING REQUIREMENTS

Prior to acceptance of the work, the sewer piping system shall be tested in the presence of the Engineer. The test shall be conducted prior to finish grading. Backfill or supports shall be provided to the extent required to prevent movement of the pipe.

All necessary equipment and materials shall be provided to properly execute the tests.

Records of piping systems tests shall be prepared and maintained. The record shall show the State and Contractor personnel responsibilities, dates, test gage identification numbers, ambient temperature, pressure ranges, rates of pressure drop and leakage rates.

Air from air release valves and system high points shall be bled off.

In the event testing demonstrates leakage rates in excess of specified limits, determine source(s) of leakage, repair or replace defective materials and workmanship and retest installation until compliance with the specified requirements at the Contractor's expense.

Testing of temporary sewer line shall not be required.

All other gravity lines shall be air tested between subgrade preparation time and before final grading by and at the Contractor's expense. The air testing shall be conducted for the section of sewer installed each day and after connection of side sewers. Block each side sewer with Engineer approved temporary removable plug just upstream of the new to existing side sewer joint.

The test shall be done in accordance with the following procedure:

1. Immediately prior to testing, the sewer line shall be cleaned, and test plugs properly installed, at each end of the section of line to be tested.

2. When all necessary test equipment is in place, a compressed air supply shall be attached to the air fitting on the test equipment; and the air pressure within the line shall be increased to 27,600 pascal.

3. After an internal pressure of 17,600 pascal gauge (Pa) is obtained, the Contractor shall allow at least 2 minutes for air temperature to stabilize, adding only the amount of air required to maintain the specified pressure.

4. After the 2-minute period, the Contractor shall disconnect the air supply.

5. The Engineer, or his authorized agent, will observe the pressure gauge connected to the sewer line being tested; and, when the pressure decreases to 24,100 Pa, the Engineer or his authorized agent will start a stop watch and stop the stop watch when the pressure gauge reaches 17,200 Pa for VCP.

6. The pipe test section shall be considered to pass the air test if the time required for the pressure to decrease from 24,100 Pa to 17,200 Pa for VCP pipe is not less than the minimum holding time shown on the following charts for respective size, kind and length of pipe.

7. If the pipe installation fails to meet these requirements, the Contractor shall determine, at his own expense, the source or sources of leakage, and he shall repair or replace all defective materials or workmanship. The repaired pipe installation shall meet the requirements of this test.

8. The Contractor also shall be obligated to correct, stop or otherwise remedy apparent individual leaks in the section of the sewer line being tested, even though such leakage might come within the allowable maximum.

9. The test shall include side lateral sewers within public streets.

The air test as noted above is considered the "official test". However, preliminary air testing is strongly recommended and maybe conducted by the Contractor at any time prior to the "official test".

**VCP ONLY:**

| DIAMETER OF PIPE (mm) | LENGTH OF LINE (m) | MINIMUM HOLDING TIME MIN:SEC |
|---|---|---|
| 203 | 0 TO 52 | 2:00 |
| 203 | 52 TO 64 | 2:30 |
| 203 | 64 TO 76 | 3:00 |
| 203 | 76 TO 88 | 3:30 |
| 203 | 88 and greater | 3:45 |

If the section of sewer to be tested is composed of both a main line and more than 30 meters of total side sewer, add 2 minutes to the length of test required for the VCP main only.

Testing equipment shall be set up so that test gages are at ground level during testing.

Temporary sewer system shall be in place during testing of the sewer piping system.

**10-4.12 TRENCH RESURFACING**

Trenches in existing streets or paved areas shall be resurfaced with the type and thickness of bases, surfacing or pavement shown on the plans or designated by the Engineer. In no case the thickness of trench resurfacing be less than 100 mm. The Contractor shall proceed immediately to resurface any part of any excavation upon notice from the Engineer without waiting for completion of the full length of the sewer.

On completion of trenching, pipe laying, testing, and backfilling, restore all lawn, landscaping, unimproved surfaces, pavement, sidewalks, driveways and curbs to their original condition or better within seven days of completion of the installation work. The Engineer's decision on the comparative preconstruction and postconstruction conditions of the damaged work shall be final. Include all costs of restoration in the bid price. No additional payments will be made for restoration work. All restoration work shall be in accordance with the SSPWC and the following:

A. Lawn. Restore damaged lawn with healthy, imported sod of commercial quality to match the existing surface.

B. Landscaping. Restore all fencing, retaining walls, borders, posts, statues, rocks, gravel, bricks, patios, etc., that suffer damage during construction. If it is possible to salvage and store fencing materials such as posts, chain link fencing, etc. in a useable condition, the salvaged materials may be reused in restoration as approved by the Engineer. Furnish new materials to restore the site to its preconstruction condition whenever necessary at no extra cost to State and/or Owner.

C. Unimproved Surfaces. Restore unimproved surfaces to original grade and shape. Seed, fertilize, and water the surfaces in accordance with the seed manufacturer's recommendations for a two week period. Seed shall be of a popular commercial grade approved by the Engineer.

**10-4.13 MEASUREMENT**

Sewer work performed will be designated in the Engineer's Estimate by size, type, or thickness.

The length of the various types of sewer pipes to be paid for by the meter will be the slope length designated by the Engineer. Pipe placed in excess of the length designated will not be paid for, unless pipes are cut to fit structure. When pipes are cut to fit a structure, the quantity to be paid for will be the length of pipe placed before cutting, measured in 0.6 meter increments. Pipe bends, wyes, tees and other branches will be measured by the linear meter for the sizes of pipes involved. Bends will be measured along center lines. Wyes, tees and other branches will be measured along center lines to the point of intersections.

Quantities of sewer manholes will be determined as units from actual count.

Manhole frames and covers will be measured as miscellaneous iron and steel as provided in Section 75, "Miscellaneous Metal," of the Standard Specifications.

**10-4.14 PAYMENT**

The contract prices paid per meter for the various sizes and types of sewer pipe; the contract price paid per kilogram for miscellaneous iron and steel for frames and covers; and the contract unit price for concrete sewer manhole shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the sewer facilities, complete in place, as shown on the plans, and as specified in the specifications and these special provisions, and as directed by the Engineer.

Full compensation for concrete used in constructing manhole bases involved in constructing the sewer facility, as shown on the plans and as directed by the Engineer, shall be considered as included in the contract prices paid for the various items of sewer work involved and no separate payment will be made therefor.

Full compensation for all structure excavation, structure backfill, imported bedding material placement, bar reinforcement, various types of pavement surfacing and bases, providing temporary sewer system, capping open ends of pipe, joining of pipe to other pipe or structure, shaping bottoms of existing and new manholes, remodeling manhole bases, utility support and protective work operations required to accommodate or safeguard public traffic, testing sewer piping, flushing, and cleaning the sewer line, furnishing and disposing of water used for testing and flushing work and cleaning gravity lines and all other incidental work and material required to construct the sewer system and conforming to the requirements of this section and these special provisions, shall be considered as included in the contract prices paid for the various contract items of sewer work and no additional compensation will be allowed therefore.

**SECTION 11. (BLANK)**

**SECTION 12. (BLANK)**

**SECTION 13. (BLANK)**

# SECTION 14 FEDERAL REQUIREMENTS FOR FEDERAL-AID CONSTRUCTION PROJECTS

**GENERAL**.—The work herein proposed will be financed in whole or in part with Federal funds, and therefore all of the statutes, rules and regulations promulgated by the Federal Government and applicable to work financed in whole or in part with Federal funds will apply to such work. The "Required Contract Provisions, Federal-Aid Construction Contracts, "Form FHWA 1273, are included in this Section 14. Whenever in said required contract provisions references are made to "SHA contracting officer", "SHA resident engineer", or "authorized representative of the SHA", such references shall be construed to mean "Engineer" as defined in Section 1-1.18 of the Standard Specifications.

**PERFORMANCE OF PREVIOUS CONTRACT**.—In addition to the provisions in Section II, "Nondiscrimination," and Section VII, "Subletting or Assigning the Contract," of the required contract provisions, the Contractor shall comply with the following:

The bidder shall execute the CERTIFICATION WITH REGARD TO THE PERFORMANCE OF PREVIOUS CONTRACTS OR SUBCONTRACTS SUBJECT TO THE EQUAL OPPORTUNITY CLAUSE AND THE FILING OF REQUIRED REPORTS located in the proposal. No request for subletting or assigning any portion of the contract in excess of $10,000 will be considered under the provisions of Section VII of the required contract provisions unless such request is accompanied by the CERTIFICATION referred to above, executed by the proposed subcontractor.

**NON-COLLUSION PROVISION**.—The provisions in this section are applicable to all contracts except contracts for Federal Aid Secondary projects.

Title 23, United States Code, Section 112, requires as a condition precedent to approval by the Federal Highway Administrator of the contract for this work that each bidder file a sworn statement executed by, or on behalf of, the person, firm, association, or corporation to whom such contract is to be awarded, certifying that such person, firm, association, or corporation has not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with the submitted bid. A form to make the non-collusion affidavit statement required by Section 112 as a certification under penalty of perjury rather than as a sworn statement as permitted by 28, USC, Sec. 1746, is included in the proposal.

**PARTICIPATION BY MINORITY BUSINESS ENTERPRISES IN SUBCONTRACTING**.—Part 23, Title 49, Code of Federal Regulations applies to this Federal-aid project. Pertinent sections of said Code are incorporated in part or in its entirety within other sections of these special provisions.

Schedule B—Information for Determining Joint Venture Eligibility

(This form need not be filled in if all joint venture firms are minority owned.)

1. Name of joint venture _____
2. Address of joint venture _____
3. Phone number of joint venture _____
4. Identify the firms which comprise the joint venture. (The MBE partner must complete Schedule A.) _____
   _____

   a. Describe the role of the MBE firm in the joint venture. _____
      _____
   b. Describe very briefly the experience and business qualifications of each non-MBE joint venturer: _____
      _____

5. Nature of the joint venture's business _____
   _____
6. Provide a copy of the joint venture agreement.
7. What is the claimed percentage of MBE ownership? _____
8. Ownership of joint venture: (This need not be filled in if described in the joint venture agreement, provided by question 6.).

   a. Profit and loss sharing.
   b. Capital contributions, including equipment.

c. Other applicable ownership interests.

9. Control of and participation in this contract. Identify by name, race, sex, and "firm" those individuals (and their titles) who are responsible for day-to-day management and policy decision making, including, but not limited to, those with prime responsibility for:

a. Financial decisions _____

b. Management decisions, such as:

(1) Estimating _____

(2). Marketing and sales _____

(3). Hiring and firing of management personnel _____

_____

(4) Purchasing of major items or supplies _____

_____

c. Supervision of field operations _____

Note.—If, after filing this Schedule B and before the completion of the joint venture's work on the contract covered by this regulation, there is any significant change in the information submitted, the joint venture must inform the grantee, either directly or through the prime contractor if the joint venture is a subcontractor.

**Affidavit**

"The undersigned swear that the foregoing statements are correct and include all material information necessary to identify and explain the terms and operation of our joint venture and the intended participation by each joint venturer in the undertaking. Further, the undersigned covenant and agree to provide to grantee current, complete and accurate information regarding actual joint venture work and the payment therefor and any proposed changes in any of the joint venture arrangements and to permit the audit and examination of the books, records and files of the joint venture, or those of each joint venturer relevant to the joint venture, by authorized representatives of the grantee or the Federal funding agency. Any material misrepresentation will be grounds for terminating any contract which may be awarded and for initiating action under Federal or State laws concerning false statements."

| | |
|---|---|
| Name of Firm | Name of Firm |
| Signature | Signature |
| Name | Name |
| Title | Title |
| Date | Date |

Date _____

State of _____

County of _____

On this ____ day of _____, 19 __, before me appeared (Name) _____, to me personally known, who, being duly sworn, did execute the foregoing affidavit, and did state that he or she was properly authorized by (Name of firm) _____ to execute the affidavit and did so as his or her free act and deed.

Notary Public _____

Commission expires _____

[Seal]

Date _____

State of _____

County of _____

On this ___ day of _____, 19 __, before me appeared (Name) _____ to me personally known, who, being duly sworn, did execute the foregoing affidavit, and did state that he or she was properly authorized by (Name of firm) _____ to execute the affidavit and did so as his or her free act and deed.

Notary Public _____

Commission expires _____

[Seal]

## REQUIRED CONTRACT PROVISIONS
## FEDERAL-AID CONSTRUCTION CONTRACTS

### I. GENERAL

1. These contract provisions shall apply to all work performed on the contract by the contractor's own organization and with the assistance of workers under the contractor's immediate superintendence and to all work performed on the contract by piecework, station work, or by subcontract.

2. Except as otherwise provided for in each section, the contractor shall insert in each subcontract all of the stipulations contained in these Required Contract Provisions, and further require their inclusion in any lower tier subcontract or purchase order that may in turn be made. The Required Contract Provisions shall not be incorporated by reference in any case. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with these Required Contract Provisions.

3. A breach of any of the stipulations contained in these Required Contract Provisions shall be sufficient grounds for termination of the contract.

4. A breach of the following clauses of the Required Contract Provisions may also be grounds for debarment as provided in 29 CFR 5.12:

   Section I, paragraph 2;
   Section IV, paragraphs 1, 2, 3, 4, and 7;
   Section V, paragraphs 1 and 2a through 2g.

5. Disputes arising out of the labor standards provisions of Section IV (except paragraph 5) and Section V of these Required Contract Provisions shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the U.S. Department of Labor (DOL) as set forth in 29 CFR 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the DOL, or the contractor's employees or their representatives.

6. **Selection of Labor:** During the performance of this contract, the contractor shall not:

   a. discriminate against labor from any other State, possession, or territory of the United States (except for employment preference for Appalachian contracts, when applicable, as specified in Attachment A), or

   b. employ convict labor for any purpose within the limits of the project unless it is labor performed by convicts who are on parole, supervised release, or probation.

### II. NONDISCRIMINATION

(Applicable to all Federal-aid construction contracts and to all related subcontracts of $10,000 or more.)

1. **Equal Employment Opportunity:** Equal employment opportunity (EEO) requirements not to discriminate and to take affirmative action to assure equal opportunity as set forth under laws, executive orders, rules, regulations (28 CFR 35, 29 CFR 1630, and 41 CFR 60) and orders of the Secretary of Labor as modified by the provisions prescribed herein, and imposed pursuant to 23 U.S.C. 140 shall constitute the EEO and specific affirmative action standards for the contractor's project activities under this contract. The Equal Opportunity Construction Contract Specifications set forth under 41 CFR 60-4.3 and the provisions of the American Disabilities Act of 1990 (42 U.S.C. 12101 et seq.) set forth under 28 CFR 35 and 29 CFR 1630 are incorporated by reference in this contract. In the execution of this contract, the contractor agrees to comply with the following minimum specific requirement activities of EEO:

   a. The contractor will work with the State highway agency (SHA) and the Federal Government in carrying out EEO obligations and in their review of his/her activities under the contract.

   b. The contractor will accept as his operating policy the following statement:

"It is the policy of this Company to assure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, sex, color, national origin, age or disability. Such action shall include: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship, preapprenticeship, and/or on-the-job training."

2. **EEO Officer:** The contractor will designate and make known to the SHA contracting officers an EEO Officer who will have the responsibility for and must be capable of effectively administering and promoting an active contractor program of EEO and who must be assigned adequate authority and responsibility to do so.

3. **Dissemination of Policy:** All members of the contractor's staff who are authorized to hire, supervise, promote, and discharge employees, or who recommend such action, or who are substantially involved in such action, will be made fully cognizant of, and will implement, the contractor's EEO policy and contractual responsibilities to provide EEO in each grade and classification of employment. To ensure that the above agreement will be met, the following actions will be taken as a minimum:

   a. Periodic meetings of supervisory and personnel office employees will be conducted before the start of work and then not less often than once every six months, at which time the contractor's EEO policy and its implementation will be reviewed and explained. The meetings will be conducted by the EEO Officer.

   b. All new supervisory or personnel office employees will be given a thorough indoctrination by the EEO Officer, covering all major aspects of the contractor's EEO obligations within thirty days following their reporting for duty with the contractor.

   c. All personnel who are engaged in direct recruitment for the project will be instructed by the EEO Officer in the contractor's procedures for locating and hiring minority group employees.

   d. Notices and posters setting forth the contractor's EEO policy will be placed in areas readily accessible to employees, applicants for employment and potential employees.

   e. The contractor's EEO policy and the procedures to implement such policy will be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.

4. **Recruitment:** When advertising for employees, the contractor will include in all advertisements for employees the notation: "An Equal Opportunity Employer." All such advertisements will be placed in publications having a large circulation among minority groups in the area from which the project work force would normally be derived.

   a. The contractor will, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employee referral sources likely to yield qualified minority group applicants. To meet this requirement, the contractor will identify sources of potential minority group employees, and establish with such identified sources procedures whereby minority group applicants may be referred to the contractor for employment consideration.

   b. In the event the contractor has a valid bargaining agreement providing for exclusive hiring hall referrals, he is expected to observe the provisions of that agreement to the extent that the system permits the contractor's compliance with EEO contract provisions. (The DOL has held that where implementation of such agreements have the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Executive Order 11246, as amended.)

   c. The contractor will encourage his present employees to refer minority group applicants for employment. Information and procedures with regard to referring minority group applicants will be discussed with employees.

5. **Personnel Actions:** Wages, working conditions, and employee benefits shall be established and administered, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff, and termination, shall be taken without regard to race, color, religion, sex, national origin, age or disability. The following procedures shall be followed:

a. The contractor will conduct periodic inspections of project sites to insure that working conditions and employee facilities do not indicate discriminatory treatment of project site personnel.

b. The contractor will periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.

c. The contractor will periodically review selected personnel actions in depth to determine whether there is evidence of discrimination. Where evidence is found, the contractor will promptly take corrective action. If the review indicates that the discrimination may extend beyond the actions reviewed, such corrective action shall include all affected persons.

d. The contractor will promptly investigate all complaints of alleged discrimination made to the contractor in connection with his obligations under this contract, will attempt to resolve such complaints, and will take appropriate corrective action within a reasonable time. If the investigation indicates that the discrimination may affect persons other than the complainant, such corrective action shall include such other persons. Upon completion of each investigation, the contractor will inform every complainant of all of his avenues of appeal.

6. Training and Promotion:

a. The contractor will assist in locating, qualifying, and increasing the skills of minority group and women employees, and applicants for employment.

b. Consistent with the contractor's work force requirements and as permissible under Federal and State regulations, the contractor shall make full use of training programs, i.e., apprenticeship, and on-the-job training programs for the geographical area of contract performance. Where feasible, 25 percent of apprentices or trainees in each occupation shall be in their first year of apprenticeship or training. In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision.

c. The contractor will advise employees and applicants for employment of available training programs and entrance requirements for each.

d. The contractor will periodically review the training and promotion potential of minority group and women employees and will encourage eligible employees to apply for such training and promotion.

7. **Unions:** If the contractor relies in whole or in part upon unions as a source of employees, the contractor will use his/her best efforts to obtain the cooperation of such unions to increase opportunities for minority groups and women within the unions, and to effect referrals by such unions of minority and female employees. Actions by the contractor either directly or through a contractor's association acting as agent will include the procedures set forth below:

a. The contractor will use best efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minority group members and women for membership in the unions and increasing the skills of minority group employees and women so that they may qualify for higher paying employment.

b. The contractor will use best efforts to incorporate an EEO clause into each union agreement to the end that such union will be contractually bound to refer applicants without regard to their race, color, religion, sex, national origin, age or disability.

c. The contractor is to obtain information as to the referral practices and policies of the labor union except that to the extent such information is within the exclusive possession of the labor union and such labor union refuses to furnish such information to the contractor, the contractor shall so certify to the SHA and shall set forth what efforts have been made to obtain such information.

d. In the event the union is unable to provide the contractor with a reasonable flow of minority and women referrals within the time limit set forth in the collective bargaining agreement, the contractor will, through

independent recruitment efforts, fill the employment vacancies without regard to race, color, religion, sex, national origin, age or disability; making full efforts to obtain qualified and/or qualifiable minority group persons and women. (The DOL has held that it shall be no excuse that the union with which the contractor has a collective bargaining agreement providing for exclusive referral failed to refer minority employees.) In the event the union referral practice prevents the contractor from meeting the obligations pursuant to Executive Order 11246, as amended, and these special provisions, such contractor shall immediately notify the SHA.

8. **Selection of Subcontractors, Procurement of Materials and Leasing of Equipment:** The contractor shall not discriminate on the grounds of race, color, religion, sex, national origin, age or disability in the selection and retention of subcontractors, including procurement of materials and leases of equipment.

a. The contractor shall notify all potential subcontractors and suppliers of his/her EEO obligations under this contract.

b. Disadvantaged business enterprises (DBE), as defined in 49 CFR 23, shall have equal opportunity to compete for and perform subcontracts which the contractor enters into pursuant to this contract. The contractor will use his best efforts to solicit bids from and to utilize DBE subcontractors or subcontractors with meaningful minority group and female representation among their employees. Contractors shall obtain lists of DBE construction firms from SHA personnel.

c. The contractor will use his best efforts to ensure subcontractor compliance with their EEO obligations.

9. **Records and Reports:** The contractor shall keep such records as necessary to document compliance with the EEO requirements. Such records shall be retained for a period of three years following completion of the contract work and shall be available at reasonable times and places for inspection by authorized representatives of the SHA and the FHWA.

a. The records kept by the contractor shall document the following:

(1) The number of minority and non-minority group members and women employed in each work classification on the project;

(2) The progress and efforts being made in cooperation with unions, when applicable, to increase employment opportunities for minorities and women;

(3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minority and female employees; and

(4) The progress and efforts being made in securing the services of DBE subcontractors or subcontractors with meaningful minority and female representation among their employees.

b. The contractors will submit an annual report to the SHA each July for the duration of the project, indicating the number of minority, women, and non-minority group employees currently engaged in each work classification required by the contract work. This information is to be reported on Form FHWA-1391. If on-the-job training is being required by special provision, the contractor will be required to collect and report training data.

## III. NONSEGREGATED FACILITIES

(Applicable to all Federal-aid construction contracts and to all related subcontracts of $10,000 or more.)

a. By submission of this bid, the execution of this contract or subcontract, or the consummation of this material supply agreement or purchase order, as appropriate, the bidder, Federal-aid construction contractor, subcontractor, material supplier, or vendor, as appropriate, certifies that the firm does not maintain or provide for its employees any segregated facilities at any of its establishments, and that the firm does not permit its employees to perform their services at any location, under its control, where segregated facilities are maintained. The firm agrees that a breach of this certification is a violation of the EEO provisions of this contract. The firm further certifies that no employee will be denied access to adequate facilities on the basis of sex or disability.

b. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, restrooms and washrooms, restaurants and other eating areas, time clocks, locker rooms, and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive, or are, in fact, segregated on the basis of race, color, religion, national origin, age or disability, because of habit, local custom, or otherwise. The only exception will be for the disabled when the demands for accessibility override (e.g. disabled parking).

c. The contractor agrees that it has obtained or will obtain identical certification from proposed subcontractors or material suppliers prior to award of subcontracts or consummation of material supply agreements of $10,000 or more and that it will retain such certifications in its files.

## IV. PAYMENT OF PREDETERMINED MINIMUM WAGE

(Applicable to all Federal-aid construction contracts exceeding $2,000 and to all related subcontracts, except for projects located on roadways classified as local roads or rural minor collectors, which are exempt.)

**1. General:**

a. All mechanics and laborers employed or working upon the site of the work will be paid unconditionally and not less often than once a week and without subsequent deduction or rebate on any account [except such payroll deductions as are permitted by regulations (29 CFR 3)] issued by the Secretary of Labor under the Copeland Act (40 U.S.C. 276c) the full amounts of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment. The payment shall be computed at wage rates not less than those contained in the wage determination of the Secretary of Labor (hereinafter "the wage determination") which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor or its subcontractors and such laborers and mechanics. The wage determination (including any additional classifications and wage rates conformed under paragraph 2 of this Section IV and the DOL poster (WH-1321) or Form FHWA-1495) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers. For the purpose of this Section, contributions made or costs reasonably anticipated for bona fide fringe benefits under Section 1(b)(2) of the Davis-Bacon Act (40 U.S.C. 276a) on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of Section IV, paragraph 3b, hereof. Also, for the purpose of this Section, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs, which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in paragraphs 4 and 5 of this Section IV.

b. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein, provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed.

c. All rulings and interpretations of the Davis-Bacon Act and related acts contained in 29 CFR 1, 3, and 5 are herein incorporated by reference in this contract.

**2. Classification:**

a. The SHA contracting officer shall require that any class of laborers or mechanics employed under the contract, which is not listed in the wage determination, shall be classified in conformance with the wage determination.

b. The contracting officer shall approve an additional classification, wage rate and fringe benefits only when the following criteria have been met:

(1) the work to be performed by the additional classification requested is not performed by a classification in the wage determination;

(2) the additional classification is utilized in the area by the construction industry;

(3) the proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination; and

(4) with respect to helpers, when such a classification prevails in the area in which the work is performed.

c. If the contractor or subcontractors, as appropriate, the laborers and mechanics (if known) to be employed in the additional classification or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the DOL, Administrator of the Wage and Hour Division, Employment Standards Administration, Washington, D.C. 20210. The Wage and Hour Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

d. In the event the contractor or subcontractors, as appropriate, the laborers or mechanics to be employed in the additional classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Wage and Hour Administrator for determination. Said Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary

e. The wage rate (including fringe benefits where appropriate) determined pursuant to paragraph 2c or 2d of this Section IV shall be paid to all workers performing work in the additional classification from the first day on which work is performed in the classification.

**3. Payment of Fringe Benefits:**

a. Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor or subcontractors, as appropriate, shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly case equivalent thereof.

b. If the contractor or subcontractor, as appropriate, does not make payments to a trustee or other third person, he/she may consider as a part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, provided, that the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

**4. Apprentices and Trainees (Programs of the U.S. DOL) and Helpers:**

a. Apprentices:

(1) Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the DOL, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State apprenticeship agency recognized by the Bureau, or if a person is employed in his/her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State apprenticeship agency (where appropriate) to be eligible for probationary employment as an apprentice.

(2) The allowable ratio of apprentices to journeyman-level employees on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any employee listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate listed in the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a

contractor or subcontractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman-level hourly rate) specified in the contractor's or subcontractor's registered program shall be observed.

(3) Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeyman-level hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator for the Wage and Hour Division determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination.

(4) In the event the Bureau of Apprenticeship and Training, or a State apprenticeship agency recognized by the Bureau, withdraws approval of an apprenticeship program, the contractor or subcontractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the comparable work performed by regular employees until an acceptable program is approved.

b. Trainees:

(1) Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the DOL, Employment and Training Administration.

(2) The ratio of trainees to journeyman-level employees on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed.

(3) Every trainee must be paid at not less than the rate specified in the approved program for his/her level of progress, expressed as a percentage of the journeyman-level hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman-level wage rate on the wage determination which provides for less than full fringe benefits for apprentices, in which case such trainees shall receive the same fringe benefits as apprentices.

(4) In the event the Employment and Training Administration withdraws approval of a training program, the contractor or subcontractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

c. Helpers**:**

Helpers will be permitted to work on a project if the helper classification is specified and defined on the applicable wage determination or is approved pursuant to the conformance procedure set forth in Section IV.2. Any worker listed on a payroll at a helper wage rate, who is not a helper under an approved definition, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed.

**5. Apprentices and Trainees (Programs of the U.S. DOT):**

Apprentices and trainees working under apprenticeship and skill training programs which have been certified by the Secretary of Transportation as promoting EEO in connection with Federal-aid highway construction programs are

not subject to the requirements of paragraph 4 of this Section IV. The straight time hourly wage rates for apprentices and trainees under such programs will be established by the particular programs. The ratio of apprentices and trainees to journeymen shall not be greater than permitted by the terms of the particular program.

6. **Withholding:**
The SHA shall upon its own action or upon written request of an authorized representative of the DOL withhold, or cause to be withheld, from the contractor or subcontractor under this contract or any other Federal contract with the same prime contractor, or any other Federally-assisted contract subject to Davis-Bacon prevailing wage requirements which is held by the same prime contractor, as much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the SHA contracting officer may, after written notice to the contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

7. **Overtime Requirements:**
No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers, mechanics, watchmen, or guards (including apprentices, trainees, and helpers described in paragraphs 4 and 5 above) shall require or permit any laborer, mechanic, watchman, or guard in any workweek in which he/she is employed on such work, to work in excess of 40 hours in such workweek unless such laborer, mechanic, watchman, or guard receives compensation at a rate not less than one-and-one-half times his/her basic rate of pay for all hours worked in excess of 40 hours in such workweek.

8. **Violation:**
Liability for Unpaid Wages; Liquidated Damages: In the event of any violation of the clause set forth in paragraph 7 above, the contractor and any subcontractor responsible thereof shall be liable to the affected employee for his/her unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory) for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer, mechanic, watchman, or guard employed in violation of the clause set forth in paragraph 7, in the sum of $10 for each calendar day on which such employee was required or permitted to work in excess of the standard work week of 40 hours without payment of the overtime wages required by the clause set forth in paragraph 7.

9. **Withholding for Unpaid Wages and Liquidated Damages:**
The SHA shall upon its own action or upon written request of any authorized representative of the DOL withhold, or cause to be withheld, from any monies payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other Federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph 8 above.

## V. STATEMENTS AND PAYROLLS

(Applicable to all Federal-aid construction contracts exceeding $2,000 and to all related subcontracts, except for projects located on roadways classified as local roads or rural collectors, which are exempt.)

1. Compliance with Copeland Regulations (29 CFR 3):

   The contractor shall comply with the Copeland Regulations of the Secretary of Labor which are herein incorporated by reference.

2. Payrolls and Payroll Records:

   a. Payrolls and basic records relating thereto shall be maintained by the contractor and each subcontractor during the course of the work and preserved for a period of 3 years from the date of completion of the contract for all laborers, mechanics, apprentices, trainees, watchmen, helpers, and guards working at the site of the work.

b. The payroll records shall contain the name, social security number, and address of each such employee; his or her correct classification; hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalent thereof the types described in Section 1(b)(2)(B) of the Davis Bacon Act); daily and weekly number of hours worked; deductions made; and actual wages paid. In addition, for Appalachian contracts, the payroll records shall contain a notation indicating whether the employee does, or does not, normally reside in the labor area as defined in Attachment A, paragraph 1. Whenever the Secretary of Labor, pursuant to Section IV, paragraph 3b, has found that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in Section 1(b)(2)(B) of the Davis Bacon Act, the contractor and each subcontractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, that the plan or program has been communicated in writing to the laborers or mechanics affected, and show the cost anticipated or the actual cost incurred in providing benefits. Contractors or subcontractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprentices and trainees, and ratios and wage rates prescribed in the applicable programs.

c. Each contractor and subcontractor shall furnish, each week in which any contract work is performed, to the SHA resident engineer a payroll of wages paid each of its employees (including apprentices, trainees, and helpers, described in Section IV, paragraphs 4 and 5, and watchmen and guards engaged on work during the preceding weekly payroll period). The payroll submitted shall set out accurately and completely all of the information required to be maintained under paragraph 2b of this Section V. This information may be submitted in any form desired. Optional Form WH-347 is available for this purpose and may be purchased from the Superintendent of Documents (Federal stock number 029-005-0014-1), U.S. Government Printing Office, Washington, D.C. 20402. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors.

d. Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his/her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) that the payroll for the payroll period contains the information required to be maintained under paragraph 2b of this Section V and that such information is correct and complete;

(2) that such laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in the Regulations, 29 CFR 3;

(3) that each laborer or mechanic has been paid not less that the applicable wage rate and fringe benefits or cash equivalent for the classification of worked performed, as specified in the applicable wage determination incorporated into the contract.

e. The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph 2d of this Section V.

f. The falsification of any of the above certifications may subject the contractor to civil or criminal prosecution under 18 U.S.C. 1001 and 31 U.S.C. 231.

g. The contractor or subcontractor shall make the records required under paragraph 2b of this Section V available for inspection, copying, or transcription by authorized representatives of the SHA, the FHWA, or the DOL, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the SHA, the FHWA, the DOL, or all may, after written notice to the contractor, sponsor, applicant, or owner, take such actions as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

## VI. RECORD OF MATERIALS, SUPPLIES, AND LABOR

1. On all Federal-aid contracts on the National Highway System, except those which provide solely for the installation of protective devices at railroad grade crossings, those which are constructed on a force account or direct labor basis, highway beautification contracts, and contracts for which the total final construction cost for roadway and bridge is less than $1,000,000 (23 CFR 635) the contractor shall:

    a. Become familiar with the list of specific materials and supplies contained in Form FHWA-47, "Statement of Materials and Labor Used by Contractor of Highway Construction Involving Federal Funds," prior to the commencement of work under this contract.

    b. Maintain a record of the total cost of all materials and supplies purchased for and incorporated in the work, and also of the quantities of those specific materials and supplies listed on Form FHWA-47, and in the units shown on Form FHWA-47.

    c. Furnish, upon the completion of the contract, to the SHA resident engineer on Form FHWA-47 together with the data required in paragraph 1b relative to materials and supplies, a final labor summary of all contract work indicating the total hours worked and the total amount earned.

2. At the prime contractor's option, either a single report covering all contract work or separate reports for the contractor and for each subcontract shall be submitted.

## VII. SUBLETTING OR ASSIGNING THE CONTRACT

1. The contractor shall perform with its own organization contract work amounting to not less than 30 percent (or a greater percentage if specified elsewhere in the contract) of the total original contract price, excluding any specialty items designated by the State. Specialty items may be performed by subcontract and the amount of any such specialty items performed may be deducted from the total original contract price before computing the amount of work required to be performed by the contractor's own organization (23 CFR 635).

    a. "Its own organization" shall be construed to include only workers employed and paid directly by the prime contractor and equipment owned or rented by the prime contractor, with or without operators. Such term does not include employees or equipment of a subcontractor, assignee, or agent of the prime contractor.

    b. "Specialty Items" shall be construed to be limited to work that requires highly specialized knowledge, abilities, or equipment not ordinarily available in the type of contracting organizations qualified and expected to bid on the contract as a whole and in general are to be limited to minor components of the overall contract.

2. The contract amount upon which the requirements set forth in paragraph 1 of Section VII is computed includes the cost of material and manufactured products which are to be purchased or produced by the contractor under the contract provisions.

3. The contractor shall furnish (a) a competent superintendent or supervisor who is employed by the firm, has full authority to direct performance of the work in accordance with the contract requirements, and is in charge of all construction operations (regardless of who performs the work) and (b) such other of its own organizational resources (supervision, management, and engineering services) as the SHA contracting officer determines is necessary to assure the performance of the contract.

4. No portion of the contract shall be sublet, assigned or otherwise disposed of except with the written consent of the SHA contracting officer, or authorized representative, and such consent when given shall not be construed to relieve the contractor of any responsibility for the fulfillment of the contract. Written consent will be given only after the SHA has assured that each subcontract is evidenced in writing and that it contains all pertinent provisions and requirements of the prime contract.

## VIII. SAFETY: ACCIDENT PREVENTION

1. In the performance of this contract the contractor shall comply with all applicable Federal, State, and local laws governing safety, health, and sanitation (23 CFR 635). The contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions as it determines, or as the SHA contracting officer may

determine, to be reasonably necessary to protect the life and health of employees on the job and the safety of the public and to protect property in connection with the performance of the work covered by the contract.

2. It is a condition of this contract, and shall be made a condition of each subcontract, which the contractor enters into pursuant to this contract, that the contractor and any subcontractor shall not permit any employee, in performance of the contract, to work in surroundings or under conditions which are unsanitary, hazardous or dangerous to his/her health or safety, as determined under construction safety and health standards (29 CFR 1926) promulgated by the Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 333).

3. Pursuant to 29 CFR 1926.3, it is a condition of this contract that the Secretary of Labor or authorized representative thereof, shall have right of entry to any site of contract performance to inspect or investigate the matter of compliance with the construction safety and health standards and to carry out the duties of the Secretary under Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 333).

## IX. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

In order to assure high quality and durable construction in conformity with approved plans and specifications and a high degree of reliability on statements and representations made by engineers, contractors, suppliers, and workers on Federal-aid highway projects, it is essential that all persons concerned with the project perform their functions as carefully, thoroughly, and honestly as possible. Willful falsification, distortion, or misrepresentation with respect to any facts related to the project is a violation of Federal law. To prevent any misunderstanding regarding the seriousness of these and similar acts, the following notice shall be posted on each Federal-aid highway project (23 CFR 635) in one or more places where it is readily available to all persons concerned with the project:

**Notice To All Personnel Engaged On Federal-Aid Highway Projects**

18 U.S.C. 1020 READS AS FOLLOWS:

"Whoever being an officer, agent, or employee of the United States, or any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of the material used or to be used, or the quantity or quality of the work performed or to be performed, or the cost thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction on any highway or related project submitted for approval to the Secretary of Transportation; or

Whoever knowingly makes any false statement, false representation, false report or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or

Whoever knowingly makes any false statement or false representation as to material fact in any statement, certificate, or report submitted pursuant to provisions of the Federal-aid Roads Act approved July 1, 1916, (39 Stat. 355), as amended and supplemented;

Shall be fined not more that $10,000 or imprisoned not more than 5 years or both."

## X. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT

(Applicable to all Federal-aid construction contracts and to all related subcontracts of $100,000 or more.)

By submission of this bid or the execution of this contract, or subcontract, as appropriate, the bidder, Federal-aid construction contractor, or subcontractor, as appropriate, will be deemed to have stipulated as follows:

1. That any facility that is or will be utilized in the performance of this contract, unless such contract is exempt under the Clean Air Act, as amended (42 U.S.C. 1857 et seq., as amended by Pub.L. 91-604), and under the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251 et seq., as amended by Pub.L. 92-500), Executive Order 11738, and regulations in implementation thereof (40 CFR 15) is not listed, on the date of contract award, on the U.S. Environmental Protection Agency (EPA) List of Violating Facilities pursuant to 40 CFR 15.20.

2. That the firm agrees to comply and remain in compliance with all the requirements of Section 114 of the Clean Air Act and Section 308 of the Federal Water Pollution Control Act and all regulations and guidelines listed thereunder.

3. That the firm shall promptly notify the SHA of the receipt of any communication from the Director, Office of Federal Activities, EPA, indicating that a facility that is or will be utilized for the contract is under consideration to be listed on the EPA List of Violating Facilities.

4. That the firm agrees to include or cause to be included the requirements of paragraph 1 through 4 of this Section X in every nonexempt subcontract, and further agrees to take such action as the government may direct as a means of enforcing such requirements.

## XI. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

**1. Instructions for Certification - Primary Covered Transactions:**

(Applicable to all Federal-aid contracts - 49 CFR 29)

a. By signing and submitting this proposal, the prospective primary participant is providing the certification set out below.

b. The inability of a person to provide the certification set out below will not necessarily result in denial of participation in this covered transaction. The prospective participant shall submit an explanation of why it cannot provide the certification set out below. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective primary participant to furnish a certification or an explanation shall disqualify such a person from participation in this transaction.

c. The certification in this clause is a material representation of fact upon which reliance was placed when the department or agency determined to enter into this transaction. If it is later determined that the prospective primary participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause of default.

d. The prospective primary participant shall provide immediate written notice to the department or agency to whom this proposal is submitted if any time the prospective primary participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

e. The terms "covered transaction," "debarred," "suspended," "ineligible," "lower tier covered transaction," "participant," "person," "primary covered transaction," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the department or agency to which this proposal is submitted for assistance in obtaining a copy of those regulations.

f. The prospective primary participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency entering into this transaction.

g. The prospective primary participant further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," provided by the department or agency entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.

h. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to,

check the nonprocurement portion of the "Lists of Parties Excluded From Federal Procurement or Nonprocurement Programs" (Nonprocurement List) which is compiled by the General Services Administration.

i. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

j. Except for transactions authorized under paragraph f of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default.

**Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion — Primary Covered Transactions**

1. The prospective primary participant certifies to the best of its knowledge and belief, that it and its principals:

   a. Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;

   b. Have not within a 3-year period preceding this proposal been convicted of or had a civil judgement rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

   c. Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph 1b of this certification; and

   d. Have not within a 3-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

2. Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

**2. Instructions for Certification - Lower Tier Covered Transactions:**

(Applicable to all subcontracts, purchase orders and other lower tier transactions of $25,000 or more - 49 CFR 29)

a. By signing and submitting this proposal, the prospective lower tier is providing the certification set out below.

b. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

c. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous by reason of changed circumstances.

d. The terms "covered transaction," "debarred," "suspended," "ineligible," "primary covered transaction," "participant," "person," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations.

e. The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.

f. The prospective lower tier participant further agrees by submitting this proposal that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.

g. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the Nonprocurement List.

h. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

i. Except for transactions authorized under paragraph e of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

**Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion — Lower Tier Covered Transactions**

1. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.

2. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

## XII. CERTIFICATION REGARDING USE OF CONTRACT FUNDS FOR LOBBYING

(Applicable to all Federal-aid construction contracts and to all related subcontracts which exceed $100,000 - 49 CFR 20)

1. The prospective participant certifies, by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

   a. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

   b. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

2. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

3. The prospective participant also agrees by submitting his or her bid or proposal that he or she shall require that the language of this certification be included in all lower tier subcontracts, which exceed $100,000 and that all such recipients shall certify and disclose accordingly.

## FEDERAL-AID FEMALE AND MINORITY GOALS

In accordance with Section II, "Nondiscrimination," of "Required Contract Provisions Federal-aid Construction Contracts" the following are the goals for female utilization:

Goal for Women (applies nationwide).....(percent) 6.9

The following are goals for minority utilization:

### CALIFORNIA ECONOMIC AREA

| | | Goal (Percent) |
|---|---|---|
| **174** | **Redding, CA:** | |
| | Non-SMSA Counties | 6.8 |
| | CA Lassen; CA Modoc;CA Plumas; CA Shasta; CA Siskiyou; CA Tehama. | |
| **175** | **Eureka, CA** | |
| | Non-SMSA Counties | 6.6 |
| | CA Del Norte; CA Humboldt; CA Trinity. | |
| **176** | **San Francisco-Oakland-San Jose, CA:** | |
| | SMSA Counties: | |
| | 7120 Salinas-Seaside-Monterey, CA | 28.9 |
| | CA Monterey. | |
| | 7360 San Francisco-Oakland | 25.6 |
| | CA Alameda; CA Contra Costa; CA Marin; CA San Francisco; CA San Mateo. | |
| | 7400 San Jose, CA | 19.6 |
| | CA Santa Clara. | |
| | 7485 Santa Cruz, CA. | 14.9 |
| | CA Santa Cruz. | |
| | 7500 Santa Rosa, CA | 9.1 |
| | CA Sonoma. | |
| | 8720 Vallejo-Fairfield- Napa, CA | 17.1 |
| | CA Napa; CA Solano | |
| | Non-SMSA Counties | 23.2 |
| | CA Lake; CA Mendocino; CA San Benito | |
| **177** | **Sacramento, CA**: | |
| | SMSA Counties: | |
| | 6920 Sacramento, CA | 16.1 |
| | CA Placer; CA Sacramento; CA Yolo. | |
| | Non-SMSA Counties | 14.3 |
| | CA Butte; CA Colusa; CA El Dorado; CA Glenn; CA Nevada; CA Sierra; CA Sutter; CA Yuba. | |
| **178** | **Stockton-Modesto, CA:** | |
| | SMSA Counties: | |
| | 5170 Modesto, CA | 12.3 |
| | CA Stanislaus. | |
| | 8120 Stockton, CA | 24.3 |
| | CA San Joaquin. | |
| | Non-SMSA Counties | 19.8 |
| | CA Alpine; CA Amador; CA Calaveras; CA Mariposa; CA Merced; CA Tuolumne. | |

| | | Goal (Percent) |
|---|---|---|
| **179** | **Fresno-Bakersfield, CA** | |
| | SMSA Counties: | |
| | 0680 Bakersfield, CA | 19.1 |
| | CA Kern. | |
| | 2840 Fresno, CA | 26.1 |
| | CA Fresno. | |
| | Non-SMSA Counties | 23.6 |
| | CA Kings; CA Madera; CA Tulare. | |
| **180** | **Los Angeles, CA:** | |
| | SMSA Counties: | |
| | 0360 Anaheim-Santa Ana-Garden Grove, CA | 11.9 |
| | CA Orange. | |
| | 4480 Los Angeles-Long Beach, CA | 28.3 |
| | CA Los Angeles. | |
| | 6000 Oxnard-Simi Valley-Ventura, CA | 21.5 |
| | CA Ventura. | |
| | 6780 Riverside-San Bernardino-Ontario, CA. | 19.0 |
| | CA Riverside; CA San Bernardino. | |
| | 7480 Santa Barbara-Santa Maria-Lompoc, CA | 19.7 |
| | CA Santa Barbara. | |
| | Non-SMSA Counties | 24.6 |
| | CA Inyo; CA Mono; CA San Luis Obispo. | |
| **181** | **San Diego, CA:** | |
| | SMSA Counties | |
| | 7320 San Diego, CA. | 16.9 |
| | CA San Diego. | |
| | Non-SMSA Counties | 18.2 |
| | CA Imperial. | |

In addition to the reporting requirements set forth elsewhere in this contract the Contractor and subcontractors holding subcontracts, not including material suppliers, of $10,000 or more, shall submit for every month of July during which work is performed, employment data as contained under Form FHWA PR-1391 (Appendix C to 23 CFR, Part 230), and in accordance with the instructions included thereon.

## FEDERAL REQUIREMENT TRAINING SPECIAL PROVISIONS

As part of the Contractor's equal employment opportunity affirmative action program, training shall be provided as follows:

The Contractor shall provide on-the-job training to develop full journeymen in the types of trades or job classification involved.

The goal for the number of trainees or apprentices to be trained under the requirements of this special provision will be 18.

In the event the Contractor subcontracts a portion of the contract work, he shall determine how many, if any, of the trainees or apprentices are to be trained by the subcontractor, provided however, that the Contractor shall retain the primary responsibility for meeting the training requirements imposed by this special provision. The Contractor shall also insure that this Training Special Provision is made applicable to such subcontract. Where feasible, 25 percent of trainees or apprentices in each occupation shall be in their first year of apprenticeship or training.

The number of trainees or apprentices shall be distributed among the work classifications on the basis of the Contractor's needs and the availability of journeymen in the various classifications within a reasonable area of recruitment. Prior to commencing work, the Contractor shall submit to the Department for approval the number of trainees or apprentices to be trained in each selected classification and training program to be used. Furthermore, the Contractor shall specify the starting time for training in each of the classifications. The Contractor will be credited for each trainee or apprentice employed by him on the contract work who is currently enrolled or becomes enrolled in an approved program and will be reimbursed for such trainees or apprentices as provided hereinafter.

Training and upgrading of minorities and women toward journeymen status is a primary objective of this Training Special Provision. Accordingly, the Contractor shall make every effort to enroll minority and women trainees or apprentices (e.g., by conducting systematic and direct recruitment through public and private sources likely to yield minority and women trainees or apprentices) to the extent such persons are available within a reasonable area of recruitment. The Contractor will be responsible for demonstrating the steps that he has taken in pursuance thereof, prior to a determination as to whether the Contractor is in compliance with this Training Special Provision. This training commitment is not intended, and shall not be used, to discriminate against any applicant for training, whether a member of a minority group or not.

No employee shall be employed as a trainee or apprentice in any classification in which he has successfully completed a training course leading to journeyman status or in which he has been employed as a journeyman. The Contractor should satisfy this requirement by including appropriate questions in the employee application or by other suitable means. Regardless of the method used the Contractor's records should document the findings in each case.

The minimum length and type of training for each classification will be as established in the training program selected by the Contractor and approved by both the Department and the Federal Highway Administration. The Department and the Federal Highway Administration will approve a program if it is reasonably calculated to meet the equal employment opportunity obligations of the Contractor and to qualify the average trainee or apprentice for journeyman status in the classification concerned by the end of the training period. Furthermore, apprenticeship programs registered with the U.S. Department of Labor, Bureau of Apprenticeship and Training, or with the State of California, Department of Industrial Relations, Division of Apprenticeship Standards recognized by the Bureau and training programs approved but not necessarily sponsored by the U.S. Department of Labor, Manpower Administration, Bureau of Apprenticeship and Training shall also be considered acceptable provided it is being administered in a manner consistent with the equal employment obligations of Federal-aid highway construction contracts. Approval or acceptance of a training program shall be obtained from the State prior to commencing work on the classification covered by the program. It is the intention of these provisions that training is to be provided in the construction crafts rather than clerk-typists or secretarial-type positions. Training is permissible in lower level management positions such as office engineers, estimators, timekeepers, etc., where the training is oriented toward construction applications. Training in the laborer classification may be permitted provided that significant and meaningful training is provided and approved by the division office. Some offsite training is permissible as long as the training is an integral part of an approved training program and does not comprise a significant part of the overall training.

Except as otherwise noted below, the Contractor will be reimbursed 80 cents per hour of training given an employee on this contract in accordance with an approved training program. As approved by the Engineer, reimbursement will be made for training of persons in excess of the number specified herein. This reimbursement will be made even though the Contractor receives additional training program funds from other sources, provided such other source does not specifically prohibit the Contractor from receiving other reimbursement. Reimbursement for offsite training indicated above may only be made to the Contractor where he does one or more of the following and the trainees or apprentices are concurrently employed on a Federal-aid project; contributes to the cost of the training, provides the instruction to the trainee or apprentice or pays the trainee's or apprentice's wages during the offsite training period.

No payment shall be made to the Contractor if either the failure to provide the required training, or the failure to hire the trainee or apprentice as a journeyman, is caused by the Contractor and evidences a lack of good faith on the part of the Contractor in meeting the requirements of this Training Special Provision. It is normally expected that a trainee or apprentice will begin his training on the project as soon as feasible after start of work utilizing the skill involved and remain on the project as long as training opportunities exist in his work classification or until he has completed his training program. It is not required that all trainees or apprentices be on board for the entire length of the contract. A Contractor will have fulfilled his responsibilities under this Training Special Provision if he has provided acceptable training to the number of trainees or apprentices specified. The number trained shall be determined on the basis of the total number enrolled on the contract for a significant period.

Only trainees or apprentices registered in a program approved by the State of California's State Administrator of Apprenticeship may be employed on the project and said trainees or apprentices shall be paid the standard wage specified under the regulations of the craft or trade at which they are employed.

The Contractor shall furnish the trainee or apprentice a copy of the program he will follow in providing the training. The Contractor shall provide each trainee or apprentice with a certification showing the type and length of training satisfactorily completed.

The Contractor will provide for the maintenance of records and furnish periodic reports documenting his performance under this Training Special Provision.