



STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

**NOTICE TO BIDDERS
AND
SPECIAL PROVISIONS**

**FOR CONSTRUCTION ON STATE HIGHWAY IN SAN MATEO COUNTY IN
BURLINGAME FROM 0.3 MILE NORTH OF ANZA BOULEVARD TO 0.9 MILE
SOUTH OF MILLBRAE AVENUE OVERCROSSING**

In District 04 On Route 101

Under

Bid book dated February 24, 2014

Standard Specifications dated 2010

Project plans approved October 21, 2013

Standard Plans dated 2010

Identified by

Contract No. 04-235844

04-SM-101-16.3/17.1

Project ID 0400000684

Federal-Aid Project

ACNHP-Q101(237)E

CML-6204(113)

Bids open Tuesday, April 15, 2014
Dated February 24, 2014

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SPECIAL NOTICES

- For federal-aid projects, the Department is modifying its DBE program.

CONTRACT NO. 04-235844

The special provisions contained herein have been prepared by or under the direction of the following Registered Persons.

HIGHWAYS

ARBhoi

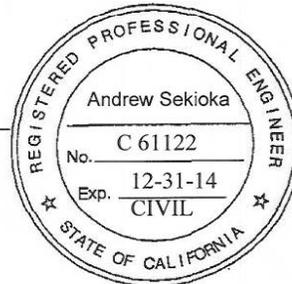
REGISTERED CIVIL ENGINEER



DRAINAGE

And Sek

REGISTERED CIVIL ENGINEER



ELECTRICAL

Angela R Obeso

REGISTERED CIVIL ENGINEER



LANDSCAPE

Leah Haygood

LICENSED LANDSCAPE ARCHITECT



STRUCTURES

Austin Prince

REGISTERED CIVIL ENGINEER



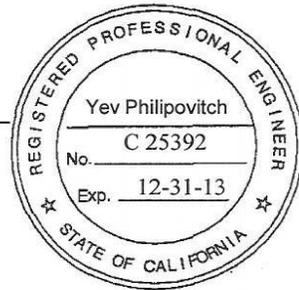
Chao Gong

REGISTERED CIVIL ENGINEER



WATER

Yev Philipovitch
REGISTERED CIVIL ENGINEER



SANITARY SEWER

Yev Philipovitch
REGISTERED CIVIL ENGINEER



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STANDARD PLANS LIST

The standard plan sheets applicable to this Contract include those listed below. The applicable revised standard plans (RSPs) listed below are included in the project plans.

| | |
|----------|---|
| A10A | Abbreviations (Sheet 1 of 2) |
| RSP A10B | Abbreviations (Sheet 2 of 2) |
| A10C | Lines and Symbols (Sheet 1 of 3) |
| A10D | Lines and Symbols (Sheet 2 of 3) |
| A10E | Lines and Symbols (Sheet 3 of 3) |
| A10F | Legend - Soil (Sheet 1 of 2) |
| A10G | Legend - Soil (Sheet 2 of 2) |
| A20A | Pavement Markers and Traffic Lines, Typical Details |
| A20B | Pavement Markers and Traffic Lines, Typical Details |
| RSP A20C | Pavement Markers and Traffic Lines, Typical Details |
| A20D | Pavement Markers and Traffic Lines, Typical Details |
| RSP A24A | Pavement Markings - Arrows |
| A24B | Pavement Markings - Arrows and Symbols |
| RSP A24C | Pavement Markings - Symbols and Numerals |
| A24D | Pavement Markings - Words |
| RSP A24E | Pavement Markings - Words, Limit and Yield Lines |
| RSP A24F | Pavement Markings - Crosswalks |
| A62A | Excavation and Backfill - Miscellaneous Details |
| A62C | Limits of Payment for Excavation and Backfill - Bridge |
| A62D | Excavation and Backfill - Concrete Pipe Culverts |
| A62DA | Excavation and Backfill - Concrete Pipe Culverts - Indirect Design Method |
| A62E | Excavation and Backfill - Cast-In-Place Reinforced Concrete Box and Arch Culverts |
| A62F | Excavation and Backfill - Metal and Plastic Culverts |
| A62G | Excavation and Backfill - Precast Reinforced Concrete Box Culverts |
| A73A | Object Markers |
| A73B | Markers |
| A73C | Delineators, Channelizers and Barricades |
| A76A | Concrete Barrier Type 60 |
| A76B | Concrete Barrier Type 60 |
| A76F | Concrete Barrier Type 60GE |

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|-----------|--|
| A76J | Concrete Barrier - Wildlife Passageway (Type S) |
| RSP A77L1 | Midwest Guardrail System Standard Railing Section (Wood Post with Wood Block) |
| RSP A77L2 | Midwest Guardrail System Standard Railing Section (Steel Post with Notched Wood or Notched Recycled Plastic Block) |
| RSP A77M1 | Midwest Guardrail System Standard Hardware |
| RSP A77N2 | Midwest Guardrail System Steel Post and Notched Wood Block Details |
| RSP A77N3 | Midwest Guardrail System Typical Line Post Embedment and Hinge Point Offset Details |
| RSP A77N4 | Midwest Guardrail System Typical Railing Delineation and Dike Positioning Details |
| RSP A77N5 | Midwest Guardrail System Typical Vegetation Control Standard Railing Section |
| RSP A77N6 | Midwest Guardrail System Typical Vegetation Control for Terminal System End Treatments |
| RSP A77N7 | Midwest Guardrail System Typical Vegetation Control at Structure Approach |
| RSP A77N8 | Midwest Guardrail System Typical Vegetation Control at Fixed Object |
| RSP A77P1 | Midwest Guardrail System Typical Layouts for Embankments |
| RSP A77P2 | Midwest Guardrail System Typical Layouts for Embankments |
| RSP A77P3 | Midwest Guardrail System Typical Layouts for Embankments |
| RSP A77P4 | Midwest Guardrail System Typical Layouts for Embankments |
| RSP A77P5 | Midwest Guardrail System Typical Layouts for Embankments |
| RSP A77P6 | Midwest Guardrail System Typical Layouts for Embankments |
| RSP A77Q1 | Midwest Guardrail System Typical Layouts for Structure Approach |
| RSP A77Q2 | Midwest Guardrail System Typical Layouts for Structure Approach and Between Structures |
| RSP A77Q3 | Midwest Guardrail System Typical Layouts for Structure Approach |
| RSP A77Q4 | Midwest Guardrail System Typical Layouts for Structure Departure |
| RSP A77Q5 | Midwest Guardrail System Typical Layouts for Structure Departure |
| RSP A77R1 | Midwest Guardrail System Typical Layouts for Fixed Objects Between Separate Roadbeds (Two-Way Traffic) |
| RSP A77R2 | Midwest Guardrail System Typical Layouts for Fixed Objects Between Separate Roadbeds (One-Way Traffic) |
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| RSP A77R4 | Midwest Guardrail System Typical Layouts for Roadside Fixed Objects |
| RSP A77R6 | Midwest Guardrail System Typical Layouts for Roadside Fixed Objects |
| RSP A77R7 | Midwest Guardrail System Typical Layouts for Roadside Fixed Objects |
| RSP A77R8 | Midwest Guardrail System Typical Layouts for Roadside Fixed Objects |
| RSP A77S1 | Midwest Guardrail System End Anchor Assembly (Type SFT) |
| RSP A77S2 | Midwest Guardrail System Rail Tensioning Assembly |
| RSP A77S3 | Metal Railing Anchor Cable and Anchor Plate Details |
| RSP A77T1 | Metal Railing End Anchor Assembly (Type CA) |
| RSP A77T2 | Midwest Guardrail System Buried Post End Anchor |

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| RSP A77U1 | Midwest Guardrail System Connections to Bridge Railings without Sidewalks Details No. 1 |
| RSP A77U2 | Midwest Guardrail System Connections to Bridge Railings without Sidewalks Details No. 2 |
| RSP A77U3 | Midwest Guardrail System Connections to Abutments and Walls |
| RSP A77U4 | Midwest Guardrail System Transition Railing (Type WB-31) |
| RSP A77U5 | Midwest Guardrail System Transition to Metal Beam Guardrail |
| RSP A77V1 | Midwest Guardrail System Connections to Bridge Railings with Sidewalks Details No. 1 |
| RSP A77V2 | Midwest Guardrail System Connections to Bridge Railings with Sidewalks Details No. 2 |
| A81A | Crash Cushion, Sand Filled (Unidirectional) |
| A81B | Crash Cushion, Sand Filled (Unidirectional) |
| A81C | Crash Cushion, Sand Filled (Bidirectional) |
| A85 | Chain Link Fence |
| A85A | Chain Link Fence Details |
| RSP A85B | Chain Link Fence Details |
| RSP A87A | Curbs and Driveways |
| RSP A87B | Hot Mix Asphalt Dikes |
| RSP A88A | Curb Ramp Details |
| RSP A88B | Curb Ramp and Island Passageway Details |
| RSP P1 | Jointed Plain Concrete Pavement New Construction |
| RSP P4 | Continuously Reinforced Concrete Pavement |
| RSP P10 | Concrete Pavement Dowel Bar Details |
| RSP P12 | Concrete Pavement Dowel Bar Basket Details |
| RSP P13 | Continuously Reinforced Concrete Pavement - Single Piece Transverse Bar Assembly |
| RSP P14 | Continuously Reinforced Concrete Pavement Transverse Construction Joint |
| RSP P15 | Concrete Pavement - Tie Bar Details |
| RSP P16 | Continuously Reinforced Concrete Pavement Tie Bars and Joint Details |
| RSP P17 | Concrete Pavement Tie Bar Basket Details |
| RSP P18 | Concrete Pavement Lane Schematics and Isolation Joint Detail |
| RSP P20 | Joint Seals |
| RSP P30 | Concrete Pavement - End Panel Pavement Transitions |
| RSP P31A | Continuously Reinforced Concrete Pavement Terminal Joint Details |
| RSP P31B | Continuously Reinforced Concrete Pavement - Expansion Joint and Anchor Details |
| P33 | Concrete Pavement - Lane Drop Paving Details No. 1 |
| P34 | Concrete Pavement - Lane Drop Paving Details No. 2 |
| P70 | Hot Mix Asphalt Paving (Longitudinal Tapered Notched Wedge Joint) |

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| RSP P75 | Pavement Edge Treatments - Overlays |
| RSP P76 | Pavement Edge Treatments - New Construction |
| D71 | Drainage Inlet Markers |
| D72 | Drainage Inlets |
| RSP D73 | Drainage Inlets |
| D73A | Drainage Inlets (Precast) |
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| D75C | Pipe Inlets - Ladder and Trash Rack Details |
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| D78B | Inlet Depressions - Concrete Shoulders |
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| D79 | Precast Reinforced Concrete Pipe - Direct Design Method |
| D79A | Precast Reinforced Concrete Pipe - Direct Design Method |
| D81 | Cast-In-Place Reinforced Concrete - Double Box Culvert |
| D82 | Cast-In-Place Reinforced Concrete Box Culvert - Miscellaneous Details |
| D84 | Box Culvert Wingwalls - Types A, B and C |
| D88 | Construction Loads on Culverts |
| D88A | Strut Details for Structural Steel Pipes, Arches and Vehicular Undercrossing |
| D89 | Pipe Culvert Headwalls - Straight and "L" |
| D94A | Metal and Plastic Flared End Sections |
| D94B | Concrete Flared End Sections |
| D97A | Corrugated Metal Pipe Coupling Details No. 1 - Annular Coupling Band Bar and Strap and Angle Connections |
| D97C | Corrugated Metal Pipe Coupling Details No. 3 - Helical and Universal Couplers |
| D97D | Corrugated Metal Pipe Coupling Details No. 4 - Hugger Coupling Bands |
| D97E | Corrugated Metal Pipe Coupling Details No. 5 - Standard Joint |
| D97H | Reinforced Concrete Pipe or Non-Reinforced Concrete Pipe - Standard and Positive Joints |
| D97I | Corrugated Polyvinyl Chloride Pipe with Smooth Interior - Standard and Positive Joints |
| D98C | Grated Line Drain Details |
| RSP H1 | Landscape and Erosion Control Abbreviations |
| RSP H2 | Landscape and Erosion Control Symbols |

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|----------|---|
| RSP H5 | Landscape Details |
| RSP H6 | Landscape Details |
| RSP H9 | Landscape Details |
| RSP H9A | Landscape Details |
| H51 | Erosion Control Details - Fiber Roll and Compost Sock |
| H52 | Rolled Erosion Control Product |
| T1A | Temporary Crash Cushion, Sand Filled (Unidirectional) |
| T1B | Temporary Crash Cushion, Sand Filled (Bidirectional) |
| T2 | Temporary Crash Cushion, Sand Filled (Shoulder Installations) |
| T3A | Temporary Railing (Type K) |
| T3B | Temporary Railing (Type K) |
| T4 | Temporary Traffic Screen |
| RSP T9 | Traffic Control System Tables for Lane and Ramp Closures |
| RSP T10 | Traffic Control System for Lane Closure on Freeways and Expressways |
| RSP T10A | Traffic Control System for Lane Closures on Freeways and Expressways |
| RSP T11 | Traffic Control System for Lane Closure on Multilane Conventional Highways |
| RSP T12 | Traffic Control System for Half Road Closure on Multilane Conventional Highways and Expressways |
| RSP T13 | Traffic Control System for Lane Closure on Two Lane Conventional Highways |
| RSP T14 | Traffic Control System for Ramp Closure |
| RSP T15 | Traffic Control System for Moving Lane Closure on Multilane Highways |
| RSP T16 | Traffic Control System for Moving Lane Closure on Multilane Highways |
| RSP T17 | Traffic Control System for Moving Lane Closure on Two Lane Highways |
| T51 | Temporary Water Pollution Control Details (Temporary Silt Fence) |
| T53 | Temporary Water Pollution Control Details (Temporary Cover) |
| T56 | Temporary Water Pollution Control Details (Temporary Fiber Roll) |
| T57 | Temporary Water Pollution Control Details (Temporary Check Dam) |
| T58 | Temporary Water Pollution Control Details (Temporary Construction Entrance) |
| T59 | Temporary Water Pollution Control Details (Temporary Concrete Washout Facility) |
| T60 | Temporary Water Pollution Control Details (Temporary Reinforced Silt Fence) |
| T61 | Temporary Water Pollution Control Details (Temporary Drainage Inlet Protection) |
| T62 | Temporary Water Pollution Control Details (Temporary Drainage Inlet Protection) |
| T63 | Temporary Water Pollution Control Details (Temporary Drainage Inlet Protection) |
| T64 | Temporary Water Pollution Control Details (Temporary Drainage Inlet Protection) |
| T65 | Temporary Water Pollution Control Details [Temporary Fence (Type ESA)] |

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|------------|---|
| B0-3 | Bridge Details |
| B2-5 | Pile Details - Class 90 and Class 140 |
| RSP B3-4A | Retaining Wall Type 5 (Case 1) |
| RSP B3-4B | Retaining Wall Type 5 (Case 2) |
| RSP B3-4C | Retaining Wall Type 5 (Case 3) |
| RSP B3-5 | Retaining Wall Details No. 1 |
| B3-6 | Retaining Wall Details No. 2 |
| B6-21 | Joint Seals (Maximum Movement Rating = 2") |
| B7-5 | Deck Drains |
| B7-6 | Deck Drains - Types D-1 and D-2 |
| B7-7 | Deck Drain - Type D-3 |
| B7-8 | Deck Drainage Details |
| B7-11 | Utility Details |
| RSP B8-5 | Cast-In-Place Post-Tensioned Girder Details |
| B11-51 | Tubular Hand Railing |
| RSP B11-54 | Concrete Barrier Type 26 |
| RSP B11-56 | Concrete Barrier Type 736 |
| RSP B11-68 | California ST-10 Bridge Rail (Sheet 1 of 3) |
| B11-69 | California ST-10 Bridge Rail (Sheet 2 of 3) |
| RSP B11-70 | California ST-10 Bridge Rail (Sheet 3 of 3) |
| B14-1 | Structural Steel Plate Vehicular Undercrossing |
| B14-3 | Communication and Sprinkler Control Conduits (Conduit Less Than 4") |
| B14-4 | Water Supply Line (Bridge) (Pipe Sizes Less Than 4") |
| B14-5 | Water Supply Line (Details) (Pipe Sizes Less Than 4") |
| RS1 | Roadside Signs, Typical Installation Details No. 1 |
| 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 IX |
| S3 | Overhead Signs - Truss, Single Post Type - Base Plate and Anchorage Details |
| S4 | Overhead Signs - Truss, Single Post Type - Structural Frame Members Details No. 1 |
| S5 | Overhead Signs - Truss, Single Post Type - Structural Frame Members Details No. 2 |
| S6 | Overhead Signs - Truss, Gusset Plate Details |
| S8 | Overhead Signs - Truss, Single Post Type - Round Pedestal Pile Foundation |

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|-----------|---|
| S12 | Overhead Signs - Truss, Structural Frame Details |
| S13 | Overhead Signs - Truss, Frame Juncture Details |
| S16 | Overhead Signs - Walkway Details No. 1 |
| S17 | Overhead Signs - Walkway Details No. 2 |
| S17A | Overhead Signs - Walkway Details No. 3 |
| S18 | Overhead Signs - Walkway Safety Railing Details |
| S19 | Overhead Signs - Truss, Sign Mounting Details - Laminated Panel - Type A |
| S20 | Overhead Signs - Steel Frames - Removable Sign Panel Frames |
| S21 | Overhead Signs - Removable Sign Panel Frames Mounting Details |
| S22 | Overhead Signs - Truss, Removable Sign Panel Frames - 110" and 120" Sign Panels |
| S89 | Roadside Sign - Formed Single Sheet Aluminum Panel |
| S90 | Channel and Bolt Hole Location, Overhead Formed Sign Panel |
| S91 | Overhead Sign - Formed Sign Panel, Type A-3 Mounting Hardware |
| S92 | Overhead Sign - Formed Sign Panel |
| RSP ES-1A | Electrical Systems (Legend and Abbreviations) |
| RSP ES-1B | Electrical Systems (Legend and Abbreviations) |
| RSP ES-1C | Electrical Systems (Legend and Abbreviations) |
| ES-2A | Electrical Systems (Service Equipment) |
| ES-3A | Electrical Systems (Controller Cabinet Details) |
| ES-3C | Electrical Systems (Controller Cabinet Foundation Details) |
| ES-3E | Electrical Systems (Telephone Demarcation Cabinet, Type B) |
| ES-3H | Electrical Systems (Irrigation Controller Enclosure Cabinet) |
| RSP ES-4A | Electrical Systems (Vehicular Signal Heads and Mountings) |
| RSP ES-4B | Electrical Systems (Pedestrian Signal and Ramp Metering Sign) |
| RSP ES-4C | Electrical Systems (Vehicular Signal Heads and Mountings) |
| ES-4D | Electrical Systems (Signal Mounting) |
| RSP ES-4E | Electrical Systems (Vehicular Signal Heads and Optical Detector Mounting) |
| ES-5A | Electrical Systems (Detectors) |
| RSP ES-5B | Electrical Systems (Detectors) |
| RSP ES-5C | Electrical Systems (Accessible Pedestrian Signal, Push Button Assemblies and Magnetic Vehicle Detector) |
| RSP ES-5D | Electrical Systems (Curb Termination and Handhole) |
| ES-6A | Electrical Systems (Lighting Standard, Types 15 and 21) |
| ES-6B | Electrical Systems (Electrolier Anchorage and Grouting for Types 15 and 21, Barrier Rail Mounted) |
| ES-6E | Electrical Systems (Lighting Standard, Types 30 and 31) |

| | |
|------------|---|
| ES-6F | Electrical Systems (Lighting Standard, Slip Base Plate) |
| RSP ES-7A | Electrical Systems (Signal and Lighting Standard, Type TS, and Push Button Assembly Post) |
| ES-7B | Electrical Systems (Signal and Lighting Standard - Type 1 and Equipment Numbering) |
| RSP ES-7E | Electrical Systems (Signal and Lighting Standard, Case 3 Signal Mast Arm Loading, Wind Velocity = 100 mph and Signal Mast Arm Lengths 15' to 45') |
| RSP ES-7F | Electrical Systems (Signal and Lighting Standard, Case 4 Signal Mast Arm Loading, Wind Velocity = 100 mph and Signal Mast Arm Lengths 25' to 45') |
| RSP ES-7G | Electrical Systems (Signal And Lighting Standard, Case 5 Signal Mast Arm Loading, Wind Velocity = 100 mph and Signal Mast Arm Lengths 50' to 55') |
| RSP ES-7H | Electrical Systems (Signal and Lighting Standard, Case 5 Signal Mast Arm Loading, Wind Velocity = 100 mph and Signal Mast Arm Lengths 60' to 65') |
| ES-7M | Electrical Systems (Signal and Lighting Standard - Detail No. 1) |
| ES-7N | Electrical Systems (Signal and Lighting Standard - Detail No. 2) |
| ES-7O | Electrical Systems (Signal and Lighting Standard - Detail No. 3) |
| ES-7P | Electrical Systems (Internally Illuminated Street Name Sign) |
| ES-7Q | Electrical Systems (Pedestrian Barricades) |
| RSP ES-7R | Electrical Systems (Signal and Lighting, Miscellaneous Attachment) |
| ES-9A | Electrical Systems (Structure Pull Box Installations) |
| ES-9B | Electrical Systems (Conduit Riser and Expansion Fitting, Structure Installations) |
| ES-9C | Electrical Systems (Structure Pull Box) |
| ES-9D | Electrical Systems (Structure Pull Box Installations) |
| RSP ES-10A | Electrical Systems (Isofootcandle Diagrams) |
| RSP ES-10B | Electrical Systems (Isofootcandle Diagrams) |
| RSP ES-11 | Electrical Systems (Foundation Installations) |
| ES-12A | Electrical Systems (Pedestrian Overcrossing Fluorescent Lighting Fixture) |
| ES-12B | Electrical Systems (Pedestrian Undercrossing Fluorescent Lighting Fixture) |
| ES-13A | Electrical Systems (Splicing Details) |
| ES-13B | Electrical Systems (Fuse Rating, Kinking and Banding Detail) |
| ES-15C | Electrical Systems (Sign Illumination Equipment) |
| ES-15D | Electrical Systems (Lighting and Sign Illumination Control) |
| ES-16A | Electrical Systems (Closed Circuit Television, 5' to 15' Overhead Sign Mounted Pole) |
| RSP ES-16B | Electrical Systems (Closed Circuit Television, 25' to 45' Pole) |
| ES-16C | Electrical Systems (Closed Circuit Television - 50' to 90' High Mast Pole) |
| RSP ES-16D | Electrical Systems (Closed Circuit Television with Vehicle Detection System, 30' to 40' Pole) |

CANCELED STANDARD PLANS LIST

The standard plan sheets listed below are canceled and not applicable to this contract.

| Plan No. | Date Canceled | Plan No. | Date Canceled | Plan No. | Date Canceled |
|------------|---------------|----------|---------------|----------|---------------|
| A77A1 | 07-19-13 | A77J4 | 07-19-13 | ES-6J | 07-19-13 |
| A77A2 | 07-19-13 | A77K1 | 07-19-13 | ES-7I | 07-19-13 |
| A77B1 | 07-19-13 | A77K2 | 07-19-13 | ES-8 | 01-20-12 |
| A77C1 | 07-19-13 | P3 | 07-19-13 | ES-10 | 07-20-12 |
| A77C2 | 07-19-13 | C8A | 07-19-13 | | |
| A77C3 | 07-19-13 | C8B | 07-19-13 | | |
| A77C4 | 07-19-13 | C8C | 07-19-13 | | |
| RSP A77C5 | 07-19-13 | B3-1 | 04-20-12 | | |
| RSP A77C6 | 07-19-13 | B3-2 | 04-20-12 | | |
| RSP A77C7 | 07-19-13 | B3-3 | 04-20-12 | | |
| RSP A77C8 | 07-19-13 | B3-4 | 04-20-12 | | |
| RSP A77C9 | 07-19-13 | B3-7 | 04-20-12 | | |
| RSP A77C10 | 07-19-13 | B3-8 | 04-20-12 | | |
| A77E1 | 07-19-13 | S7 | 07-19-13 | | |
| A77E2 | 07-19-13 | S14 | 07-19-13 | | |
| A77E3 | 07-19-13 | S41 | 07-19-13 | | |
| A77E4 | 07-19-13 | S42 | 07-19-13 | | |
| A77E5 | 07-19-13 | S43 | 07-19-13 | | |
| A77E6 | 07-19-13 | S44 | 07-19-13 | | |
| A77F1 | 07-19-13 | S45 | 07-19-13 | | |
| A77F2 | 07-19-13 | S46 | 07-19-13 | | |
| A77F3 | 07-19-13 | S47 | 07-19-13 | | |
| A77F4 | 07-19-13 | S120 | 07-19-13 | | |
| A77F5 | 07-19-13 | S121 | 07-19-13 | | |
| A77G1 | 07-19-13 | S122 | 07-19-13 | | |
| A77G2 | 07-19-13 | S123 | 07-19-13 | | |
| A77G3 | 07-19-13 | S124 | 07-19-13 | | |
| A77G4 | 07-19-13 | S125 | 07-19-13 | | |
| A77G5 | 07-19-13 | S126 | 07-19-13 | | |
| A77G6 | 07-19-13 | S127 | 07-19-13 | | |
| A77G7 | 07-19-13 | S128 | 07-19-13 | | |
| A77G8 | 07-19-13 | S129 | 07-19-13 | | |
| A77H1 | 07-19-13 | S130 | 07-19-13 | | |
| A77H2 | 07-19-13 | S131 | 07-19-13 | | |
| A77H3 | 07-19-13 | S132 | 07-19-13 | | |
| A77I1 | 07-19-13 | S133 | 07-19-13 | | |
| A77I2 | 07-19-13 | S134 | 07-19-13 | | |
| A77J1 | 07-19-13 | S135 | 07-19-13 | | |
| A77J2 | 07-19-13 | ES-6H | 07-19-13 | | |
| A77J3 | 07-19-13 | ES-6I | 07-19-13 | | |

NOTICE TO BIDDERS

Bids open Tuesday, April 15, 2014

Dated February 24, 2014

General work description: Reconstruct overcrossing, retaining walls, ground improvement,

The Department will receive sealed bids for CONSTRUCTION ON STATE HIGHWAY IN SAN MATEO COUNTY IN BURLINGAME FROM 0.3 MILE NORTH OF ANZA BOULEVARD TO 0.9 MILE SOUTH OF MILLBRAE AVENUE OVERCROSSING.

District-County-Route-Post Mile: 04-SM-101-16.3/17.1

Contract No. 04-235844

The Contractor must have either a Class A license or any combination of the following Class C licenses which constitutes a majority of the work: C-8, C-12.

The DBE Contract goal is 8 percent.

Federal-aid project no.:

ACNHP-Q101(237)E

CML-6204(113)

Bids must be on a unit price basis.

Complete the work, excluding plant establishment work, within 600 working days.

Complete the work, including plant establishment work, within 800 working days.

Complete the plant establishment work within 200 working days.

The estimated cost of the project is \$44,252,000.

No prebid meeting is scheduled for this project.

The Department will receive bids until 2:00 p.m. on the bid open date at 1727 30th Street, Bidders' Exchange, MS 26, Sacramento, CA 95816. Bids received after this time will not be accepted. Department staff will direct the bidders to the bid opening.

The Department will open and publicly read the bids at the above location immediately after the specified closing time.

District office addresses are provided in the *Standard Specifications*.

Present bidders' inquiries to the Department and view the Department's responses at:

http://www.dot.ca.gov/hq/esc/oe/inquiry/bid_inquiries.php

Questions about alleged patent ambiguity of the plans, specifications, or estimate must be asked before bid opening. After bid opening, the Department does not consider these questions as bid protests.

Submit your bid with bidder's security equal to at least 10 percent of the bid.

Prevailing wages are required on this Contract. The Director of the California Department of Industrial Relations determines the general prevailing wage rates. Obtain the wage rates at the DIR Web site, <http://www.dir.ca.gov>, or from the Department's Labor Compliance Office of the district in which the work is located.

The federal minimum wage rates for this Contract as determined by the United States Secretary of Labor are available at <http://www.dot.ca.gov/hq/esc/oe/federal-wages>.

If the minimum wage rates as determined by the United States Secretary of Labor differs from 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 must not pay less than the higher wage rate. The Department does 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 must not pay less than the federal minimum wage rate that most closely approximates the duties of the employees in question.

The Department has made available Notices of Suspension and Proposed Debarment from the Federal Highway Administration. For a copy of the notices, go to http://www.dot.ca.gov/hq/esc/oe/contractor_info. Additional information is provided in the Excluded Parties List System at <https://www.epls.gov>.

Department of Transportation

D04

BID ITEM LIST

| Item No. | Item Code | Item Description | Unit of Measure | Estimated Quantity |
|----------|-----------|--|-----------------|--------------------|
| 1 | 070030 | LEAD COMPLIANCE PLAN | LS | LUMP SUM |
| 2 | 080050 | PROGRESS SCHEDULE (CRITICAL PATH METHOD) | LS | LUMP SUM |
| 3 | 090100 | TIME-RELATED OVERHEAD (WDAY) | WDAY | 600 |
| 4 | 120090 | CONSTRUCTION AREA SIGNS | LS | LUMP SUM |
| 5 | 120100 | TRAFFIC CONTROL SYSTEM | LS | LUMP SUM |
| 6 | 120120 | TYPE III BARRICADE | EA | 14 |
| 7 | 120165 | CHANNELIZER (SURFACE MOUNTED) | EA | 190 |
| 8 | 128652 | PORTABLE CHANGEABLE MESSAGE SIGN (LS) | LS | LUMP SUM |
| 9 | 129000 | TEMPORARY RAILING (TYPE K) | LF | 38,800 |
| 10 | 129100 | TEMPORARY CRASH CUSHION MODULE | EA | 330 |
| 11 | 026978 | TEMPORARY ALTERNATIVE CRASH CUSHION | EA | 19 |
| 12 | 129150 | TEMPORARY TRAFFIC SCREEN | LF | 13,100 |
| 13 | 130100 | JOB SITE MANAGEMENT | LS | LUMP SUM |
| 14 | 026979 | TEMPORARY CREEK DIVERSION SYSTEM | LS | LUMP SUM |
| 15 | 130300 | PREPARE STORM WATER POLLUTION PREVENTIONPLAN | LS | LUMP SUM |
| 16 | 130310 | RAIN EVENT ACTION PLAN | EA | 101 |
| 17 | 130320 | STORM WATER SAMPLING AND ANALYSIS DAY | EA | 40 |
| 18 | 130330 | STORM WATER ANNUAL REPORT | EA | 3 |
| 19 | 130505 | MOVE-IN/MOVE-OUT (TEMPORARY EROSION CONTROL) | EA | 41 |
| 20 | 130530 | TEMPORARY HYDRAULIC MULCH (BONDED FIBER MATRIX) | SQYD | 26,500 |

| Item No. | Item Code | Item Description | Unit of Measure | Estimated Quantity |
|----------|-----------|--|-----------------|--------------------|
| 21 | 130570 | TEMPORARY COVER | SQYD | 1,350 |
| 22 | 130610 | TEMPORARY CHECK DAM | LF | 100 |
| 23 | 130620 | TEMPORARY DRAINAGE INLET PROTECTION | EA | 95 |
| 24 | 130640 | TEMPORARY FIBER ROLL | LF | 3,330 |
| 25 | 130670 | TEMPORARY REINFORCED SILT FENCE | LF | 2,050 |
| 26 | 130680 | TEMPORARY SILT FENCE | LF | 3,330 |
| 27 | 130710 | TEMPORARY CONSTRUCTION ENTRANCE | EA | 27 |
| 28 | 130730 | STREET SWEEPING | LS | LUMP SUM |
| 29 | 026980 | DEWATERING AND NON STORM WATER DISCHARGE SYSTEM | LS | LUMP SUM |
| 30 | 130900 | TEMPORARY CONCRETE WASHOUT | LS | LUMP SUM |
| 31 | 131103 | WATER QUALITY SAMPLING AND ANALYSIS DAY | EA | 30 |
| 32 | 131104 | WATER QUALITY MONITORING REPORT | EA | 5 |
| 33 | 140003 | ASBESTOS COMPLIANCE PLAN | LS | LUMP SUM |
| 34 | 141000 | TEMPORARY FENCE (TYPE ESA) | LF | 2,440 |
| 35 | 141103 | REMOVE YELLOW THERMOPLASTIC TRAFFIC STRIPE (HAZARDOUS WASTE) | LF | 15,700 |
| 36 | 141109 | ADL BURIAL LOCATION REPORT | LS | LUMP SUM |
| 37 | 141120 | TREATED WOOD WASTE | LB | 25,600 |
| 38 | 148005 | NOISE MONITORING | LS | LUMP SUM |
| 39 | 150204 | ABANDON CULVERT (LF) | LF | 250 |
| 40 | 150221 | ABANDON INLET | EA | 1 |

| Item No. | Item Code | Item Description | Unit of Measure | Estimated Quantity |
|----------|-----------|---------------------------------------|-----------------|--------------------|
| 41 | 150227 | ABANDON PIPELINE | LF | 340 |
| 42 | 026981 | ABANDON SEWER LINE | LF | 660 |
| 43 | 150608 | REMOVE CHAIN LINK FENCE | LF | 1,450 |
| 44 | 150661 | REMOVE GUARDRAIL | LF | 2,240 |
| 45 | 150685 | REMOVE IRRIGATION FACILITY | LS | LUMP SUM |
| 46 | 150711 | REMOVE PAINTED TRAFFIC STRIPE | LF | 199,000 |
| 47 | 150712 | REMOVE PAINTED PAVEMENT MARKING | SQFT | 11,000 |
| 48 | 150714 | REMOVE THERMOPLASTIC TRAFFIC STRIPE | LF | 35,900 |
| 49 | 150715 | REMOVE THERMOPLASTIC PAVEMENT MARKING | SQFT | 950 |
| 50 | 150722 | REMOVE PAVEMENT MARKER | EA | 7,050 |
| 51 | 150742 | REMOVE ROADSIDE SIGN | EA | 170 |
| 52 | 150743 | REMOVE SIGN FROM ELECTROLIER | EA | 3 |
| 53 | 150757 | REMOVE SIGN STRUCTURE (EA) | EA | 2 |
| 54 | 026982 | REMOVE METAL STRUCTURE | EA | 13 |
| 55 | 150763 | REMOVE SIGN PANEL | EA | 1 |
| 56 | 150812 | REMOVE PIPE (LF) | LF | 4,090 |
| 57 | 150820 | REMOVE INLET | EA | 27 |
| 58 | 150824 | REMOVE SEWER MANHOLE | EA | 12 |
| 59 | 150826 | REMOVE MANHOLE | EA | 1 |
| 60 | 026983 | REMOVE WATER VALVES | EA | 4 |

| Item No. | Item Code | Item Description | Unit of Measure | Estimated Quantity |
|----------|-----------|--------------------------------------|-----------------|--------------------|
| 61 | 150841 | REMOVE SEWER PIPE | LF | 4,500 |
| 62 | 150860 | REMOVE BASE AND SURFACING | CY | 2,690 |
| 63 | 026984 | SALVAGE WATER METER | EA | 18 |
| 64 | 151251 | SALVAGE IRRIGATION FACILITY | LS | LUMP SUM |
| 65 | 152390 | RELOCATE ROADSIDE SIGN | EA | 6 |
| 66 | 152400 | ADJUST SEWER CLEANOUT TO GRADE | EA | 3 |
| 67 | 152430 | ADJUST INLET | EA | 5 |
| 68 | 152440 | ADJUST MANHOLE TO GRADE | EA | 4 |
| 69 | 152469 | ADJUST UTILITY COVER TO GRADE | EA | 11 |
| 70 | 152604 | MODIFY INLET | EA | 2 |
| 71 | 026935 | MODIFY SEWER MANHOLE | EA | 2 |
| 72 | 153103 | COLD PLANE ASPHALT CONCRETE PAVEMENT | SQYD | 64,800 |
| 73 | 153123 | REMOVE CONCRETE (SQYD) | SQYD | 4,780 |
| 74 | 153221 | REMOVE CONCRETE BARRIER | LF | 1,600 |
| 75 | 155003 | CAP INLET | EA | 1 |
| 76 | 155232 | SAND BACKFILL | CY | 170 |
| 77 | 156585 | REMOVE CRASH CUSHION | EA | 4 |
| 78 | 157550 | BRIDGE REMOVAL | LS | LUMP SUM |
| 79 | 160102 | CLEARING AND GRUBBING (LS) | LS | LUMP SUM |
| 80 | 170101 | DEVELOP WATER SUPPLY | LS | LUMP SUM |

| Item No. | Item Code | Item Description | Unit of Measure | Estimated Quantity |
|----------|-----------|--|-----------------|--------------------|
| 81 | 190101 | ROADWAY EXCAVATION | CY | 33,000 |
| 82 | 190106 | ROADWAY EXCAVATION (TYPE Z-3) (AERIALY DEPOSITED LEAD) | CY | 410 |
| 83 | 190107 | ROADWAY EXCAVATION (TYPE Y-1) (AERIALY DEPOSITED LEAD) | CY | 3,180 |
| 84 | 190108 | ROADWAY EXCAVATION (TYPE Y-2) (AERIALY DEPOSITED LEAD) | CY | 20,000 |
| 85 (F) | 192001 | STRUCTURE EXCAVATION | CY | 90 |
| 86 (F) | 192020 | STRUCTURE EXCAVATION (TYPE D) | CY | 3,715 |
| 87 (F) | 193003 | STRUCTURE BACKFILL (BRIDGE) | CY | 2,550 |
| 88 (F) | 193013 | STRUCTURE BACKFILL (RETAINING WALL) | CY | 1,678 |
| 89 (F) | 193030 | PERVIOUS BACKFILL MATERIAL | CY | 243 |
| 90 (F) | 193031 | PERVIOUS BACKFILL MATERIAL (RETAINING WALL) | CY | 107 |
| 91 | 198010 | IMPORTED BORROW (CY) | CY | 61,900 |
| 92 | 026986 | LIGHTWEIGHT EMBANKMENT MATERIAL (CELLULAR CONCRETE) | CY | 11,100 |
| 93 | 198209 | SUBGRADE ENHANCEMENT GEOTEXTILE, CLASS B2 | SQYD | 12,800 |
| 94 | 026987 | SOIL-CEMENT | CY | 71,600 |
| 95 | 200002 | ROADSIDE CLEARING | LS | LUMP SUM |
| 96 | 200122 | WEED GERMINATION | SQYD | 7,230 |
| 97 | 200123 | CULTIVATION | SQYD | 7,230 |
| 98 | 202006 | SOIL AMENDMENT | CY | 610 |
| 99 | 202038 | PACKET FERTILIZER | EA | 21,900 |
| 100 | 026988 | PLANT (GROUP K48)(48" BOX) | EA | 33 |

| Item No. | Item Code | Item Description | Unit of Measure | Estimated Quantity |
|----------|-----------|--|-----------------|--------------------|
| 101 | 026989 | PLANT (GROUP K60)(60" BOX) | EA | 11 |
| 102 | 204035 | PLANT (GROUP A) | EA | 16,000 |
| 103 | 204036 | PLANT (GROUP B) | EA | 2,750 |
| 104 | 204096 | MAINTAIN EXISTING PLANTED AREAS | LS | LUMP SUM |
| 105 | 204099 | PLANT ESTABLISHMENT WORK | LS | LUMP SUM |
| 106 | 205035 | WOOD MULCH | CY | 1,010 |
| 107 | 205062 | ROOT BARRIER | LF | 1,500 |
| 108 | 206400 | CHECK AND TEST EXISTING IRRIGATION FACILITIES | LS | LUMP SUM |
| 109 | 206402 | OPERATE EXISTING IRRIGATION FACILITIES | LS | LUMP SUM |
| 110 | 206559 | CONTROL AND NEUTRAL CONDUCTORS (ARMOR-CLAD) | LS | LUMP SUM |
| 111 | 206560 | CONTROL AND NEUTRAL CONDUCTORS | LS | LUMP SUM |
| 112 | 206562 | 1" REMOTE CONTROL VALVE | EA | 29 |
| 113 | 206564 | 1 1/2" REMOTE CONTROL VALVE | EA | 21 |
| 114 | 206565 | 2" REMOTE CONTROL VALVE | EA | 4 |
| 115 | 206631 | 1" WYE STRAINER ASSEMBLY | EA | 10 |
| 116 | 206634 | 2" WYE STRAINER ASSEMBLY | EA | 14 |
| 117 | 206761 | 24-32 STATION IRRIGATION CONTROLLER (PEDESTAL MOUNTED) | EA | 1 |
| 118 | 206762 | 30-42 STATION IRRIGATION CONTROLLER (PEDESTAL MOUNTED) | EA | 1 |
| 119 | 206921 | SOLAR POWERED IRRIGATION CONTROLLER | EA | 1 |
| 120 (F) | 208026 | 2" SUPPLY LINE (BRIDGE) | LF | 295 |

| Item No. | Item Code | Item Description | Unit of Measure | Estimated Quantity |
|----------|-----------|--|-----------------|--------------------|
| 121 | 026990 | 5/8" PLASTIC PIPE IRRIGATION LINE WITH INTEGRAL EMITTERS | LF | 12,400 |
| 122 | 208301 | IRRIGATION CONTROLLER ENCLOSURE CABINET | EA | 3 |
| 123 | 208416 | CERTIFY EXISTING BACKFLOW PREVENTERS | LS | LUMP SUM |
| 124 | 208426 | 2" BACKFLOW PREVENTER ASSEMBLY | EA | 4 |
| 125 | 208442 | FLOW SENSOR | EA | 4 |
| 126 | 026991 | FLOW SENSOR CABLE IN CONDUIT | LF | 490 |
| 127 | 208447 | POP-UP SPRINKLER ASSEMBLY (GEAR DRIVEN) | EA | 14 |
| 128 | 026992 | RISER SPRINKLER ASSEMBLY (TYPE C-2) | EA | 3,380 |
| 129 | 208575 | 2" GATE VALVE | EA | 4 |
| 130 | 208576 | 2 1/2" GATE VALVE | EA | 4 |
| 131 | 208588 | 3" GATE VALVE | EA | 13 |
| 132 (F) | 208594 | 3/4" PLASTIC PIPE (SCHEDULE 40) (SUPPLY LINE) | LF | 9,615 |
| 133 (F) | 208595 | 1" PLASTIC PIPE (SCHEDULE 40) (SUPPLY LINE) | LF | 1,684 |
| 134 (F) | 208596 | 1 1/4" PLASTIC PIPE (SCHEDULE 40) (SUPPLY LINE) | LF | 1,076 |
| 135 (F) | 208597 | 1 1/2" PLASTIC PIPE (SCHEDULE 40) (SUPPLY LINE) | LF | 540 |
| 136 (F) | 208598 | 2" PLASTIC PIPE (SCHEDULE 40) (SUPPLY LINE) | LF | 3,582 |
| 137 (F) | 208599 | 2 1/2" PLASTIC PIPE (SCHEDULE 40) (SUPPLY LINE) | LF | 80 |
| 138 | 208640 | PRESSURE REGULATING VALVE | EA | 18 |
| 139 | 208649 | QUICK COUPLING VALVE | EA | 16 |
| 140 | 026993 | FLUSHING VALVE | EA | 28 |

| Item No. | Item Code | Item Description | Unit of Measure | Estimated Quantity |
|----------|-----------|--|-----------------|--------------------|
| 141 | 208683 | BALL VALVE | EA | 24 |
| 142 | 208738 | 8" CORRUGATED HIGH DENSITY POLYETHYLENE PIPE CONDUIT | LF | 1,620 |
| 143 | 210010 | MOVE-IN/MOVE-OUT (EROSION CONTROL) | EA | 3 |
| 144 | 210110 | IMPORTED TOPSOIL (CY) | CY | 5,140 |
| 145 | 026994 | IMPORTED BIOFILTRATION SOIL (CY) | CY | 1,700 |
| 146 | 210270 | ROLLED EROSION CONTROL PRODUCT (NETTING) | SQFT | 29,000 |
| 147 | 210300 | HYDROMULCH | SQFT | 296,000 |
| 148 | 210350 | FIBER ROLLS | LF | 3,690 |
| 149 | 210420 | STRAW | SQFT | 267,000 |
| 150 | 210430 | HYDROSEED | SQFT | 296,000 |
| 151 | 210600 | COMPOST | SQFT | 296,000 |
| 152 | 240105 | LIME STABILIZED SOIL | SQYD | 12,800 |
| 153 | 250401 | CLASS 4 AGGREGATE SUBBASE | CY | 14,500 |
| 154 | 260203 | CLASS 2 AGGREGATE BASE (CY) | CY | 13,700 |
| 155 | 280000 | LEAN CONCRETE BASE | CY | 99 |
| 156 | 377501 | SLURRY SEAL | TON | 47 |
| 157 | 390011 | PREPAVING INERTIAL PROFILER | LS | LUMP SUM |
| 158 | 390020 | PREPAVING GRINDING DAY | EA | 10 |
| 159 | 390131 | HOT MIX ASPHALT | TON | 29,100 |
| 160 | 390134 | HOT MIX ASPHALT (OPEN GRADED) | TON | 4,880 |

| Item No. | Item Code | Item Description | Unit of Measure | Estimated Quantity |
|----------|-----------|---|-----------------|--------------------|
| 161 | 390137 | RUBBERIZED HOT MIX ASPHALT (GAP GRADED) | TON | 2,090 |
| 162 | 394060 | DATA CORE | LS | LUMP SUM |
| 163 | 394090 | PLACE HOT MIX ASPHALT (MISCELLANEOUS AREA) | SQYD | 33 |
| 164 | 397005 | TACK COAT | TON | 81 |
| 165 | 401050 | JOINTED PLAIN CONCRETE PAVEMENT | CY | 27 |
| 166 (F) | 477021 | MECHANICALLY STABILIZED EMBANKMENT, LOCATION A | SQFT | 2,370 |
| 167 (F) | 477022 | MECHANICALLY STABILIZED EMBANKMENT, LOCATION B | SQFT | 9,560 |
| 168 (F) | 477023 | MECHANICALLY STABILIZED EMBANKMENT, LOCATION C | SQFT | 6,610 |
| 169 (F) | 477024 | MECHANICALLY STABILIZED EMBANKMENT, LOCATION D | SQFT | 900 |
| 170 (F) | 477025 | MECHANICALLY STABILIZED EMBANKMENT, LOCATION E | SQFT | 1,020 |
| 171 (F) | 477026 | MECHANICALLY STABILIZED EMBANKMENT, LOCATION F | SQFT | 910 |
| 172 | 026995 | TEMPORARY SHORING (SQFT) | SQFT | 14,900 |
| 173 | 490601 | 16" CAST-IN-DRILLED-HOLE CONCRETE PILING | LF | 45 |
| 174 | 044567 | FURNISH PILING (CLASS 90) (ALTERNATIVE X MODIFIED) | LF | 5,053 |
| 175 | 044568 | DRIVE PILE (CLASS 90) (ALTERNATIVE X MODIFIED) | EA | 123 |
| 176 | 044569 | FURNISH PILING (CLASS 140) (ALTERNATIVE X MODIFIED) | LF | 12,910 |
| 177 | 044570 | DRIVE PILE (CLASS 140) (ALTERNATIVE X MODIFIED) | EA | 220 |
| 178 | 495115 | FURNISH 24" CAST-IN-STEEL SHELL CONCRETE PILING | LF | 4,180 |
| 179 | 495116 | DRIVE 24" CAST-IN-STEEL SHELL CONCRETE PILE | EA | 80 |
| 180 | 500020 | PRESTRESSING PRECAST GIRDER | LS | LUMP SUM |

| Item No. | Item Code | Item Description | Unit of Measure | Estimated Quantity |
|------------|-----------|--|-----------------|--------------------|
| 181 (F) | 510050 | STRUCTURAL CONCRETE | CY | 147 |
| 182 (F) | 510051 | STRUCTURAL CONCRETE, BRIDGE FOOTING | CY | 1,033 |
| 183 (F) | 510053 | STRUCTURAL CONCRETE, BRIDGE | CY | 2,325 |
| 184 (F) | 510060 | STRUCTURAL CONCRETE, RETAINING WALL | CY | 604 |
| 185 (F) | 510072 | STRUCTURAL CONCRETE, BARRIER SLAB | CY | 740 |
| 186 (F) | 510086 | STRUCTURAL CONCRETE, APPROACH SLAB (TYPE N) | CY | 44 |
| 187 (F) | 510088 | STRUCTURAL CONCRETE, APPROACH SLAB (TYPE N MODIFIED) | CY | 533 |
| 188 (F) | 510090 | STRUCTURAL CONCRETE, BOX CULVERT | CY | 63 |
| 189 (F) | 510502 | MINOR CONCRETE (MINOR STRUCTURE) | CY | 159 |
| 190 | 510526 | MINOR CONCRETE (BACKFILL) | CY | 360 |
| 191 (F) | 511064 | FRACTURED RIB TEXTURE | SQFT | 3,568 |
| 192 (F) | 044571 | FRACTURED RIB (TREE PATTERN) | SQFT | 5,820 |
| 193 | 512206 | FURNISH PRECAST PRESTRESSED CONCRETE GIRDER (70'-80') | EA | 7 |
| 194 | 512207 | FURNISH PRECAST PRESTRESSED CONCRETE GIRDER (80'-90') | EA | 7 |
| 195 | 044572 | FURNISH PRECAST PRESTRESSED CONCRETE GIRDER (120'-130') | EA | 14 |
| 196 (F) | 512500 | ERECT PRECAST PRESTRESSED CONCRETE GIRDER | EA | 28 |
| 197 (F) | 044573 | CORBEL CAP (PRECAST CONCRETE) | EA | 8 |
| 198 | 519081 | JOINT SEAL (MR 1/2") | LF | 105 |
| 199 | 519091 | JOINT SEAL (MR 1 1/2") | LF | 232 |
| 200 (F) | 520101 | BAR REINFORCING STEEL | LB | 19,630 |

| Item No. | Item Code | Item Description | Unit of Measure | Estimated Quantity |
|------------|-----------|---|-----------------|--------------------|
| 201 (F) | 520102 | BAR REINFORCING STEEL (BRIDGE) | LB | 868,060 |
| 202 (F) | 520103 | BAR REINFORCING STEEL (RETAINING WALL) | LB | 104,000 |
| 203 (F) | 520107 | BAR REINFORCING STEEL (BOX CULVERT) | LB | 20,443 |
| 204 (F) | 520110 | BAR REINFORCING STEEL (EPOXY COATED) (BRIDGE) | LB | 2,550 |
| 205 (F) | 520120 | HEADED BAR REINFORCEMENT | EA | 580 |
| 206 | 560205 | INSTALL REMOVABLE SIGN PANEL FRAME | EA | 2 |
| 207 (F) | 560218 | FURNISH SIGN STRUCTURE (TRUSS) | LB | 22,500 |
| 208 (F) | 560219 | INSTALL SIGN STRUCTURE (TRUSS) | LB | 22,500 |
| 209 | 560244 | FURNISH LAMINATED PANEL SIGN (1"-TYPE A) | SQFT | 320 |
| 210 | 560245 | FURNISH LAMINATED PANEL SIGN (1"-TYPE B) | SQFT | 350 |
| 211 | 560248 | FURNISH SINGLE SHEET ALUMINUM SIGN (0.063"-UNFRAMED) | SQFT | 620 |
| 212 | 560249 | FURNISH SINGLE SHEET ALUMINUM SIGN (0.080"-UNFRAMED) | SQFT | 420 |
| 213 | 560251 | FURNISH SINGLE SHEET ALUMINUM SIGN (0.063"-FRAMED) | SQFT | 94 |
| 214 | 560252 | FURNISH SINGLE SHEET ALUMINUM SIGN (0.080"-FRAMED) | SQFT | 160 |
| 215 | 562001 | METAL (ROADSIDE SIGN) | LB | 2,040 |
| 216 | 566011 | ROADSIDE SIGN - ONE POST | EA | 32 |
| 217 | 566012 | ROADSIDE SIGN - TWO POST | EA | 17 |
| 218 | 568001 | INSTALL SIGN (STRAP AND SADDLE BRACKET METHOD) | EA | 37 |
| 219 | 597600 | PREPARE AND PAINT CONCRETE | SQFT | 6 |
| 220 | 620060 | 12" ALTERNATIVE PIPE CULVERT | LF | 98 |

| Item No. | Item Code | Item Description | Unit of Measure | Estimated Quantity |
|------------|-----------|---|-----------------|--------------------|
| 221 | 620100 | 18" ALTERNATIVE PIPE CULVERT | LF | 2,740 |
| 222 | 620140 | 24" ALTERNATIVE PIPE CULVERT | LF | 1,760 |
| 223 | 620220 | 36" ALTERNATIVE PIPE CULVERT | LF | 540 |
| 224 | 026996 | CONCRETE BACKFILL (RAPID STRENGTH CONCRETE) | CY | 10 |
| 225 | 623000 | TEMPORARY CULVERT | LF | 1,090 |
| 226 | 026997 | 6" PLASTIC PIPE | LF | 780 |
| 227 | 026998 | 8" PLASTIC PIPE | LF | 10 |
| 228 | 650018 | 24" REINFORCED CONCRETE PIPE | LF | 1,000 |
| 229 | 026999 | 14"X23" OVAL SHAPED REINFORCED CONCRETE PIPE | LF | 290 |
| 230 | 680902 | 6" PERFORATED PLASTIC PIPE UNDERDRAIN | LF | 1,000 |
| 231 | 680905 | 8" PERFORATED PLASTIC PIPE UNDERDRAIN | LF | 710 |
| 232 | 700617 | DRAINAGE INLET MARKER | EA | 89 |
| 233 | 703233 | GRATED LINE DRAIN | LF | 1,120 |
| 234 | 705307 | 12" ALTERNATIVE FLARED END SECTION | EA | 1 |
| 235 | 705311 | 18" ALTERNATIVE FLARED END SECTION | EA | 10 |
| 236 | 705315 | 24" ALTERNATIVE FLARED END SECTION | EA | 3 |
| 237 | 705500 | AUTOMATIC DRAINAGE GATE | EA | 3 |
| 238 (F) | 721015 | ROCK SLOPE PROTECTION (LIGHT, METHOD B) (CY) | CY | 184 |
| 239 | 729011 | ROCK SLOPE PROTECTION FABRIC (CLASS 8) | SQYD | 360 |
| 240 (F) | 730040 | MINOR CONCRETE (GUTTER) (LF) | LF | 294 |

| Item No. | Item Code | Item Description | Unit of Measure | Estimated Quantity |
|------------|-----------|--|-----------------|--------------------|
| 241 | 731502 | MINOR CONCRETE (MISCELLANEOUS CONSTRUCTION) | CY | 1,200 |
| 242 | 731518 | MINOR CONCRETE (BRUSHED CONCRETE) | SQFT | 5,080 |
| 243 | 731519 | MINOR CONCRETE (STAMPED CONCRETE) | SQFT | 4,750 |
| 244 | 731530 | MINOR CONCRETE (TEXTURED PAVING) | CY | 140 |
| 245 (F) | 750001 | MISCELLANEOUS IRON AND STEEL | LB | 30,776 |
| 246 | 027000 | REMOVE FIRE HYDRANT | EA | 3 |
| 247 | 027001 | JACKED 14" STEEL CASING | LF | 28 |
| 248 | 027002 | JACKED 16" STEEL CASING | LF | 120 |
| 249 | 027003 | JACKED 36" STEEL CASING | LF | 370 |
| 250 (F) | 750002 | MISCELLANEOUS IRON AND STEEL (SEWER SYSTEM) | LB | 8,265 |
| 251 | 027004 | STEEL SLEEVE | LF | 40 |
| 252 | 027005 | 6" PVC SEWER PIPE | LF | 60 |
| 253 | 027006 | 6" PVC FORCE MAIN SEWER PIPE | LF | 590 |
| 254 | 027007 | 6" HDPE LATERAL (PIPE BURST) | LF | 160 |
| 255 | 027008 | 8" PVC SEWER PIPE | LF | 660 |
| 256 | 027009 | 10" PVC SEWER PIPE | LF | 760 |
| 257 | 027010 | 16" PVC FORCE MAIN SEWER PIPE | LF | 510 |
| 258 | 027011 | 24" PVC SEWER PIPE | LF | 980 |
| 259 | 027012 | 30" PVC FORCE MAIN SEWER PIPE | LF | 770 |
| 260 | 027013 | SEWER MANHOLE (TYPE 1) | EA | 8 |

| Item No. | Item Code | Item Description | Unit of Measure | Estimated Quantity |
|------------|-----------|---|-----------------|--------------------|
| 261 | 027014 | SEWER MANHOLE (TYPE 2) | EA | 1 |
| 262 | 027015 | SEWER MANHOLE (TYPE 3) | EA | 6 |
| 263 | 027016 | PRESSURED MANHOLE | EA | 4 |
| 264 | 027017 | TEMPORARY BYPASS SEWER | LS | LUMP SUM |
| 265 | 027018 | TEMPORARY BYPASS CONNECTION | LS | LUMP SUM |
| 266 | 027019 | FIRE HYDRANT | EA | 3 |
| 267 | 027020 | 12" BUTTERFLY VALVE | EA | 8 |
| 268 | 027021 | CONNECT TO EXISTING WATER LINES | EA | 3 |
| 269 | 027022 | WATER METER WITH WATER METER BOX | EA | 17 |
| 270 | 027023 | INSTALL DROP IN VALVE | EA | 2 |
| 271 | 027024 | ADJUST WATER VALVE BOX | EA | 23 |
| 272 | 027025 | 2" LATERAL WATER LINE | LF | 250 |
| 273 | 027026 | 12" PVC PIPE (WATER LINE) | LF | 1,200 |
| 274 | 027027 | ARCHITECTURAL CONCRETE | CY | 79 |
| 275 (F) | 027028 | STONE VENEER | SQFT | 2,910 |
| 276 | 027029 | 36" JACKED REINFORCED CONCRETE PIPE | LF | 200 |
| 277 | 800302 | CHAIN LINK FENCE (TYPE CL-3, VINYL-CLAD) | LF | 613 |
| 278 | 800361 | CHAIN LINK FENCE (TYPE CL-6, VINYL-CLAD) | LF | 302 |
| 279 | 802520 | 6' CHAIN LINK GATE (TYPE CL-6) | EA | 6 |
| 280 | 802540 | 8' CHAIN LINK GATE (TYPE CL-6) | EA | 2 |

| Item No. | Item Code | Item Description | Unit of Measure | Estimated Quantity |
|----------|-----------|--|-----------------|--------------------|
| 281 | 820107 | DELINEATOR (CLASS 1) | EA | 78 |
| 282 | 820130 | OBJECT MARKER | EA | 24 |
| 283 | 832006 | MIDWEST GUARDRAIL SYSTEM (STEEL POST) | LF | 1,560 |
| 284 | 832070 | VEGETATION CONTROL (MINOR CONCRETE) | SQYD | 1,100 |
| 285 (F) | 044574 | ORNAMENTAL RAILING | LF | 516 |
| 286 (F) | 044575 | CHAIN LINK RAILING (TYPE 2 - ST-10 MODIFIED 4.5, VINYL-CLAD) | LF | 134 |
| 287 (F) | 044576 | CHAIN LINK RAILING (TYPE 2 - ST-10 MODIFIED 6, VINYL-CLAD) | LF | 140 |
| 288 | 833072 | WILDLIFE PASSAGE WAY (TYPE S) | EA | 77 |
| 289 (F) | 833088 | TUBULAR HANDRAILING | LF | 480 |
| 290 (F) | 833142 | CONCRETE BARRIER (TYPE 26 MODIFIED) | LF | 239 |
| 291 (F) | 833143 | CONCRETE BARRIER (TYPE 26A MODIFIED) | LF | 27 |
| 292 (F) | 839514 | HANDRAILING | LF | 59 |
| 293 | 839543 | TRANSITION RAILING (TYPE WB-31) | EA | 6 |
| 294 | 839581 | END ANCHOR ASSEMBLY (TYPE SFT) | EA | 3 |
| 295 | 839584 | ALTERNATIVE IN-LINE TERMINAL SYSTEM | EA | 6 |
| 296 | 839585 | ALTERNATIVE FLARED TERMINAL SYSTEM | EA | 1 |
| 297 | 027030 | CRASH CUSHION (TYPE SCI-100GM) | EA | 2 |
| 298 | 839699 | CONCRETE BARRIER (TYPE 60P) | LF | 24 |
| 299 | 839701 | CONCRETE BARRIER (TYPE 60) | LF | 200 |
| 300 | 839703 | CONCRETE BARRIER (TYPE 60C) | LF | 4,470 |

| Item No. | Item Code | Item Description | Unit of Measure | Estimated Quantity |
|----------|-----------|--|-----------------|--------------------|
| 301 | 839704 | CONCRETE BARRIER (TYPE 60D) | LF | 930 |
| 302 | 839709 | CONCRETE BARRIER (TYPE 60GE) | LF | 87 |
| 303 | 027031 | CONCRETE BARRIER (TYPE 60R MODIFIED) | LF | 240 |
| 304 (F) | 839725 | CONCRETE BARRIER (TYPE 736) | LF | 116 |
| 305 (F) | 027032 | CONCRETE BARRIER (TYPE 736A MODIFIED) | LF | 118 |
| 306 (F) | 839727 | CONCRETE BARRIER (TYPE 736 MODIFIED) | LF | 1,541 |
| 307 (F) | 839740 | CALIFORNIA ST-10 BRIDGE RAIL | LF | 274 |
| 308 | 840515 | THERMOPLASTIC PAVEMENT MARKING | SQFT | 5,380 |
| 309 | 840655 | PAINT TRAFFIC STRIPE (1-COAT) | LF | 199,000 |
| 310 | 840665 | PAINT PAVEMENT MARKING (1-COAT) | SQFT | 11,000 |
| 311 | 840666 | PAINT PAVEMENT MARKING (2-COAT) | SQFT | 810 |
| 312 | 846001 | 4" THERMOPLASTIC TRAFFIC STRIPE (ENHANCED WET NIGHT VISIBILITY) | LF | 31,000 |
| 313 | 846002 | 4" THERMOPLASTIC TRAFFIC STRIPE (ENHANCED WET NIGHT VISIBILITY) (BROKEN 6-1) | LF | 260 |
| 314 | 846004 | 4" THERMOPLASTIC TRAFFIC STRIPE (ENHANCED WET NIGHT VISIBILITY) (BROKEN 17-7) | LF | 11,300 |
| 315 | 846005 | 4" THERMOPLASTIC TRAFFIC STRIPE (ENHANCED WET NIGHT VISIBILITY) (BROKEN 36-12) | LF | 21,200 |
| 316 | 846007 | 6" THERMOPLASTIC TRAFFIC STRIPE (ENHANCED WET NIGHT VISIBILITY) | LF | 4,340 |
| 317 | 846008 | 6" THERMOPLASTIC TRAFFIC STRIPE (ENHANCED WET NIGHT VISIBILITY) (BROKEN 8-4) | LF | 550 |
| 318 | 846009 | 8" THERMOPLASTIC TRAFFIC STRIPE (ENHANCED WET NIGHT VISIBILITY) | LF | 13,000 |
| 319 | 846010 | 8" THERMOPLASTIC TRAFFIC STRIPE (ENHANCED WET NIGHT VISIBILITY) (BROKEN 12-3) | LF | 410 |
| 320 | 850101 | PAVEMENT MARKER (NON-REFLECTIVE) | EA | 2,180 |

| Item No. | Item Code | Item Description | Unit of Measure | Estimated Quantity |
|----------|-----------|---|-----------------|--------------------|
| 321 | 850111 | PAVEMENT MARKER (RETROREFLECTIVE) | EA | 5,690 |
| 322 | 860090 | MAINTAINING EXISTING TRAFFIC MANAGEMENT SYSTEM ELEMENTS DURING CONSTRUCTION | LS | LUMP SUM |
| 323 | 027033 | SIGNAL AND LIGHTING (LOCATION 1)(TEMPORARY) | LS | LUMP SUM |
| 324 | 027034 | SIGNAL AND LIGHTING (LOCATION 2)(TEMPORARY) | LS | LUMP SUM |
| 325 | 027035 | SIGNAL AND LIGHTING (LOCATION 3)(TEMPORARY) | LS | LUMP SUM |
| 326 | 027036 | SIGNAL AND LIGHTING (LOCATION 4)(TEMPORARY) | LS | LUMP SUM |
| 327 | 027037 | SIGNAL AND LIGHTING (LOCATION 5)(TEMPORARY) | LS | LUMP SUM |
| 328 | 027038 | SIGNAL AND LIGHTING (LOCATION 6)(TEMPORARY) | LS | LUMP SUM |
| 329 | 027039 | SIGNAL AND LIGHTING (LOCATION 7)(TEMPORARY) | LS | LUMP SUM |
| 330 | 860251 | SIGNAL AND LIGHTING (LOCATION 1) | LS | LUMP SUM |
| 331 | 860252 | SIGNAL AND LIGHTING (LOCATION 2) | LS | LUMP SUM |
| 332 | 860253 | SIGNAL AND LIGHTING (LOCATION 3) | LS | LUMP SUM |
| 333 | 860254 | SIGNAL AND LIGHTING (LOCATION 4) | LS | LUMP SUM |
| 334 | 860255 | SIGNAL AND LIGHTING (LOCATION 5) | LS | LUMP SUM |
| 335 | 860401 | LIGHTING | LS | LUMP SUM |
| 336 | 860460 | LIGHTING AND SIGN ILLUMINATION | LS | LUMP SUM |
| 337 | 027040 | LIGHTING AND SIGN ILLUMINATION (TEMPORARY) | LS | LUMP SUM |
| 338 | 860705 | INTERCONNECTION CONDUIT AND CABLE (LS) | LS | LUMP SUM |
| 339 | 860797 | ELECTRIC SERVICE (IRRIGATION) | LS | LUMP SUM |
| 340 | 027041 | TRAFFIC OPERATIONS SYSTEM | LS | LUMP SUM |

| Item No. | Item Code | Item Description | Unit of Measure | Estimated Quantity |
|----------|-----------|------------------|-----------------|--------------------|
| 341 | 999990 | MOBILIZATION | LS | LUMP SUM |

SPECIAL PROVISIONS

ORGANIZATION

Special provisions are under headings that correspond with the main-section headings of the *Standard Specifications*. A main-section heading is a heading shown in the table of contents of the *Standard Specifications*.

Each special provision begins with a revision clause that describes or introduces a revision to the *Standard Specifications* as revised by any revised standard specification.

Any paragraph added or deleted by a revision clause does not change the paragraph numbering of the *Standard Specifications* for any other reference to a paragraph of the *Standard Specifications*.

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DIVISION I GENERAL PROVISIONS

1 GENERAL

Add to section 1-1.01:

Bid Items and Applicable Sections

| Item code | Item description | Applicable section |
|-----------|--|--------------------|
| 026978 | Temporary Alternative Crash Cushion | 12 |
| 026979 | Temporary Creek Diversion System | 13 |
| 026980 | Dewatering and Non Storm Water Discharge System | 15 |
| 150227 | Abandon Pipeline | 15 |
| 026981 | Abandon Sewer Line | 15 |
| 026982 | Remove Metal Structure | 15 |
| 026983 | Remove Water Valves | 15 |
| 026984 | Salvage Water Meter | 15 |
| 152469 | Adjust Utility Cover To Grade | 15 |
| 026985 | Modify Sewer Manhole | 15 |
| 026986 | Lightweight Embankment Material (Cellular Concrete) | 19 |
| 026987 | Soil Cement | 19 |
| 026988 | Plant (Group K48) (48" Box) | 20 |
| 026989 | Plant (Group K60) (60" Box) | 20 |
| 026990 | 5/8" Plastic Pipe Irrigation Line with Integral Emitters | 20 |
| 026991 | Flow Sensor Cable in Conduit | 20 |

| Item code | Item description | Applicable section |
|-----------|---|--------------------|
| 026992 | Riser Sprinkler Assembly (Type C-2) | 20 |
| 026993 | Flushing Valve | 20 |
| 026994 | Imported Biofiltration Soil (CY) | 21 |
| 026995 | Temporary Shoring (SQFT) | 48 |
| 044567 | Furnish Piling (Class 90) (Alternative "X" Modified) | 49 |
| 044568 | Drive Pile (Class 90) (Alternative "X" Modified) | 49 |
| 044569 | Furnish Piling (Class 140) (Alternative "X" Modified) | 49 |
| 044570 | Drive Pile (Class 140) (Alternative "X" Modified) | 49 |
| 044571 | Fractured Rib Texture (Tree Pattern) | 51 |
| 044572 | Furnish Precast Prestressed Concrete Girder (120'-130') | 51 |
| 044573 | Corbel Cap (Precast Concrete) | 51 |
| 026996 | Concrete Backfill (Rapid Strength Concrete) | 62 |
| 026997 | 6" Plastic Pipe | 64 |
| 026998 | 8" Plastic Pipe | 64 |
| 026999 | 14" x 23" Oval Shaped Reinforced Concrete Pipe | 65 |
| 027000 | Remove Fire Hydrant | 77 |
| 027001 | Jacked 14" Steel Casing | 77 |
| 027002 | Jacked 16" Steel Casing | 77 |
| 027003 | Jacked 36" Steel Casing | 77 |
| 750002 | Miscellaneous Iron and Steel (Sewer System) | 77 |
| 027004 | Steel Sleeve | 77 |
| 027005 | 6" PVC Sewer Pipe | 77 |
| 027006 | 6" PVC Force Main Sewer Pipe | 77 |
| 027007 | 6" HDPE Lateral (Pipe Burst) | 77 |
| 027008 | 8" PVC Sewer Pipe | 77 |
| 027009 | 10" PVC Sewer Pipe | 77 |
| 027010 | 16" PVC Force Main Sewer Pipe | 77 |
| 027011 | 24" PVC Sewer Pipe | 77 |
| 027012 | 30" PVC Force Main Sewer Pipe | 77 |
| 027013 | Sewer Manhole (Type 1) | 77 |
| 027014 | Sewer Manhole (Type 2) | 77 |
| 027015 | Sewer Manhole (Type 3) | 77 |
| 027016 | Pressured Manhole | 77 |

| Item code | Item description | Applicable section |
|-----------|--|--------------------|
| 027017 | Temporary Bypass Sewer | 77 |
| 027018 | Temporary Bypass Connection | 77 |
| 027019 | Fire Hydrant | 77 |
| 027020 | 12" Butterfly Valve | 77 |
| 027021 | Connect to Existing Water Lines | 77 |
| 027022 | Furnished Water Meter and Water Meter Box | 77 |
| 027023 | Install Drop In Valve | 77 |
| 027024 | Adjust Water Valve Box | 77 |
| 027025 | 2" Lateral Water Line | 77 |
| 027026 | 12" PVC Pipe (Water Line) | 77 |
| 027027 | Architectural Concrete | 77 |
| 027028 | Stone Veneer | 77 |
| 027029 | 36" Jacked Reinforced Concrete Pipe | 78 |
| 044574 | Ornamental Railing | 83 |
| 044575 | Chain Link Railing (Type 2 - ST-10 Modified 4.5, Vinyl-Clad) | 83 |
| 044576 | Chain Link Railing (Type 2 - ST-10 Modified 6, Vinyl-Clad) | 83 |
| 027030 | Crash Cushion (TYPE SCI-100GM) | 83 |
| 027031 | Concrete Barrier (Type 60R Modified) | 83 |
| 027032 | Concrete Barrier (Type 736A Modified) | |
| 027033 | Signal and Lighting (Location 1) (Temporary) | 86 |
| 027034 | Signal and Lighting (Location 2) (Temporary) | 86 |
| 027035 | Signal and Lighting (Location 3) (Temporary) | 86 |
| 027036 | Signal and Lighting (Location 4) (Temporary) | 86 |
| 027037 | Signal and Lighting (Location 5) (Temporary) | 86 |
| 027038 | Signal and Lighting (Location 6) (Temporary) | 86 |
| 027039 | Signal and Lighting (Location 7) (Temporary) | 86 |
| 027040 | Lighting and Sign Illumination (Temporary) | 86 |
| 027041 | Traffic Operations System | 86 |

Add to section 5-1.20A:

During the progress of the work under this Contract, work under the following contracts may be in progress at or near the job site of this Contract:

Coincident or Adjacent Contracts

| Contract no. | County–Route–Post Mile | Location | Type of work |
|--------------|------------------------|-------------------------------------|-------------------------------|
| 04-3G8004 | SM-101-21.3/21.5 | South San Francisco | Ramp Improvements |
| 04-2E7004 | SM-101-17.9 | Millbrae | Clean And Paint Steel Girders |
| 04-2A7904 | SM-101-7.5/25.9 | South San Francisco, and San Carlos | Ramp Metering |

Add to section 5-1.20C:

This project does not include work on the railroad property, but a railroad is shown on the general plan sheet within the project limits. Do not trespass on the railroad property on Broadway between Carolan Avenue and California Drive.

Add to section 5-1.36D:

The utility owner will relocate a utility shown in the following table before the corresponding date shown:

Utility Relocation and Date of the Relocation

| Utility | Location | Date |
|--|---|-----------|
| PG&E Overhead Electric Line (16Kv) No.41 | Rollins Rd "RLN" 22+58, 30' LT to 36+78, 33' LT | 8/30/2014 |
| PG&E Pole | Rollins Rd "RLN" 23+60, 52' RT | 8/30/2014 |
| PG&E Pole | Rollins Rd "RLN" 23+64, 15' LT | 8/30/2014 |
| PG&E Pole | Rollins Rd "RLN" 24+74, 22' LT | 8/30/2014 |

During the progress of the work under this Contract, the utility owner will relocate a utility shown in the following table within the corresponding number of days shown. Notify the Engineer before you work near a utility shown. The days start on the notification date.

Utility Relocation and Department-Arranged Time for the Relocation

| Utility | Location | Days |
|--|---|------|
| Joint Trench: | | |
| 1. PG&E UG electric line (21 kv), including vaults & pull boxes No. 29 | 1. Bayshore Highway-"BYSH" 36+78, 33' LT to "HTL"52+37, 50' LT | 240 |
| 2. PG&E 4" HP Gas Main No. 14 | 2. Bayshore Highway – "BYSH" 36+67, 42' LT to "HTL" 52+55, 28' RT | |
| 3. PG&E UG electric line (21 kv), including vaults & pull boxes No. 13 | 3. Bayshore Highway-"BYSH" 36+75, 37' LT to "HTL"52+46, 38' LT | |
| 4. AT&T UG Telephone Line No. 11 | 4. Bayshore Highway-"BYSH" 36+75, 37' LT to "HTL"52+46, 38' LT | |
| 5. Comcast UG TV Cable Line No.10 | 5. Bayshore Highway-"BYSH" 36+70, 42' LT to "HTL"52+38, 50' LT | |
| 6. Sprint UG Fiber Optic Line No. 12 | 6. Bayshore Highway-"BYSH" 36+73, 41' LT to "HTL"52+38, 50' LT | |
| 7. Sprint UG Telephone Line No. 17 | 7. Bayshore Highway-"BYSH" 36+66, 44' RT to "HTL"52+38, 50' LT | |
| PG&E UG Electric Line (21 KV) No. 29 | Bayshore Highway "BYSH" 33+69, 34' LT to 34+88, 35' LT | 45 |
| PG&E Electric Vent | Rollins Rd "RLN" 25+90, 20' LT | 30 |
| PG&E Electric Vent | Rollins Rd "RLN" 24+71, 17' LT | 30 |
| PG&E Gas Vent | Rollins Rd "RLN" 24+74, 22' LT | 30 |

The utilities shown in the following table will not be rearranged. The utilities may interfere with pile driving, drilling activities, or substructure construction. If you want any of them rearranged or temporarily deactivated, make arrangements with the utility owner.

Utilities Not Rearranged for Pile Driving, Drilling Activities, or Substructure Construction

| Utility | Location |
|---|------------------------------|
| PG&E Electric Transmission Lines & Towers | "BWY" 16+00 to 17+00, 48' RT |

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6 CONTROL OF MATERIALS

Add to section 6-2.03:

The Department furnishes you with:

- Loop detector sensor units
- Model 2070 controller assembly, including controller unit, completely wired controller cabinet, and detector sensor units

The Department furnishes you with completely wired controller cabinets with auxiliary equipment but without controller unit at Caltrans Maintenance Station, 30 Rickard Street, San Francisco, CA 94134. At least 48 hours before you pick up the materials, inform the Engineer of what you will pick up and when you will pick it up.

4. To identify all construction activities that may affect the public through:
 - 4.1. Traffic
 - 4.2. Noise
 - 4.3. Vibration
 - 4.4. Work that requires:
 - 4.4.1. Shoulder closure
 - 4.4.2. Lane closure
 - 4.4.3. Ramp closure
 - 4.4.4. Freeway closure
 - 4.4.5. Construction Zone Enhancement Enforcement Program (COZEEP)

Identify each activity in the 4-week schedule using the activity ID numbering system from the baseline schedule or the last accepted update schedule. To create the 4-week schedule, utilize the use of EXCEL spreadsheet or a scheduling software as acceptable by the Engineer.

Replace "Reserved" in section 8-1.04C with:

Section 8-1.04B does not apply.

Start job site activities within 55 days after receiving notice that the Contract has been approved by the Attorney General or the attorney appointed and authorized to represent the Department.

Do not start job site activities until the Department authorizes or accepts your submittal for:

1. CPM baseline schedule
2. WPCP or SWPPP, whichever applies
3. Notification of DRA or DRB nominee and disclosure statement
4. Contingency plan for opening closures to public traffic

You may enter the job site only to measure controlling field dimensions and locate utilities.

Do not start other job site activities until all the submittals from the above list are authorized or accepted and the following information is received by the Engineer:

1. *Notice of Materials To Be Used* form.
2. Written statement from the vendor that the order for the sign panels has been received and accepted by the vendor. The statement must show the dates that the materials will be shipped.
3. Written statement from the vendor that the order for electrical material has been received and accepted by the vendor. The statement must show the dates that the materials will be shipped.
4. Written statement from the vendor that the order for structural steel has been received and accepted by the vendor. The statement must show the dates that the materials will be shipped.

You may start job site activities before the 55th day after Contract approval if you:

1. Obtain specified authorization or acceptance for each submittal before the 55th day
2. Receive authorization to start

Submit a notice 72 hours before starting job site activities. If the project has more than 1 location of work, submit a separate notice for each location.

Add to section 8-1.10B:

Liquidated damages for not completing stage construction, stage 2, phase 1 (once you start stage 2, phase 1) within 100 days are \$5,400 per day.

Liquidated damages for not completing stage construction, stage 3, phase 1 (once you start stage 3, phase 1) within 175 days are \$5,000 per day.

Liquidated damages for not completing stage construction, stage 4, phase 1 (once you start stage 4, phase 1) within 55 days are \$6,000 per day.

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9 PAYMENT

Add to section 9-1.16C:

The following items are eligible for progress payment even if they are not incorporated into the work:

1. Control and Neutral Conductors
2. Irrigation Controllers
3. Irrigation Controller Enclosure Cabinets
4. Pipe (Irrigation Systems)
5. Backflow Preventers
6. Backflow Preventer Assembly Enclosures
7. Valves
8. Sprinklers
9. Stone Veneer
10. Pavement Markers
11. Signal and Lighting standards
12. Signal Heads and Mounting Brackets
13. Underdrain Pipe
14. Precast Concrete Members
15. Piling (except CIDH Piling)
16. Prestressing Steel for Post-tensioning Precast Members (Sealed Packages only)
17. Type B Joint Seals and Joint Seal Assemblies
18. Reinforcement
19. Fences and Gates
20. Railings
21. Culvert Pipe
22. Rock Slope Protection Fabric
23. Crash Cushions
24. Miscellaneous iron and Steel
25. Sewer Pipes and Appurtenances
26. Lighting Fixtures
27. Luminaires
28. Earth Retaining System
29. Steel Sleeve
30. Fire Hydrant
31. Water Pipes and Appurtenances
32. Steel Casing
33. Camera Assemblies
34. Corrugated Steel Pipe Conduit
35. Fiber Optic Cable
36. Fiber Optic Conduit
37. Signal Fixtures

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DIVISION II GENERAL CONSTRUCTION

10 GENERAL

Add to section 10-1.02:

Do not place the uppermost layer of new pavement until all underlying conduits and loop detectors are installed.

For 5 days, starting on the day of signal activation, place 1 portable changeable message sign in each direction of travel and display the following message: "SIGNAL AHEAD -- PREPARE TO STOP."

Replace section 12-3.13 with:

12-3.13 IMPACT ATTENUATOR VEHICLE

12-3.13A General

12-3.13A(1) Summary

Section 12-3.13 includes specifications for protecting traffic and workers with an impact attenuator vehicle during moving lane closures and when placing and removing components of stationary lane closures, ramp closures, shoulder closures, or a combination.

Impact attenuator vehicles must comply with the following test levels under National Cooperative Highway Research Program 350:

1. Test level 3 if the preconstruction posted speed limit is 50 mph or more
2. Test levels 2 or 3 if the preconstruction posted speed limit is 45 mph or less

Comply with the attenuator manufacturer's instructions for:

1. Support truck
2. Trailer-mounted operation
3. Truck-mounted operation

Flashing arrow signs must comply with section 12-3.03. You may use a portable changeable message sign instead of a flashing arrow sign. If a portable changeable message sign is used as a flashing arrow sign, it must comply with section 6F.56 "Arrow Panels" of the *California MUTCD*.

12-3.13A(2) Definitions

impact attenuator vehicle: A support truck that is towing a deployed attenuator mounted to a trailer or a support truck with a deployed attenuator that is mounted to the support truck.

12-3.13A(3) Submittals

Upon request, submit a certificate of compliance for each attenuator used on the project.

12-3.13A(4) Quality Control and Assurance

Do not start impact attenuator vehicle activities until authorized.

Before starting impact attenuator vehicle activities, conduct a preinstallation meeting with the Engineer, subcontractors, and other parties involved with traffic control to discuss the operation of the impact attenuator vehicle during moving lane closures and when placing and removing components of stationary traffic control systems.

Schedule the location, time, and date for the preinstallation meeting with all participants. Furnish the facility for the preinstallation meeting within 5 miles of the job site or at another location if authorized.

12-3.13B Materials

Attenuators must be a brand on the Authorized Material List for highway safety features.

The combined weight of the support truck and the attenuator must be at least 19,800 pounds, except the weight of the support truck must not be less than 16,100 or greater than 26,400 pounds.

For the Trinity MPS-350 truck-mounted attenuator, the support truck must not have a fuel tank mounted underneath within 10'-6" of the rear of the support truck.

Each impact attenuator vehicle must have:

1. Legal brake lights, taillights, sidelights, and turn signals
2. Inverted "V" chevron pattern placed across the entire rear of the attenuator composed of alternating 4-inch wide nonreflective black stripes and 4-inch wide yellow retroreflective stripes sloping at 45 degrees
3. Type II flashing arrow sign
4. Flashing or rotating amber light
5. Operable 2-way communication system for maintaining contact with workers

12-3.13C Construction

Except where prohibited, use an impact attenuator vehicle:

1. To follow behind equipment and workers who are placing and removing components of a stationary lane closure, ramp closure, shoulder closure, or any combination. Operate the flashing arrow sign in the arrow or caution mode during this activity, whichever applies. Follow at a distance that prevents intrusion into the workspace from passing traffic.
2. As a shadow vehicle in a moving lane closure.

After placing components of a stationary traffic control system you may place the impact attenuator vehicle in advance of the work area or at another authorized location to protect traffic and workers.

Secure objects, including equipment, tools, and ballast on impact attenuator vehicles to prevent loosening upon impact by an errant vehicle.

Do not use a damaged attenuator in the work. Replace any attenuator damaged from an impact during work activities at your expense.

12-3.13 Payment

Not Used

Replace section 12-3.14 with:

12-3.14 TEMPORARY TRAFFIC SCREEN

12-3.14A General

Section 12-3.14 includes specifications for constructing temporary traffic screen at the locations shown.

12-3.14B Materials

Temporary traffic screen panels must be new or used, CDX grade or better, plywood or weather-resistant strandboard mounted and anchored on Type K temporary railing.

Wale boards must be new or used Douglas fir, rough sawn, construction grade or better.

Pipe screen supports must be new or used schedule 40, galvanized steel pipe.

Nuts, bolts, and washers must be cadmium plated.

Screws must be black or cadmium-plated flat head, cross-slotted screws with full thread length.

12-3.14C Construction

Mount and anchor temporary traffic screen on top of Type K temporary railing.

Remove the traffic screen from the highway when the Engineer determines it is no longer required. The traffic screen that is removed becomes your property.

A lateral move of Type K temporary railing with attached temporary traffic screen is change order work if ordered and the repositioning is not shown.

12-3.14D Payment

Temporary traffic screen is measured along the line of the completed screen.

Replace section 12-3.16 with:

12-3.16 TEMPORARY SIGNAL SYSTEM

12-3.16A General

Installing temporary signal system (TSS) consists of installing and maintaining temporary traffic signal, lighting, and flashing beacons for traffic control.

The Department will furnish Model 2070 traffic signal controller assembly, including wired cabinet, controller unit, and loop detector sensor units.

Furnish other materials and equipment for a TSS, including flashing beacons, signal heads, mast arms, luminaires, wood poles, conductors, and hardware.

Material and equipment used in the TSS may be new or used but must be suitable for the intended use.

Orient each signal face to be clearly visible to traffic approaching from the direction that the signal is intended to control.

12-3.16B Operation

TSS must operate at nominal 120 V(ac). Lighting must operate at 120 V(ac) or 240 V(ac).

Unless otherwise directed, the system must operate on a continuous, 24-hour basis except when it is necessary that traffic be controlled by flaggers.

The Department will perform timing for the TSS.

12-3.16C Maintaining Temporary Signal System

Except for the controller assembly, you are responsible for maintaining the TSS.

If components in the TSS are damaged, displaced, or cease to operate or function as specified from any cause during the progress of the work, immediately repair or replace the components, then restore to the original condition. Components include signs, generator, flashing beacons, and signal equipment.

If the TSS is out of operation, provide flaggers, at your expense, to maintain traffic control until the traffic signals are returned to service.

12-3.16D Conduit

At locations where conduit is required to be installed under pavement and if a delay to vehicles will not exceed 5 minutes, conduit may be installed by the trenching in pavement method as specified in section 86-2.05C.

12-3.16E Conductors and Wiring

Conductors must be the types specified in section 86-2.08 or Type UF cable of the size and number of conductors shown. The minimum conductor size must be no. 12.

If conductors are placed across paved areas, placement must comply with one of the following:

1. Place in a conduit
2. Suspend at least 25 feet above the roadway

Conductors placed outside of paved areas must be placed by one of the following methods:

1. Direct burial method with Type UF cable installed at a minimum depth of 24 inches below grade.
2. Placed in conduit. If Type 1 or 2 conduit is used, the minimum depth must be 12 inches. If Type 3 conduit is used, the minimum depth must be 18 inches.
3. Suspended from wood poles with a minimum clearance of 25 feet from grade at any point. Place the portions of the conductor installed on the face of wood poles in either Type 3 or Type 4 conduit.

Conductors placed across structures must be placed in a Type 1, 2, or 3 conduit. Install the conduit on the outside face of the railing and secure by a method determined by the Engineer.

Conductors to a terminal compartment or signal head on a pole may be spliced to through conductors of the same phase in a pull box adjacent to the pole. Do not splice conductors or cables except in pull boxes or in NEMA Type 3R enclosures.

12-3.16F Bonding and Grounding

Comply with section 86-2.10.

12-3.16G Service

12-3.16G(1) General

Commercial power from an existing utility company must be used to provide power for the TSS.

12-3.16G(2) Commercial Power

Commercial power must be 120 V(ac) or 120/240 V(ac). Protect the power source in a locked enclosure. Provide keys to all locks.

Do not use power from private parties.

Do not use electrical power from existing highway facilities unless authorized.

Make the arrangements with the utility company for providing service.

Commercial electrical power is available at the job site.

12-3.16G(3) Generator

Not Used

12-3.16G(4) Generator Operation

Not Used

12-3.16H Department-Furnished Controller Assembly

Construct the controller cabinet foundation as shown for Model 332L, 334L, or 336L cabinets, including furnishing and installing anchor bolts. Install the controller cabinet on the foundation and make field wiring connections to the terminal blocks in the controller cabinet.

A listing of field conductor terminations in each Department-furnished controller cabinet will be furnished to you at the job site.

The Department or local forces will maintain all controller assemblies.

12-3.16I Detectors

Loop detector sensor units are Department-furnished as part of the controller assembly.

Loop detector lead-in cable must be Type B.

Comply with section 86-5.01A.

12-3.16J Completion and Restoration

Backfill pole holes.

The following materials may be abandoned in place when no longer required:

1. Conductors placed in slots across paved areas
2. Direct buried cables, installed 24 inches or more below the ground surface

Replace section 12-3.19 of the RSS with:

12-3.19 TEMPORARY ALTERNATIVE CRASH CUSHION

12-3.19A General

12-3.19A(1) Summary

Section 12-3.19 includes specifications for furnishing, installing, maintaining and removing temporary alternative crash cushions as shown.

12-3.19A(2) Submittals

Submit one copy of the manufacturer's plan and parts list for each model installed.

Submit a certificate of compliance from the manufacturer for each temporary alternative crash cushion used on the project.

12-3.19B Materials

12-3.19B(1) General

Temporary alternative crash cushion must be:

1. A non-redirective, gating type
2. An ADIEM - 350, as manufactured by Trinity Industries, Inc.
3. An ABSORB 350, TL-2 or TL-3, as manufactured by Barrier Systems, Inc.
4. The QuadGuard II CZ System, Model QZ2405Y or ACZ350, as manufactured by Energy Absorption Systems, Inc.

12-3.19B(2) ADIEM - 350

You can obtain the temporary alternative crash cushion ADIEM - 350 from the manufacturer:

TRINITY INDUSTRIES, INC.
P.O. BOX 99
950 WEST 400S, CENTERVILLE, UT 84014
TELEPHONE (800) 772-7976.

12-3.19B(3) ABSORB - 350, TL-2 and TL-3

You can obtain the ABSORB - 350, TL-2 and TL-3 crash cushions from the following sources:

MANUFACTURER:
BARRIER SYSTEMS, INC.,
180 RIVER ROAD,
RIO VISTA, CA 94571,
TELEPHONE (888) 800-3691

DISTRIBUTORS: NORTHERN CALIFORNIA:
STATEWIDE SAFETY & SIGNS, INC.
130 GROBRIC COURT
FAIRFIELD, CA 94533
TELEPHONE (707) 864-9956

12-3.19B(4) QuadGuard II CZ System Model QZ2405Y and ACZ350 Systems

You can obtain QuadGuard II CZ System, Model QZ2405Y and ACZ350 System from the following:

MANUFACTURER:

ENERGY ABSORPTION SYSTEMS, INC.
ONE EAST WACKER DRIVE, SUITE 3000
CHICAGO, IL 60601-2076
TELEPHONE (760) 438-7887

DISTRIBUTOR:

TRAFFIC CONTROL SERVICE, INC.
1881 BETMOR LANE, ANAHEIM, CA 92805
TELEPHONE (800) 222-8274

TRAFFIC CONTROL SERVICE, INC.
8585 THYS COURT, SACRAMENTO, CA 95828
TELEPHONE (800) 884-8274

12-3.19C Construction

12-3.19C(1) Installation

Install the temporary alternative crash cushion under the manufacturer's instructions.

Attach a Type P marker panel to the front of the temporary alternative crash cushion when the closest point of the crash cushion array is within 12 feet of the traveled way. When required, firmly fasten the marker panel to the temporary alternative crash cushion with commercial quality hardware or by other methods.

Dispose of surplus excavated material remaining after the temporary alternative crash cushion has been installed in a uniform manner along the adjacent roadway as designated by the Engineer.

Limit the anchorage devices used for attaching the QuadGuard CZ II System to the pavement to those that have been provided by the manufacturer

12-3.19C(2) Repair/Restoration

Keep on hand 2 replacement modules for each ADIEM in case of minor damage.

Fill holes left in the pavement after removal of the anchor rods with slurry cement backfill under section 19-3.02D.

At the completion of the project, temporary alternative crash cushion and marker panels become your property.

Remove them from the job site.

12-3.19C(3) Temporary Alternative Crash Cushions Damaged by Your Operations

Immediately repair temporary alternative crash cushions damaged due to your operations at your expense. Remove and replace at your expense temporary alternative crash cushions damaged beyond repair due to your operations.

12-3.19C(4) Temporary Alternative Crash Cushions Damaged by Public Traffic

Remove and immediately replace temporary alternative crash cushions damaged beyond repair by public traffic when ordered by the Engineer.

12-3.19D Payment

The Engineer measures temporary alternative crash cushion by the unit from actual count of cushions used in the work or as ordered by the Engineer.

Repairing the temporary crash cushion damaged by public traffic is change order work.

If the Engineer orders a lateral move of the temporary alternative crash cushion and the repositioning is not shown, moving the temporary alternative crash cushion is by change order work and the temporary alternative crash cushion is not counted for payment in the new position.

Add to section 12-4.02A:

If work including installing, maintaining, and removing Type K temporary railing is to be performed within 6 feet of the adjacent traffic lane, close the adjacent traffic lane.

Except as listed above, closure of the adjacent traffic lane is not required for installing, maintaining, and removing traffic control devices.

For grinding and grooving operations, sawcutting concrete slabs, and installing loop detectors, closure of the adjacent traffic lane is not required if an impact attenuator vehicle is used as a shadow vehicle.

Designated holidays are shown in the following table:

Designated Holidays

| Holiday | Date observed |
|-----------------------|--------------------------|
| New Year's Day | January 1st |
| Washington's Birthday | 3rd Monday in February |
| Memorial Day | Last Monday in May |
| Independence Day | July 4th |
| Labor Day | 1st Monday in September |
| Veterans Day | November 11th |
| Thanksgiving Day | 4th Thursday in November |
| Christmas Day | December 25th |

If a designated holiday falls on a Sunday, the following Monday is a designated holiday. If November 11th falls on a Saturday, the preceding Friday is a designated holiday.

Special day is the third Monday in January.

Freeway closure charts are for the erection and removal of falsework, placement and removal of overhead sign structures, and other authorized work.

Personal vehicles of your employees must not be parked on the traveled way or shoulders, including sections closed to traffic.

If work vehicles or equipment are parked within 6 feet of a traffic lane, close the shoulder area as shown.

Precast concrete members must not be cast within the right-of-way of Route 101.

Erect precast girders over Route 101 one span at a time. During girder erection, traffic in the lanes over which girders are being placed must be detoured or stopped as specified in section 12-4.02A.

Have the necessary materials and equipment on site to erect or remove the girders in any 1 span before detouring traffic.

Add to the RSS for section 12-4.03B:

For each 10-minute interval or fraction thereof past the time specified to open the closure, the Department deducts the amount for liquidated damages per interval shown in the table below. Liquidated damages are limited to 5 percent of the total bid per occurrence. Liquidated damages are not assessed if the Engineer orders the closure to remain in place beyond the scheduled pickup time.

| Type of facility | Route or segment | Period | Damages/interval (\$) |
|----------------------------|------------------|---------------------|-----------------------|
| Mainline (Full Closure) | Route 101 | 1st half hour | \$4,300/10 minutes |
| | | 2nd half hour | \$6,500/10 minutes |
| | | 2nd hour and beyond | \$8,600/10 minutes |
| Mainline (Lane Closure) | Route 101 | 1st half hour | \$2,700/10 minutes |
| | | 2nd half hour | \$4,000/10 minutes |
| | | 2nd hour and beyond | \$5,300/10 minutes |
| Ramp | | 1st half hour | \$1,000/10 minutes |
| | | 2nd half hour | \$1,000/10 minutes |
| | | 2nd hour and beyond | \$1,000/10 minutes |

Add to the RSS for section 12-4.03C:

Submit a contingency plan for each of the following activities:

1. Rapid-set concrete activities
2. Cold-planing asphalt concrete pavement
3. Bridge work
4. Falsework erection or removal, including adjustments
5. Bridge demolition
6. Striping

Discuss the contingency plan with the Engineer at least 5 business days before starting the activity.

Replace "Reserved" in section 12-4.04 with:

| Lane Closure Restriction for Designated Holidays and Special Days | | | | | | | | | | |
|---|--|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----|-----|-----|
| 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 xx | xxx | | | | | |
| | x | xx | xx | SD xx | xxx | | | | | |
| | | | | x | H xx | | | | | |
| | | | | x | SD xx | | | | | |
| | | | | | x | H xx | | | | |
| | | | | | | SD xx | | | | |
| | | | | | | x | H xx | xx | xx | xx |
| | | | | | | | SD xx | | | |
| Legend: | | | | | | | | | | |
| | Refer to lane requirement charts | | | | | | | | | |
| x | The full width of the traveled way must be open for use by traffic after 5 A.M. | | | | | | | | | |
| xx | The full width of the traveled way must be open for use by traffic. | | | | | | | | | |
| xxx | The full width of the traveled way must be open for use by traffic until 11:00 PM. | | | | | | | | | |
| H | Designated holiday | | | | | | | | | |
| SD | Special day | | | | | | | | | |

Replace "Reserved" in section 12-4.05B with:

| Chart no. 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|---|---|---|---|---|---|--|---|---|----|----|----|----|----|---------------|----|----|----|----|----|----|----|----|---|---|---|---|---|--|--|
| Freeway/Expressway Lane Requirements | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| County: San Mateo | | | | | | | | Route/Direction: US 101/ Northbound | | | | | | | | PM: 16.3/17.1 | | | | | | | | | | | | | | | |
| Closure limits: From 0.3 mile north of Anza Boulevard to 0.9 mile south of East Millbrae Avenue | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hour | 24 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | | | | | | | |
| Mon-Thu | | 1 | 1 | 1 | 1 | 2 | | | | | | | | | | | | | | | | | 3 | 2 | | | | | | | |
| Fri | | 1 | 1 | 1 | 1 | 2 | | | | | | | | | | | | | | | | | | 3 | | | | | | | |
| Sat | | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | | | | | | | | | | | | | | | 3 | | | | | | | |
| Sun | | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | | | | | | | | | | | | | | 3 | 2 | | | | | | | |
| Legend: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table style="width:100%; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">1</td> <td>Provide at least 1 through freeway lane open in direction of travel</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">2</td> <td>Provide at least 2 adjacent through freeway lanes open in direction of travel</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">3</td> <td>Provide at least 3 adjacent through freeway lanes open in direction of travel</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;"></td> <td>Work allowed within the highway where shoulder or lane closure is not required</td> </tr> </table> | | | | | | | | | | | | | | | | | | | | | | | | 1 | Provide at least 1 through freeway lane open in direction of travel | 2 | Provide at least 2 adjacent through freeway lanes open in direction of travel | 3 | Provide at least 3 adjacent through freeway lanes open in direction of travel | | Work allowed within the highway where shoulder or lane closure is not required |
| 1 | Provide at least 1 through freeway lane open in direction of travel | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | Provide at least 2 adjacent through freeway lanes open in direction of travel | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | Provide at least 3 adjacent through freeway lanes open in direction of travel | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Work allowed within the highway where shoulder or lane closure is not required | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| REMARKS: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Chart no. 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|---|---|---|---|---|---|--|---|---|----|----|----|----|----|---------------|----|----|----|----|----|----|----|----|---|---|---|---|---|--|--|
| Freeway/Expressway Lane Requirements | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| County: San Mateo | | | | | | | | Route/Direction: US 101/ Southbound | | | | | | | | PM: 17.1/16.3 | | | | | | | | | | | | | | | |
| Closure limits: From 0.9 mile south of East Millbrae Avenue to 0.3 mile north of Anza Boulevard | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hour | 24 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | | | | | | | |
| Mon-Thu | | 2 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | | | | | | 3 | | | | | | | |
| Fri | | 2 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sat | | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 3 | | | | | | | | | | | | | | | | | | | | | | |
| Sun | | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | | | | | | | | | | | | | | | 3 | | | | | | | |
| Legend: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table style="width:100%; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">1</td> <td>Provide at least 1 through freeway lane open in direction of travel</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">2</td> <td>Provide at least 2 adjacent through freeway lanes open in direction of travel</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">3</td> <td>Provide at least 3 adjacent through freeway lanes open in direction of travel</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;"></td> <td>Work allowed within the highway where shoulder or lane closure is not required</td> </tr> </table> | | | | | | | | | | | | | | | | | | | | | | | | 1 | Provide at least 1 through freeway lane open in direction of travel | 2 | Provide at least 2 adjacent through freeway lanes open in direction of travel | 3 | Provide at least 3 adjacent through freeway lanes open in direction of travel | | Work allowed within the highway where shoulder or lane closure is not required |
| 1 | Provide at least 1 through freeway lane open in direction of travel | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | Provide at least 2 adjacent through freeway lanes open in direction of travel | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | Provide at least 3 adjacent through freeway lanes open in direction of travel | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Work allowed within the highway where shoulder or lane closure is not required | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| REMARKS: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Replace "Reserved" in section 12-4.05C with:

| Chart no. 3 | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|----|---|---|---|---|---|--|---|---|---|----|----|----|------------------|----|----|----|----|----|----|----|----|----|----|----|
| Complete Freeway/Expressway Closure Hours | | | | | | | | | | | | | | | | | | | | | | | | | |
| County: San Mateo | | | | | | | Route/Direction: US 101/ Northbound | | | | | | | PM: 16.4 to 16.7 | | | | | | | | | | | |
| Closure limits: US101 Mainline Northbound From NB off-ramp to Broadway/Bayshore to NB on-ramp from Broadway/Bayshore | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hour | 24 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| Mon-Thu | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fri | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sat | C | C | C | C | C | C | | | | | | | | | | | | | | | | | | | |
| Sun | C | C | C | C | C | C | | | | | | | | | | | | | | | | | | | |
| <p>Legend:</p> <p><input type="checkbox"/> C Freeway or expressway may be closed completely</p> <p><input type="checkbox"/> No complete freeway or expressway closure is allowed</p> <p>REMARKS: Detour traffic as per Construction Area Sign Plans (CS-2 and CS-3). Freeway closure allowed only for false work, erection, and removal for bridge # 35-0351. NB 101 freeway closure is not allowed in conjunction with SB 101 freeway closure.</p> | | | | | | | | | | | | | | | | | | | | | | | | | |

| Chart no. 4 | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|----|---|---|---|---|---|--|---|---|---|----|----|----|------------------|----|----|----|----|----|----|----|----|----|----|----|
| Complete Freeway/Expressway Closure Hours | | | | | | | | | | | | | | | | | | | | | | | | | |
| County: San Mateo | | | | | | | Route/Direction: US 101/ Southbound | | | | | | | PM: 16.7 to 16.4 | | | | | | | | | | | |
| Closure limits: US101 Mainline Southbound From SB off-ramp to Westbound Broadway to SB on-ramp from Rollins Rd | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hour | 24 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| Mon-Thu | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fri | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sat | | C | C | C | C | C | C | | | | | | | | | | | | | | | | | | |
| Sun | | C | C | C | C | C | C | | | | | | | | | | | | | | | | | | |
| <p>Legend:</p> <p><input type="checkbox"/> C Freeway or expressway may be closed completely</p> <p><input type="checkbox"/> No complete freeway or expressway closure is allowed</p> <p>REMARKS: Detour traffic as per Construction Area Sign Plan (CS-4 and CS-5). Freeway closure allowed only for false work, erection, and removal of bridge. SB 101 freeway closure is not allowed in conjunction with NB 101 closure.</p> | | | | | | | | | | | | | | | | | | | | | | | | | |

Replace "Reserved" in section 12-4.05E with:

| Chart no. 5 | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|----|---|---|---|---|---|--|---|---|---|----|----|----|----------|----|----|----|----|----|----|----|----|----|----|----|---|
| Complete Ramp Closure Hours/Ramp Lane Requirements | | | | | | | | | | | | | | | | | | | | | | | | | | |
| County: San Mateo | | | | | | | Route/Direction: US 101/ Northbound | | | | | | | PM: 16.4 | | | | | | | | | | | | |
| Closure limits: Off-Ramp to Broadway/Bayshore Highway | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hour | 24 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | |
| Mon-Thu | C | C | C | C | C | | | | | | | | | | | | | | | | | | | | C | |
| Fri | C | C | C | C | C | | | | | | | | | | | | | | | | | | | | C | |
| Sat | C | C | C | C | C | C | | | | | | | | | | | | | | | | | | | C | |
| Sun | C | C | C | C | C | C | | | | | | | | | | | | | | | | | | C | C | C |

Legend:
 C Ramp may be closed completely
 Work allowed within the highway where shoulder or lane closure is not required

REMARKS: Detour traffic as per Construction Area Sign Plan (CS-8).

| Chart no. 6 | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|----|---|---|---|---|---|--|---|---|---|----|----|----|----------|----|----|----|----|----|----|----|----|----|----|----|
| Complete Ramp Closure Hours/Ramp Lane Requirements | | | | | | | | | | | | | | | | | | | | | | | | | |
| County: San Mateo | | | | | | | Route/Direction: US 101/ Southbound | | | | | | | PM: 16.7 | | | | | | | | | | | |
| Closure limits: Off-Ramp to Broadway/Rollins Rd | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hour | 24 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| Mon-Thu | C | C | C | C | C | | | | | | | | | | | | | | | | | | | | |
| Fri | C | C | C | C | C | | | | | | | | | | | | | | | | | | | | |
| Sat | C | C | C | C | C | C | | | | | | | | | | | | | | | | | | | |
| Sun | C | C | C | C | C | C | | | | | | | | | | | | | | | | | | | |

Legend:
 C Ramp may be closed completely
 Work allowed within the highway where shoulder or lane closure is not required

REMARKS: Detour traffic as per Construction Area Sign Plan (CS-9).

| Chart no. 7 Complete Ramp Closure Hours/Ramp Lane Requirements | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|----|---|---|---|---|---|--|---|---|---|----|----|----|----------|----|----|----|----|----|----|----|----|----|----|----|
| County: San Mateo | | | | | | | Route/Direction: US 101/ Southbound | | | | | | | PM: 16.5 | | | | | | | | | | | |
| Closure limits: On-Ramp from Broadway/Rollins Road | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hour | 24 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| Mon-Thu | C | C | C | C | C | | | | | | | | | | | | | | | | | | | | C |
| Fri | C | C | C | C | C | | | | | | | | | | | | | | | | | | | | |
| Sat | C | C | C | C | C | C | | | | | | | | | | | | | | | | | | | |
| Sun | C | C | C | C | C | C | | | | | | | | | | | | | | | | | | | |
| Legend: | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> C Ramp may be closed completely <input type="checkbox"/> Work allowed within the highway where shoulder or lane closure is not required | | | | | | | | | | | | | | | | | | | | | | | | | |
| REMARKS: Detour traffic as per Construction Area Sign Plan (CS-10). | | | | | | | | | | | | | | | | | | | | | | | | | |

| Chart no. 8 Complete Ramp Closure Hours/Ramp Lane Requirements | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|----|---|---|---|---|---|--|---|---|---|----|----|----|----------|----|----|----|----|----|----|----|----|----|----|----|
| County: San Mateo | | | | | | | Route/Direction: US 101/ Northbound | | | | | | | PM: 16.8 | | | | | | | | | | | |
| Closure limits: On-Ramp from Broadway/Bayshore Highway (Detour to Millbrae Avenue) | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hour | 24 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| Mon-Thu | C | C | C | C | C | | | | | | | | | | | | | | | | | | | C | C |
| Fri | C | C | C | C | C | | | | | | | | | | | | | | | | | | | | C |
| Sat | C | C | C | C | C | C | | | | | | | | | | | | | | | | | | | C |
| Sun | C | C | C | C | C | C | | | | | | | | | | | | | | | | | | | C |
| Legend: | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> C Ramp may be closed completely <input type="checkbox"/> Work allowed within the highway where shoulder or lane closure is not required | | | | | | | | | | | | | | | | | | | | | | | | | |
| REMARKS: Detour traffic as per Construction Area Sign Plan (CS-11). | | | | | | | | | | | | | | | | | | | | | | | | | |

| Chart no. 9 Complete Ramp Closure Hours/Ramp Lane Requirements | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|----|---|---|---|---|---|--|---|---|---|----|----|----|----------|----|----|----|----|----|----|----|----|----|----|----|
| County: San Mateo | | | | | | | Route/Direction: US 101/ Southbound | | | | | | | PM: 16.5 | | | | | | | | | | | |
| Closure limits: On-Ramp from Broadway/Bayshore Highway (Loop) | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hour | 24 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| Mon-Thu | | C | C | C | | | | | | | | | | | | | | | | | | | | | |
| Fri | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sat | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sun | | | | | | | | | | | | | | | | | | | | | | | | | |
| Legend: | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> C Ramp may be closed completely <input type="checkbox"/> Work allowed within the highway where shoulder or lane closure is not required | | | | | | | | | | | | | | | | | | | | | | | | | |
| REMARKS: Detour traffic as per Construction Area Sign Plan (CS-10). | | | | | | | | | | | | | | | | | | | | | | | | | |

| Chart no. 10 Complete Ramp Closure Hours/Ramp Lane Requirements | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|----|---|---|---|---|---|--|---|---|---|----|----|----|----------|----|----|----|----|----|----|----|----|----|----|----|
| County: San Mateo | | | | | | | Route/Direction: US 101/ Northbound | | | | | | | PM: 16.4 | | | | | | | | | | | |
| Closure limits: Off-Ramp to Bayshore Highway/Airport Blvd | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hour | 24 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| Mon-Thu | C | C | C | C | C | | | | | | | | | | | | | | | | | | | | C |
| Fri | C | C | C | C | C | | | | | | | | | | | | | | | | | | | | C |
| Sat | C | C | C | C | C | C | | | | | | | | | | | | | | | | | | | C |
| Sun | C | C | C | C | C | C | | | | | | | | | | | | | | | | | C | C | C |
| Legend: | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> C Ramp may be closed completely <input type="checkbox"/> Work allowed within the highway where shoulder or lane closure is not required | | | | | | | | | | | | | | | | | | | | | | | | | |
| REMARKS: Detour traffic as per Construction Area Sign Plan (CS-12). | | | | | | | | | | | | | | | | | | | | | | | | | |

Replace section 12-4.05H with:

12-4.05H City Street Closures

| Chart no. 11 | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|---|---|---|---|---|---|---|---|-----------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Complete City Street Closure Hours/City Street Requirements and Hours of Work | | | | | | | | | | | | | | | | | | | | | | | | | |
| Location: San Mateo | | | | | | | | | | Direction: Rollins Rd | | | | | | | | | | | | | | | |
| Closure limits: "RLN" 18+79.58 to "RLN" 25+00.00 (Rollins Rd between Marsten Rd and Broadway) | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hour | 24 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| Mon-Thu | 1 | 1 | 1 | 1 | 1 | | | | | | 1 | 1 | 1 | 1 | 1 | | | | | | 1 | 1 | 1 | 1 | |
| Fri | 1 | 1 | 1 | 1 | 1 | | | | | | 1 | 1 | 1 | 1 | 1 | | | | | | 1 | 1 | 1 | 1 | |
| Sat | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Sun | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Legend: | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Provide at least 1 city street lane open in direction of travel | | | | | | | | | | | | | | | | | | | | | | | | |
| | Work allowed within the city street where shoulder or lane closure is not required | | | | | | | | | | | | | | | | | | | | | | | | |
| REMARKS: | | | | | | | | | | | | | | | | | | | | | | | | | |

| Chart no. 12 | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|---|---|---|---|---|---|---|---|-----------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Complete City Street Closure Hours/City Street Requirements and Hours of Work | | | | | | | | | | | | | | | | | | | | | | | | | |
| Location: San Mateo | | | | | | | | | | Direction: Rollins Rd | | | | | | | | | | | | | | | |
| Closure limits: "RLN" 25+00.00 to "RLN" 29+00.00 (Rollins Rd between Broadway and Cadillac Way) | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hour | 24 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| Mon-Thu | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | | | | | | 1 | 1 | 1 |
| Fri | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | | | | | | 1 | 1 | 1 |
| Sat | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | | | | 1 | 1 | 1 |
| Sun | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | | | | 1 | 1 | 1 |
| Legend: | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Provide at least 1 city street lane open in direction of travel | | | | | | | | | | | | | | | | | | | | | | | | |
| | Work allowed within the city street where shoulder or lane closure is not required | | | | | | | | | | | | | | | | | | | | | | | | |
| REMARKS: | | | | | | | | | | | | | | | | | | | | | | | | | |

| Chart no. 13 | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|-----------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Complete City Street Closure Hours/City Street Requirements and Hours of Work | | | | | | | | | | | | | | | | | | | | | | | | | |
| Location: San Mateo | | | | | | | | | | Direction: Rollins Rd | | | | | | | | | | | | | | | |
| Closure limits: "RLN" 29+00.00 to "RLN" 35+50.00 (Rollins Rd south of Cadillac Way) | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hour | 24 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| Mon-Thu | N | N | N | N | N | N | N | N | N | N | N | R | R | R | R | R | N | N | N | N | N | N | N | N | N |
| Fri | N | N | N | N | N | N | N | N | N | N | N | R | R | R | R | R | N | N | N | N | N | N | N | N | N |
| Sat | N | N | N | N | N | N | N | N | N | R | R | R | R | R | R | R | R | R | R | R | N | N | N | N | N |
| Sun | N | N | N | N | N | N | N | N | N | R | R | R | R | R | R | R | R | R | R | R | N | N | N | N | N |
| Legend: | | | | | | | | | | | | | | | | | | | | | | | | | |
| R | Provide at least 1 through traffic lane, not less than 10 feet in width, for use by both directions of travel (Reversing Control) | | | | | | | | | | | | | | | | | | | | | | | | |
| N | No work allowed | | | | | | | | | | | | | | | | | | | | | | | | |
| REMARKS: | | | | | | | | | | | | | | | | | | | | | | | | | |

| Chart no. 14 | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|---|---|---|---|---|---|---|---|---------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Complete City Street Closure Hours/City Street Requirements and Hours of Work | | | | | | | | | | | | | | | | | | | | | | | | | |
| Location: San Mateo | | | | | | | | | | Direction: Broadway | | | | | | | | | | | | | | | |
| Closure limits: Broadway between Carolan Ave and intersection of Bayshore Hwy/NB US101 off ramp | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hour | 24 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| Mon-Thu | 1 | 1 | 1 | 1 | 1 | | | | | | 1 | 1 | 1 | 1 | 1 | | | | | | 1 | 1 | 1 | 1 | |
| Fri | 1 | 1 | 1 | 1 | 1 | | | | | | 1 | 1 | 1 | 1 | 1 | | | | | | 1 | 1 | 1 | 1 | |
| Sat | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Sun | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Legend: | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Provide at least 1 city street lane open in direction of travel | | | | | | | | | | | | | | | | | | | | | | | | |
| | Work allowed within the city street where shoulder or lane closure is not required | | | | | | | | | | | | | | | | | | | | | | | | |
| REMARKS: | | | | | | | | | | | | | | | | | | | | | | | | | |

| Chart no. 15 | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|--|---|---|---|---|---|---|---|---|-------------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Complete City Street Closure Hours/City Street Requirements and Hours of Work | | | | | | | | | | | | | | | | | | | | | | | | | |
| Location: San Mateo | | | | | | | | | | Direction: Bayshore Hwy | | | | | | | | | | | | | | | |
| Closure limits: "BYSH" 29+97.47 to "HTL" 52+00.00 | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hour | 24 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| Mon-Thu | 1 | 1 | 1 | 1 | 1 | | | | | | 1 | 1 | 1 | 1 | 1 | | | | | | 1 | 1 | 1 | 1 | |
| Fri | 1 | 1 | 1 | 1 | 1 | | | | | | 1 | 1 | 1 | 1 | 1 | | | | | | 1 | 1 | 1 | 1 | |
| Sat | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Sun | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Legend: | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Provide at least 1 city street lane open in direction of travel | | | | | | | | | | | | | | | | | | | | | | | | |
| | Work allowed within the city street where shoulder or lane closure is not required | | | | | | | | | | | | | | | | | | | | | | | | |
| REMARKS: | | | | | | | | | | | | | | | | | | | | | | | | | |

| Chart no. 16 | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|---|---|---|---|---|---|---|---|-------------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Complete City Street Closure Hours/City Street Requirements and Hours of Work | | | | | | | | | | | | | | | | | | | | | | | | | |
| Location: San Mateo | | | | | | | | | | Direction: Airport Blvd | | | | | | | | | | | | | | | |
| Closure limits: Airport Blvd between intersection of Bayshore Hwy/NB US101 off-ramp and "BWY" 25+88.83 (End of existing median) | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hour | 24 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| Mon-Thu | 1 | 1 | 1 | 1 | 1 | | | | | | 1 | 1 | 1 | 1 | 1 | | | | | | 1 | 1 | 1 | 1 | |
| Fri | 1 | 1 | 1 | 1 | 1 | | | | | | 1 | 1 | 1 | 1 | 1 | | | | | | 1 | 1 | 1 | 1 | |
| Sat | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Sun | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Legend: | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Provide at least 1 city street lane open in direction of travel | | | | | | | | | | | | | | | | | | | | | | | | |
| | Work allowed within the city street where shoulder or lane closure is not required | | | | | | | | | | | | | | | | | | | | | | | | |
| REMARKS: | | | | | | | | | | | | | | | | | | | | | | | | | |

| Chart no. 17 Complete City Street Closure Hours/City Street Requirements and Hours of Work | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|----|-------------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Location: San Mateo | | | | | | | | | | | | Direction: Airport Blvd | | | | | | | | | | | | | |
| Closure limits: "BWY" 25+88.83 (End of existing median) to "BWY" 31+00 | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hour | 24 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| Mon-Thu | R | R | R | R | R | | | | | | R | R | R | R | R | | | | | | R | R | R | R | |
| Fri | R | R | R | R | R | | | | | | R | R | R | R | R | | | | | | R | R | R | R | |
| Sat | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R |
| Sun | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R |
| Legend: | | | | | | | | | | | | | | | | | | | | | | | | | |
| R | Provide at least 1 through traffic lane, not less than 10 feet in width, for use by both directions of travel (Reversing Control) | | | | | | | | | | | | | | | | | | | | | | | | |
| | Work allowed within the city street where shoulder or lane closure is not required | | | | | | | | | | | | | | | | | | | | | | | | |
| REMARKS: | | | | | | | | | | | | | | | | | | | | | | | | | |

**Replace section 12-5 with:
12-5 TRAFFIC CONTROL SYSTEM FOR LANE CLOSURE**

12-5.01 GENERAL

Section 12-5 includes specifications for closing traffic lanes, ramps, or a combination, with stationary and moving lane closures on multilane highways and 2-lane, 2-way highways. The traffic control system for a lane closure or a ramp closure must comply with the details shown.

Traffic control system includes signs.

12-5.02 MATERIALS

Vehicles equipped with attenuators must comply with section 12-3.13 of the special provisions.

12-5.03 CONSTRUCTION

12-5.03A General

During traffic striping and pavement marker placement using bituminous adhesive, control traffic with a stationary or a moving lane closure. During other activities, control traffic with stationary lane closures.

Whenever components of the traffic control system are displaced or cease to operate or function as specified from any cause, immediately repair the components to the original condition or replace the components and restore the components to the original location.

12-5.03B Stationary Lane Closures

For a stationary lane closure, ramp closure, or a combination, made only for the work period, remove the components of the traffic control system from the traveled way and shoulder, except for portable delineators placed along open trenches or excavation adjacent to the traveled way at the end of each work period. You may store the components at selected central locations designated by the Engineer within the limits of the highway.

Each vehicle used to place, maintain, and remove components of a traffic control system on a multilane highway must be equipped with a Type II flashing arrow sign that must be in operation whenever the vehicle is being used for placing, maintaining, or removing the components. Vehicles equipped with a Type II flashing arrow sign not involved in placing, maintaining, or removing the components if operated within a stationary-type lane closure must display only the caution display mode. The sign must be controllable by the operator of the vehicle while the vehicle is in motion. If a flashing arrow sign is required for a lane closure, the flashing arrow sign must be operational before the lane closure is in place.

For multilane freeway or expressway lane closures, do not place the 2L tangent section shown along lane lines between the lane closure tapers.

12-5.03C Moving Lane Closures

A changeable message sign used in a moving lane closure must comply with section 12-3.12 except the sign must be truck-mounted. The full operational height to the bottom of the sign may be less than 7 feet above the ground but must be as high as practicable.

A flashing arrow sign used in a moving lane closure must be truck-mounted. Operate the flashing arrow sign in the caution display mode whenever it is being used on a 2-lane, 2-way highway.

12-5.04 PAYMENT

Traffic control system for lane closure is paid for as traffic control system.

The requirements in section 4-1.05 for payment adjustment do not apply to traffic control system. Adjustments in compensation for traffic control system will be made for an increase or decrease in traffic control work if ordered and will be made on the basis of the cost of the necessary increased or decreased traffic control. The adjustment will be made on a force account basis for increased work and estimated on the same basis in the case of decreased work.

A traffic control system required by change order work is paid for as a part of the change order work.

Replace section 12-8 with:

12-8 TEMPORARY PAVEMENT DELINEATION

12-8.01 GENERAL

Section 12-8 includes specifications for placing, applying, maintaining, and removing temporary pavement delineation.

Temporary signing for no-passing zones must comply with section 12-3.06.

Temporary painted traffic stripes and painted pavement markings used for temporary delineation must comply with section 84-3.

12-8.02 MATERIALS

12-8.02A General

Not Used

12-8.02B Temporary Lane Line and Centerline Delineation

Temporary pavement markers must be the same color as the lane line or centerline markers being replaced. Temporary pavement markers must be temporary pavement markers on the Authorized Material List for short-term day/night use, 14 days or less, or long-term day/night use, 180 days or less. Place temporary pavement markers under the manufacturer's instructions.

12-8.02C Temporary Edge Line Delineation

On multilane roadways, freeways, and expressways open to traffic where edge lines are obliterated and temporary pavement delineation to replace those edge lines is not shown, provide temporary pavement delineation for:

1. Right edge lines consisting of (1) a solid 4-inch wide traffic stripe tape of the same color as the stripe being replaced, (2) traffic cones, or (3) portable delineators or channelizers placed longitudinally at intervals not exceeding 100 feet
2. Left edge lines consisting of (1) solid 4-inch wide traffic stripe tape of the same color as the stripe being replaced, (2) traffic cones, (3) portable delineators or channelizers placed longitudinally at intervals not exceeding 100 feet, or (4) temporary pavement markers placed longitudinally at intervals not exceeding 6 feet

12-8.02D Temporary Traffic Stripe Tape

Temporary traffic stripe tape must be one of the types of temporary, removable striping tape on the Authorized Material List.

12-8.02E Temporary Traffic Stripe Paint

Not Used

12-8.02F Temporary Pavement Marking Tape

Temporary pavement marking tape must be one of the types of temporary, removable pavement marking tape on the Authorized Material List and must be applied and removed as specified for applying and removing temporary, removable traffic stripe tape.

12-8.02G Temporary Pavement Marking Paint

12- 8.02H Temporary Pavement Markers

Temporary pavement markers must be one of the temporary pavement markers on the Authorized Material List for long term day/night use, 180 days or less.

12-8.03 CONSTRUCTION

12-8.03A General

Wherever work activities obliterate pavement delineation, place temporary or permanent pavement delineation before opening the traveled way to traffic. Place lane line and centerline pavement delineation for traveled ways open to traffic. On multilane roadways, freeways and expressways, place edge line delineation for traveled ways open to traffic.

Establish the alignment for the temporary pavement delineation including required lines or markers. Surfaces to receive an application of paint or removable traffic tape must be dry and free of dirt and loose material. Do not apply temporary pavement delineation over existing pavement delineation or other temporary pavement delineation. Maintain temporary pavement delineation until it is superseded or you replace it with a new pattern of temporary pavement delineation or permanent pavement delineation.

When the Engineer determines the temporary pavement delineation is no longer required for the direction of traffic, remove the temporary pavement markers, underlying adhesive, and removable traffic tape from the final layer of surfacing and from the existing pavement to remain in place. Remove temporary pavement delineation that conflicts with any subsequent or new traffic pattern for the area.

12-8.03B Temporary Lane line and Centerline Delineation

Whenever lane lines or centerlines are obliterated and temporary pavement delineation to replace the lines is not shown, the minimum lane line and centerline delineation must consist of temporary pavement markers placed longitudinally at intervals not exceeding 24 feet. For temporary pavement markers on the Authorized Material List for long-term day/night use, 180 days or less, cement the markers to the surfacing with the adhesive recommended by the manufacturer except do not use epoxy adhesive to place the pavement markers in areas where removal of the markers will be required.

For temporary lane line or centerline delineation consisting entirely of temporary pavement markers on the Authorized Material List for short-term day/night use, 14 days or less, place the markers longitudinally at intervals not exceeding 24 feet. Do not use the markers for more than 14 days on lanes opened to traffic. Place the permanent pavement delineation before the end of the 14 days. If the permanent pavement delineation is not placed within the 14 days, replace the temporary pavement markers with additional temporary pavement delineation equivalent to the pattern specified or shown for the permanent pavement delineation for the area. The Department does not pay for the additional temporary pavement delineation.

12-8.03C Temporary Edge Line Delineation

You may apply temporary painted traffic stripe where removal of a 4-inch wide traffic stripe is not required.

The Engineer determines the lateral offset for traffic cones, portable delineators, and channelizers used for temporary edge line delineation. If traffic cones or portable delineators are used for temporary pavement delineation for edge lines, maintain the cones or delineators during hours of the day when the cones or delineators are being used for temporary edge line delineation.

Channelizers used for temporary edge line delineation must be an orange surface-mounted type. Cement channelizer bases to the pavement under section 85 for cementing pavement markers to pavement

except do not use epoxy adhesive to place channelizers on the top layer of the pavement. Channelizers must be one of the 36-inch, surface-mounted types on the Authorized Material List.

Remove the temporary edge line delineation when the Engineer determines it is no longer required for the direction of traffic.

12-8.03D Temporary Traffic Stripe Tape

Apply temporary traffic stripe tape under the manufacturer's instructions. Slowly roll the tape with a rubber-tired vehicle or roller to ensure complete contact with the pavement surface. Apply the tape straight on a tangent alignment and on a true arc on a curved alignment. Do not apply the tape when the air or pavement temperature is less than 50 degrees F unless the installation procedures are authorized beforehand.

The temporary traffic stripe tape must be complete in place at the location shown before opening the traveled way to traffic.

12-8.03E Temporary Traffic Stripe Paint

Apply 1 or 2 coats of temporary traffic stripe paint for new or existing pavement.

The painted temporary traffic stripe must be complete in place at the location shown before opening the traveled way to traffic. Removal of painted temporary traffic stripe is not required.

12-8.03F Temporary Pavement Marking Tape

Apply temporary pavement marking tape at the locations shown. The tape must be complete in place at the location shown before opening the traveled way to traffic.

12-8.03G Temporary Pavement Marking Paint

Apply and maintain temporary pavement markings consisting of painted pavement markings at the locations shown. The painted temporary pavement marking must be complete in place at the location shown before opening the traveled way to traffic. Removal of painted temporary pavement marking is not required.

Apply 1 or 2 coats of temporary pavement marking paint for new or existing pavement.

12- 8.03H Temporary Pavement Markers

Place temporary pavement markers under the manufacturer's instructions. Cement the markers to the surfacing with the manufacturer's recommended adhesive, except do not use epoxy adhesive in areas where removal of the pavement markers is required.

You may use retroreflective pavement markers specified in section 85 instead of temporary pavement markers for long term day/night use, 180 days or less, except to simulate patterns of broken traffic stripe. Retroreflective pavement markers used for temporary pavement markers must comply with section 85, except the waiting period before placing pavement markers on new HMA surfacing as specified in section 85-1.03 does not apply. Do not use epoxy adhesive to place pavement markers in areas where removal of the pavement markers is required.

Temporary pavement markers must be complete in place before opening the traveled way to traffic.

12-8.04 PAYMENT

Not Used

AA

13 WATER POLLUTION CONTROL

Add to section 13-1.01A:

The San Francisco Bay, Region 2 RWQCB will review the authorized SWPPP.

Add to section 13-3.01A:

The project is risk level 2.

**Replace section 13-11 with:
13-11 WATER QUALITY MONITORING**

13-11.01 GENERAL

Section 13-11 includes specifications for monitoring water quality at the temporary creek diversion system during the construction activities.

The receiving water for this project is Easton Creek.

13-11.02 WATER QUALITY MONITOR

13-11.02A General

Assign a water quality monitor (WQM) to collect water samples and record water quality data. The WQM must be responsible for generating and submitting water quality reports.

Within 7 days after Contract approval, submit the WQM qualifications including training and experience in collecting and analyzing water quality samples.

The WQM must have the same qualifications as the WPC manager including the requirements for QSP and must have training and experience in collecting and analyzing water quality samples. The WQM may be the same person as the WPC manager.

If other personnel will be collecting water quality samples, their training must include:

- 1. SAP review
- 2. Health and safety review
- 3. Sampling simulations

If there is an unauthorized discharge, the WQM must immediately notify the Engineer within 6 hours.

13-11.02B Visual Inspections

The WQM must perform a visual inspection after each:

- 1. Storm event
- 2. Nonstormwater discharge as follows:
 - 2.1. Observe receiving waters:
 - 2.1.1. 24 hours before beginning in-water work including the installation of clear water diversions
 - 2.1.2. At least 4 times daily during in-water work activities including the installation, operation, and removal of clear water diversions
 - 2.2. Observe receiving waters for the presence of floating and suspended materials, sheen on the surface, discoloration, turbidity, odors, and sources of observed pollutants
 - 2.3. Observe the job site for the presence of authorized and unauthorized nonstormwater discharges and their sources. Unauthorized discharges to surface waters include:
 - 2.3.1. Soil, silt, and sand
 - 2.3.2. Bark, sawdust, and slash
 - 2.3.3. Rubbish and debris
 - 2.3.4. Cement, concrete, and concrete washings
 - 2.3.5. Oil and petroleum products

- 2.3.6. Welding slag
- 2.3.7. Other organic or earthen materials

The WQM must prepare a visual inspection report for each storm event and nonstormwater discharge. Each visual inspection report must include:

1. Name of personnel performing the inspection, inspection date, and date the inspection report is completed
2. Storm and weather conditions
3. Locations and observations
4. Corrective actions taken

Retain visual inspection reports at the job site.

13-11.03 WATER QUALITY SAMPLING AND ANALYSIS DAY

Water quality sampling and analysis day includes activities such as preparation, collection, analysis, and reporting of water quality samples.

This project is subject the water quality objectives (WQO) shown in the following table:

| Water Quality Objectives | | | | |
|---|---|-----------------------|-------|---|
| Parameter | Test Method | Detection limit (min) | Units | WQO |
| Turbidity (during activities for in-water work) | Field test with calibrated portable instrument (Measured at downstream sampling location) | 1 | NTU | Must not exceed 20 percent above natural background |
| pH | Field test with calibrated portable instrument (Measured at downstream sampling location) | 0.2 | pH | Lower WQO = 6.5 Upper WQO = 8.5 And any change greater than 0.5 units from natural background |
| Temperature | Field test with calibrated portable instrument | 0.1 | °F | Must not be increased 5 degrees above natural background |
| Dissolved oxygen | Field test with calibrated portable instrument | 1 | mg/L | Must not be reduced below 7 mg/L |

Perform water quality sampling whenever a project activity, conducted within waters of the State, has the potential to mobilize sediment or alter background conditions within waters of the State. Perform surface water quality sampling when:

1. Conducting in-water work
2. Work activities result in materials reaching receiving waters
3. Work activities result in the creation of a visible plume in receiving waters

Comply with the equipment manufacturer's recommendation for sample collection, analysis methods, and equipment calibration.

At least 24 hours before starting in-water work:

1. Establish locations for water quality sampling:
 - 1.1. Upstream of the effluent discharge point or location of in-water work by no more than 50 feet.
 - 1.2. Effluent discharge point including location of in-water work.

- 1.3. Downstream of the effluent discharge point or location of in-water work between 35 and 50 feet.
2. Conduct water quality sampling to document background conditions for upstream, effluent, and downstream locations. Sample for each WQO shown in the table titled "Water Quality Objectives."
3. Estimate water flow.

Whenever conducting in-water work including the installation of a clear water diversion, conduct water quality sampling:

1. At least 4 times daily for each water quality objective
2. At upstream, effluent, and downstream locations

If sample results exceed a WQO, immediately notify the Engineer within 30 minutes and:

1. Conduct water quality sampling every hour until measurements comply with WQOs
2. Measure the distance from the effluent location to the downstream extent of the exceedance
3. Obtain photos of the tributary upstream, downstream, and at the location of in-water work
4. If BMPs are installed, repaired, or modified to control the source of the exceedance, monitor the activity and document with samples, photos, and a brief summary

You are not required to physically collect samples under the following conditions:

1. During dangerous weather conditions such as flooding or electrical storms
2. Outside of normal working hours

If downstream samples show levels outside of the acceptable range and indicate a possible WQO exceedance, assess WPC practices, site conditions, and surrounding influences to determine the probable cause for the increase.

Retain calibration logs, water quality sampling documentation, and analytical results at the job site.

13-11.04 WATER QUALITY MONITORING REPORT

13-11.04A General

Submit a monthly water quality monitoring report by the 7th of the month for monitoring work conducted during the previous month. The report must include:

1. Visual inspection reports
2. If in-water work was done, the following field sampling results and inspections:
 - 2.1. Analytical methods, reporting units, and detection limits
 - 2.2. Date, location, time of sampling, visual observation, photos, and measurements
 - 2.3. Estimate of water flow
 - 2.4. Calibration logs for field monitoring equipment
3. If a storm event generates visible runoff, include visual inspections and sampling results with:
 - 3.1. Date, location, and time of visual observation
 - 3.2. Photos of areas disturbed by project activities including excess materials disposal areas
 - 3.3. Photos showing disturbed soil areas and documenting compliance for erosion control and revegetation measures including soil stabilization and sediment control BMPs
4. Summary of exceedance
5. Summary of corrective actions

13-11.04B Water Quality Objective Exceedance Report

If a WQO is exceeded, the WQM must:

1. Notify the Engineer by phone or electronic media within 30 minutes after WQO is exceeded
2. Submit a WQO exceedance report within 6 hours after WQO is exceeded

The report must include:

1. Field sampling results and inspections including:
 - 1.1. Analytical methods, reporting units, and detection limits
 - 1.2. Date, location, time of sampling, visual observation, photos, and measurements
 - 1.3. Estimate of water flow
2. Description of BMPs and corrective actions taken to manage WQO exceedance

13-11.04C Additional Reports

Not Used

13-11.05 WATER QUALITY ANNUAL REPORT

Not Used

Replace section 13-12 with:

13-12 TEMPORARY CREEK DIVERSION SYSTEM

13-12.01 GENERAL

13-12.01A Summary

Section 13-12 includes specifications for constructing, maintaining, reconstructing, and removing temporary creek diversion (TCDS) system where shown.

Construction, use, and removal of the TCDS is restricted to the period from April 15 to October 15.

13-12.01B Submittals

13-12.01B(1) Temporary Creek Diversion System Plan

Temporary Creek Diversion System Plan (TCDSP) must include:

1. Installation and removal process, including equipment, pumps, platforms for equipment, and access locations.
2. Calculations supporting the sizing of any piping or other conveyance. The conveyance pipe through the job-site must be sized for a flow rate of 52.2 cfs.
3. Plans showing location(s) of diversion, including layouts, cross sections, and elevations.
4. Materials proposed for use, including Material Safety Data Sheet (MSDS) and pumping system, if used.
5. Restoration plans showing before and after conditions, including photos of existing conditions for areas disturbed during the installation, operation, and removal of the TCDS.
6. Schedule of work, including BMP implementation.

At least 55 days before TCDS work in the creek:

1. Submit 3 copies of your TCDSP for review. Allow 5 days for the Engineer's review. The Engineer provides comments and specifies the date when the review stopped if revisions are required.
2. Change and resubmit a revised TCDSP within 5 days of receiving the Engineer's comments. The Engineer's review resumes when a complete TCDSP is resubmitted. Allow 5 days for the Engineer's second review. Note that the Engineer's comments may include the regulatory agencies' comments.
3. If additional comments are provided by the Engineer, change and resubmit a revised TCDSP within 5 days of receiving the Engineer's comments.
4. When the Engineer authorizes the TCDSP, submit an electronic file and 4 printed copies of the authorized TCDSP.

13-12.02 MATERIALS

13-12.02A Gravel

Gravel must:

1. Be river run gravel obtained from a river or creek bed and have the gradation of 100 percent passing through 3/4 inch sieve and 0 percent passing through 3/8-inch sieve

2. Be clean, hard, sound, durable, uniform in quality, and free of any detrimental quantity of soft, thin, elongated or laminated pieces, disintegrated material, organic matter, or other deleterious substances
3. Be composed entirely of particles that have no more than one fractured face
4. Have a cleanliness value of at least 85, as determined by the Cleanliness Value Test Method for California Test No. 227

13-12.02B Impermeable Plastic Membrane

Impermeable plastic membrane must be:

1. Single ply, commercial quality, non-photodegradable polyethylene with a minimum thickness of 10 mils under ASTM D 5199
2. Free of holes, punctures, tears or other defects that compromise the impermeability of the material
3. Suitable for use as a impermeable membrane

13-12.02C Gravel-filled Bags

Gravel-filled bags must comply with section 13-5.02G.

The 2nd paragraph of section 13-5.02G does not apply.

13-12.02D Plastic Pipes

Plastic pipe must be Type S, and comply with section 64-1.02C and:

1. Be clean, uncoated, in good condition free of paint, oil, dirt, or other residues that could potentially contribute to water pollution
2. Be adequately supported for planned loads
3. Use watertight joints and comply with section 61-1.01D(1)(b)
4. Be made of a material or combination of materials that are suitable for clean water and which do not contain banned, hazardous or unlawful substances

13-12.02E Pumping System

Pumping system, if applicable, must comply with section 14-6.

Pumps used to dewater job site with fish must be equipped with screens that meet the following National Marine Fisheries fish screening criteria:

1. Perforated plate or woven wire: screen openings must not exceed 0.1 inch measured in diameter for round openings and diagonal for square openings. Slotted openings must not exceed 0.07 inch.
2. Screen material must provide a minimum of 27 percent open area.

Pumps used to dewater job site with frogs must be equipped with screens that meet the following National Marine Fisheries fish screening criteria:

1. Perforated plate or woven wire: screen openings must not exceed 0.2 inch measured in diameter for round openings and diagonal for square openings.

13-12.03 CONSTRUCTION

13-12.03A General

Do not use motorized vehicles and equipment in areas of flowing and standing water for the construction of the TCDS

Remove vegetation to ground level and clear away debris.

Place temporary or permanent fill as allowed by PLACs.

Do not construct or reconstruct diversion system if the 72-hour NOAA weather forecasts predict a 50 percent or greater chance of rain in the project area.

Stop all work and remove or minimize all material and equipment that are sources of pollutants from the creek between upstream and downstream cofferdams if the 72-hour NOAA weather forecasts predict a 50 percent or greater chance of rain in the project area and the predicted rainfall is estimated to produce a flow volume exceeding the design capacity of the TCDS.

Construct the TCDS within the temporary impact area allowed in the PLAC in the Water Quality Information Handout.

If the work in the creek extends beyond October 15, remove TCDS, restore the creek to original flow condition, and reconstruct the TCDS after April 15 of the following year.

Lap and join all joints between the edges of impermeable plastic membrane with commercial quality waterproof tape with minimum 4-inch lapping at the edges.

13-12.03B Maintenance

Prevent leaks in the TCDS.

Repair holes, rips and voids in the impermeable plastic membrane by taping. Replace impermeable plastic membrane when patches or repairs compromise the impermeability of the material.

Repair TCDS within 24 hours after the damage occurs.

Prevent debris from entering the creek.

Remove and replace immediately gravel, gravel-filled bags, impermeable plastic membrane, or plastic pipes contaminated by construction activities.

Remove sediment deposits and debris from TCDS, as needed. If removed sediment is deposited within project limits, stabilize it and do not let it be subject to erosion by wind or water.

Maintain the temporary creek diversion system to provide adequate holding capacity with a minimum freeboard of 12 inches.

13-12.03C Removal

Return the creek bed to the pre-construction conditions.

Do not excavate the native creek material. Backfill holes and depressions caused by the construction and removal of the TCDS with permeable material. Restore the original line and grade of the creek bed.

13-12.04 PAYMENT

Not Used

Replace section 13-13 with:

13-13 DEWATERING AND NON-STORM WATER DISCHARGE SYSTEM

13-13.01 GENERAL

13.13.01A Summary

Section 13-13 includes specifications for designing, installing, implementing, monitoring, maintaining, and removing a dewatering and non-storm water discharge system for the treatment and discharge of contaminated groundwater and accumulated stormwater from excavation, or other areas requiring dewatering, including water resulting from piling work. The dewatering and non-storm water discharge system is referred to as system.

Design, installation, operation, and monitoring of a dewatering and non-storm water discharge system and monitoring, collection, conveyance, treatment, and disposal of the treated accumulated precipitation and groundwater effluent must comply with San Francisco Bay Regional Water Quality Control Board (RWQCB) General NPDES Permits for Discharge or Reuse of Extracted and Treated Groundwater Resulting from the Cleanup of Groundwater Polluted by Volatile Organic Compounds, Fuel Leaks and Other Related Wastes (*Order No. R2-2012-0012, NPDES No. CAG912002*).

You may discharge into a Publicly Owned Treatment Works (POTW) system instead of using a Dewatering and Non-Storm Water Discharge System. If contaminated groundwater, stormwater, or both are discharged to a POTW, obtain a municipal batch discharge permit. You are responsible for all costs and requirements related to obtaining the municipal batch discharge permit and discharging the water.

A Non-Stormwater Information Package (Information Package) has been prepared for this Contract and is available as described in "Supplemental Project Information" of these special provisions. This Information Package includes:

1. Estimated groundwater seepage rates in the project area
2. RWQCB General Waste Discharge Requirements for Order No. R2-2012-0012, NPDES General Permit No. CAG912002, refer as Order R2-2012-0012 thereafter.
3. Local POTW facility information
4. Relevant portion of 2001 Geotechnical Report, US101/Broadway Interchange Reconstruction Project by Parikh Consultants, Inc., City of Burlingame, San Mateo County California,

13-13.01B Submittals

13-13.01B(1) General

Reserved.

13-13.01B(2) Dewatering and Discharge Plan (DDP)

Start the following process for the DDP within 20 days of Contract approval:

1. Submit 3 copies of your DDP for review. Allow 20 days for the Engineer's review. The Engineer provides comments and specifies the date when the review stopped if revisions are required.
2. Change and resubmit a revised DDP within 15 days of receiving the Engineer's comments. The Engineer's review resumes when a complete DDP has been resubmitted.
3. When the Engineer authorizes the DPP, submit an electronic copy and 4 printed copies of the authorized DDP.
4. Allow 15 days for the Engineer to submit the authorized DDP to the State Water Resources Control Board and RWQCB.
5. If the Engineer requests changes to the DDP based on the RWQCB's comments, amend the DDP within 5 days.
6. Construction activities may begin 30 days after the Engineer approves the DDP.

The Dewatering and Discharge Plan (DDP) must include:

1. Title sheet
2. Table of contents
3. Certification and approval sheet described in the Department's *Storm Water Prevention. Plan (SWPPP) and Water Pollution Control Plan (WPCP) Preparation Manual*
4. Amendment log and format described in the Department's *Storm Water Prevention Plan (SWPPP) and Water Pollution Control Plan (WPCP) Preparation Manual*
5. Description and schedule of the dewatering and discharge operations
6. Discharge alternatives, including:
 - 6.1 Dust control
 - 6.2 Percolation
 - 6.3 Storm sewers
 - 6.4 Surface waters
7. Treatment system description and components
8. Anticipated flow rates
9. Operation and maintenance manual for equipment.
10. Monitoring, sampling, and reporting plan, including quality assurance and quality control.
11. Health and safety plan.
12. Spill prevention plan.
13. Field-recorded data, visual inspection, calibration procedures, and examples of logs.
14. Measuring equipment descriptions.
15. Shop drawings showing:
 - 15.1. Section and plan views of stormwater effluent treatment systems
 - 15.2. Location of sampling points for water quality measurements
 - 15.3. Flow path and placement of pipes, hoses, pumps, holding tanks, and other equipment used to convey water
 - 15.4. General position of treatment components relative to excavations or other areas requiring dewatering

- 15.5. Point of stormwater discharge
- 16. Daily inspection report form. The daily inspection report must include:
 - 16.1. Discharge volumes
 - 16.2. Water quality monitoring records
 - 16.3. Discharge point information that includes:
 - 16.3.1. Date and time
 - 16.3.2. Weather conditions, including wind direction and velocity
 - 16.3.3. Presence or absence of water fowl or aquatic wildlife
 - 16.3.4. Color and clarity of the effluent discharge
 - 16.3.5. Erosion or ponding downstream of the discharge site
 - 16.3.6. Photographs labeled with the time, date, and location
- 17. Municipal batch discharge permit from a publicly owned treatment works if required.
- 18. Coagulant pollution prevention plan (CPPP) with the DDP. If you use chemical coagulants, in-line flocculants, or both, in the treatment system. Chemical coagulants and flocculants proposed for use in CPPP must comply with Attachment F, Provisions D and E, in *General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities (Order No. 2009-0009-DWQ, NPDES No. CAS000002)* referred to as Order 2009-0009 thereafter. The Coagulant pollution prevention plan (CPPP) must include:
 - 18.1. Description of BMPs to prevent accidental spillage, overfeeding into the treatment system, or other mishandling of coagulant agents
 - 18.2. Monitoring plan for all coagulants, flocculants, or both that complies with Attachment F in Order 2009-0009
 - 18.3. Description of the agents, including chemical and trade names
 - 18.4. Determination of acute and chronic toxicity for aquatic organisms conforming to EPA methods for the agents
 - 18.5. Monitoring plan to detect a residual agent at concentrations at or below established acute toxicity levels for freshwater and marine conditions for that agent

13-13.01B(3) Notice of Discharge Report

Whenever observations and measurements confirm that a residual chemical or water quality standard is exceeded:

- 1. Submit the notice of discharge within 48 hours after exceeding the limits
- 2. Document the reasons for exceeding the water quality standard and any corrective work performed to prevent a recurrence in the notice of discharge

13-13.01B(4) Other Treatment System Submittals

If the system is discharging treated effluent, submit a daily inspection report within 24 hours.

Submit records of delivery and removal of system components.

13-13.01C Quality Control and Assurance

A residual chemical for the coagulant must be at less than 10 percent of the maximum allowable threshold concentration for the most sensitive species.

Discharges must comply with Order R2-2012-0012.

13-13.02 MATERIALS

13-13.02A General

Design and implement an appropriate system for the site conditions and anticipate flow rate that includes (1) a treatment system, (2) a collection and conveyance system, (3) temporary holding tanks, and (4) discharge methods.

13-13.02B Treatment Systems

Treatment systems must be capable of removing sediment, turbidity-producing suspended solids, petroleum hydrocarbon, volatile organic compounds (VOCs), and metal listed in geotechnical report.

Primary and secondary treatment may be required, or the design of the system may require combined use of the various treatment components in series to achieve effective treatment. System must have components to:

1. Remove sediment, turbidity-producing suspended solids, petroleum hydrocarbon, volatile organic compounds (VOCs), and metal. Components may include desilting basins, weir tanks, settling tanks, sediment traps, gravity bag filters sand media filters, pressurized bag filters, cartridge filters, in-line chemical coagulants and flocculants, activated clay filters, activated carbon filters or any combination necessary to provide primary and secondary treatment.
2. Adjust pH or dissolved oxygen by:
 - 2.1. Addition of sulfuric, phosphoric, citric, or nitric acid under the supplier's specifications and by the RWQCB. You are fully and solely responsible for securing approval from the RWQCB. Written approval from the RWQCB must be submitted to the Engineer for review before any use for treatment of water with high pH. You may use hydrochloric acid if the water is dechlorinated before discharge.
 - 2.2. Filtration through a limestone bed or addition of sodium hydroxide for treatment of water with a low pH. You may use carbon dioxide diffusion that produces carbonic acid for pH adjustment.
 - 2.3. Aeration for treatment of water with low dissolved oxygen.

13-13.02C Collection and Conveyance System

Provide pumps and piping to convey the water from the point of dewatering or non stormwater capture to the treatment system and to the point of discharge. Pumps and piping must comply with section 74-2.

Use a flow meter to measure all discharges from treatment activities.

13-13.02D Temporary Holding Tanks

Water pumped during dewatering operations that is not diverted to other excavations must be stored in temporary holding tanks placed at the work area for treatment to remove sediment.

Use temporary holding tanks including transportable closed-top holding tanks or tanker trucks. Provide a sufficient number of holding tanks based on:

1. Anticipated flow rate
2. Pumping rates
3. Capacity inefficiencies due to sediment retention within the holding tanks
4. Sediment settling rates
5. Sediment removal frequency
6. Anticipated water loss or reuse rates

Provide temporary holding tanks with a holding capacity sufficient to handle the water removed from dewatering operations, and prevent delay of work.

Each temporary holding tank must have an inlet and outlet capable of receiving and discharging flows at a sufficient rate to dewater the excavation.

Maintain a minimum freeboard of 1 foot in each of the temporary holding tanks at all times. Clean the holding tanks when 25 percent of the tank's volume is filled with sediments.

13-13.02E Discharge Methods:

Provide a method for discharging treated water or uncontaminated ground or surface water and include a discharge location. Do not discharge treated water in a way that impacts the natural bedding and aquatic life.

Discharge treated water:

1. To control dust in active work areas.
2. To land where the grade allows sheet flow and the soil allows infiltration.
3. In a way that does not cause erosion and scour. Whenever scour occurs, repair the damage and install a velocity dissipater.

Replace section 14-6.02 with:

14-6.02 SPECIES PROTECTION

14-6.02A General

Section 14-6.02 includes specifications for protecting regulated species or their habitat.

This project is within or near habitat for regulated species shown in the following table:

| Species Name |
|---|
| California red-legged frog (<i>Rana draytonii</i>) |
| San Francisco Garter Snake (<i>Thamnophis sirtalis tetrataenia</i>) |
| Green sturgeon (<i>Acipenser medirostris</i>) |

The Department anticipates nesting or attempted nesting by migratory and nongame birds from February 15 to September 1.

14-6.02B Material

Not Used

14-6.02C Construction

14-6.02C(1) General

Not Used

14-6.02C(2) Protective Radius

Upon discovery of a regulated species, stop construction activities within a 100 feet radius of the discovery or as defined in the table below. Immediately notify the Engineer. Do not resume activities until receiving notification from the Engineer.

| Regulated species name | Protective radius |
|---|-------------------|
| California red-legged frog (<i>Rana draytonii</i>) | 50 feet |
| San Francisco Garter Snake (<i>Thamnophis sirtalis tetrataenia</i>) | 50 feet |
| Raptor and owl nests | 300 feet |
| Migratory birds | 50 feet |

14-6.02C(3) Protocols

Not Used

14-6.02C(4) Biological Resource Information

Not Used

14-6.02C(5) Protection Measures

Within the jobsite, implement the following protection measures:

1. Before construction work, install and maintain temporary reinforced silt fence (TRSF) as shown. TRSF is used as a wildlife exclusion fence (WEF) to prevent California red-legged frogs from entering the project site.
2. Department biologist surveys for regulated species. Request a survey 30 days before start of ground disturbing work. Do not start ground disturbing activities until pre-construction survey for regulated species is completed by the Department Biologist.

3. If you encounter a California red-legged frog(s), cease all work within 50 feet of the frog and immediately notify the Engineer. Do not resume work until authorized.
4. All field personnel must a Department provided 2 hour "Environmental Awareness" training. Training is at the Engineer's field office. Notify the Engineer 30 days before construction to schedule the training. Submit an attendance sheet within 24 hours of the training indicating the field personnel have received and understood the training. Do not allow field personnel at the jobsite without the training.
5. To prevent inadvertent entrapment of sensitive species during construction, cover all excavated, steep-walled holes or trenches more than 2 feet deep with plywood or similar materials at the end of each workday. Or, construct in the holes and trenches, one or more earth fill or wooden plank escape ramps. Inspect thoroughly for trapped animals before such holes or trenches are filled.
6. Vegetation removal is allowed only between September 1 and January 31.

14-6.02C(6) Monitoring Schedule

Not Used

14-6.02D Payment

Not Used

Replace item 1 in the list in the 7th paragraph of section 14-6.03A with:

Stop all work within a 100-foot radius of the discovery except as shown in the following table:

Radius Exceptions

| Species | Work stoppage radius (feet) |
|--|-----------------------------|
| American Peregrine Falcon (<i>Falco peregrinus anatum</i>) | 300 |
| White tailed kite (<i>Elanus leucurus</i>) | 300 |
| Northern harrier (<i>Circuscyaneus</i>) | 300 |
| Red-tailed hawk (<i>Buteo jamaicensis</i>) | 300 |
| Cooper's hawk (<i>Accipiter cooperii</i>) | 300 |
| Sharp-shinned hawk (<i>Accipiter striatus</i>) | 300 |

Replace section 14-6.06 with:

14-6.06 SPECIES PROTECTION AREA

14-6.06A General

14-6.06A(1) Summary

Section 14-6.06 includes specifications for areas that have species protection requirements.

Species protection areas (SPAs) within the project limits are shown:

Species Protection Areas

| Identification | Location |
|----------------|--|
| ESA (Type 1) | "US101" 490+78.16 TO "US101" 500+62.46 Rt |
| ESA (Type 2) | "US101" 490+51.52 TO "US101" 495+96.81 Lt |
| ESA (Type 3) | "BYSH" 39+56.46 TO "BYSH" 39+78.05 Lt |

14-6.06B Materials

Not Used

14-6.06C Construction

Not Used

14-6.06D Payment

Not Used

Replace the 1st paragraph of section 14-8.02A with:

Do not exceed 86 dBA LMax at 50 feet from the job site activities from 6 p.m. to 7 a.m. except you may perform the following activities during the hours and for the days shown in the following table:

Noise Restriction Exceptions

| Activity | Hours | | Days | |
|----------------|------------|-----------|----------|---------|
| | From | To | From | Through |
| Bridge removal | 12:00 a.m. | 6:00 a.m. | Saturday | Sunday |

Add to section 14-8.02:

Provide one Type 1 sound level meter and 1 acoustic calibrator to be used by the Department until Contract acceptance. Provide training by a person trained in noise monitoring to 1 Department employee designated by the Engineer. The sound level meter must be calibrated and certified by the manufacturer or other independent acoustical laboratory before delivery to the Department. Provide annual recalibration by the manufacturer or other independent acoustical laboratory. The sound level meter must be capable of taking measurements using the A-weighting network and the slow response settings. The measurement microphone must be fitted with a windscreen. The Department returns the equipment to you at Contract acceptance. Work specified in this paragraph is paid for as noise monitoring.

Add to section 14-8.02A:

14-8.02A(1) Submittals

Submit a report within 24 hours of completing work when work is performed during the hours specified in the Noise Restriction Exception table. The report must summarize the date and time of activities performed, means and methods used, equipment on the job, and actual measured noise levels.

Replace "Not Used" in section 14-8.02C with:

Prepare and implement a noise control and monitoring program for all construction activities between the hours of 9:00 p.m. and 6:00 a.m. Monitor and record noise levels each night that work is performed during the hours specified in the Noise Restriction Exception table.

Add to section 14-9.02A:

Submit a demolition notification form to the air pollution control district or air quality management district at least 30 days before starting demolition under the National Emission Standards for Hazardous Air Pollutants (NESHAP), subpart M, National Emission Standard for Asbestos, 40 CFR § 61.140 et seq. and the Health & Safety Code § 39658(b)(1).

Obtain notification form and other information from:

BAY AREA AIR QUALITY MANAGEMENT DISTRICT
939 ELLIS ST
SAN FRANCISCO, CA 94109
<http://www.baaqmd.gov>

Submit a copy of the completed demolition notification form as an informational submittal.

Submit the acknowledgement letter from the district as an informational submittal.

Do not start demolition before the date specified in the acknowledgement letter.

Replace section 14-11.03 with:

14-11.03 MATERIAL CONTAINING HAZARDOUS WASTE CONCENTRATIONS OF AERIALY DEPOSITED LEAD

14-11.03A General

14-11.03A(1) Summary

Section 14-11.03 includes specifications for hazardous waste management while excavating, stockpiling, transporting, placing, and disposing of material containing hazardous waste concentrations of aerially deposited lead (ADL).

ADL is present within the project limits.

The Department has received from the DTSC a variance regarding the use of material containing ADL. The variance applies if Type Y-1 or Y-2 material are shown. The variance is available for inspection at the Department of Transportation, District 4, 111 Grand Avenue, Oakland, California.

14-11.03A(2) Definitions

Type Y-1: Material that contains ADL in average concentrations (using the 90 percent Upper Confidence Limit) of 1.5 mg/L or less extractable lead (based on a modified waste extraction test using deionized water as the extractant) and 1,411 mg/kg or less total lead. This material is a California hazardous waste that may be reused as permitted under the variance of the DTSC provided that the lead contaminated soil is placed a minimum of 5 feet above the maximum historic water table elevation and covered with at least 1 foot of non-hazardous soil.

Type Y-2: Material that contains ADL in average concentrations (using the 90 percent Upper Confidence Limit) that exceed either 1.5 mg/L extractable lead (based on a modified waste extraction test using deionized water as the extractant) or 1,411 mg/kg total lead but are less than 150 mg/L extractable lead (based on a modified waste extraction test using deionized water as the extractant) and less than 3,397 mg/kg of total lead. This material is a California hazardous waste that may be reused as permitted under the variance of DTSC provided that the lead contaminated soil is placed a minimum of 5 feet above the maximum historic water table elevation and protected from infiltration by a pavement structure which will be maintained by the Department.

Type Z-2: Material that contains ADL in average concentrations (using the 95 percent Upper Confidence Limit) greater than or equal to 1,000 mg/kg total lead, greater than or equal to 5.0 mg/L soluble lead (as tested using the California Waste Extraction Test), and the material is surplus; or material that contains ADL in average concentrations greater than 150 mg/L extractable lead (based on a modified waste extraction test using deionized water as the extractant) or greater than 3,397 mg/kg total lead. This material is a Department-generated California hazardous waste and must be transported to and disposed of at a California Class I disposal site.

Type Z-3: Material that contains ADL in average concentrations (using the 95 percent Upper Confidence Limit) greater than 5.0 mg/L soluble lead, (as tested using the Toxicity Characteristic Leaching Procedure). This material is a Department-generated federal hazardous waste and must be transported to and disposed of at a California Class I disposal site.

14-11.03A(3) Site Conditions

ADL concentration data and sample locations maps are included in the *Information Handout*.

Type Y-1 material exists as shown.

Type Y-2 material exists as shown.

Type Z-3 material exists as shown.

14-11.03A(4) Submittals

14-11.03A(4)(a) Lead Compliance Plan

Submit a lead compliance plan under section 7-1.02K(6)(j)(ii).

14-11.03A(4)(b) Excavation and Transportation Plan

Within 15 days after approval of the Contract, submit 3 copies of an excavation and transportation plan. Allow 7 days for review. If revisions are required, as determined by the Engineer, submit the revised plan within 7 days of receipt of the Engineer's comments. For the revision, allow 7 days for the review. Minor changes to or clarifications of 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 plan while minor revisions or amendments are being completed.

Prepare the written, project specific excavation and transportation plan establishing the procedures you will use to comply with requirements for excavating, stockpiling, transporting, and placing or disposing of material containing ADL. The plan must comply with the regulations of the DTSC and Cal/OSHA and the requirements of the variance. The sampling and analysis portions of the excavation and transportation plan must meet the requirements for the design and development of the sampling plan, statistical analysis, and reporting of test results contained in US EPA, SW 846, "Test Methods for Evaluating Solid Waste," Volume II: Field Manual Physical/Chemical, Chapter Nine, Section 9.1. The plan must include the following elements:

1. Excavation schedule by location and date
2. Temporary locations of stockpiled material
3. Sampling and analysis plans for areas after removal of a stockpile. Include the following:
 - 3.1. Location and number of samples
 - 3.2. Name and address of the CDPH Environmental Laboratory Accreditation Program (ELAP) certified laboratory where the analysis was performed
4. Survey methods for Type Y-1 or Y-2 material burial locations
5. Dust control measures
6. Air monitoring. Include the following information:
 - 6.1. Location and type of equipment
 - 6.2. Sampling frequency
 - 6.3. Name and address of the accredited laboratory where the analysis was performed
7. Transportation equipment and routes
8. Method for preventing spills and tracking material onto public roads
9. Truck waiting and staging areas
10. Site for disposal of hazardous waste
11. Spill Contingency Plan for material containing ADL

14-11.03A(4)(c) Burial Location Report

Within 5 business days of completing placement of Type Y-1 or Y-2 material at a burial location, submit a report for that burial location, including "Burial Location of Soil Containing Aerial Deposited Lead" form and electronic geospatial vector data shapefiles of the top and bottom perimeters of the burial location. Submit to the Engineer and to:

ADL@dot.ca.gov

The Engineer notifies you of acceptance or rejection of the burial location report within 5 business days of receipt. If the report is rejected, you have 5 business days to submit a corrected report.

14-11.03A(4)(d) Bill of Lading

Copies of the bills of lading must be submitted as an information handout upon placement of Type Y-2 material in its final location.

14-11.03A(5) Quality Control and Assurance

Excavation, reuse, and disposal of material with ADL must comply with rules and regulations of the following agencies:

1. US DOT
2. US EPA
3. California Environmental Protection Agency
4. CDPH
5. DTSC
6. Cal/OSHA
7. California Department of Resources Recycling and Recovery
8. RWQCB, Region 2, San Francisco Bay
9. State Air Resources Control Board
10. Bay Area Air Quality Management District

Transport and dispose of material containing hazardous levels of lead under federal and state laws and regulations and county and municipal ordinances and regulations. Laws and regulations that govern this work include:

1. Health & Safety Code, Division 20, Chp 6.5 (California Hazardous Waste Control Act)
2. 22 CA Code of Regs, Div. 4.5 (Environmental Health Standards for the Management of Hazardous Waste)
3. 8 CA Code of Regs

14-11.03B Materials

Not Used

14-11.03C Construction**14-11.03C(1) General**

Not Used

14-11.03C(2) Material Management

Place Type Y-1 material as shown and cover with a minimum 2.0 foot layer of nonhazardous soil or the pavement structure. Temporary surplus material may be generated on this project due to the requirements of stage construction. Do not transport temporary surplus outside the job site. It may be necessary to:

1. Stockpile material for subsequent stages.
2. Construct some embankments out of stage.
3. Handle temporary surplus material more than once.

Place Type Y-2 material as shown and cover with the pavement structure. Temporary surplus material may be generated on this project due to the requirements of stage construction. Do not transport temporary surplus material outside the job site. It may be necessary to:

1. Stockpile material for subsequent stages.
2. Construct some embankments out of stage.
3. Handle temporary surplus material more than once.

Transport excavated Type Z-3 material using:

1. Hazardous waste manifest
2. Hazardous waste transporter with a current DTSC registration certificate and CHP BIT Program compliance documentation

14-11.03C(3) Dust Control

Excavation, transportation, placement, and handling of material containing ADL must result in no visible dust migration. A water truck or tank must be on the job site at all times while clearing and grubbing or performing earthwork operations in work areas containing ADL. Apply water to prevent visible dust.

14-11.03C(4) Surveying Type Y-1 or Y-2 Material Burial Locations

Survey the location of the bottom and top perimeters of each area where you bury Type Y-1 or Y-2 material (burial locations). The survey must be performed by or under the direction of one of the following:

1. Land surveyor licensed under the Bus & Prof Code, Chp 15 (commencing with § 8700)
2. Civil engineer licensed prior to January 1, 1982 under the Bus & Prof Code, Chp 7 (commencing with § 6700)

Survey 10 points to determine each burial location horizontally and vertically within the specified accuracies and to create closed polygons of the perimeters of the bottom and top of the burial location. If 10 points are not sufficient to define the polygon, add additional points until the polygon is defined. Establish the position of the bottom and top perimeters before placing subsequent layers of material that obstruct the location.

Report each burial location in California State Plane Coordinates in US Survey feet within the appropriate zone of the California Coordinate System of 1983 (CCS83) and in latitude and longitude. Horizontal positions must be referenced to CCS83 (epoch 2007.00 or later National Geodetic Survey [NGS] or California Spatial Reference Center [CSRC] published epoch) to an accuracy of 3 ft horizontally. The elevation of points identifying the burial location must locate the bottom and top of Type Y-1 or Y-2 material to an accuracy of 1 ft vertically. Elevations of the bottom and top of Type Y-1 or Y-2 material must be referenced to North American Vertical Datum of 1988 (NAVD88). Report accuracy of spatial data in US Survey feet under Federal Geographic Data Committee (FGDC)-STD-007.1-1998.

14-11.03C(5) Material Transportation

Before traveling on public roads, remove loose and extraneous material from surfaces outside the cargo areas of the transporting vehicles and cover the cargo with tarpaulins or other cover, as outlined in the approved excavation and transportation plan. You are responsible for costs due to spillage of material containing lead during transport. Transportation routes for Type Y-1 or Y-2 material must only include the highway.

14-11.03C(6) Disposal

The Engineer will obtain the State of California Board of Equalization identification no, for hazardous waste disposal. The Engineer will sign all hazardous waste manifests. Notify the Engineer 5 business days before the manifests are to be signed.

Not Used

14-11.03D Payment

Payment for a lead compliance plan is not included in the payment for environmental stewardship work.

The Department does not pay for stockpiling of material containing ADL, unless the stockpiling is ordered. The Department does not pay for sampling and analysis unless it is ordered. The Department does not pay for additional sampling and analysis required by the receiving landfill.

Replace section 14-11.07 with:

14-11.07 REMOVE YELLOW TRAFFIC STRIPE AND PAVEMENT MARKING WITH HAZARDOUS WASTE RESIDUE

14-11.07A General

14-11.07A(1) Summary

Section 14-11.07 includes specifications for removing existing yellow thermoplastic and yellow painted traffic stripe and pavement marking. The residue from the removal of this material is a Department-generated hazardous waste.

Residue from removal of yellow thermoplastic and yellow painted traffic stripe and pavement marking contains lead chromate. The average lead concentration is at least 1,000 mg/kg total lead or 5 mg/l soluble lead. When applied to the roadway, the yellow thermoplastic and yellow painted traffic stripe and pavement marking contained as much as 2.6 percent lead. Residue produced from the removal of this yellow thermoplastic and yellow painted traffic stripe and pavement marking contains heavy metals in concentrations that exceed thresholds established by the Health & Safety Code and 22 CA Code of Regs. For bidding purposes, assume the residue is not regulated under the Federal Resource Conservation and Recovery Act (RCRA), 42 USC § 6901 et seq.

Work associated with disposal of hazardous waste residue regulated under RCRA as determined by test results is change order work.

Yellow thermoplastic and yellow paint may produce toxic fumes when heated.

14-11.07A(2) Submittals

14-11.07A(2)(a) General

Reserved

14-11.07A(2)(b) Lead Compliance Plan

Submit a lead compliance plan under section 7-1.02K(6)(j)(ii).

14-11.07A(2)(c) Work Plan

Submit a work plan for the removal, containment, storage, and disposal of yellow thermoplastic and yellow painted traffic stripe and pavement marking. The work plan must include:

1. Objective of the operation
2. Removal equipment
3. Procedures for removal and collection of yellow thermoplastic and yellow painted traffic stripe and pavement marking residue, including dust
4. Type of hazardous waste storage containers
5. Container storage location and how it will be secured
6. Hazardous waste sampling protocol and QA/QC requirements and procedures
7. Qualifications of sampling personnel
8. Analytical lab that will perform the analyses
9. DTSC registration certificate and CA Highway Patrol (CHP) Biennial Inspection of Terminals (BIT) Program compliance documentation of the hazardous waste hauler that will transport the hazardous waste
10. Disposal site that will accept the hazardous waste residue

The Engineer will review the work plan within 5 business days of receipt.

Do not perform work that generates hazardous waste residue until the work plan has been authorized.

Correct any rejected work plan and resubmit a corrected work plan within 5 business days of notification by the Engineer. A new review period of 5 business days will begin from date of resubmittal.

14-11.07A(2)(d) Analytical Test Results

Submit analytical test results of the residue from removal of yellow thermoplastic and yellow painted traffic stripe and pavement marking, including chain of custody documentation, for review and acceptance before:

1. Requesting the Engineer's signature on the waste profile requested by the disposal facility
2. Requesting the Engineer obtain an US EPA Generator Identification Number for disposal
3. Removing the residue from the site

14-11.07A(2)(e) U.S. Environmental Protection Agency Identification Number Request

Submit a request for the US EPA Generator Identification Number when the Engineer accepts analytical test results documenting that residue from removal of yellow thermoplastic and yellow painted traffic stripe and pavement marking is a hazardous waste.

14-11.07A(2)(f) Disposal Documentation

Submit documentation of proper disposal from the receiving landfill within 5 business days of residue transport from the project.

14-11.07B Materials

Not Used

14-11.07C Construction

Where grinding or other authorized methods are used to remove yellow thermoplastic and yellow painted traffic stripe and pavement marking that will produce a hazardous waste residue, immediately contain and collect the removed residue, including dust. Use a HEPA filter-equipped vacuum attachment operated concurrently with the removal operations or other equally effective approved methods for collection of the residue.

Make necessary arrangements to test the yellow thermoplastic and yellow paint hazardous waste residue as required by the disposal facility and these special provisions. Testing must include:

1. Total lead by US EPA Method 6010B
2. Total chromium by US EPA Method 6010B
3. Soluble lead by California Waste Extraction Test (CA WET)
4. Soluble chromium by CA WET
5. Soluble lead by Toxicity Characteristic Leaching Procedure (TCLP)
6. Soluble chromium by TCLP

From the first 220 gal of hazardous waste or portion thereof if less than 220 gal of hazardous waste are produced, a minimum of 4 randomly selected samples must be taken and analyzed individually. Samples must not be composited. From each additional 880 gal of hazardous waste or portion thereof if less than 880 gal are produced, a minimum of 1 additional random sample must be taken and analyzed. Use chain of custody procedures consistent with chapter 9 of US EPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846) while transporting samples from the project to the laboratory. Each sample must be homogenized before analysis by the laboratory performing the analyses. A sample aliquot sufficient to cover the amount necessary for the total and the soluble analyses must then be taken. This aliquot must be homogenized a 2nd time and the total and soluble analyses run on this aliquot. The homogenization process must not include grinding of the samples. Submit the name and location of the disposal facility that will be accepting the hazardous waste and the analytical laboratory along with the testing requirements not less than 5 business days before the start of removal of yellow thermoplastic and yellow painted traffic stripe and pavement marking. The analytical laboratory must be certified by the California Department of Public Health (CDPH) Environmental Laboratory Accreditation Program (ELAP) for all analyses to be performed.

After the Engineer accepts the analytical test results, dispose of yellow thermoplastic and yellow paint hazardous waste residue at a Class 1 disposal facility located in California under the requirements of the disposal facility operator within 90 days after accumulating 220 pounds of residue and dust.

If less than 220 pounds of hazardous waste residue and dust is generated in total, dispose of it within 90 days after the start of accumulation of the residue and dust.

The Engineer will sign all manifests as the generator within 2 business days of receiving and accepting the analytical test results and receiving your request for the US EPA Generator Identification Number. Use a transporter with a current DTSC registration certificate and that is in compliance with the CHP BIT Program when transporting hazardous waste.

14-11.07D Payment

Payment for a lead compliance plan is not included in the payment for environmental stewardship work.

If analytical test results demonstrate that the residue is a non-hazardous waste and the Engineer agrees, dispose of the residue at an appropriately permitted CA Class II or CA Class III facility. The Department does not adjust payment for this disposal.

Replace section 14-11.09 with:

14-11.09 TREATED WOOD WASTE

14-11.09A General

14-11.09A(1) Summary

Section 14-11.09 includes specifications for handling, storing, transporting, and disposing of treated wood waste (TWW).

Wood removed from metal beam guard rail and roadside signs is TWW. Manage TWW under 22 CA Code of Regs, Div. 4.5, Chp. 34.

14-11.09A(2) Submittals

For disposal of TWW, submit as an informational submittal a copy of each completed shipping record and weight receipt within 5 business days.

14-11.09B Materials

Not Used

14-11.09C Construction

14-11.09C(1) General

Not Used

14-11.09C(2) Training

Provide training to personnel who handle TWW or may come in contact with TWW. Training must include:

1. Applicable requirements of 8 CA Code of Regs
2. Procedures for identifying and segregating TWW
3. Safe handling practices
4. Requirements of 22 CA Code of Regs, Div. 4.5, Chp. 34
5. Proper disposal methods

Maintain records of personnel training for 3 years.

14-11.09C(3) Storage

Store TWW before disposal using the following methods:

1. Elevate on blocks above a foreseeable run-on elevation and protect from precipitation for no more than 90 days.
2. Place on a containment surface or pad protected from run-on and precipitation for no more than 180 days.
3. Place in water-resistant containers designed for shipping or solid waste collection for no more than 1 year.
4. Place in a storage building as defined in 22 CA Code of Regs, Div. 4.5, Chp. 34, § 67386.6(a)(2)(C).

Prevent unauthorized access to TWW using a secured enclosure such as a locked chain-link-fenced area or a lockable shipping container located within the job site.

Resize and segregate TWW at a location where debris from the operation including sawdust and chips can be contained. Collect and manage the debris as TWW.

Provide water-resistant labels that comply with 22 CA Code of Regs, Div. 4.5, Chp. 34, §67386.5, to clearly mark and identify TWW and accumulation areas. Labels must include:

1. Caltrans, District number, Construction, Construction Contract number
2. District office address
3. Engineer's name, address, and telephone number
4. Contractor's contact name, address and telephone number
5. Date placed in storage

14-11.09C(4) Transporting and Disposal

Before transporting TWW, obtain an agreement from the receiving facility that the TWW will be accepted. Protect shipments of TWW from loss and exposure to precipitation. For projects with 10,000 lb or more of TWW, request a generator's EPA Identification Number at least 5 business days before the 1st shipment. Each shipment must be accompanied by a shipping record such as a bill of lading or invoice that includes:

1. Caltrans with district number
2. Construction Contract number
3. District office address
4. Engineer's name, address, and telephone number
5. Contractor's contact name and telephone number
6. Receiving facility name and address
7. Waste description: Treated Wood Waste with preservative type if known or unknown/mixture
8. Project location
9. Estimated quantity of shipment by weight or volume
10. Date of transport
11. Date of receipt by the receiving TWW facility
12. Weight of shipment as measured by the receiving TWW facility
13. Generator's EPA Identification Number for projects with 10,000 lb or more of TWW

The shipping record must be at least a 4-part carbon or carbonless 8-1/2-by-11-inch form to allow retention of copies by the Engineer, transporter, and disposal facility.

Dispose of TWW at an approved TWW facility. A list of currently approved TWW facilities is available at:

<http://www.dtsc.ca.gov/HazardousWaste/upload/lanfillapr11pdated1.pdf>

Dispose of TWW within:

1. 90 days of generation if stored on blocks
2. 180 days of generation if stored on a containment surface or pad
3. 1 year of generation if stored in a water-resistant container or within 90 days after the container is full, whichever is shorter
4. 1 year of generation if storing in a storage building as defined in 22 CA Code of Regs, Div. 4.5, Chp. 34, § 67386.6(a)(2)(C)

14-11.09D Payment

Not Used

Replace section 14-11.11 with:

14-11.11 MANAGEMENT OF ASBESTOS-CONTAINING MATERIALS

14-11.11A General

14-11.11A(1) Summary

Section 14-11.11 includes specifications for surveying and sampling or for removal and disposal of asbestos-containing material (ACM). Friable ACM generated as part of this work is Department-generated hazardous waste under 14-11.02F.

14-11.11A(2) Definitions

asbestos: Includes chrysotile, amosite, crocidolite, tremolite, anthrophyllite, actinolite and any of these minerals that has been chemically treated and/or altered.

asbestos-containing material (ACM): Any building material, including asbestos cement pipe containing commercial asbestos in an amount greater than 1% by weight, area, or count.

certified asbestos consultant (CAC): An asbestos consultant certified by Cal/OSHA under 8 CA Code of Regs § 341.15 and 1529.

friable ACM: Any material containing more than 1 percent asbestos by area that hand pressure can crumble, pulverize or reduce to powder when dry".

non-friable ACM: Asbestos fibers are tightly bound into the matrix of the material and should not become an airborne hazard as long as the material remains intact and undamaged, and is not sawed, sanded, drilled or otherwise abraded during removal (Asbestos Hazard Emergency Response Act (AHERA)).

14-11.11A(3) Asbestos Survey Results

Not Used

14-11.11A(4) Submittals

14-11.11A(4)(a) Asbestos Surveying Work Plan for Sampling

Before starting removal of two buildings at 1212 Rollins Road or renovation, submit an asbestos inspection work plan that establishes the procedures to comply with requirements for asbestos surveying and sampling, including:

1. Sampling procedures. ACM sampling methods must meet USEPA, SW-846, "Test Methods for Evaluating Solid Waste," Volume II: Field Manual, Physical/Chemical, Chapter Nine Section 9.1. Include the name of the laboratory that will perform the asbestos analyses and a copy of the laboratories ELAP certification.
2. Analytical method for analyses. Samples must be analyzed for asbestos according to Analytical Method 600/R-93-116 under 40 CFR Part 763 Subpart F, Appendix A (Polarized Light Microscopy).
3. Sample handling and preservation. Transport samples under chain of custody to the laboratory within 24 hours of sampling. The laboratory must test the samples within 48 hours. Submit laboratory results as soon as they are available. Supply a summary report of sampling protocols, photographs of the structures and of the locations where samples were taken, chain of custody, analysis and laboratory data sheets to the Engineer within 10 days of completion of sampling.

Do not start sampling and analysis work until the work plan is authorized by the Engineer. If the work plan is unacceptable, it will be returned to you within 5 business days of the submittal for revision. Revise the plan within 5 business days and resubmit. The Engineer has 5 days to review and authorize or reject the revised plan from the date the revised plan is received. The plan must be prepared and signed by a CAC. Sampling and analysis must comply with USEPA "Asbestos/NESHAP Regulated Asbestos Containing Materials Guidance."

Collect a minimum of 1 sample per suspected ACM location. For pipes and other linear components of suspected ACM, collect 1 sample per 5 feet of exposed material. Sample all exposed suspected ACM on the structure. Sample suspected ACM encapsulated in concrete when exposed during demolition.

14-11.11(4)(b) Asbestos Sampling and Analysis Report

Submit a report on the asbestos inspection within 10 days after completion of the inspection. The report must include:

1. Sampling protocols
2. Photographs of the structures and of the locations where samples were taken
3. Assessment of condition of ACM (friable/non-friable)
4. Quantification of ACM
5. Recommendations for removal and disposal of confirmed ACM.
6. Chain of custody
7. Laboratory data
8. Documentation of Cal-OSHA Certification as a Certified Asbestos Consultant

Allow 5 business days for the Engineer to review and authorize the report. Make any changes requested for acceptance within business 5 days. Submit 4 copies of the final report.

14-11.11A(4)(c) Air Quality Management District (AQMD) or Air Pollution Control District (APCD) Notification of Demolition

Submit a copy of the NESHAP notification form and attachments, required under section 14-9.02, before submittal to the AQMD or APCD.

14-11.11A(4)(d) Asbestos Compliance Plan

Prepare an Asbestos Compliance Plan (ACP) to prevent or minimize exposure to asbestos. The ACP must be signed by a CIH before submission to the Engineer for review and authorization. Submit the ACP to the Engineer at least 15 business days before beginning work in areas containing or suspected to contain asbestos. The ACP must contain:

1. Identification of key personnel for the project
2. Scope of work and equipment that will be used
3. Job hazard analysis for work assignments
4. Summary of risk assessment
5. Personal protective equipment
6. Delineation of work zones on-site
7. Decontamination procedures
8. General safe work practices
9. Security measures
10. Emergency response plans
11. Worker training

14-11.11A(4)(e) Removal Work Plan

Not Used

14-11.11A(4)(f) Certification of Completion of Safety Training

Submit a certification of completion of safety training for all trained personnel before starting work in areas containing or suspected to contain asbestos.

14-11.11A(4)(g) Waste Shipment Records

Not Used

14-11.11A(5) Quality Control and Assurance

14-11.11A(5)(a) Qualifications

The person in charge of asbestos inspection and abatement planning must be a CAC.

Laboratories used to perform asbestos analysis must be certified by the CDPH Environmental Laboratory Accreditation Program (ELAP) for all analyses to be performed.

14-11.11A(5)(b) Regulatory Requirements

Codes which govern removal and disposal of materials containing asbestos include:

1. CA Health and Safety Code, Division 20, Chapter 6.5, Hazardous Waste Control

3. Is not regulated under the Federal Resource Conservation and Recovery Act (RCRA), 42 USC § 6901 et seq.

Submit a lead compliance plan under section 7-1.02K(6)(j)(ii).

Payment for a lead compliance plan is not included in the payment for existing facilities work.

Payment for handling, removal, and disposal of grinding or cold planing residue that is a nonhazardous waste is included in the payment for the type of removal work involved.

Replace section 15-1.03C with:

15-1.03C Loop Detectors

The existing inductive loop detectors shown at Signal and Lighting, (City Street), (Location 5) on Cadillac Way must remain in place and operational.

If you damage part of a loop conductor including an adjacent loop and the portion leading to the adjacent pull box, replace the entire loop detector.

Replace section 15-2.02B(3) with:

15-2.02B(3) Cold Planing Asphalt Concrete Pavement

15-2.02B(3)(a) General

Schedule cold planing activities to ensure that cold planing, placement of HMA, and reopening the area to traffic is completed during the same work shift.

If you do not complete HMA placement before opening the area to traffic, you must:

1. Construct a temporary HMA taper to the level of the existing pavement
2. Place HMA during the next work shift
3. Submit a corrective action plan that shows you will complete cold planing and placement of HMA in the same work shift. Do not restart cold planing activities until the Engineer approves the corrective action plan.

15-2.02B(3)(b) Materials

Use the same quality of HMA for temporary tapers that is used for the HMA overlay or comply with the specifications for minor HMA in section 39.

15-2.02B(3)(c) Construction

15-2.02B(3)(c)(i) General

Do not use a heating device to soften the pavement.

The cold planing machine must be:

1. Equipped with a cutter head width that matches the planing width. If the cutter head width is wider than the cold plane area shown, submit to the Engineer a request for using a wider cutter head. Do not cold plane unless the Engineer approves your request.
2. Equipped with automatic controls for the longitudinal grade and transverse slope of the cutter head and:
 - 2.1. If a ski device is used, it must be at least 30 feet long, rigid, and a 1-piece unit. The entire length must be used in activating the sensor.
 - 2.2. If referencing from existing pavement, the cold planing machine must be controlled by a self-contained grade reference system. The system must be used at or near the centerline of the roadway. On the adjacent pass with the cold planing machine, a joint-matching shoe may be used.
3. Equipped to effectively control dust generated by the planing operation
4. Operated so that no fumes or smoke is produced.

Replace broken, missing, or worn machine teeth.

15-2.02B(3)(c)(ii) Grade Control and Surface Smoothness

Furnish, install, and maintain grade and transverse slope references.

The depth, length, width, and shape of the cut must be as shown or as ordered. The final cut must result in a neat and uniform surface. Do not damage the remaining surface.

The completed surface of the planed asphalt concrete pavement must not vary more than 0.02 foot when measured with a 12-foot straightedge parallel with the centerline. With the straightedge at right angles to the centerline, the transverse slope of the planed surface must not vary more than 0.03 foot.

Where lanes are open to traffic, the drop-off of between adjacent lanes must not be more than 0.15 foot.

15-2.02B(3)(c)(iii) Temporary HMA Tapers

If a drop-off between the existing pavement and the planed area at transverse joints cannot be avoided before opening to traffic, construct a temporary HMA taper. The HMA temporary taper must be:

1. Placed to the level of the existing pavement and tapered on a slope of 30:1 (horizontal:vertical) or flatter to the level of the planed area
2. Compacted by any method that will produce a smooth riding surface

Completely remove temporary tapers before placing permanent surfacing.

15-2.02B(3)(c)(iv) Remove Planed Material

Remove cold planed material concurrent with planing activities so that removal does not lag more than 50 feet behind the planer.

15-2.02B(3)(d) Payment

Payment for removal of pavement markers, thermoplastic traffic stripe, painted traffic stripe, and pavement marking within the area of cold planing is included in the payment for cold plane asphalt concrete pavement of the types shown in the Bid Item List.

Replace section 15-2.02C(2) with:

15-2.02C(2) Remove Traffic Stripes and Pavement Markings Containing Lead

Residue from removing traffic stripes and pavement markings contains lead from the paint or thermoplastic. The average lead concentrations are less than 1,000 mg/kg total lead and 5 mg/L soluble lead. This residue:

1. Is a nonhazardous waste
2. Does not contain heavy metals in concentrations that exceed thresholds established by the Health and Safety Code and 22 CA Code of Regs
3. Is not regulated under the Federal Resource Conservation and Recovery Act (RCRA), 42 USC § 6901 et seq.

Submit a lead compliance plan under section 7-1.02K(6)(j)(ii).

Payment for a lead compliance plan is not included in the payment for existing facilities work.

Payment for handling, removal, and disposal of pavement residue that is a nonhazardous waste is included in the payment for the type of removal work involved.

Replace section 15-2.02I with:

15-2.02I Remove Sign Structures

Removing overhead sign structures includes removal of:

1. Frames, braces, supports, and brackets
2. Portions of foundations
3. Sign panels

4. Mounting hardware for light fixtures
5. Walkways, safety railing, gutter
6. Electrical equipment for sign lighting
7. Hardware
8. Posts
9. Portions of foundations

Concrete foundations may be abandoned in place except that the top portion, including anchor bolts, reinforcing steel, and conduits, must be removed to a depth of not less than 3 feet below the adjacent finished grade. The resulting holes must be backfilled and compacted with material that is equivalent to the surrounding material.

Remove signs' conduit and wiring to the nearest pull box. Remove fuses within spliced connections in the pull box.

Replace section 15-2.02K with:

15-2.02K Remove Drainage, Water, and Sewer Facilities

Box culverts, pipes, inlets, manholes, headwalls, and endwalls, water valves, and sewer manholes-must be completely removed if any portion of these structures is (1) within 3 feet of the grading plane in excavation areas, (2) within one foot of original ground in embankment areas, or (3) shown to be removed.

Except for concrete pipe, removing PCC components of drainage and sewer facilities must comply with section 15-3.

Reuse frames, grates, and covers at the locations shown. Payment for removing and reusing frames, grates, and covers is included in the payment for the various items of work that include the reused frames, grates, and covers.

Add the following to section 15-2.03A(1):

Salvage the following:

1. Existing sewer manhole covers
2. Existing sewer pipes in Bayshore Highway (three 33" diameter concrete pipes of ten foot segment each for City of Burlingame testing)

Replace section 15-2.03A(2)(b) with:

15-2.03A(2)(b) City of Burlingame Salvage Location

A minimum of 2 business days before hauling salvaged material to the City of Burlingame salvage storage location, notify the:

1. Engineer
2. City of Burlingame coordinator at telephone number (650) 558-7670

The City of Burlingame salvage location is:

The City of Burlingame Corporation Yard
1361 North Carolan Avenue, Burlingame, CA 94010

The Department salvage storage location is:

Caltrans Maintenance Station
30 Rickard Street, San Francisco, CA 94134

Replace section 15-2.03C with:

15-2.03C Salvage Irrigation Facilities

For irrigation facilities that are shown to be removed, salvage the following items:

1. Irrigation controller field units
2. Irrigation backflow preventer assemblies
3. Irrigation water meters – see Utility Plans

With each delivery to the salvage location, include a list of the quantity and size of each item.

Replace section 15-2.05C with:

15-2.05C Abandon Sewer, Culverts, and Pipelines

15-2.05C(1) General

Section 15-2.05C includes specifications for abandoning sewer, culverts and pipelines.

Abandon sewer, culverts or pipelines by removing portions of the sewer, culverts or pipelines, filling the inside, and backfilling the depressions and trenches to grade. As an alternative to abandoning a culvert or pipeline, you may remove the sewer, culvert or pipeline, dispose of it, and backfill.

Pipelines includes water pipelines.

Notify the Engineer before abandoning a sewer, culvert or pipeline.

15-2.05C(2) Materials

Plug openings into existing structures that are to remain in place with minor concrete under section 90.

15-2.05C(3) Construction

Wherever sewer, culverts or pipelines intersect side slopes, remove them to a depth of at least 3 feet. Measure the depth normal to the plane of the finished side slope. Abandon the remaining portion of the sewer, culvert or pipeline.

Fill completely the sewer, culverts, or pipelines that are 12 inches or more in diameter by authorized methods. Backfill with sand that is clean, free draining, and free from roots and other deleterious substances. As an alternative to sand, you may backfill with one of the following:

1. Controlled low-strength material under section 19-3.02F
2. Slurry cement backfill under section 19-3.02D

Securely close the ends of sewer, culverts and pipelines by a 6-inch thick, tight-fitting plug or wall of commercial-quality concrete.

15-2.05C(4) Payment

If backfilling inside the sewer, culvert or pipeline is required, payment for backfilling inside the sewer, culvert or pipeline is paid for as sand backfill. Payment for backfilling outside the sewer, culvert or pipeline is included in the payment for abandon sewer, culvert or abandon pipeline.

Replace section 15-2.05D with:

15-2.05D Abandon Inlets

Abandon concrete drainage inlets as shown.

The top portion of the inlets must be removed to a depth of 3 feet below finished grade.

Replace section 15-2.07D with:

15-2.07D Modify Inlets, Manholes, and Risers

Minor concrete must contain at least 590 lb/cu yd of cementitious material.

Do not construct to final grade where paving or surfacing work is shown, until the adjacent pavement or surfacing is complete.

Replace section 15-2.07G with:

15-2.07G Cap Inlets

Excavate and remove inlet structures to a depth of at least 1 foot below the grading plane.

Cap inlet structures with minor concrete. Where shown, round the bottom of structures with minor concrete. Minor concrete must contain at least 590 lb/cu yd of cementitious material.

Backfill to match the grading plane.

Replace heading and 1st paragraph of section 15-2.10B with:

15-2.10B Adjust Frames, Covers, Grates, Sewer Cleanouts, and Manholes

Adjust frames, covers, grates, sewer cleanouts, and manholes by lowering before cold planing and raising after paving or surfacing. Before opening the lane to traffic, either (1) complete permanent paving or surfacing or (2) temporarily fill any depressions with HMA.

Add to section 15-4.01A(2):

The Department's review time for work plans for removing specific structures or portions of structures is shown in the following table:

| Structure or portion of structure | Review time |
|-----------------------------------|-------------|
| Bridge Number 35-0096 | 35 Days |

Replace the 2nd paragraph in section 15-4.01C(2)(a) with:

Temporary support shoring, temporary bracing, and protective covers must not encroach within 8 feet horizontally or 15 feet vertically of any traffic lane or shoulder, except for freeway median shoulders, open to public traffic.

Temporary support shoring, temporary bracing, and protective covers must not encroach within 5 feet horizontally or 15 feet vertically of any freeway median shoulder open to public traffic.

Replace item 4 of the 1st paragraph in section 15-4.01C(2)(b) with:

4. Provide the openings specified in section 12-4 except that when no openings are specified for bridge removal provide:
 - 4.1. A vertical opening of 15 feet and a horizontal opening of 48 feet for public traffic on Route 101.
 - 4.2. A vertical opening of 15 feet and a horizontal opening of 12 feet for public traffic on the northbound Route 101 off-ramp.

AA

19 EARTHWORK

Replace the 2nd, 3rd, and 4th paragraphs of section 19-2.03B with:

Dispose of surplus material. Ensure enough material is available to complete the embankments before disposing of it.

Add to section 19-3.04:

Except at locations where seal course concrete is shown, structure excavation for footings at locations not shown as structure excavation (Type D) and where ground or surface water is encountered is paid for as structure excavation.

Structure excavation (pier column) is measured from the bottom of the completed foundation excavation to the upper and horizontal limits shown.

Pervious backfill material placed within the limits of payment for bridges is paid for as structure backfill (bridge). Pervious backfill material placed within the limits of payment for retaining walls is paid for as structure backfill (retaining wall).

Replace the 2nd sentence in the 7th paragraph of section 19-3.04 with:

Structure excavation more than 1 foot from the depth shown is paid for as a work-character change if you request an adjustment or the Engineer orders an adjustment.

Add to section 19-7.02C:

The portion of imported borrow placed within 4 feet of the finished grade must have a resistance (R-Value) of at least 15.

Replace section 19-10 with:

19-10 SOIL-CEMENT

19-10.01 GENERAL

19-10.01A Summary

Section 19-10 includes specifications for soil-cement for ground improvement.

19-10.01B Definitions

soil-cement element: a soil-cement element is constructed by uniformly mixing in-situ soils with cement grout by way of deep soil cement mixing technology.

mixing shaft: a component of the mixing rig, driven by a power source sufficient to provide torque for the range of expected drilling/augering conditions indicated by the available boring and cone penetration test logs and other test data included in the Information Handout. The mixing shaft must have mixing augers and blades (paddles) configured and oriented in such a manner so that they are capable of thoroughly blending the in-situ soils and grout. The mixing shafts are positioned to overlap one another to form continuously mixed overlapping columns.

grout: a mixture of portland cement and water added to the blended in-situ soils. The grout strengthens the in-situ soils. Premix grout in a mixing plant which combines portland cement and water in predetermined proportions.

19-10.01C Submittals

19-10.01C(1) Statement of Previous Work Experience

Sixty days before starting work, submit a statement of the previous work experience similar to the specified work, signed by an engineer registered as a civil engineer in the State. The statement must include at least 10 successful soil-cement mixing projects within the past 5 years. The statement must 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 your ability to carry out the specified work.

19-10.01C(2) Pre-Production (PPC) Program

Establish a PPC Program within the limits of soil-cement treatment area at either Abut 1 or Abut 3 as specified for the load test.

Submit a Pre-Production (PPC) Program, as an action submittal, to establish production parameters, procedures, and materials to be used during the production phase. The PPC submittal must contain descriptions of the construction procedures, equipment, and ancillary equipment to be used for mixing and binder proportioning and injection, mix design parameters and associated soil strata to be evaluated, operational and material parameters to be monitored, and for containment and processing the spoils created during soil-cement element construction. Examples of the forms that will be used to document the work must also be provided. The submittal must also include names and qualifications of the soil-cement mixing personnel and surveyors, including project experience, resumes and other documentation that demonstrate the experience qualifications of the project engineers, each field superintendent, rig operators, and batch plant operators for the deep soil-cement mixing.

The PPC Program must establish initial production parameters as follows:

1. Cement-grout injection pressure and rates
2. Mixing rotational speeds
3. Penetration and withdrawal rates of the mixing tools
4. Mixing times at bottom of the soil-cement element when there is no vertical movement of the mixing tools

Soil-cement elements constructed for the PPC Program must be within the load test area specified in 19-10.01C (3).

Approval of the PPC Program depends on the strength testing results of soil-cement samples meeting soil-cement strength acceptance criteria outlined in 19-10.01D(2).

19-10.01C(3) Load Test

Conduct a load test to verify the effectiveness of the specified soil treatment coverage as shown on the plans and only after soil-cement element strength is accepted in the PPC program.. Provide a minimum plan dimension of 30 feet by 60 feet of soil-cement treated area for the load test. Incorporate load test area as a part of the final production. Surcharge the load test area and monitor settlement under California Test Method 112. Construct the surcharge load in the test area at or above the grading plane at the location specified in the following table.

| Bridge Number | Abutment Number | Surcharge Load (psf) | Settlement Period (days) | Maximum Settlement (inch) |
|---------------|-----------------|----------------------|--------------------------|---------------------------|
| 35-0351 | 1 or 3 | 3,000 | 60 | 1.0 |

Adjust soil-cement element production pattern as determined by the Engineer, based on load test results.

19-10.01C(4) Pre-construction Submittals

At least 28 days before starting any mobilization of deep soil-cement mixing equipment for production mixing, submit the following:

1. Names and qualifications of the soil-cement mixing personnel and surveyors, including project experience, resumes and other documentation that demonstrate the experience qualifications of the project engineers, each field superintendent, rig operators, and batch plant operators for the deep soil-cement mixing.
2. 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 10 years. Include contractors' names, addresses and telephone numbers for these projects representing the individual's comparable experience. The projects listed to demonstrate personnel qualifications must have employed equipment using similar auger configuration(s) as proposed for the work of this Contract.
3. Submit data on equipment to be used for the deep soil-cement mixing, proportioning, pumping, injecting, and mixing soil-cement, as well as all other ancillary equipment, including equipment capable of remixing non-conforming soil-cement elements, established in the PPC.
4. 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. 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 details and methods to be used to collect and dispose of the spoil return and other spoil materials.
5. Sequence and time schedule of all operations including plan location and sequence of all deep soil-cement mixing. Submit a soil-cement element layout plan based on the limits shown to achieve the required area configurations and coverage, and necessary overlaps, auger re-penetrations over the depths. Locations of all proposed soil-cement mixing must be shown on 50-scale layout plans. Soil-cement elements on the layout plans must be numbered and dimensioned.
6. 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 as specified.
7. The results of the PPC Program including: estimated in-situ 28 day unconfined compressive strengths of the soil-cement elements, 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.
8. Description of Quality Control Plan for deep soil-cement mixing including:
 - 8.1. A detailed description of the Quality Control Plan to be undertaken each day during soil-cement mixing, including the plan area coverage over the required depths and limits, and required horizontal and vertical alignments, to confirm that the constructed soil-cement conforms to the required unconfined compressive strengths.
 - 8.2. Details of procedures to obtain soil-cement samples, catalog cuts of the soil-cement sampling device, and curing boxes.
 - 8.3. 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.
 - 8.4. Example formats of Daily Production Reports conforming to the requirements.
 - 8.5. Names, certifications, and licenses of the laboratories and companies responsible for performing quality control tests.
 - 8.6. Proposed details and formats of all required tabular and graphical data presentations to be submitted to the Engineer during the course of the work.

19-10.01C(5) Construction Report

Within 2 working days after completing each soil-cement element, submit:

1. Deviations of the center coordinates from the layout plan to the nearest 3 inches at the top of the element.
2. Vertical alignment profiles at every 6 inches or higher frequency over the measurement length and to the nearest 0.5 inch along axes parallel and perpendicular to the line of longitudinal progression. Measure the elevation to the nearest 2 inches of the top and bottom of the element.
3. The Daily Quality Control Reports must include the results of the following QC parameter monitoring for each element:
 - 3.1. Rig number
 - 3.2. Type of mixing tool
 - 3.3. Date and time (start and finish) of column construction
 - 3.4. Column number and reference drawing number
 - 3.5. Column diameter
 - 3.6. Column top and bottom elevations
 - 3.7. Grout mix design designation
 - 3.8. Grout specific gravity measurements
 - 3.9. Description of obstructions, interruptions, or other difficulties during construction and how they were resolved
 - 3.10. The following parameters, recorded automatically or manually, for each element at intervals no greater than 2 feet and submitted in the form of either tables or figures, as authorized:
 - 3.10.1. Elevation in feet vs. real time
 - 3.10.2. Shaft rotation speed in rotations per minute (RPM) vs. real time
 - 3.10.3. Penetration and withdrawal rates in feet per minute vs. real time
 - 3.10.4. Grout injection rate in gallons per minute (gpm) vs. real time
 - 3.10.5. Average quantity of grout in gallons per foot injected per vertical foot of column vs. depth

19-10.01D Quality Control and Assurance

19-10.01D(1) General

Implement a quality assurance and quality control (QA/QC) program including, as a minimum:

1. Control of vertical and horizontal alignments of soil-cement elements
2. Field monitor construction parameters during soil-cement element production construction.
3. Collect samples including full-depth continuous coring to be tested by the Engineer.
4. Collect, form, preserve, cure and transport soil-cement core samples under ASTM and AASHTO specifications.
5. Report field monitoring, sampling and strength testing results, recovery and quality of core samples daily for each work shift, by the end of the following work shift.
6. Monitor and record drilling and mixing depths, mixing tool penetration and withdrawal rates, mixing tool rotation speeds, grout injection rates, and the verticality of the mixing tool shaft in two orthogonal directions.

19-10.01D(2) Soil-Cement Strength

19-10.01D(2)(a) General

Verify that the constructed soil-cement elements achieving an average unconfined compressive strength for all tested specimens greater than 160 psi at 28 days. More than 90 percent of the samples tested from the same soil-cement element group must exhibit a strength more than 100 psi. The unconfined compressive strength of all tested specimens must also exceed 50 psi.

Obtain soil-cement samples, including fluid and core samples, and provide them to the laboratory for testing as specified. The laboratory must form, preserve, cure, transport, and test the samples and report the test results to the Engineer. The test results must be signed by an engineer registered as a civil engineer in the State from the laboratory. Coordinate sampling and testing activities with the laboratory. Supply incidental items, access, inside storage space, curing boxes, and electrical power to the curing boxes. Supply molds for use in forming the samples.

19-10.01D(2)(b) Wet Grab Soil-Cement Samples

A minimum of 2 in-situ sampling rounds must be performed daily during the PPC Program at locations selected by the Engineer. Obtain sampling rounds at the same soil-cement element, which must consist of non-cured soil-cement samples from 3 depths selected by the Engineer. Separate soil-cement samples must be retrieved within 60 minutes of the completion of the soil-cement element. The device used to retrieve the wet grab soil-cement samples must be capable of obtaining a discrete fluid sample of soil-cement at a depth determined by the Engineer and must be capable of accepting particles not thoroughly mixed that are up to 6 inches in maximum dimension. Lower the sampler empty, air only, to the required depth in the soil-cement element and then open. Once filled with the soil-cement, close the sampler to exclude entry or loss of soil-cement and immediately raise the filled sampler to ground surface.

Each retrieved soil-cement sample must be of sufficient volume to produce a minimum of 6 full cylinders, each 3 inches in diameter by 6 inches high. Separate and retain all soil-cement retrieved from each depth. Cut all retrieved particles of soil larger than 1 inch into smaller pieces that will pass a 1 inch sieve, and then immediately form the six cylinders with material passing through a 1 inch sieve.

Form, cure, and preserve soil-cement samples under AASHTO T 23 and protect the samples at all times from extreme weather conditions which could have deleterious effects.

If you cannot obtain all of the required wet grab samples of the soil-cement in the designated soil-cement element, obtain a full round of wet grab samples from the next soil-cement element constructed by that rig.

Continue taking wet grab samples in subsequent soil-cement elements until a full round is obtained. From each sampling round, use 1 cylinder from each sampling depth to determine the cement factor based on the cement content under AASHTO T 144 (or ASTM D 806),

For each soil-cement element, the laboratory must test 1 cylinder at 7 days, 1 cylinder at 14 days, 2 cylinders at 28 days, and 2 cylinders at 56 days for unconfined compressive strength under ASTM D 2166. The laboratory must submit the test results to the Engineer.

19-10.01D(2)(c) Soil-Cement Core Samples

At locations designated by the Engineer, conduct continuous coring, vibra-coring, or double tube sampling for the full depth of the soil-cement elements. Up to two additional core locations are required when soil-cement core sample testing fail to achieve the required soil-cement strength. Obtain an independent lab that is authorized by the Engineer to conduct unconfined compressive strength testing.

Each core run must be at least 4 feet in length and contain at least 4 test specimens with a length to diameter ratio of 2 or greater. A minimum recovery of 85 percent for each 4-foot-long core run must be achieved. During coring, measure the elevation of the bottom of the hole after each core run to calculate the core recovery. Determine the time interval between column construction and coring except that the time interval must not be longer than required to conduct 28-day strength testing. Upon retrieval, give the full-depth samples to the Engineer for logging and test specimen selection.

Fill all core holes with neat cement grout using tremie method.

The laboratory must store each core sample in a moist room under ASTM C 192 until the test date.

Testing for 28-day unconfined compressive strength must comply with ASTM D 2166.

Store the remaining portions of the untested full-depth samples in a moist room under ASTM C192 until completion and acceptance of all soil-cement elements for possible inspection and confirmation testing by the Engineer.

19-10.01D(3) Acceptance Criteria

All soil-cement elements must meet the acceptance criteria of soil-cement element strength, soil-cement core uniformity, vertical and horizontal alignments, and depth of soil-cement element as specified.

19-10.02 MATERIALS

19-10.02A Cement Grout

19-10.02A(1) Cement

Cement must comply with ASTM C150, Type II, and must be as specified in the submitted cement grout mix design.

Measure, handle, transport, and store bulk cement under the manufacturer's recommendations. Seal cement packaged in cloth or paper bags within plastic or rubber vapor barriers.

Store cement to prevent damage by moisture. Do not use material that has become caked due to moisture absorption. Stack bags of cement no more than ten bags high to avoid compaction. Do not use cement containing lumps or foreign matter of a nature and in amounts that are deleterious to the grouting operations.

19-10.02A(2) Water

Water used in soil-cement and cement grout mixing must comply with section 90-1.02D.

19-10.03 CONSTRUCTION

19-10.03A Horizontal Alignment

Before starting construction, accurately stake the locations of the soil-cement elements as shown, based on controls established by a surveyor registered as a land surveyor in the State.

The elements must be constructed within 6 inches of the horizontal locations as shown for the top of soil-cement elements. The minimum 20 percent overlap of adjacent element must be achieved at all depths.

Provide a method to allow the Engineer to verify the as-built locations of the elements during construction.

If an obstruction preventing drilling advancement is encountered, investigate the location and extent of the obstruction using methods authorized. Propose remedial measures to clear the obstruction for authorization.

During investigation for an obstruction, continue to construct soil-cement elements in areas away from the obstruction location.

If the Engineer determines that misaligned soil-cement elements will interfere with the driven pile foundation, correct the alignment by re-drilling the misaligned elements and remixing the elements to a strength that is approximately equal to that of the unimproved soil.

19-10.03B Vertical Alignment

Your equipment operator must control vertical alignment of the mixing shaft. Two measures of verticality must be monitored: longitudinal and transverse to the element alignment. The inclination of each soil-cement element must not deviate more than 1 to 100 (horizontal to vertical) from vertical at any point.

19-10.03C Depth of Soil-Cement Element

Depths of soil-cement elements must extend to the lines and grades as shown.

Measure the total depth of penetration either by observing the length of the mixing shaft inserted below a reference point on the mast or by subtracting the exposed length of shaft above the reference point from the total shaft length.

Note and record the final depth of the stroke on the Daily Quality Control Report. Mark the mixing shaft equipment to allow the Engineer to confirm the penetration depth during construction.

The bottom elevations of soil-cement elements as shown are estimates of required minimum penetration of the elements into soils underlying the site. When the elevations of the top of soils are found to differ from shown, the Engineer will authorize to shorten or deepen the soil-cement elements. The Engineer will decrease or increase the volume of the soil-elements for payment due to shortening or deepening.

19-10.04 PAYMENT

The payment quantity for soil-cement includes:

1. Spoil containment during excavation and mixing
2. Removing and disposing excess materials resulting from mixing of soil-cement elements and spoils

Add to section 19:

19-11 LIGHTWEIGHT EMBANKMENT MATERIAL (CELLULAR CONCRETE)

19-11.01 GENERAL

19-11.01A Summary

Section 19-11 includes specifications for constructing lightweight embankment material (cellular concrete).

19-11.01B Submittals

19-11.01B(1) General

Submit mix design and work plan at least 30 working days before work. Do not start work until authorized.

19-11.01B(2) Mix Design

Furnish a mix design which produces a cast density at point of placement of 23.55 to 35.65 lb/cu ft with a minimum compressive strength of 79.91 psi at 28 days.

19-11.01B(3) Work Plan

Provide a work plan, including the equipment and procedures proposed, working drawings for formwork for the lightweight embankment material (cellular concrete) showing work areas which must be formed in segments such that they can be filled in less than 2 hours.

19-11.02 MATERIALS

19-11.02A Admixtures

Admixtures for accelerating the set time must comply with the manufacturer's recommendations. Use a foaming agent and test under ASTM C 796.

19-11.02B Mixing Water

Use potable water, free of deleterious amounts of acids, alkali, salts, oils, and organic materials which would adversely affect the setting or strength of the lightweight embankment material (cellular concrete).

19-11.02C Portland Cement

Use Portland Cement complying with ASTM C150, Types I, II, or III. Use pozzolans and other cementitious materials only when specifically approved by the manufacturer.

19-11.02D Thickening Agent

Add a thickening agent specified by the manufacturer in the top 6 inches to obtain the desired tolerances.

19-11.03 CONSTRUCTION

At the point of placement, the density must comply with the specified cast density. A single cast density test must represent the lesser of 10,000 cubic feet or one day's production.

Take compressive strength test under ASTM C 495 except as follows:

1. Unless otherwise authorized, the specimens must be 3 inches by 6 inches cylinders. During molding, place the cellular concrete in 2 approximately equal layers; no rodding is allowed. Cover and protect the specimens immediately after casting to prevent damage and loss of moisture.
2. Specimens must be moist cured in the molds prior to the 28-day compressive strength test. Specimens must not be oven dried.

Place lightweight embankment material (cellular concrete) to the designated dimensions and grades as shown. Grades must not vary by 4 inches over 10 feet in length, in any direction. Any areas outside this tolerance must be ground down or filled in as needed. Lift thickness for lightweight embankment material (cellular concrete) must not exceed 4 feet. After curing for 12 hours, remove any crumbling area on the surface. Limit surface stepping to 6 inches. Provide a minimum 12-hour waiting time between lifts. Reduce the minimum waiting time as directed by the Engineer. If ambient temperatures are anticipated to

Replace "Reserved" in section 20-1.03E of the RSS for section 20 with:

Do not perform planting work in cultivated areas for a period of 30 days after:

1. Cultivation is complete
2. Irrigation systems have been installed

For cultivated areas, keep the soil sufficiently moist to germinate weeds. Weeds that germinate must be controlled by the use of pesticides.

Add to section 20-2.01A(3)(a) of the RSS for section 20:

Submit a watering schedule for each controller.

Replace the 3rd paragraph of section 20-2.01A(4)(b)(i) of the RSS for section 20 with:

Supply lines on the discharge side of the valve must be tested in conformance with Method B only. Testing by Method A is not allowed.

After supply lines on the upstream side of the valve have been backfilled to 12 inches on top with fittings locations exposed, each section of pipe on the upstream side of the valve must be tested in conformance with Method A.

Add to section 20-2.01A(4)(d) of the RSS for section 20:

Perform two functional tests, one without and one with connection to the remote irrigation controller system base station. Demonstrate in both tests that systems and components operate.

Include all irrigation equipment in both tests. Second test must include radio connection to central computer, flow alarms for high, low, zero, and maximum mainline flows.

Perform the first test before planting, without connection to the central controller base station. Plant in the areas watered by the irrigation system after completion of a satisfactory functional test and correction of any deficiencies.

Perform second test before starting plant establishment.

Add to section 20-2.03B(2) of the RSS for section 20:

Prime the backflow preventer components, including pipes, brass, and bronze parts, with rust preventative paint. Paint the components to match the City of Burlingame green referee sample after the backflow preventer is assembled. Do not paint test cocks, wheel stems, or other turning mechanisms.

Replace section 20-2.03B(4) of the RSS for section 20 with:

Each backflow preventer enclosure must be:

1. Weather resistant and fabricated from 1/8-inch thick marine grade solid sheet aluminum with stainless steel hardware
2. Secured to flush mounted stainless steel locking mechanism with padlock access
3. Sized to fit over backflow preventer and allow room for access, minimum size 45 inches long x 15 inches wide x 30 inches high
4. Factory powder coated by the manufacturer to match City of Burlingame green referee sample

The Engineer will supply the padlock.

Replace "Reserved" under section 20-2.05A(3) of the RSS for section 20 with:

Submit a schedule of values for control and neutral conductors. Submit the schedule after the wiring plans and diagrams for the electrical components of the irrigation system, except electrical service, have been authorized.

The unit descriptions shown in the table are the minimum. You may include additional unit descriptions. Include the quantity, value, and amount for those additional unit descriptions.

Use the authorized wiring plan and diagrams to determine the quantities required to complete the work.

No adjustment in compensation is made in the contract lump sum price paid for control and neutral conductors work due to differences between the quantities shown in the schedule of values for control and neutral conductors work and the quantities required to complete the work.

Schedule of Values for Control and Neutral Conductors

| Contract no. 04-235844 | | | | |
|---|------|----------------------|-------|--------|
| Unit description | Unit | Approximate quantity | Value | Amount |
| AWG (UF) conductors (provide size) | LF | | | |
| AWG (UF) conductors (provide size) | LF | | | |
| AWG (UF) conductors (provide size) | LF | | | |
| AWG armor-clad conductors | LF | | | |
| AWG armor-clad conductors | LF | | | |
| AWG armor-clad conductors | LF | | | |
| No. 5 or larger pull box | EA | | | |
| Splices | EA | | | |
| Sprinkler control conduit (provide size) | LF | | | |
| Flow sensor cable in conduit | LF | | | |

Total _____

Add to section 20-2.06B of the RSS for section 20:

Flow sensor cable must be rated 600V and 194 degree F, be UL listed as Type TC, meet requirements of ICEA/NEMA, and comply with the following:

1. Consist of two no. 14 minimum stranded copper conductors. Insulated conductor must be color coded with a PVC or nylon jacket.
2. Include a tinned cooper braid or aluminized polyester film shield. Where the film is used, a no. 18 (or larger stranded) or no. 16 (solid), tinned, copper drain wire to be placed between the insulated conductors and the shield and in contact with the conductive surface of the shield.
3. Include a black PVC jacket with a minimum nominal thickness of either 50 mils or 48 mils where capacitance of conductors to other conductors and the shield is 87 pF/ft or better. The cable jacket must be marked with the insulation type designation, conductor size, and voltage and temperature ratings.

4. Have an outside diameter of .28 to .51 inch.
5. Have no splices between components except where shown.
6. Installed within a 3/4" Schedule 40 conduit.

Flow sensor must monitor real time flow of water.

Flow sensor must be compatible and interface with irrigation controller.

Replace item 1 in the 1st paragraph of section 20-2.07B(2)(a) of the RSS for section 20:

1. Be a remote irrigation control system (RICS) consisting of a field irrigation controller that communicates by radio to the existing base station.

Replace the 4th paragraph in section 20-2.07B(2)(a) of the RSS for section 20 with:

RICS Field irrigation controllers must include irrigation controller, communication equipment and a central control interface installed in a pedestal mounted irrigation controller enclosure cabinet. Solar (non-RICS) irrigation controller must include rain sensor. The manufacturer installs the RICS irrigation controllers in the stainless steel enclosure cabinets and provides the stainless steel pedestals.

Add to section 20-2.07B(2)(a) of the RSS for section 20:

Field irrigation controllers monitor the main line flows when operating with, or independently of, the base station. Link the field controllers installed in groups to share a common communication unit with the base station. Field controllers must be compatible with City's central computer base station.

Provide the following for field irrigation controllers and central control interfaces:

1. Output that energizes the remote control valve (master) in addition to the normal stations.
2. Interfaces and a terminal strip labeled for each sensor:
 - 2.1 Flow sensor with cable connection to controller in conduit
3. Monitor sensors.
4. Receiving programs downloaded from the base station and retained as resident programs.
5. Provide manual operation allowing cycle start at the desired station and activation of a single station.
6. Display on control panel the station number and watering time of the station currently operating.
7. Programmability to monitor flow rate selection of:
 - 7.1 Percent-high flow
 - 7.2 Percent-low flow
 - 7.3 Provisions for supply line fill time
8. Closing of remote control valve (master), shutting off pumps and remote control valves when flow rates are exceeded on main lines or through remote control valve (as determined by entered parameters). Conduct a series of test steps to determine one of the following and take the corresponding action when an excess high flow is determined by the field unit:
 - 8.1 Mainline break or stuck open remote control valve: Entire irrigation system shuts down.
 - 8.2 Lateral line break or missing sprinklers: Operating remote control valves shut down. Irrigation program continues to the next scheduled remote control valve.
9. Time delay feature to prevent an instantaneous response to a temporary surge at start-up or momentary system condition.
10. Log and upload field unit activities (alarms) to the base station upon base station request in real-time and scheduled unattended time:
 - 10.1. Low flow alarm: Actual flow is less than the percent-low and the supply line fill time has passed.
 - 10.2 High flow alarm: Actual flow is greater than the percent-high and the supply line fill time has passed.
 - 10.3 No actual flow detected and the supply line fill time has passed.
11. Protection fuses or circuit breakers for field units and low voltage output source.
12. Low voltage control and neutral conductors plug and receptacle connectors located in the irrigation controller enclosure for the field controller panel and circuit board.

13. Direct burial conductors connected to the terminal strips with the proper size open-end crimp-on wire terminals. Exposed wire must not extend beyond the crimp of the terminal. Wires must be parallel on the terminal strip.
14. Nonvolatile memory or a rechargeable battery for program protection.
15. Lithium battery or a rechargeable battery back-up for the clock and to prevent data loss during power failure.
16. Current operation manual.
17. Current software compatible with Department central computer for communications between central computer and field unit or web enabled device.

Inputs and outputs of the communication system must be lightning, transient, and surge protected, including power, antenna, and control connections. Provide proper length grounding rod.

The communication equipment for the field units must have a 2-way data communication link with the City's base station by radio and must include separate Yagi antennas grounded and attached to galvanized steel poles painted black with exterior weather resistant paint and antenna cable in conduits to connection in controllers. Locate antennas in planting areas away from roads and sidewalks.

The City's RICS base station central computer is located at the park maintenance yard, 420 Carolan Avenue, Burlingame, CA, telephone (650) 558-7330.

Coordinate field controller communication via radio to base station with the Engineer.

Provide a minimum of 60 hours of classroom and field training for 4 personnel on the use and adjustment of the base station equipment (including software) and field units. Conduct the training over 8 consecutive working days, unless otherwise permitted by the Engineer. Provide 1 complete set of training documentation and training aids to each trainee and 2 sets to the Engineer (if videos are included in the training sessions, only one reproducible video copy will be required). The training materials will become City property.

Before the irrigation system functional test begins, furnish 2 remote access devices.

The City RICS irrigation controllers must be manufactured by Calsense and must have 2-way communication by radio. The vendor must install any necessary software and conduct any initial software or proprietary website setup configuration for communications between controller and any web-enabled device.

You may obtain specified equipment listed below from:

Company: Imperial Sprinkler Supply
Address: 6630 Patterson Pass Road, Livermore, CA, 94550
Business phone number: 925.667.2190
Mobile phone number: 925.518.0349
Email address: mikeb@imperialsprinkler.com

The Department has obtained quoted prices excluding sales tax and delivery for the equipment shown in the following table:

| Equipment description | Quoted price | Quantity | Extended price | Controller identification |
|--|--------------|----------|----------------|--|
| ET2000E-24-LR-(LR-YAGI)-(LMR-400DB-30)-RRE-SSE-R (POLE NOT INCLUDED) | \$7,544.04 | 1 | \$7,544.04 | Calsense Controller ISS Quote 1858325 |
| ET2000E-40-LR-(LR-YAGI)-(LMR-400DB-30)-RRE-SSE-R (POLE NOT INCLUDED) | \$8559.83 | 1 | \$8,559.83 | Calsense Controller ISS Quote 1858325 |
| LEIT-4008 / MCOL-4000L / ENCL-4000 / LEIT-KEYS / MINICLIK / SKIT-8821-4 / LEMA-1600HE / 30-926 | \$1,546.58 | 1 | \$1,546.58 | DIG 8 ST LEIT Energized Controller / 48" Mounting Column / DIG SS Enclosure / 2 DIG LEIT Keys for Programming / Hunter MINICLIK Rain Sensor / DIG Rain Sensor Adaptor Kit / 6 DIG Solenoids / 6 DIG Adaptors for Rain Bird Valves. Specify kind needed at time of order. / ISS Quote 1858325 |

These prices are good until December 31, 2014.

Delete items 2.1, 2.2, and 2.3 in the list in the 1st paragraph of section 20-2.07B(3) of the RSS for section 20.

Replace item 6 in the list in the 1st paragraph in section 20-2.07B(3) of the RSS for section 20 with:

6. Have door locks with a removable-core mortise cam cylinder door lock compatible with the City of Burlingame lock core and a different lock core for the Crowne Plaza irrigation controller enclosure cabinet. Keys must be removable from the locks in the locked position only. Install door locks in conformance with the manufacturer's written instructions. Furnish 2 keys for each door lock to the Engineer.

Add to section 20-2.07B(3) of the RSS for section 20:

A single irrigation controller enclosure cabinet for a RICS irrigation controller must be 38 inches high by 14 inches wide by 12 inches deep.

A single irrigation controller enclosure cabinet with mounting column, for a non-RICS solar irrigation controller, must be 11 inches high by 7-1/2 inches wide by 4 inches deep mounted on a 48-inch tall column.

Replace section 20-2.09B(4) of the RSS for section 20 with:

20-2.09B(4) Plastic Pipe Irrigation Lines

Plastic pipe irrigation lines used for dripline must be polyethylene pipe and comply with ASTM D 2737, Type 1, Class C. Plastic pipe irrigation lines must include welded emitters impregnated with an EPA approved root inhibiting chemical. Emitters within the lines must be on a 12-inch spacing.

Wall thickness of polyethylene pipe must comply with the following requirements when tested under ASTM D 2122:

| Pipe size, nominal (inch) | Minimum wall thickness ^a (inch) | Maximum wall thickness ^a (inch) |
|---------------------------|--|--|
| 5/8 | 0.045 | 0.075 |

^aAs measured at any point on the cross-section

The polyethylene pipe must provide leak-free, non-separating connections suitable for the purpose intended when connected to the fittings specified.

Fittings for polyethylene pipe must be a barbed fitting with an outer diameter locking ring and recommended by the manufacturer of the polyethylene pipe. Fittings must provide a positive pipe-to-fitting connection that will not separate at the designed pressure.

Replace section 20-2.09C(3) of the RSS for section 20 with:

20-2.09C(3) Plastic Pipe Irrigation Lines

Plants rootballs must be irrigated by emitters.

Secure plastic pipe irrigation lines on grade with "U" staples. Do not pinch plastic pipe irrigation lines with staples.

Cover plastic pipe irrigation lines with mulch.

Replace the 1st paragraph in section 20-2.11B(2) of the RSS for section 20 with:

Ball valve must be PVC or chlorinated PVC and must comply with the requirements shown in the following table:

| Property | Requirements |
|---|-------------------------|
| Nonshock working pressure for 3/4 to 4 inch valves, min | 235 psi |
| Nonshock working pressure for 6 inch valves, min | 150 psi |
| Seats | PTFE |
| O-ring seals | EPDM or fluoroelastomer |

Replace item 2 in the list in the 1st paragraph in section 20-2.11B(10)(a) of the RSS for section 20 with:

2. Be glass filled nylon with angle pattern or straight pattern.

Add to section 20-2.11B of the RSS for section 20:

20-2.11B(12) Flushing Valves

Flushing valves flush debris and sediment from the plastic pipe irrigation lines.

Flushing valves must be fully compatible with plastic pipe irrigation dripline.

Add to section 20-3.01A(1) of the RSS for section 20:

Before starting planting work:

1. Site improvements must be complete before soil amendment installation and cultivation starts.
2. Before installing soil amendment and digging plant holes, verify and stake the locations of any underground utilities.
3. If utilities are in conflict with plant holes, review with Engineer.

Add to section 20-3.01A(3)(b) of the RSS for section 20:

Some plants required may not be readily available and must be grown specifically for this project. Submit a statement within 30 days after Contract approval from the vendor that the order to grow the plants, including inspection plants and replacement plants, has been received and accepted by the vendor. The statement from the vendor must include the plant names, sizes, and quantities and the anticipated delivery date. Notify the Engineer when the vendor has started growing the plants.

Vendors must have grown 48 inch and 60 inch box trees at least 500 days before planting. All other plants must have been grown 180 days before planting.

Replace the 2nd sentence in the 1st paragraph of section 20-3.01B(3) of the RSS for section 20 with:

Soil amendment must be compost.

Replace item 4 in the 2nd paragraph of section 20-3.01B(7) of the RSS for section 20 with:

4. Be at least 2 feet wide and 3 feet in depth.

Add to section 20-3.01B of the RSS for section 20:

20-3.01B(12) Guy Wire Assembly

Guy wire assembly must consist of the following:

1. 8 gauge galvanized cables
2. Galvanized clamps with loops
3. 1-5/16 by 6 inch long compression spring-3 rod with a safe load of 532 lbs
4. 5/16 by 8 inch galvanized turnbuckle with eye and jaw
5. Schedule 40 white PVC pipe covering turnbuckle and compression spring
6. 4 by 4 by 36 inch long construction heart redwood deadman

Add to the 1st paragraph of section 20-3.02A(3) of the RSS for section 20:

3. The days and times each week when work is to be conducted.

Replace the 2nd paragraph of section 20-3.02C(4) of the RSS for section 20:

Control weeds within the existing planted area and:

1. From the existing planted area limit to the adjacent edges of paving and fences
2. Within a 3-foot radius from each existing tree and shrub
3. From paved surfaces including sidewalks and curbs that are adjacent to maintain existing planting areas

Add to section 20-3.02C(4) of the RSS for section 20:

After deficiencies are corrected, perform work to maintain existing planted areas in a neat and presentable condition and to promote healthy plant growth.

Control weeds under section 20-1.03C(3).

Pesticides used for maintaining existing planted areas must comply with section 20-1.02C.

Water plants automatically if the new irrigation system for that area is operational.

Prune existing plants as ordered. Pruning existing plants is change order work.

Add to section 20-3.03C(2) of the RSS for section 20:

Perform percolation tests in tree planting holes. Percolation tests must include the following steps:

1. Fill tree plant holes with water to test percolation rate.
2. Minimum acceptable percolation rate is 1 inch per hour.
3. If hole does not drain at the minimum rate and at the Engineer's authorization, install 3 6-inch diameter by 4-foot deep auger holes equally spaced a minimum of 3 feet apart tree plant hole.
4. Backfill augered holes with washed 3/4-inch crushed rock and cover with filter cloth.

Do not auger holes where water table is high.

Auger holes will be paid for as change order work.

Add to the 4th paragraph of section 20-3.03C(3)(a) of the RSS for section 20:

Root barriers must be continuous without gaps. Replace cracked and damaged root barriers.

Replace the 1st sentence of the 1st paragraph for section 20-3.03C(3)(b) with:

After preparing holes, backfill as shown.

Add to section 20-3.03C(3)(b) of the RSS for section 20:

Use excavated amended topsoil from plant hole for shrub backfill. For tree backfill from the bottom of plant hole to 12 inches from the top of plant hole must be imported topsoil. For the top 12 inches of backfill at trees, use the top 12 inches of amended topsoil from the plant hole.

Add to section 20-4.01A of the RSS for section 20:

The plant establishment period must be Type 2.

Replace the 3rd paragraph in section 20-4.03A of the RSS for section 20 with:

Turf areas are not required to be trimmed and mowed.

Add to section 20-4.03C of the RSS for section 20:

Apply organic fertilizer to the plants during the 1st week of March and September of each year.

Replace section 20-4.03D of the RSS for section 20 with:

Control weeds under section 20-1.03C(3) and by:

1. Hand pulling:
 - 1.1. In plant basins and on basin walls
 - 1.2. In ground cover planting areas without plant basins
2. Killing:
 - 2.1. In mulched areas and ground cover planting areas outside of plant basins
 - 2.2. In planting areas without ground cover plantings or located outside of ground cover areas
 - 2.3. In ground cover planting areas without plant basins
 - 2.4. Within medians, pavement, curbs, sidewalks, and other surfaced areas

Submit a certificate of compliance for compost at least 5 days before obtaining. Certificates of compliance must include:

1. Soil Test Results for compost. Soil test must meet the following requirements:
 - 1.1. Noxious and invasive weed seed check
 - 1.2. Soil Fertility: Half-saturation %, pH, salinity, nitrate, ammonium, phosphate, potassium, calcium, magnesium
 - 1.3. Agricultural Suitability: pH, salinity, boron, Sodium Absorption Ratio (SAR), using saturation paste extract
 - 1.4. Particle Size/Appraisal: pH, salinity, organic %, USDA Particle size
 - 1.5. A06-2 percolation rate
 - 1.6. Fecal coliform
 - 1.7. Heavy metals
 - 1.8. Recommendations for the rate of compost application
 - 1.9. Recommendations on the type and amount of fertilizer for the project
 - 1.10. Soil test must be prepared within 60 days of obtaining compost
2. Information on the soil laboratory that prepared the Soil Test Results
3. Grade of compost
4. Weight of compost
5. Source of compost
6. Anticipated delivery date of compost
7. A statement from the soil laboratory stating they have reviewed the planting plans and the planting specifications for this project
8. Compost producer's technical data sheet including the list of product ingredients
9. A copy of the compost producer's Seal of Testing Assurance certification

Submit a sample of imported biofiltration soil at least 5 days before obtaining from supplier.

Submit a certificate of compliance for imported biofiltration soil at least 5 days before obtaining. Certificates of compliance must include:

1. Soil Test Results for imported biofiltration soil including the following:
 - 1.1. Germination (bio-assay) test
 - 1.2. Noxious and invasive weed seed check
 - 1.3. Soil Fertility: Half-saturation %, pH, salinity, nitrate, ammonium, phosphate, potassium, calcium, magnesium
 - 1.4. Agricultural Suitability: pH, salinity, boron, Sodium Absorption Ratio (SAR), using saturation paste extract
 - 1.5. Particle Size/Appraisal: pH, salinity, organic %, USDA Particle size
 - 1.6. A06-2 percolation rate
 - 1.7. Recommendations from the soil laboratory with project-specific requirements for improving plant health and vigor
2. Source of imported biofiltration soil
3. Letter stating the imported biofiltration soil tested by the soil laboratory is the same being delivered to the site
4. A statement from the soil laboratory stating they have reviewed the planting plans and the planting specifications for this project
5. Grain size analysis of sand under section 21-1.02N

Submit soil fertility recommendations for existing topsoil. Soil fertility recommendations must include:

1. Soil Test Results for existing topsoil including:
 - 1.1. Germination (bio-assay) test
 - 1.2. Soil Fertility: Half-saturation %, pH, salinity, nitrate, ammonium, phosphate, potassium, calcium, magnesium
 - 1.3. Agricultural Suitability: pH, salinity, boron, Sodium Absorption Ratio (SAR), using saturation paste extract
 - 1.4. Particle Size/Appraisal: pH, salinity, organic %, USDA Particle size.
 - 1.5. A06-2 percolation rate

- 1.6. Recommendations from the soil laboratory with project specific requirements for improving plant health and vigor
- 1.7. Recommendations from the soil laboratory for compost and fertilizers to bring the soil organic matter to a minimum of 5%
2. Include a statement from the soil laboratory stating they have reviewed the planting plans and the planting specifications for this project

Add to section 21-1.01C:

Test imported topsoil, compost, imported biofiltration soil, and existing topsoil using an approved commercial soil laboratory. Approved soil laboratories include:

1. Soil and Plant Laboratory in Santa Clara, California
2. Fruit Growers Laboratory Environmental in Santa Paula, California

Replace item 2 in the 2nd paragraph of section 21-1.02D with:

2. Imported topsoil must be free from wood, deleterious substances such as litter, refuse, toxic waste, stones larger than 1 inch in size, coarse sand, heavy or stiff clay, brush, sticks, grasses, roots, noxious weed seed, weeds, and other substances detrimental to plant, animal, and human health. Obtain from well-drained arable and fertile agricultural land.

Add to item 2 in the 2nd paragraph for section 21-1.02D:

Imported topsoil must be sandy loam, sandy clay loam, or loam, by particle examination, containing the following physical texture:

| Class | Particle Size Range | Minimum % | Maximum % |
|------------------|-----------------------|-------------------|-----------|
| Coarse Sand | 0.02 inch - 0.08 inch | 0% | 15% |
| Silt | 0.002 - 0.05 inch | 10% | 30% |
| Clay | 0 - 0.002 inch | 10% | 25% |
| Gravel | 0.08 inch - 1 inch | 0% | 15% |
| Rock | 0.00 inch - 1 inch | 5% max. by volume | |
| Organic Material | | 0% | 15% |

Imported topsoil must meet the following chemical analysis:

| Properties | Test Method | Requirement |
|-------------|---------------------------------------|---|
| Salinity | Saturation Extract Conductivity (Ece) | less than 3.0 dS/m @ 25°C |
| Silt Sodium | Sodium Adsorption Ratio (SAR) | less than 6.0 |
| Boron | Saturation Extract Concentration | less than 1.0 ppm |
| Reaction | Ph of Saturated Paste | between 7.5 - 7.8 without high lime content |

Imported topsoil must contain sufficient quantities of available nitrogen, phosphorus, potassium, calcium and magnesium to support normal plant growth which is determined by the soil test. If there are nutrient inadequacies, add materials recommended by the soil report materials and these special provisions before planting.

Imported topsoil must have a percolation rate between 1 and 3 inches per hour.

Replace the row for soluble salts content in the table in the 4th paragraph of section 21-1.02M with:

Compost

| Property | Test method ^a | Requirement |
|---------------|---|-------------|
| Soluble salts | TMECC 04.10-A Electrical conductivity 1:5 slurry method dS/m (mmhos/cm) | 0-4 |

Replace "Reserved" in section 21-1.02N with:

21-1.02N Imported Biofiltration Soil

Saturated hydraulic conductivity for imported biofiltration soil must be at least 5 inches per hour.

Imported biofiltration soil must be a mixture of the following:

1. 4 parts sand
2. 2 parts compost
3. 1 part topsoil

Sand must be free of wood, waste, coating such as clay, stone dust, carbonate, or any other deleterious material. All aggregate passing No. 200 sieve size must be non-plastic. Sand must be graded within the following limits:

| Sieve Size | Percentage Passing |
|------------|--------------------|
| 3/8" | 100 |
| No. 4 | 90 - 100 |
| No. 8 | 70 - 100 |
| No. 16 | 40 - 95 |
| No. 30 | 15 - 70 |
| No. 40 | 5 - 55 |
| No. 100 | 0 - 15 |
| No. 200 | 0 - 5 |

Perform grain size analysis of the sand component under ASTM D 422.

Compost must comply with section 21-1.02M.

Topsoil must comply with section 21-1.02D.

Add to section 21-1.03D:

Before placing imported topsoil, test medians for water percolation. In the "BYSH" Line and "RLN" Line medians, test the subgrade areas every 50 feet. To test for percolation, dig a 12 inch wide and 12 inch deep hole after the median is excavated. Mark and number test locations on the planting plans. At the start of the construction work day fill hole to the top with water. Measure and record depth of water after 4 hours at each hole location. If less than 4 inches of water has drained out from any of the test locations, the Engineer. Auger holes or additional excavation may be required before installation of topsoil. Augered holes and additional excavation is change order work.

In the "BWY" Line medians, test subgrade under each tree location for percolation. Percolation tests must comply with section 20-3.03C(2).

Rip subgrade to a minimum 12-inch depth. Install topsoil in 6-inch lifts. Rototill first lift into surface of subgrade material. Do not mechanically compact soils with heavy machinery and compactors like sheep's foot during placement. Water-settle topsoil layers and lightly roll each layer after placement. Do not saturate soils with water.

Add to section 39-1.03B:

For the mix design of HMA Type A produced under the QC/QA construction process, determine the plasticity index of the aggregate blend under California Test 204. Choose an antistripping treatment and use the corresponding laboratory procedure for the mix design based on the antistripping treatments shown in the following table:

| Antistripping treatment | Laboratory procedure |
|--|----------------------|
| Plasticity index from 4 to 10 ^a | |
| Dry hydrated lime with marination | LP-6 |
| Lime slurry with marination | LP-7 |
| Plasticity index less than 4 | |
| Liquid | LP-5 |
| Dry hydrated lime without marination | LP-6 |
| Dry hydrated lime with marination | LP-6 |
| Lime slurry with marination | LP-7 |

^a If the plasticity index is greater than 10, do not use that aggregate blend.

For the mix design of HMA Type A produced under the QC/QA construction process, determine the tensile strength ratio under California Test 371 on untreated HMA. If the tensile strength ratio is less than 70:

1. Choose from the antistripping treatments specified based on the plasticity index
2. Test treated HMA under California Test 371
3. Treat to a minimum tensile strength ratio of 70

Determine the OBC for RHMA-G at 5 percent air voids under California Test 367. The OBC must be greater than or equal to 7.5 percent based on the total weight of mix.

Do not test HMA-O aggregate for plasticity index and tensile strength ratio.

Add to section 39-1.11D of the RSS for section 39-1.11:

Pave shoulders and median borders adjacent to the lane before opening a lane to traffic.

Place additional HMA along the pavement's edge to conform to road connections and driveways. Hand rake, if necessary, and compact the additional HMA to form a smooth conform taper.

Replace the headings and paragraphs in section 39-1.12 with:

39-1.12A General

Section 39-1.12 includes specifications for measuring pavement smoothness with an inertial profiler (IP) and straightedge, analyzing the data with FHWA's engineering software ProVAL, and correcting deficient smoothness.

The RSS for sections 39-1.12 and 39-1.12C do not apply.

Test pavement smoothness using an IP except use a 12-foot straightedge at the following locations:

1. Traffic lanes less than 1,000 feet in length including ramps, turn lanes, and acceleration and deceleration lanes
2. HMA pavement within 3 feet from and parallel to the construction joint formed between curbs, gutters, or existing pavement
3. Areas within 15 feet of manholes
4. Shoulders
5. Weigh-in-motion areas
6. Miscellaneous areas such as medians, gore areas, turnouts, and maintenance pullouts

Where IP testing is required, pavement smoothness for each lane must be determined by the international roughness index (IRI) for the left and right wheel paths in an individual lane and then averaging the results. The average of the IRIs from the left and right wheel paths for the same lane is the mean roughness index (MRI) of the lane. The wheel paths are a pair of lines 3 feet from and parallel to the edge of a lane. Left and right wheel paths are based on the direction of travel.

Where IP testing is required, identify areas of localized roughness. Areas of localized roughness must be identified using the ProVAL smoothness assurance analysis by calculating continuous IRI for each wheel path with a 25-foot interval.

Collect profiling data under AASHTO R 56 and analyze data using 250 mm and IRI filters.

Interpret references to "must-grinds" as "localized roughness" and "PI₀" as "MRI" in the RSS for section 39.

39-1.12B Submittals

At least 5 business days before start of initial profiling or changing profiler or operator, submit:

1. IP certification issued by the Department. The certification must be not more than 12 months old.
2. Operator certification for the IP issued by the Department. The operator must be certified for each different model of IP device operated. The certification must be not more than 12 months old.
3. List of manufacturer's recommended test procedures for IP calibration and verification.

As an alternative to the IP and operator certification by the Department, an equivalent certification from the Texas Transportation Institute will be accepted if the certification is dated before July 1, 2013 and is not more than 12 months old.

Within 2 business days after cross correlation testing, submit ProVAL profiler certification analysis report for cross correlation test results performed on test section to the Engineer and to the electronic mailbox address:

smoothness@dot.ca.gov

Within 2 business days after each day of inertial profiling, submit profile data to the Engineer and to the electronic mailbox address:

smoothness@dot.ca.gov

The profiling data must include:

1. Raw profile data for each lane.
2. ProVAL ride quality analysis report for IRIs of left and right wheel paths of each lane. Submit in pdf file format.
3. ProVAL ride quality analysis report for MRIs of each lane. Submit in pdf file format.
4. ProVAL smoothness assurance analysis report for IRIs of left wheel path. Submit in pdf file format.
5. ProVAL smoothness assurance analysis report for IRIs of right wheel path. Submit in pdf file format.
6. GPS data file for each lane in GPS exchange. Submit in GPS eXchange file format.
7. Manufacturer's recommended IP calibration and verification tests results.
8. AASHTO IP calibration and verification test results including bounce, block, and distance measurement instrument (DMI).

Submit the raw profile data in unfiltered electronic pavement profile file (PPF) format. Name the PPF file using the following naming convention:

YYYYMMDD_TTCCRRR_D_L_W_S_X_PT.PPF

where:

YYYY = year

MM = Month, leading zero

DD = Day of month, leading zero

TT = District, leading zero

CCC = County, 2 or 3 letter abbreviation as shown in section 1-1.08

RRR = Route number, no leading zeros

D = Traffic direction as NB, SB, WB, or EB

L = Lane number from left to right in direction of travel

W = Wheel path as "L" for left, "R" for right, or "B" for both

S = Beginning station to the nearest foot (i.e., 10+20) or beginning post mile to the nearest hundredth (i.e., 25.06) no leading zero

X = Profile operation as "EXIST" for existing pavement, "INTER" for after prepaving smoothness correction, "PAVE" for after paving, and "CORR" for after final surface pavement correction

PT = Pavement type (i.e., HMA, RHMA, HMA-O, RHMA-O, RHMA-G, etc.)

Within 2 business days of performing straightedge measurements, submit areas requiring smoothness correction. Identify locations of smoothness correction by:

1. Location Number
2. District-County-Route
3. Beginning station or post mile to the nearest 0.01 mile
4. For correction areas within a lane:
 - 4.1. Lane direction as NB, SB, EB, or WB
 - 4.2. Lane number from left to right in direction of travel
 - 4.3. Wheel path as "L" for left, "R" for right, or "B" for both
5. For correction areas not within a lane:
 - 5.1. Identify pavement area (i.e., shoulder, weight station, turnout)
 - 5.2. Direction and distance from centerline as "L" for left or "R" for right
6. Estimated size of correction area

39-1.12C Inertial Profiler Calibration and Verification Tests

IP equipment must display a current certification decal with expiration date.

Operate the IP according to the manufacturer's recommendations and AASHTO R 57 at 1-inch recording intervals.

Notify the Engineer 2 business days before performing IP calibration and verification testing.

Conduct the following IP calibration and verification tests in the Engineer's presence each day before performing inertial profiling:

1. Block test. Verify the height sensor accuracy under AASHTO R 57, section 5.3.2.3.
2. Bounce test. Verify the combined height sensor and accelerometer accuracy under AASHTO R 57, section 5.3.2.3.2.
3. DMI test. Calibrate the accuracy of the testing procedure under AASHTO R 56, section 8.4.
4. Manufacturer's recommended tests.

Conduct cross correlation IP verification test in the Engineer's presence before performing initial profiling. Verify cross correlation IP verification test at least annually. Conduct 5 repeat runs of the IP on an authorized test section. The test section must be on an existing asphalt concrete pavement surface 0.1 mile long. Calculate a cross correlation to determine the repeatability of your device under Section 8.3.1.2 of AASHTO R 56 using ProVAL profiler certification analysis with a 3 feet maximum offset. The cross correlation must be a minimum of 0.92.

For each 0.1 mile section, your IRI values must be within 10 percent of the Department's IRI values. The Engineer may order you to recalibrate your IP equipment and reprofile. If your results are inaccurate due to operator error, the Engineer may disqualify your IP operator.

39-1.12D Acceptance Criteria

For areas that require pavement smoothness determined using an IP, the pavement surface must:

1. Have no areas of localized roughness with an IRI greater than 120 in/mi
2. Comply with the MRI requirements shown in the following tables for a 0.1 mile section:

HMA^a Pavement Smoothness Acceptance Criteria

| HMA thickness | MRI requirement |
|---------------|------------------|
| > 0.20 foot | 60 in/mi or less |
| ≤0.20 foot | 75 in/mi or less |

^a Except OGFC

OGFC Pavement Smoothness Acceptance Criteria

| OGFC placement on | MRI requirement |
|----------------------------------|------------------|
| New construction, or HMA overlay | 60 in/mi or less |
| Existing pavement | 75 in/mi or less |
| Milled surface | 75 in/mi or less |

For areas that require pavement smoothness determined using a 12-foot straightedge, the HMA pavement surface must not vary from the lower edge of the straightedge by more than:

1. 0.01 foot when the straightedge is laid parallel with the centerline
2. 0.02 foot when the straightedge is laid perpendicular to the centerline and extends from edge to edge of a traffic lane
3. 0.02 foot when the straightedge is laid within 24 feet of a pavement conform

Pavement smoothness may be accepted based on your testing in the absence of the Department's testing.

39-1.12E Smoothness Testing

39-1.12E(1) General

Notify the Engineer of start location by station and start time at least 2 business days before performing smoothness testing.

Remove foreign objects on the pavement surface before testing.

Mark the beginning and ending station on the pavement shoulder before testing. Stationing must be the same when profiling more than one surface.

39-1.12E(2) Inertial Profiler

While collecting the profile data to determine IRI, record the following locations in the raw profile data:

1. Begin and end of all bridge approach slabs
2. Begin and end of all bridges
3. Begin and end of all culverts visible on the roadway surface

Determine the MRI for each 0.1-mile fixed interval using the ProVAL ride quality analysis. Profile the left and right wheel paths of each lane. Calculate the MRI of each lane. A partial section less than 0.1 mile

that is the result of an interruption to continuous pavement surface must comply with the MRI specifications for a full section. Adjust the MRI for a partial section to reflect a full section based on the proportion of a section paved.

Determine the areas of localized roughness using a continuous IRI for each wheel path with a 25-foot interval. Localized roughness greater than 120 in/mi must be corrected regardless of the IRI values of a 0.1-mile section.

Determine the MRI of the HMA, except OGFC. If the MRI of the final pavement surface is greater than the MRI acceptance requirement in the table titled "HMA Pavement Smoothness Acceptance Criteria" in section 39-1.12D, correct to the MRI acceptance requirement in the table.

The final surface of HMA must meet MRI acceptance requirements in the table titled "HMA Pavement Smoothness Acceptance Criteria" in section 39-1.12D before placing OGFC.

Determine the MRI of the OGFC. If OGFC MRI is greater than the accepted value in the table titled "OGFC Pavement Smoothness Acceptance Criteria" in section 39-1.12D, correct to the MRI acceptance requirement in the table.

39-1.12E(3) Straightedge

Measure areas that require 12-foot straightedge. If the straightedge measurement is greater than the accepted value in section 39-1.12D, correct to the acceptance requirement.

39-1.12F Smoothness Correction

If the final surface of the pavement does not comply with section 39-1.12D, grind the pavement to within specified tolerances, remove and replace it, or place an overlay of HMA. Do not start corrective work until your method is authorized.

Smoothness correction of the final pavement surface must leave at least 75 percent of the specified HMA thickness. If ordered, core the pavement at the locations determined by the Engineer. Coring, including traffic control, is change order work. Remove and replace deficient pavement areas where the overlay thickness is less than 75 percent of the thickness specified as determined by the Engineer.

If you choose to correct OGFC, the Engineer determines if the corrective method causes raveling. OGFC that is raveling must be removed and replaced.

Corrected HMA pavement areas must be uniform rectangles with edges:

1. Parallel to the nearest HMA pavement edge or lane line
2. Perpendicular to the pavement centerline

On ground areas not to be overlaid with OGFC, apply fog seal coat under section 37-2.

Where corrections are made within areas requiring testing with IP, reprofile the entire lane length with the IP device.

Where corrections are made within areas requiring testing with a 12-foot straightedge, retest the corrected area with the straightedge.

39-1.12G Prepaving Inertial Profiler

Section 39-1.12G applies to existing asphalt concrete areas receiving an HMA overlay or OGFC. Comply with section 39-1.12A–39-1.12C and 39-1.12E.

Before starting paving operations, perform prepaving IP measurements. Prepaving IP includes taking profiles of the existing pavement, analyzing the data with ProVAL to determine existing pavement IRI, MRI, and areas of localized roughness.

Identify areas of localized roughness greater than 140 in/mi.

39-1.12H Prepaving Grinding

Section 39-1.12H applies to existing asphalt concrete areas receiving an HMA overlay of less than or equal to 0.20 foot.

After performing prepaving inertial profiling, correct areas of localized roughness greater than 140 in/mi.

Prepaving grinding day includes correcting areas of localized roughness, taking profiles of the corrected areas, and submitting profile data as specified in section 39-1.12B.

Notify the Engineer of those areas of localized roughness that cannot be corrected by prepaving grinding. The Engineer responds to your notification within 5 business days.

For those areas of localized roughness that cannot be corrected by grinding, the Engineer may order you to either (1) not correct the areas of localized roughness or (2) correct areas of localized roughness by a different method and take profiles of the corrected areas with an IP. Corrective work performed by a different method, including taking profiles of the corrected areas and associated traffic control, is change order work.

Correct prepaving areas of localized roughness that you predict will cause the final surface of HMA pavement to be noncompliant with the smoothness specifications. After correcting prepaving areas of localized roughness, take profiles of the corrected area and submit profile data as specified in section 39-1.12B.

Dispose of grinding residue.

Pave within 7 days of correcting areas.

The final pavement surface must comply with section 39-1.12D.

If ordered not to correct areas of localized roughness, the smoothness specifications do not apply to the final pavement surface placed in those areas.

Add to section 39-1.14:

In median areas adjacent to slotted median drains, each layer of HMA must not exceed 0.10 foot maximum compacted thickness.

Replace section 39-1.17 with:

39-1.17 DATA CORES

39-1.17A General

39-1.17A(1) Summary

This work includes taking data cores and submitting the information.

Three business days before starting coring, submit proposed methods and materials for backfilling data core holes.

39-1.17A(2) Submittals

Submit the following to the Engineer and to Coring@dot.ca.gov:

1. Summary of data cores taken
2. Photograph of each data core

For each data core, the summary must include:

1. Project identification number
2. Date cored
3. Core identification number
4. Type of materials recovered
5. Type and approximate thickness of unstabilized material not recovered
6. Total core thickness
7. Thickness of each individual material to within:
 - 7.1 1/2 inch for recovered material
 - 7.2 1.0 inch for unstabilized material

8. Location including:
 - 8.1. County
 - 8.2. Route
 - 8.3. Post mile
 - 8.4. Lane number
 - 8.5. Lane direction
 - 8.6. Station

Each data core digital photograph must include a ruler laid next to the data core. Each photograph must include:

1. Core
2. Project identification number
3. Core identification number
4. Date cored
5. County
6. Route
7. Post mile
8. Lane number
9. Lane direction

39-1.17B Materials

Not Used

39-1.17C Construction

Take data cores that include the completed HMA pavement, underlying base, and subbase material. Protect data cores and surrounding pavement from damage.

Take 4- or 6-inch-diameter data cores:

1. At the beginning, end, and every 1/2 mile within the paving limits of each route on the project
2. After all paving is complete
3. From the center of the specified lane

On a 2-lane roadway, take data cores from either lane. On a 4-lane roadway, take data cores from each direction in the outermost lane. On a roadway with more than 4 lanes, take data cores from the median lane and the outermost lane in each direction.

Each core must include the stabilized materials encountered. You may choose not to recover unstabilized material, but you must identify the material. Unstabilized material includes:

1. Granular material
2. Crumbled or cracked stabilized material
3. Sandy or clayey soil

After submitting the data core summary and photograph, dispose of cores.

Replace "Reserved" in section 39-1.18 with:

39-1.18A General

39-1.18A(1) Summary

Treat HMA aggregate with lime using the dry lime method either with marination or without.

Treat aggregate for HMA Type A with dry lime.

39-1.18A(2) Submittals

Determine the exact lime proportions for fine and coarse virgin aggregate and submit them as part of the proposed JMF.

If marination is required, submit the averaged aggregate quality test results within 24 hours of sampling.

Submit a treatment data log from the dry lime and aggregate proportioning device in the following order:

1. Treatment date
2. Time of day the data is captured
3. Aggregate size being treated
4. HMA type and mix aggregate size
5. Wet aggregate flow rate collected directly from the aggregate weigh belt
6. Aggregate moisture content, expressed as a percent of the dry aggregate weight
7. Flow rate of dry aggregate calculated from the flow rate of wet aggregate
8. Dry lime flow rate
9. Lime ratio from the accepted JMF for each aggregate size being treated
10. Lime ratio from the accepted JMF for the combined aggregate
11. Actual lime ratio calculated from the aggregate weigh belt output, the aggregate moisture input, and the dry lime meter output, expressed as a percent of the dry aggregate weight
12. Calculated difference between the authorized lime ratio and the actual lime ratio

Each day during lime treatment, submit the treatment data log on electronic media in tab delimited format on a removable CD-ROM storage disk. Each continuous treatment data set must be a separate record using a line feed carriage return to present the specified data on 1 line. The reported data must include data titles at least once per report.

39-1.18A(3) Quality Control and Assurance

If marination is required, the QC plan must include aggregate quality control sampling and testing during lime treatment. Sample and test in compliance with minimum frequencies shown in the following table:

Aggregate Quality Control During Lime Treatment

| Quality characteristic | Test method | Minimum sampling and testing frequency |
|------------------------------|---------------------|--|
| Sand equivalent | California Test 217 | Once per 1,000 tons of aggregate treated with lime |
| Percent of crushed particles | California Test 205 | As necessary and as designated in the QC plan |
| Los Angeles Rattler | California Test 211 | |
| Fine aggregate angularity | California Test 234 | |
| Flat and elongated particles | California Test 235 | |

Note: During lime treatment, sample coarse and fine aggregate from individual stockpiles. Combine aggregate in the JMF proportions. Run tests for aggregate quality in triplicate and report test results as the average of 3 tests.

For any of the following, the Engineer orders proportioning operations stopped if you:

1. Do not submit the treatment data log
2. Do not submit the aggregate quality control data for marinated aggregate
3. Submit incomplete, untimely, or incorrectly formatted data
4. Do not take corrective actions
5. Take late or unsuccessful corrective actions
6. Do not stop treatment when proportioning tolerances are exceeded
7. Use malfunctioning or failed proportioning devices

If you stop treatment, notify the Engineer of any corrective actions taken and conduct a successful 20-minute test run before resuming treatment.

39-1.18B Materials

High-calcium hydrated lime and water must comply with section 24-2.02.

Before virgin aggregate is treated, it must comply with the aggregate quality specifications. Do not test treated aggregate for quality control except for gradation. The Department does not test treated aggregate for acceptance except for gradation.

The Engineer determines the combined aggregate gradation during HMA production after you have treated the aggregate.

Treated aggregate must not have lime balls or clods.

39-1.18C Construction

39-1.18C(1) General

Notify the Engineer at least 24 hours before the start of aggregate treatment.

Do not treat RAP.

Marinate aggregate if the plasticity index determined under California Test 204 is from 4 to 10.

If marination is required:

1. Treat and marinate coarse and fine aggregates separately.
2. Treat the aggregate and stockpile for marination only once.
3. Treat the aggregate separate from HMA production.

The lime ratio is the pounds of dry hydrated lime per 100 lb of dry virgin aggregate expressed as a percentage. Water content of slurry or untreated aggregate must not affect the lime ratio.

Aggregate gradations must have the lime ratio ranges shown in the following table:

| Aggregate gradation | Lime ratio percent |
|---------------------|--------------------|
| Coarse | 0.4–1.0 |
| Fine | 1.5–2.0 |
| Combined | 0.8–1.5 |

You may reduce the combined aggregate lime ratio for OGFC to 0.5–1.0 percent.

The lime ratio for fine and coarse aggregate must be within ±0.2 percent of the lime ratio in the accepted JMF. The lime ratio must be within ±0.2 percent of the authorized lime ratio when you combine the individual aggregate sizes in the JMF proportions.

Proportion dry lime by weight with a continuous operation.

The device controlling dry lime and aggregate proportioning must produce a treatment data log. The log consists of a series of data sets captured at 10-minute intervals throughout daily treatment. The data must be a treatment activity register and not a summation. The material represented by a data set is the quantity produced 5 minutes before and 5 minutes after the capture time. For the duration of the Contract, collected data must be stored by the controller.

If 3 consecutive sets of recorded treatment data indicate deviation more than 0.2 percent above or below the lime ratio in the accepted JMF, stop treatment.

If a set of recorded treatment data indicates a deviation of more than 0.4 percent above or below the lime ratio in the accepted JMF, stop treatment and do not use the material represented by that set of data in HMA.

If 20 percent or more of the total daily treatment indicates deviation of more than 0.2 percent above or below the lime ratio in the accepted JMF, stop treatment and do not use the day's treated aggregate in HMA.

If you stop treatment for noncompliance, you must implement corrective action and successfully treat aggregate for a 20-minute period. Notify the Engineer before beginning the 20-minute treatment period.

If you use a batch-type proportioning operation for HMA production, control proportioning in compliance with the specifications for continuous mixing plants. Use a separate dry lime aggregate treatment operation from HMA batching operations including:

1. Pugmill mixer
2. Controller
3. Weigh belt for the lime
4. Weigh belt for the aggregate

If using a continuous mixing operation for HMA without lime marinated aggregates, use a controller that measures the blended aggregate weight after any additional water is added to the mixture. The controller must determine the quantity of lime added to the aggregate from the aggregate weigh belt input in connection with the manually input total aggregate moisture, the manually input target lime content, and the lime proportioning system output. Use a continuous aggregate weigh belt and pugmill mixer for the lime treatment operation in addition to the weigh belt for the aggregate proportioning to asphalt binder in the HMA plant. If you use a water meter for moisture control for lime treatment, the meter must comply with California Test 109.

At the time of mixing dry lime with aggregate, the aggregate moisture content must ensure complete lime coating. The aggregate moisture content must not cause aggregate to be lost between the point of weighing the combined aggregate continuous stream and the dryer. Add water for mixing and coating aggregate to the aggregate before dry lime addition. Immediately before mixing lime with aggregate, water must not visibly separate from aggregate.

The HMA plant must be equipped with a bag-house dust system. Material collected in the dust system must be returned to the mix.

39-1.18C(2) Mixing Dry Lime and Aggregate

Mix aggregate, water, and dry lime with a continuous pugmill mixer with twin shafts. Immediately before mixing lime with aggregate, water must not visibly separate from the aggregate. Store dry lime in a uniform and free-flowing condition. Introduce dry lime to the pugmill in a continuous operation. The introduction must occur after the aggregate cold feed and before the point of proportioning across a weigh belt and the aggregate dryer. Prevent loss of dry lime.

If marination is required, marinate treated aggregate in stockpiles from 24 hours to 60 days before using in HMA. Do not use aggregate marinated more than 60 days.

The pugmill must be equipped with paddles arranged to provide sufficient mixing action and mixture movement. The pugmill must produce a homogeneous mixture of uniformly coated aggregates at mixer discharge.

If the aggregate treatment operation is stopped longer than 1 hour, clean the equipment of partially treated aggregate and lime.

Aggregate must be completely treated before introduction into the mixing drum.

39-1.18D Payment

Not Used

Replace "Reserved" in section 39-1.19 with:

39-1.19A General

39-1.19A(1) Summary

Treat HMA aggregate with lime using the slurry method and place it in stockpiles to marinate.

Treat aggregate for HMA Type A with lime slurry.

39-1.19A(2) Submittals

Determine the exact lime proportions for fine and coarse virgin aggregate and submit them as part of the proposed JMF.

Submit the averaged aggregate quality test results to the Engineer within 24 hours of sampling.

Submit a treatment data log from the slurry proportioning device in the following order:

1. Treatment date
2. Time of day the data is captured
3. Aggregate size being treated
4. Wet aggregate flow rate collected directly from the aggregate weigh belt
5. Moisture content of the aggregate just before treatment, expressed as a percent of the dry aggregate weight
6. Dry aggregate flow rate calculated from the wet aggregate flow rate
7. Lime slurry flow rate measured by the slurry meter
8. Dry lime flow rate calculated from the slurry meter output
9. Authorized lime ratio for each aggregate size being treated
10. Actual lime ratio calculated from the aggregate weigh belt and the slurry meter output, expressed as a percent of the dry aggregate weight
11. Calculated difference between the authorized lime ratio and the actual lime ratio
12. Dry lime and water proportions at the slurry treatment time

Every day during lime treatment, submit the treatment data log on electronic media in tab delimited format on a removable CD-ROM storage disk. Each continuous treatment data set must be a separate record using a line feed carriage return to present the specified data on 1 line. The reported data must include data titles at least once per report.

39-1.19A(3) Quality Control and Assurance

The QC plan must include aggregate quality control sampling and testing during aggregate lime treatment. Sample and test in compliance with frequencies in the following table:

Aggregate Quality Control During Lime Treatment

| Quality characteristic | Test method | Minimum sampling and testing frequency |
|------------------------------|---------------------|--|
| Sand equivalent | California Test 217 | Once per 1,000 tons of aggregate treated with lime |
| Percent of crushed particles | California Test 205 | As necessary and as designated in the QC plan |
| Los Angeles Rattler | California Test 211 | |
| Fine aggregate angularity | California Test 234 | |
| Flat and elongated particles | California Test 235 | |

Note: During lime treatment, sample coarse and fine aggregate from individual stockpiles. Combine aggregate in the JMF proportions. Run tests for aggregate quality in triplicate and report test results as the average of 3 tests.

For any of the following, the Engineer orders proportioning operations stopped if you:

1. Do not submit the treatment data log
2. Do not submit the aggregate quality control data
3. Submit incomplete, untimely, or incorrectly formatted data
4. Do not take corrective actions
5. Take late or unsuccessful corrective actions

6. Do not stop treatment when proportioning tolerances are exceeded
7. Use malfunctioning or failed proportioning devices

If you stop treatment, notify the Engineer of any corrective actions taken and conduct a successful 20-minute test run before resuming treatment.

For the aggregate to be treated, determine the moisture content at least once during each 2 hours of treatment. Calculate moisture content under California Test 226 or 370 and report it as a percent of dry aggregate weight. Use the moisture content calculations as a set point for the proportioning process controller.

39-1.19B Materials

High-calcium hydrated lime and water must comply with section 24-2.02.

Before virgin aggregate is treated, it must comply with the aggregate quality specifications. Do not test treated aggregate for quality control except for gradation. The Engineer does not test treated aggregate for acceptance except for gradation.

The Engineer determines the combined aggregate gradation during HMA production after you have treated the aggregate. If RAP is used, the Engineer determines combined aggregate gradations containing RAP under Laboratory Procedure LP-9.

Treated aggregate must not have lime balls or clods.

39-1.19C Construction

39-1.19C(1) General

Notify the Engineer at least 24 hours before the start of aggregate treatment.

Treat aggregate separate from HMA production.

Do not treat RAP.

Add lime to the aggregate as slurry consisting of mixed dry lime and water at a ratio of 1 part lime to from 2 to 3 parts water by weight. The slurry must completely coat the aggregate.

Lime treat and marinate coarse and fine aggregates separately.

Immediately before mixing lime slurry with the aggregate, water must not visibly separate from the aggregate.

Treat the aggregate and stockpile for marination only once.

The lime ratio is the pounds of dry hydrated lime per 100 lb of dry virgin aggregate expressed as a percentage. Water content of slurry or untreated aggregate must not affect the lime ratio.

The following aggregate gradations must have the lime ratio ranges shown in the following table:

| Aggregate gradation | Lime ratio percent |
|---------------------------|--------------------|
| Coarse | 0.4–1.0 |
| Fine | 1.5–2.0 |
| Combined virgin aggregate | 0.8–1.5 |

You may reduce the combined aggregate lime ratio for OGFC to 0.5–1.0 percent.

The lime ratio for fine and coarse aggregate must be within ± 0.2 percent of the lime ratio in the accepted JMF. The lime ratio must be within ± 0.2 percent of the authorized lime ratio when you combine the individual aggregate sizes in the JMF proportions. The lime ratio must be determined before the addition of RAP.

If 3 consecutive sets of recorded treatment data indicate deviation more than 0.2 percent above or below the lime ratio in the accepted JMF, stop treatment.

If a set of recorded treatment data indicates a deviation of more than 0.4 percent above or below the lime ratio in the accepted JMF, stop treatment and do not use the material represented by that set of data in HMA.

If 20 percent or more of the total daily treatment indicates deviation of more than 0.2 percent above or below the lime ratio in the accepted JMF, stop treatment and do not use the day's total treatment in HMA.

If you stop treatment for noncompliance, you must implement corrective action and successfully treat aggregate for a 20-minute period. Notify the Engineer before beginning the 20-minute treatment period.

39-1.19C(2) Lime Slurry Proportioning

Proportion lime and water with a continuous or batch operation.

The device controlling slurry proportioning must produce a treatment data log. The log consists of a series of data sets captured at 10-minute intervals throughout daily treatment. The data must be a treatment activity register and not a summation. The material represented by the data set is the quantity produced 5 minutes before and 5 minutes after the capture time. For the Contract's duration, collected data must be stored by the controller.

39-1.19C(3) Proportioning and Mixing Lime Slurry Treated Aggregate

Treat HMA aggregate by proportioning lime slurry and aggregate by weight in a continuous operation.

Marinate treated aggregate in stockpiles from 24 hours to 60 days before using in HMA. Do not use aggregate marinated longer than 60 days.

39-1.19D Payment

Not Used

Replace "Reserved" in section 39-1.20 with:

39-1.20A General

39-1.20A(1) Summary

Treat asphalt binder with liquid antistrip (LAS) treatment to bond the asphalt binder to aggregate in HMA.

39-1.20A(2) Submittals

For LAS, submit with the proposed JMF submittal:

1. MSDS
2. One 1-pint sample
3. Infrared analysis including copy of absorption spectra

Submit a certified copy of test results and an MSDS for each LAS lot.

Submit a certificate of compliance for each LAS shipment. With each certificate of compliance, submit:

1. Your signature and printed name
2. Shipment number
3. Material type
4. Material specific gravity
5. Refinery
6. Consignee
7. Destination
8. Quantity
9. Contact or purchase order number
10. Shipment date

Submit proportions for LAS as part of the JMF submittal. If you change the brand or type of LAS, submit a new JMF.

For each job site delivery of LAS, submit one 1/2-pint sample to METS. Submit shipping documents to the Engineer. Label each LAS sampling container with:

1. LAS type
2. Application rate
3. Sample date
4. Contract number

At the end of each day's production shift, submit production data in electronic and printed media. Present data on electronic media in tab delimited format. Use line feed carriage return with 1 separate record per line for each production data set. Allow sufficient fields for the specified data. Include data titles at least once per report. For each mixing operation type, submit in order:

1. Batch mixing:
 - 1.1. Production date
 - 1.2. Time of batch completion
 - 1.3. Mix size and type
 - 1.4. Each ingredient's weight
 - 1.5. Asphalt binder content as a percentage of the dry aggregate weight
 - 1.6. LAS content as a percentage of the asphalt binder weight
2. Continuous mixing:
 - 2.1. Production date
 - 2.2. Data capture time
 - 2.3. Mix size and type
 - 2.4. Flow rate of wet aggregate collected directly from the aggregate weigh belt
 - 2.5. Aggregate moisture content as percentage of the dry aggregate weight
 - 2.6. Flow rate of asphalt binder collected from the asphalt binder meter
 - 2.7. Flow rate of LAS collected from the LAS meter
 - 2.8. Asphalt binder content as percentage of total weight of mix calculated from:
 - 2.8.1. Aggregate weigh belt output
 - 2.8.2. Aggregate moisture input
 - 2.8.3. Asphalt binder meter output
 - 2.9. LAS content as percentage of the asphalt binder weight calculated from:
 - 2.9.1. Asphalt binder meter output
 - 2.9.2. LAS meter output

39-1.20A(3) Quality Control and Assurance

For continuous mixing and batch mixing operations, sample asphalt binder before adding LAS. For continuous mixing operations, sample combined asphalt binder and LAS after the static mixer.

The Engineer orders proportioning operations stopped for any of the following if you:

1. Do not submit data
2. Submit incomplete, untimely, or incorrectly formatted data
3. Do not take corrective actions
4. Take late or unsuccessful corrective actions
5. Do not stop production when proportioning tolerances are exceeded
6. Use malfunctioning or failed proportioning devices

If you stop production, notify the Engineer of any corrective actions taken before resuming.

39-1.20B Materials

LAS-treated asphalt binder must comply with the specifications for asphalt binder in section 39-1.02C. Do not use LAS as a substitute for asphalt binder.

LAS total amine value must be 325 minimum when tested under ASTM D 2074.

Use only 1 LAS type or brand at a time. Do not mix LAS types or brands.

Store and mix LAS under the manufacturer's instruction.

39-1.20C Construction

LAS must be from 0.5 to 1.0 percent by weight of asphalt binder.

If 3 consecutive sets of recorded production data show actual delivered LAS weight is more than ± 1 percent of the authorized mix design LAS weight, stop production and take corrective action.

If a set of recorded production data shows actual delivered LAS weight is more than ± 2 percent of the authorized mix design LAS weight, stop production. If the LAS weight exceeds 1.2 percent of the asphalt binder weight, do not use the HMA represented by that data.

The continuous mixing plant controller proportioning the HMA must produce a production data log. The log consists of a series of data sets captured at 10-minute intervals throughout daily production. The data must be a production activity register and not a summation. The material represented by the data is the quantity produced 5 minutes before and 5 minutes after the capture time. For the duration of the Contract, collected data must be stored by the plant controller or a computer's memory at the plant.

39-1.20D Payment

Not Used

Replace section 39-1.30 with:

39-1.30 EDGE TREATMENT, HOT MIX ASPHALT PAVEMENT

39-1.30A General

Section 39-1.30 includes specifications for constructing the edges of HMA pavement as shown.

39-1.30B Materials

For the safety edge, use the same type of HMA used for the adjacent lane or shoulder.

39-1.30C Construction

The edge of roadway where the safety edge treatment is to be placed must have a solid base, free of debris such as loose material, grass, weeds, or mud. Grade areas to receive the safety edge as required.

The safety edge treatment must be placed monolithic with the adjacent lane or shoulder and shaped and compacted with a device attached to the paver.

The device must be capable of shaping and compacting HMA to the required cross section as shown. Compaction must be by constraining the HMA to reduce the cross sectional area by 10 to 15 percent. The device must produce a uniform surface texture without tearing, shoving, or gouging and must not leave marks such as ridges and indentations. The device must be capable of transition to cross roads, driveways, and obstructions.

For safety edge treatment, the angle of the slope must not deviate by more than ± 5 degrees from the angle shown. Measure the angle from the plane of the adjacent finished pavement surface.

If paving is done in multiple lifts, the safety edge treatment must be placed with each lift.

Short sections of hand work are allowed to construct transitions for safety edge treatment.

For more information on the safety edge treatment, go to:

http://safety.fhwa.dot.gov/roadway_dept/pavement/safedge/

You can find a list of commercially available devices at the above Web site under "Frequently Asked Questions" and "Construction Questions."

39-1.30D Payment

Not Used

Replace section 39-1.31 with:

39-1.31 WARM MIX ASPHALT TECHNOLOGY OPTION

39-1.31A GENERAL

39-1.31A(1) Summary

You may produce HMA Type A, Type B, or RHMA-G using an authorized warm mix asphalt (WMA) technology. For Department-authorized WMA technologies, go to the METS Web site.

AASHTO T 324 (Modified) is AASHTO T 324, "Hamburg Wheel-Track Testing of Compacted Hot Mix Asphalt (HMA)," with the following parameters:

1. Target air void content is 7 ± 1 percent
2. 4 test specimens
3. 6-inch gyratory compacted test specimen
4. Test temperature is 122 ± 2 degrees F
5. Impression measurements at every 100 passes
6. Inflection point as the number of wheel passes at the intersection of the creep slope and the stripping slope
7. Testing shut off after 25,000 passes
8. For RHMA test specimens:
 - 8.1. Superpave Gyratory Compactor ram pressure may be increased to a maximum 825 kPa
 - 8.2. Specimens may be held at a constant height for a maximum 90 minutes

HMA samples must be prepared under California Test 304, except the samples must be cured in a forced air draft oven at 275 degrees F for 4 hours \pm 10 minutes.

39-1.31A(2) Definitions

WMA: HMA produced at temperatures no greater than 275 degrees F.

HMA with WMA technology: HMA produced using additives to aid with mixing and compaction of HMA produced at temperatures greater than 275 degrees F.

39-1.31A(3) Submittals

39-1.31A(3)(a) General

With the JMF submittal as specified in section 39-1.03C, submit:

1. For WMA water injection foam technology:
 - 1.1. Name of technology
 - 1.2. Laboratory Procedure LP-12 test result for foamed bitumen expansion ratio dated within 12 months of submittal
 - 1.3. Laboratory Procedure LP-12 test result for foamed bitumen half-life dated within 12 months of submittal
 - 1.4. Optimum foaming water content
 - 1.5. Proposed HMA production temperature range
2. For WMA additive technology:
 - 2.1. Name of technology
 - 2.2. Percent admixture by weight of binder and percent admixture by total weight of HMA as recommended by the manufacturer
 - 2.3. Methodology for inclusion of admixture in laboratory-produced HMA
 - 2.4. Proposed HMA production temperature range

The 4th and 5th paragraphs of section 39-1.03C do not apply. Instead submit:

1. California Test 371 test results for dry strength for untreated plant-produced HMA
2. California Test 371 test results for tensile strength ratio for untreated plant-produced HMA
3. California Test 204 test results for plasticity index if untreated plant-produced HMA test result determined under California Test 371 is below the specified HMA mix design requirements
4. California Test 371 test results for treated plant-produced HMA if untreated plant-produced HMA test result determined under California Test 371 is below the specified HMA mix design requirements

5. AASHTO T 324 (Modified) test results data showing number of passes with rut depth for plant-produced HMA
6. AASHTO T 324 (Modified) test results data showing number of passes at inflection point for plant-produced HMA

39-1.31A(3)(b) Prepaving Conference

With the JMF submittal, submit a list of names participating in the prepaving conference. Identify each participant's name, employer, title, and role in the production and placement of WMA or HMA with WMA technology.

39-1.31A(3)(c) Tests and Samples

The 6th paragraph of section 39-1.03C does not apply.

At production start-up and within $\pm 1,000$ tons of the halfway point of production of HMA produced using WMA technology, submit samples split from your HMA production sample for California Test 371 and AASHTO T 324 (Modified) test to the Engineer and METS, Attention: Moisture Test.

With the JMF submittal, at JMF verification, at production start-up, and for each 10,000 tons of HMA produced, submit California Test 371 test results and AASHTO T 324 (Modified) test results for mix design and production to the Engineer and electronically to:

Moisture_Tests@dot.ca.gov

With the JMF submittal, at JMF verification, at production start-up evaluation, and for each 10,000 tons of HMA produced, submit 1 tested sample set from the AASHTO T 324 (Modified) test to the Engineer.

39-1.31A(3)(d) Daily Production Log

Submit the log of production data, daily and upon request.

39-1.31A(4) Quality Control and Assurance

39-1.31A(4)(a) General

Not Used

39-1.31A(4)(b) Technical Representative

A technical representative from the WMA technology supplier must be present during the first 3 days of production and placement of WMA or HMA using WMA technology. The technical representative must advise you, the Engineer, and the HMA producer regarding the HMA mix operation as it relates to the WMA technology.

The technical representative must advise the HMA producer regarding HMA plant and HMA plant process-controller modifications necessary for integrating WMA technology with HMA plant. HMA plant modifications and WMA technology equipment, scales, and meters must comply with the Department's Materials Plant Quality Program (MPQP).

39-1.31A(4)(c) Prepaving Conference

Schedule a prepaving conference with the Engineer at a mutually agreed time and place. Make arrangements for the conference facility. Be prepared to discuss:

1. HMA production and placement
2. Method for incorporating WMA technology and any impacts on HMA production and placement including requirements for compaction and workmanship
3. Contingency plan

The following personnel must attend the prepaving conference:

1. Project Manager
2. Superintendent
3. Technical representative for WMA technology
4. HMA plant manager
5. HMA plant operators
6. HMA paving foreman

39-1.31A(4)(d) Quality Control Testing

In addition to the requirements specified in section 39-2.02B for Standard construction process and section 39-4.02C for QC/QA construction process and for Method construction process, perform sampling and testing at the specified frequency and location for the following additional quality characteristics:

Minimum Quality Control

| Quality characteristic | Test method | Minimum sampling and testing frequency | Requirement | | | Sampling location | Maximum reporting time allowance |
|--|-------------------------|--|--------------------------------------|--------------------------------------|----------------------------------|---|----------------------------------|
| | | | HMA Type | | | | |
| | | | A | B | RHMA-G | | |
| Moisture susceptibility (minimum dry strength, psi) | California Test 371 | First production day and 1 per every 10,000 tons | 120 | 120 | 120 | Loose mix behind the paver. See California Test 125 | 15 days |
| Moisture susceptibility (tensile strength ratio, %) | California Test 371 | | Report Only | Report Only | Report Only | | |
| Hamburg wheel track (minimum number of passes at 0.5 inch average rut depth) PG-58 PG-64 PG-70 PG-76 | AASHTO T 324 (Modified) | | 10,000 15,000 20,000 25,000 | 10,000 15,000 20,000 25,000 | 15,000 20,000 25,000 -- | Loose mix behind the paver. See California Test 125 | 7 days ^a |
| Hamburg wheel track (inflection point minimum number of passes) PG-58 PG-64 PG-70 PG-76 | AASHTO T 324 (Modified) | | 10,000 10,000 12,500 15,000 | 10,000 10,000 12,500 15,000 | 10,000 12,500 15,000 -- | | |

^a Submit test data and 1 tested sample set.

39-1.31A(4)(e) Engineer's Acceptance

In addition to the requirements specified in section 39-2.03A for Standard construction process, section 39-3.02A for Method construction process, and section 39-4.04A for QC/QA construction process, the Engineer samples HMA for acceptance testing and tests for the following additional quality characteristic:

HMA Acceptance

| Quality characteristic | Test method | Requirement | | | Sampling location |
|--|-------------------------|--------------------------|--------------------------|--------------------------|---|
| | | HMA Type | | | |
| | | A | B | RHMA-G | |
| Moisture susceptibility (minimum dry strength, psi) | California Test 371 | 120 | 120 | 120 | Loose mix behind the paver. See California Test 125 |
| Moisture susceptibility (tensile strength ratio, %) | California Test 371 | Report Only ^a | Report Only ^a | Report Only ^a | |
| Hamburg wheel track (minimum number of passes at 0.5 inch average rut depth) | AASHTO T 324 (Modified) | | | | |
| PG-58 | | 10,000 | 10,000 | 15,000 | |
| PG-64 | | 15,000 | 15,000 | 20,000 | |
| PG-70 | | 20,000 | 20,000 | 25,000 | |
| PG-76 | | 25,000 | 25,000 | -- | |
| Hamburg wheel track (inflection point minimum number of passes) | AASHTO T 324 (Modified) | | | | |
| PG-58 | | 10,000 | 10,000 | 10,000 | |
| PG 64 | | 10,000 | 10,000 | 12,500 | |
| PG-70 | | 12,500 | 12,500 | 15,000 | |
| PG-76 | | 15,000 | 15,000 | -- | |

^aThe Department does not use California Test 371 tensile strength ratio test results from production to determine specification compliance.

39-1.31B MATERIALS

39-1.31B(1) General

Not Used

39-1.31B(2) Foaming Bitumen

If water injection is used by the WMA technology, the foamed bitumen must have the following quality characteristics:

Quality Requirements for Foaming Bitumen

| Quality characteristic | Test method | Requirement |
|-----------------------------|-------------|-------------|
| Expansion ratio (minimum) | LP-12 | 4 |
| Half-life (seconds minimum) | LP-12 | 4 |

For Laboratory Procedure LP-12, go to the METS Web site.

39-1.31B(3) Hot Mix Asphalt

39-1.31B(3)(a) General

Not Used

39-1.31B(3)(b) Mix Design

For WMA additive technology, produce HMA mix samples for your mix design using your methodology for inclusion of WMA admixture in laboratory produced HMA. For WMA water injection foam technology, the use of foamed asphalt for mix design is not required.

HMA mix design must comply with the following quality characteristics:

Hot Mix Asphalt Mix Design Requirements

| Quality characteristic | Test method | HMA Type | | |
|--|-------------------------|----------|--------|--------|
| | | A | B | RHMA |
| Moisture susceptibility (minimum dry strength, psi) | California Test 371 | 120 | 120 | 120 |
| Moisture susceptibility (tensile strength ratio, %) | California Test 371 | 70 | 70 | 70 |
| Hamburg wheel track (minimum number of passes at 0.5 inch average rut depth) | AASHTO T 324 (Modified) | | | |
| PG-58 | | 10,000 | 10,000 | 15,000 |
| PG 64 | | 15,000 | 15,000 | 20,000 |
| PG-70 | | 20,000 | 20,000 | 25,000 |
| PG-76 | | 25,000 | 25,000 | -- |
| Hamburg wheel track (inflection point minimum number of passes) | AASHTO T 324 (Modified) | | | |
| PG-58 | | 10,000 | 10,000 | 10,000 |
| PG 64 | | 10,000 | 10,000 | 12,500 |
| PG-70 | | 12,500 | 12,500 | 15,000 |
| PG-76 | | 15,000 | 15,000 | -- |

If the determined test results under California Test 371 or AASHTO T 324 (Modified) for untreated plant produced HMA are less than the minimum requirement for the mix design, determine the plasticity index of the aggregate blend under California Test 204. Choose from the antistrip treatments based on plasticity index as shown in the following table:

Hot Mix Asphalt Antistrip Treatment Options

| Quality characteristic | Test method | Treatment requirement |
|--|---------------------|--|
| Plasticity index from 4 to 10 ^a | California Test 204 | Dry hydrated lime with marination Lime slurry with marination |
| Plasticity index less than 4 | | Liquid antistrip Dry hydrated lime without marination Dry hydrated lime with marination Lime slurry with marination |

^a If the plasticity index is greater than 10, do not use that aggregate blend.

Mix design for treated plant-produced HMA must comply with the mix design requirements, except if the tensile strength ratio test result for treated plant produced RHMA-G is less than the mix design requirement for tensile strength ratio, the minimum tensile strength ratio requirement is waived, but you must use any of the following antistrip treatments:

1. HMA aggregate lime treatment – slurry method
2. HMA aggregate lime treatment – dry lime method
3. Liquid antistrip treatment using 0.5 percent liquid antistrip

39-1.31B(3)(c) Job Mix Formula Verification

HMA produced for JMF verification must be produced using the WMA technology shown in the JMF submittal.

Perform the AASHTO T 324 (Modified) test for compliance with the mix design requirements. Submit test data and one tested sample set from the AASHTO T 324 (Modified) test.

The Engineer may verify that the HMA complies with the mix design requirements for AASHTO T 324 (Modified) and California Test 371.

If you request, the Engineer verifies RHMA-G quality requirements within 5 business days of sampling. The 2nd sentence in the 8th paragraph of section 39-1.03E does not apply.

39-1.31B(4) Production

39-1.31B(4)(a) General

For the Standard and QC/QA construction processes, HMA produced using WMA technology must be produced at a temperature between 240 and 325 degrees F.

For the Method construction process, HMA produced using WMA technology must be produced at the temperatures specified in section 39-1.08.

HMA additives used for antistripping treatment and WMA technologies may be either in a liquid or dry state.

The HMA plant must have a sampling device in the feed line connecting the additive storage to the additive metering system. The sampling equipment must comply with California Test 125.

39-1.31B(4)(b) Proportioning Warm Mix Asphalt Technologies

HMA plants using WMA technology must comply with the Department's MPQP.

Proportion all ingredients by weight. The HMA plant process controller (PPC) must be the sole source of ingredient proportioning control and be fully interfaced with all scales and meters used in the production process. The addition of the HMA additive must be controlled by the PPC.

Weighing and metering devices used for the production of additive enhanced HMA must comply with the requirements of the MPQP. If a loss-in-weight meter is used for dry HMA additive, the meter must:

1. Comply with the requirements of the MPQP
2. Have an automatic and integral material delivery control system for the refill cycle

Calibrate the loss-in-weight meter by:

1. Including at least 1 complete system refill cycle during each calibration test run
2. Operating the device in a normal run mode for 10 minutes immediately before starting the calibration process
3. Isolating the scale system within the loss-in-weight feeder from surrounding vibration
4. Checking the scale system within the loss-in-weight feeder for accuracy before and after the calibration process and daily during mix production
5. Using a 15-minute or 250-pound-minimum test run size for a dry ingredient delivery rate of less than 1 ton/hr
6. Complying with the limits of Table B, "Conveyor Scale Testing Extremes," in the MPQP

Produce additive enhanced HMA by using either a continuous mixing or a batch type HMA plant.

Liquid ingredient additive, including a normally dry ingredient made liquid, must be proportioned with a mass flow meter at continuous mixing plants. Use a mass flow meter or a container scale to proportion liquid additives at batch mixing plants.

Continuous mixing plants using HMA additives must comply with the following:

1. Dry ingredient additives for continuous production must be proportioned with a conveyor scale or a loss-in-weight meter.
2. HMA PPC and ingredient measuring systems must be capable of varying all ingredient feed rates proportionate with the dry aggregate delivery at all production rates and rate changes.

3. Liquid HMA additive must enter the production stream with the binder. Dry HMA additive must enter the production stream at or before the mixing area.
4. If dry HMA additives are used at continuous mixing HMA plants, baghouse dust systems must return all captured material to the mix.
5. HMA additive must be proportioned to within ± 0.3 percent of the target additive rate.

Batch mixing plants using HMA additives must comply with the following:

1. Metered HMA additive must be placed in an intermediate holding vessel before being added to the stream of asphalt binder as it enters the pugmill.
2. If a container scale is used, weigh additive before combining with asphalt binder. Keep the container scale separate from other ingredient proportioning. The container scale capacity must be no more than twice the volume of the maximum additive batch size. The container scale's graduations must be smaller than the proportioning tolerance or 0.001 times the container scale capacity.
3. Dry HMA additive proportioning devices must be separate from metering devices for the aggregates and asphalt binder. Proportion dry HMA additive directly into the pugmill or place in an intermediate holding vessel to be added to the pugmill at the appropriate time in the batch cycle. Dry ingredients for batch production must be proportioned with a hopper scale.
4. Zero tolerance for the HMA additive batch scale is ± 0.5 percent of the target additive weight. The indicated HMA additive batch scale weight may vary from the preselected weight setting by up to ± 1.0 percent of the target additive weight.

39-1.31B(4)(c) Production Data Collection

The HMA PPC must produce an electronic log of production data consisting of a series of snapshots captured at a maximum of 1-minute intervals throughout daily production. Each snapshot of production data must be a register of production activity at that time and not a summation of the data over the preceding interval to the previous snapshot. The amount of material represented by each snapshot is the amount produced during the 0.5-minute interval before and the 0.5-minute interval after the capture time. Collect and hold data for the duration of the contract and submit the electronic media, daily and upon request. The snapshot of production data must include the following:

1. Date of production
2. Production location
3. Time of day the data is captured
4. HMA mix type being produced and target binder rate
5. HMA additive type, brand, and target rate
6. Temperature of the binder and HMA mixture
7. For a continuous mix operation, the rate of flow of the dry aggregate calculated from the wet aggregate flow rate as determined by the conveyor scale
8. For a continuous mix plant operation, the rate of flow of the asphalt meter
9. For a continuous mix plant operation, the rate of flow of HMA additive meter
10. For a batch plant operation, actual batch weights of all ingredients
11. Dry aggregate to binder ratio calculated from metered ingredient output
12. Dry aggregate to HMA additive ratio calculated from metered output

Electronic media must be presented in a comma-separated values (CSV) or tab-separated values (TSV) format. Captured data, for the ingredients represented by production snapshot, must have allowances for sufficient fields to satisfy the amount of data required by these specifications and include data titles at least once per report.

39-1.31C CONSTRUCTION

You must request adjustments to the plant asphalt binder set point based on new RAP stockpiles average asphalt binder content. Do not adjust the HMA plant asphalt binder set point unless authorized.

The specified temperatures in section 39-1.11 for transporting, spreading and compacting of HMA apply to HMA produced using WMA technology. For the Method construction process, the specified temperatures in section 39-3.04 for transporting, spreading, and compacting of HMA apply to HMA produced using WMA technology.

Allow 30 days for the Engineer's review. The Engineer provides comments and specifies the date when the review stopped if revisions are required.

Resubmit a revised temporary shoring work plan within 15 days of receiving the Engineer's comments. Allow 30 days for the Engineer's review of the revised plan.

Upon authorization, submit 4 additional set of drawings and 2 additional copies of the design calculations.

Temporary shoring plan must comply with the following:

1. Drawings must be either 11 in x 17 in, or 22 in x 34 in in size
2. Drawings and calculation sheets must include the State-assigned designations Contract number and District-County-Route-Postmile
3. Drawings and calculation sheets must include design firm's name, address, and phone number
4. Each sheet numbered in the lower right hand corner and contain a blank space in the upper right hand corner for future sheet numbers

Verify the existing ground elevations at the site before preparing the temporary shoring work plan.

Provide information for the proper construction of the temporary shoring, 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. Supplement calculations as necessary for particular installations. Drawings and calculations must be stamped and signed by an engineer who is registered as a Civil Engineer in the State of California.

Do not constructing temporary shoring until the authorized.

You are responsible for the design, construction, maintenance, and removal of the temporary shoring.

48-3.02B Materials

Not Used

48-3.02C Construction

When the Engineer determines that the temporary shoring is no longer required, you may remove the temporary shoring or leave it in place.

Temporary shoring in conflict with other items of work must be removed. If you leave the temporary shoring in place, remove the top portion to a depth of 3 feet below finished grade.

Backfilling voids created during removal must comply with section 19-3.02D of the special provisions.

Dispose of all temporary shoring material.

48-3.02D Payment

Not used

Replace "Reserved" in section 48-6 with:

48-6 TEMPORARY WOOD POLES

48-6.01 GENERAL

48-6.01A Summary

Section 48-6 includes specifications for constructing, maintaining, and removing temporary wood poles for the support of electrical hardware and posts for the support of miscellaneous hardware.

48-6.01B Definitions

temporary wood pole: Round timber wood pole and any attached structural components with no more than five years of anticipated service before removal or replacement.

Overhead conductor: A conductor or cable supported overhead.

Overhead bundle: An assembly consisting of a messenger wire, one or more overhead conductors, and one or more lashing wires.

Temporary wood post: A square or rectangular timber with no more than five years of anticipated service before removal or replacement.

48-6.01C Submittals

48-6.01C(1) General

Submit a letter of certification that certifies all components of the manufactured assemblies are used in compliance with the manufacturer's recommendations. If requested, (1) submit manufacturer's data for manufactured assemblies to verify manufacturer's recommendations or (2) perform tests demonstrating adequacy of the proposed assemblies.

Submit a letter of certification for all temporary structural support members with field welded splices. The letter must certify that all welding and NDT, including visual inspection, comply with the Contract and the welding standard shown on the shop drawings. The letter must be signed by an engineer who is registered as a civil engineer in the State. Submit the letter before installing messenger wires, tether wires, or luminaire arms.

Submit a welding certification for temporary structural support members with previously welded splices. The certification must:

1. Itemize the testing and inspection methods used
2. Include tracking and identifying documents for previously welded members
3. Be signed by an engineer who is registered as a civil engineer in the State
4. Be submitted before erecting the members

48-6.01C(2) Guy Wire Anchors

Submit the guy wire anchor manufacturer's product information and installation instructions. Do not install anchors unless authorized.

48-6.01D Quality Control and Assurance

48-6.01D(1) General

Not Used

48-6.01D(2) Welding and Nondestructive Testing

Welding must comply with AWS D1.1 or other recognized welding standard except (1) for previously welded splices and (2) if fillet welds are used where load demands are 1,000 lb or less per inch for each 1/8 inch of fillet weld.

Perform NDT on splices made by field welding at the job site. You may use UT or RT. Each field weld and any repair made to a previously welded splice must be tested. You must select locations for testing. The length of a splice weld where NDT is to be performed must be a cumulative weld length equal to 25 percent of the original splice weld length. The cover pass must be ground smooth at test locations. Acceptance criteria must comply with the specifications for cyclically loaded nontubular connections subject to tensile stress in clause 6 of AWS D1.1. If repairs are required in a portion of the weld, perform additional NDT on the repaired sections. The NDT method chosen must be used for an entire splice evaluation, including any repairs.

For previously welded splices, you must determine and perform all necessary testing and inspection required to certify the ability of the temporary structural support members to sustain the design stresses.

48-6.02 MATERIALS

48-6.02A General

Wire used for messenger wires, tether wires, and guy wires, must comply with ASTM A475, Utilities Grade, 7-wire strand.

Connection hardware for wires must provide termination efficiency factor of not less than 0.80.

Wood poles, push braces, and stubs must comply with Alliance for Telecommunications Industry Solutions O5.1. Treat wood under AWPA U1, Use Category UC4B, Commodity Specification D.

Other steel components must comply with section 86.

48-6.02B Helical Anchors, Expanded Steel Plate Anchors, Cross Plate Anchors, and Expanding Rock Anchors

Fabricate helical anchors, expanded steel plate anchors, and cross plate anchors under section 55.

Fabricate attachable thimble eyes and expanding rock anchors from suitable ferrous material.

Welding must comply with AWS D1.1.

Fabricate as a continuous piece or as separate segments with mechanical connections between segments. Include integral thimble eye or include attachable thimble eye.

Galvanize all helical anchor parts under section 75-1.05.

Paint expanded steel plate anchors, cross plate anchors, and expanding rock anchors as specified for repairing damaged galvanized surfaces in section 75-1.05.

The final assembly must have (1) a minimum ultimate tension strength greater than the minimum required breaking strength of the guy wire and (2) a minimum ultimate torsion strength greater than twice the minimum installation torque.

48-6.02C Reuse of Materials and Relocation of Temporary Supports

You may reuse structural components and relocate temporary supports provided that the materials remain in acceptable condition for reuse except do not reuse:

1. Components of galvanized high-strength-bolt assemblies that have been or are required to be tensioned past snug tight
2. Galvanized high-strength cap-screws that have been or are required to be tensioned past snug tight
3. Tension control bolts

48-6.03 CONSTRUCTION

48-6.03A General

Install construction bracing as necessary to withstand all imposed loads during erection, construction, and removal of any temporary structural supports.

Install Type K temporary railing on both sides of vehicular openings through temporary structural supports. The Engineer may order you to install temporary railing at other temporary structural supports less than 12 feet from the edge of a traffic lane.

Install all temporary railing protecting temporary structural supports before erecting temporary structural supports. Do not remove temporary railing until authorized.

For overhead line construction not specifically covered in the contract documents, comply with Public Utility Commission General Order No. 95

48-6.03B Foundations

Verify the design soil parameters before starting construction of temporary wood poles.

Remove any accumulated water from the pole excavation before placing granular backfill at the bottom of the pole excavation. Thoroughly compact and level the granular backfill at the bottom of pole excavation before setting pole.

Backfill around poles with manufactured sand that is free of rocks or other deleterious material. Place the backfill material in 4-inch thick layers. Moisten and thoroughly compact each layer.

Install required pull boxes at least 2 feet clear from face of pole.

Remove accumulated water from the anchor excavation before placing expanded steel anchor. Expand the base of the expanded steel anchor before placing backfill. Place backfill around expanded steel anchor in 4-inch thick layers. Thoroughly compact each layer.

Protect foundations from softening and undermining.

48-6.03C Erection

If temporary structural supports are over or adjacent to roadways or railroads, all details of the temporary structural support system that contribute to horizontal stability and resistance to impact, except for connections in bracing, must (1) be installed at the time each element of the temporary structural support is erected and (2) remain in place until the temporary structural support is removed.

Suspend overhead conductors from messenger wire by continuous lashing wire. No spare overhead conductors are allowed unless described. Sag the overhead bundles to maintain required clearances and sags over the temperature range of -30 degrees F to 120 degrees F. Required sag is between 4.6 percent and 5.4 of horizontal span unless shown otherwise. Minimum vertical clearance over grade is 25 feet unless shown otherwise. Sag tether wires to maintain approximately uniform separation from their overhead bundles.

48-6.03D Attachments

If specific connection details are not shown, mount attachments under the manufacturer's written instructions and such that there is no loss of structural component cross section.

48-6.03E Damping

If at any time during service, the temporary wood poles exhibit excessive vibration, immediately install dampers. Dampers must be effective in mitigating the vibration and must not compromise the temporary wood poles or the supported hardware.

48-6.03F Removal

Remove temporary wood poles such that portions not yet removed remain stable at all times.

Remove temporary wood poles and helical anchors. Fill the void with excavated material or sand that is free of deleterious material. Place the backfill material in 4-inch thick layers. Moisten and thoroughly compact each layer.

Dispose of surplus excavated material uniformly along the adjacent roadway.

Dispose of temporary structural support materials and work debris.

48-6.03G Guy Wire Helical Anchors

48-6.03G(1) General

Not Used

48-6.03G(2) Installation Parameters

Use the minimum installation torque shown. You may request an alternative minimum installation torque based on a revised value for empirical torque factor.

For alternative minimum installation torque, use the following equation to calculate the installation torque:

$$T = Q_a(FS/K_f)$$

where:

T = Minimum installation torque, lb-ft

FS = Factor of safety of 2.0

Q_a = Minimum allowable tension capacity shown, lb

K_f = Empirical torque factor, 1/ft (inverse foot)

Include a geotechnical report sealed by a licensed geotechnical engineer with recommended values for empirical torque factor and alternative minimum installation torque with your request.

Do not start installation unless your alternative installation parameters are authorized.

Verify the installation parameters before the start of anchor installation.

48-6.03G(3) Installation

Install under the anchor manufacturer's written instructions and:

1. Do not install anchors underneath utilities or subsurface structures.
2. Maintain horizontal clearances as required by the Engineer.
3. Install to the minimum embedment length.
4. Continuously monitor and record torque during installation. If torque at the minimum embedment length is not equal to or greater than the minimum required, continue installation to greater embedment until the minimum installation torque is achieved for 2 continuous feet.

48-6.03G(4) Removal

After service is complete, remove using reverse torque. Fill the space left behind with excavated material or sand free of deleterious materials. Place the backfill material in 4-inch thick layers. Moisten and thoroughly compact each layer.

48-6.03H Expanded Steel Plate Anchors, Cross Plate Anchors, and Expanding Rock Anchors

48-6.03H(1) General

Reserved.

48-6.03H(2) Installation

Install anchors in compliance with the manufacturer's instructions.

Locate and mark all substructures and utilities. Do not install anchors underneath subsurface utilities or structures.

48-6.03H(3) Removal

After service is complete, remove anchors to a depth of at least 3 feet below finished grade. Fill the space left behind with sand free of deleterious materials. Place the backfill material in 4-inch thick layers. Moisten and thoroughly compact each layer.

48-6.03I Temporary Wood Post

48-6.03I(1) General

Not Used

48-6.03I(2) Installation

Temporary 6x6 wood posts must comply with Section 56-4.02C. Do not drill breakaway holes unless shown.

48-6.03I(3) Removal

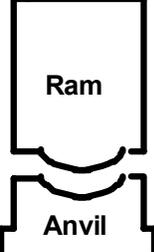
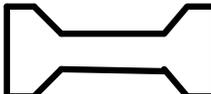
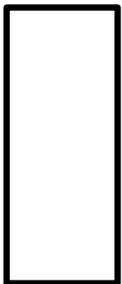
After service is complete, completely remove post. Fill hole with sand free of deleterious materials.

48-6.04 PAYMENT

Payment for constructing, maintaining, and removing temporary wood poles for the support of electrical hardware and temporary wood posts for the support of miscellaneous hardware is included in the payment for the electrical bid item involved.

PILE AND DRIVING DATA FORM

Structure Name : _____ Contract No.: _____
 _____ Project: _____
 Structure No.: _____ Pile Driving Contractor or
 Dist./Co./Rte./Post Mi: _____ Subcontractor _____ (Pile Driven By)

| | | | | | | |
|--|--|--|--------|--------|-------------|-----------|
|  <p style="text-align: center;">Ram Anvil</p> | Hammer | Manufacturer: _____ Model: _____ Type: _____ Serial No.: _____ Rated Energy: _____ at _____ Length of Stroke _____ Modifications: _____ _____ _____ _____ | | | | |
|  | Capblock (Hammer Cushion) | Material: _____ Thickness: _____ in Area: _____ in ² Modulus of Elasticity - E: _____ ksi Coefficient of Restitution - e: _____ | | | | |
|  | Pile Cap | <table border="1" style="display: inline-table; border-collapse: collapse;"> <tr><td style="padding: 2px;">Helmet</td></tr> <tr><td style="padding: 2px;">Bonnet</td></tr> <tr><td style="padding: 2px;">Anvil Block</td></tr> <tr><td style="padding: 2px;">Drivehead</td></tr> </table> Weight: _____ kips | Helmet | Bonnet | Anvil Block | Drivehead |
| Helmet | | | | | | |
| Bonnet | | | | | | |
| Anvil Block | | | | | | |
| Drivehead | | | | | | |
|  | Pile Cushion | Material: _____ Thickness: _____ in Area: _____ in ² Modulus of Elasticity - E: _____ ksi Coefficient of Restitution - e: _____ | | | | |
|  | Pile | Pile Type: _____ Length (In Leads): _____ ft Lb/ft.: _____ Taper: _____ Wall Thickness: _____ in Cross Sectional Area: _____ in ² Design Pile Capacity: _____ kips Description of Splice: _____ _____ Tip Treatment Description: _____ _____ | | | | |

DISTRIBUTE:

Translab,
Foundation Testing

Translab,
Geotechnical Design

Resident Engineer

Note: If mandrel is used to drive the pile, attach separate manufacturer's detail sheet(s) including weight and dimensions.

Submitted By: _____

Date: _____ Phone No.: _____

Add to section 49-2.01C(5):

Piles at the Broadway Overcrossing (Replace) and the Broadway On-Ramp that do not attain the nominal driving resistance at the specified tip elevation shown may be allowed to stand for a "set period" without driving. The "set period" must be at least 12 hours.

After the "set period" has elapsed, redrive 2 piles or 10 percent of the piles in the footing, whichever is greater. The Engineer designates which piles are to be redriven. Redriving consists of operating the driving hammer at full rated energy on the pile and calculating the nominal driving resistance of the pile.

If the nominal driving resistance is attained for each pile designated to be redriven, the remaining piles in that footing are considered satisfactory and further driving will not be required. If redriving the designated piles demonstrates that the nominal driving resistance has not been attained, redrive all piles in the footing until the nominal driving resistance is attained.

Add to section 49-2.04B(1):

Alternative "X" type piles must have a dimension, T, of at least 16 inches.

Replace "Reserved" in section 49-3.02A(4)(b) with:

Schedule and hold a preconstruction meeting for CIDH concrete pile construction (1) at least 5 business days after submitting the pile installation plan and (2) at least 10 days before the start of CIDH concrete pile construction. You must provide a facility for the meeting.

The meeting must include the Engineer, your representatives, and any subcontractors involved in CIDH concrete pile construction.

The purpose of this meeting is to:

1. Establish contacts and communication protocol between you and your representatives, any subcontractors, and the Engineer
2. Review the construction process, acceptance testing, and anomaly mitigation of CIDH concrete piles

The Engineer will conduct the meeting. Be prepared to discuss the following:

1. Pile placement plan, dry and wet
2. Acceptance testing, including gamma-gamma logging, cross-hole sonic logging, and coring
3. *Pile Design Data Form*
4. Mitigation process
5. Timeline and critical path activities
6. Structural, geotechnical, and corrosion design requirements
7. Future meetings, if necessary, for pile mitigation and pile mitigation plan review
8. Safety requirements, including Cal/OSHA and Tunnel Safety Orders

Add to section 49-3.02B(6)(c):

The synthetic slurry must be one of the materials shown in the following table:

| Material | Manufacturer |
|-----------------------------|--|
| SlurryPro CDP | KB INTERNATIONAL LLC 735 BOARD ST STE 209 CHATTANOOGA TN 37402 (423) 266-6964 |
| Super Mud | PDS CO INC 105 W SHARP ST EL DORADO AR 71731 (870) 863-5707 |
| Shore Pac GCV | CETCO CONSTRUCTION DRILLING PRODUCTS 2870 FORBS AVE HOFFMAN ESTATES IL 60192 (800) 527-9948 |
| Terragel or Novagel Polymer | GEO-TECH SERVICES LLC 220 N. ZAPATA HWY STE 11A-449A LAREDO TX 78043 (210) 259-6386 |

Use synthetic slurries in compliance with the manufacturer's instructions. Synthetic slurries shown in the above table may not be appropriate for a given job site.

Synthetic slurries must comply with the Department's requirements for synthetic slurries to be included in the above table. The requirements are available from the Offices of Structure Design, P.O. Box 168041, MS# 9-4/11G, Sacramento, CA 95816-8041.

SlurryPro CDP synthetic slurry must comply with the requirements shown in the following table:

SLURRYPRO CDP

| Property | Test | Value |
|--|--|-------------------------|
| Density During drilling | Mud Weight (density), API 13B-1, section 1 | ≤ 67.0 pcf ^a |
| Before final cleaning and immediately before placing concrete | | ≤ 64.0 pcf ^a |
| Viscosity During drilling | Marsh Funnel and Cup. API 13B-1, section 2.2 | 50–120 sec/qt |
| Before final cleaning and immediately before placing concrete | | ≤ 70 sec/qt |
| pH | Glass electrode pH meter or pH paper | 6.0–11.5 |
| Sand content, percent by volume Before final cleaning and immediately before placing concrete | Sand, API 13B-1, section 5 | ≤ 0.5 percent |

^aIf authorized, you may use slurry in salt water. The allowable density of slurry in salt water may be increased by 2 pcf.

Slurry temperature must be at least 40 degrees F when tested.

Super Mud synthetic slurry must comply with the requirements shown in the following table:

SUPER MUD

| Property | Test | Value |
|---|--|-------------------------|
| Density During drilling | Mud Weight (Density), API 13B-1, section 1 | ≤ 64.0 pcf ^a |
| Before final cleaning and immediately before placing concrete | | ≤ 64.0 pcf ^a |
| Viscosity During drilling | Marsh Funnel and Cup. API 13B-1, section 2.2 | 32–60 sec/qt |
| Before final cleaning and immediately before placing concrete | | ≤ 60 sec/qt |
| pH | Glass electrode pH meter or pH paper | 8.0–10.0 |
| Sand content, percent by volume Before final cleaning and immediately before placing concrete | Sand, API 13B-1, section 5 | ≤ 0.5 percent |

^aIf authorized, you may use slurry in salt water. The allowable density of slurry in salt water may be increased by 2 pcf.

Slurry temperature must be at least 40 degrees F when tested.

Shore Pac GCV synthetic slurry must comply with the requirements shown in the following table:

SHORE PAC GCV

| Property | Test | Value |
|---|--|-------------------------|
| Density During drilling | Mud Weight (Density), API 13B-1, section 1 | ≤ 64.0 pcf ^a |
| Before final cleaning and immediately before placing concrete | | ≤ 64.0 pcf ^a |
| Viscosity During drilling | Marsh Funnel and Cup. API 13B-1, section 2.2 | 33–74 sec/qt |
| Before final cleaning and immediately before placing concrete | | ≤ 57 sec/qt |
| pH | Glass electrode pH meter or pH paper | 8.0–11.0 |
| Sand content, percent by volume Before final cleaning and immediately before placing concrete | Sand, API 13B-1, section 5 | ≤ 0.5 percent |

^aIf authorized, you may use slurry in salt water. The allowable density of slurry in salt water may be increased by 2 pcf.

Slurry temperature must be at least 40 degrees F when tested.

Terragel or Novagel Polymer synthetic slurry must comply with the requirements shown in the following table:

TERRAGEL OR NOVAGEL POLYMER

| Property | Test | Value |
|--|--|-------------------------|
| Density During drilling | Mud Weight (Density), API 13B-1, section 1 | ≤ 67.0 pcf ^a |
| Before final cleaning and immediately before placing concrete | | ≤ 64.0 pcf ^a |
| Viscosity During drilling | Marsh Funnel and Cup. API 13B-1, section 2.2 | 45–104 sec/qt |
| Before final cleaning and immediately before placing concrete | | ≤ 104 sec/qt |
| pH | Glass electrode pH meter or pH paper | 6.0–11.5 |
| Sand content, percent by volume Before final cleaning and immediately before placing concrete | Sand, API 13B-1, section 5 | ≤ 0.5 percent |

^aIf authorized, you may use slurry in salt water. The allowable density of slurry in salt water may be increased by 2 pcf.
Slurry temperature must be at least 40 degrees F when tested.

50 PRESTRESSING CONCRETE

Add to section 50-1.01A:

The details shown for Bridge number 35-0351 are based on a precast girder prestressing system using a combination of bonded full length pre-tensioned tendons, partially debonded full length pre-tensioned tendons, and bonded full length draped post-tensioned tendons. For this bridge you may submit a VECP for an alternative prestressing system using bonded partial length tendons if the proposed system and associated details comply with the following requirements:

1. The proposed system and details must provide moment and shear resistances at least equal to those used for the design of the structure shown.
2. The concrete strength must be at least that shown.
3. Not less than 35 percent of the total prestressing force at any section must be provided by full length draped tendons.
4. Anchorage blocks for partial length tendons must be located such that the blocks will not interfere with the placement of the utility facilities shown or of any future utilities to be placed through openings shown. Anchorage blocks for partial length tendons must not be located on exterior faces of exterior girders.
5. Temporary prestressing tendons, if used, must be detensioned, and the temporary ducts must be filled with grout before completion of the work. Temporary tendons must be either removed or fully encased in grout before completion of the work.

Upon your request, the Department furnishes you with the demand moments and shears used in the design shown.

Submit shop drawings of the proposed system, including all details and supporting checked calculations.

Replace the 2nd paragraph of section 50-1.01C(3) with:

For initial review, submit:

1. 8 copies for railroad bridges
2. 10 copies for railroad bridges if the project includes a BNSF Railway underpass
3. 6 copies for other structures

AA

51 CONCRETE STRUCTURES

Add to section 51-1.01C(1):

If the methacrylate crack treatment is performed within 100 feet of a residence, business, or public space, submit a public safety plan that includes the following:

1. Public notification letter with a list of delivery and posting addresses. The letter must describe the work to be performed and state the treatment work locations, dates, and times. Deliver the letter to residences and businesses within 100 feet of overlay work and to local fire and police officials not less than 7 days before starting overlay activities. Post the letter at the job site.
2. Airborne emissions monitoring plan. A CIH certified in comprehensive practice by the American Board of Industrial Hygiene must prepare and execute the plan. The plan must have at least 4 monitoring points including the mixing point, application point, and point of nearest public contact. Monitor airborne emissions during overlay activities.
3. Action plan for protecting the public if levels of airborne emissions exceed permissible levels.
4. Copy of the CIH's certification.

After completing methacrylate crack treatment activities, submit results from monitoring production airborne emissions as an informational submittal.

Replace "Reserved" in section 51-1.03A with:

Vertical, horizontal, radial, or normal dimensions shown on the typical section are for zero percent cross slope. You may construct superelevated concrete box girder structures with the typical section rotated around the profile grade line in superelevation areas, that have the following characteristics:

1. Sloping exterior girders
2. Straight, uninterrupted cross slope between edges of deck
3. A single profile grade line

For portions of superstructures rotated about the profile grade:

1. Horizontal distances between the profile grade line and the edges of deck must be as shown
2. Girder widths and slab thicknesses must be as shown
3. Interior girder stems must remain vertical

Replace the 1st paragraph in section 51-1.03F(5)(b)(i) with:

Except for bridge widenings, texture the bridge deck surfaces longitudinally by grinding and grooving.

Replace the 1st sentence of the 2nd paragraph of section 51-1.03G(1) with:

Fractured rib texture must consist of straight ribs of concrete with a bush hammered texture on the raised surfaces of ribs.

Add to the 5th paragraph of section 51-1.03G(1) with:

Construct a full size test panel at least 16 feet wide by 14 feet high for fractured rib texture (tree pattern). Center panel between correctly spaced background short tree trunk and foreground short tree trunk, and include all ribs and pattern details that will fit on the panel. This test panel satisfies requirements for full size samples shown.

Add to section 51-1.03G(1):

Fractured rib texture (tree pattern) must consist of the pattern as shown.

Delete the 5th paragraph of the RSS for section 51-1.04.

Add to section 51-1.04:

The payment quantity for fractured rib texture does not include the area of fractured rib texture on concrete barriers or on mechanically stabilized embankment facing panels.

Fractured rib texture (tree pattern) is measured on the gross out-to-out areas of fractured ribs. No deduction is made for smooth areas of included patterns.

The payment quantity for fractured rib texture (tree pattern) does not include the area of fractured rib texture (tree pattern) on mechanically stabilized embankment facing panels.

Add to section 51-4.02A:

Concrete for corbel caps must have at least 658 pounds of cementitious material per cubic yard, and must have at least 30 percent coarse aggregate.

Add to section 51-4.02B:

51-4.02B(8) Corbel Caps

Corbel caps must be cast against steel forms or plywood forms coated with plastic. Corners must be sharp, square, unchamfered and free of grout leaks.

Lightly tap forms after placing and vibrating or tamping concrete to consolidate concrete at the formed surfaces, and to bring air bubbles to the top of the concrete. Vibration of concrete and tapping of forms must not cause poor weatherability.

Unformed surfaces must be steel trowel finished to form a dense, sealed, true and smooth surface.

Replace item 3 in the list in the 4th paragraph of section 51-4.03B with:

3. Except for box girders, a minimum of 1.5 inch of deck slab concrete is maintained between deck slab reinforcement and the top of PC I and double T girders

Add to section 51-4.03B:

Except for box girders and double T girders, provide temporary lateral bracing for girders over Route 101. Install bracing at each end of the girder segments and at the midspan. Bracing must be in place before releasing erection equipment and must remain in place until 48 hours after concrete diaphragms are placed.

70-6.02A Line Drain Channel

Drain channel sections must be manufactured using monolithic polymer concrete with no side extensions. The interior surface of the line drain channel must be smooth below the level of the frame, grate, and associated connections.

Monolithic polymer concrete must consist of aggregate with either polyester resin or vinyl ester resin. The polymer concrete must have the values and properties shown in the following table:

| Property | ASTM Test method | Value |
|---|------------------|------------|
| Tensile strength, psi | C 307 | 1,450 min |
| Compressive strength, psi | C 579 | 11,600 min |
| Bending strength, psi | C 580 | 2,900 min |
| Moisture absorption, percentage | C 140 | 0.5 max |
| Chemical resistance | C 267 | Pass |
| Freeze-thaw, number of cycles without weight loss | C 666 | 1,600 min |

70-6.02B Line Drain Frames and Grates

Frames and grates must be heavy duty rated under General Services Administration CID A-A-60005 *Frames, Covers, Gratings, Steps, Manholes, Sump and Catch Basin*. The design and performance requirements include the following:

1. Grated line drain frames and grates must be manufactured of ductile iron complying with section 75-1.02. Frames and grates include bolts, nuts, frame anchors, and other connecting hardware. Galvanizing or asphalt paint coating is not required.
2. Frames and grates, whether one-piece or separate, must be classified heavy duty traffic rated with a transverse proof-load strength of 25,000 pounds
3. Grates and frames must be one piece anchored into the body of the line drain unless shown as removable. Removable grates must be separate from the frame and must:
 - 3.1 Be held in place by locking devices that are tamper resistant
 - 3.2 Provide a minimum repetitive pullout resistance of 340 lb/ft of length after completion of 1,000 hours of salt spray testing under ASTM B 117
 - 3.3. Be match marked in pairs before delivery to the work and grates must fit into the frames without rocking
4. If a combination of one piece frame and grate and removable grates are used, the locations of the removable grates are shown
5. Except for grates installed within designated pedestrian paths of travel, grate design must accept inflow of runoff through openings consisting of a minimum of 60 percent of the total top surface area of the grate. Individual openings or slots must have a dimension not greater than 2 inches measured in the direction of the grated line drain flow line.
6. Grates installed within designated pedestrian paths of travel must be certified as conforming to the requirements of the Americans with Disabilities Act.

70-6.03 CONSTRUCTION

Excavation and backfill must comply with section 19-3.

Grated line drains must be installed in trenches excavated to the lines and grades established by the Engineer. Grade and prepare the bottom of the trench to provide a firm and uniform bearing throughout the entire length of the grated line drain.

Installation of grated line drains and joints must comply with the manufacturer's instructions.

Install 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 must not extend above the level of the surrounding concrete backfill.

Connect grated line drains to new or existing drainage facilities as shown.

Backfill with minor concrete.

Cardboard Submittal: Make cardboard letters for each letter for stone veneer wall. Before drilling mounting holes in wall, attach cardboard letters to stone veneer wall with non-disfiguring tape for Engineer to review layout of all letters. Match letters to font style, height and widths of letters but not the thickness of the letters.

Add to section 73-4.01C:

Guarantee metal letters and bands against defects in materials for a period of three years against defects in manufacturing, materials, installation, construction and fabrication starting the first calendar day following project acceptance.

Replace defective work within 10 days after notification by the Engineer with new materials matching the original installation requirements at your expense. Ensure that the replacement elements are constructed as described in the Contract and match the installed elements.

Add to section 73-4.02:

The cementitious material content of Minor Concrete (Brushed Concrete) and Minor Concrete (Stamped Concrete) must be at least 600 lb/cu yd.

Metal bands must be uniformly smooth throughout all surfaces with no pits, dips, bulges, scratches, divits, patch marks, burrs, or discoloration.

Water jet cut bands must be from 3/8 inch thick bronze sheet.

Finish must be polished US9 Finish, hand-polished faces, bead-blasted returns, sprayed with 2-part hardened acrylic polyurethane clear coat, lead and mercury-free bronze alloy, baked.

Bronze studs and anchors for bands must be 5/8 inch in diameter as shown, and with finely ridged or textured finish to resist being dislodged from concrete.

Bronze studs for wall-mounted letters must be 3/8 inch diameter as shown, and with finely ridged or textured finish to resist being dislodged from mounting hole filled with non-sag epoxy.

All welds must be bronze welds.

Cast metal bands must have flat surfaces on top of letter face and on top surface of band and with high polish finish. Edges must be 90 degrees to face of letter and polished smooth with no sharp edges. Polished edges must be consistent throughout all letters and throughout bands and have a high polish matching face of letters and top surface of bands.

Epoxy must be non-sag epoxy.

Metal must be bronze with alloy. Color must be warm copper-colored bronze to match referee sample. Paint color "Antique Bronze" XME204 by MM Modern Masters. Finish must be smooth and highly polished.

Do not use lead or mercury bronze metal.

Add to section 73-4.03:

Stud and anchor placement and final quantity must keep surface finish grade of bands flush with adjacent surface finish grade of concrete without displacement and under heavy truck loading conditions, and wall mounted letters firmly in place without displacement.

Cast metal letters for stone veneer walls must be flush mounted. Bronze welded bronze studs must be on back surface of letters. Length of stud must match mounting drill hole depth which must penetrate entire depth of granite block, mortar and 5 inches into concrete core wall. Stud must be of length to extend the full depth of mounting hole minus 1/4 inch to allow for epoxy between end of stud and end of drill hole.

77-1.04 PAYMENT

Not Used

77-2 SANITARY SEWER FACILITIES

77-2.01 GENERAL

77-2.01A Summary

Section 77-2 includes specifications for constructing sanitary sewer facilities.

The sanitary sewer facilities include:

1. Forced, gravity, and pipe burst pipelines, including elbows, wyes, tees, connections; excavation backfilling, filter fabric, and restoring the roadway area
2. HDPE lateral including excavation, backfilling, filter fabric, and restoring the roadway area
3. Pressured and non-pressured manholes and connections
4. Air release valve assemblies
5. Modifying and adjusting existing manholes
6. Adjusting existing cleanouts
7. Miscellaneous iron and steel
8. Abandoning and removing existing pipelines and manholes
9. Temporary bypass sewer systems and connections

Dewatering must comply with section 13-13.

No connection to the existing sewer line, including the bypass sewer system connection is allowed between November 1 and April 30 of any year. The connection work must start and complete within the 4 hour shutdown period between midnight and 5:00 a.m.

77-2.01B Definition

Reserved

77-2.01C Submittals

77-2.01C(1) Shop Drawings

Submit shop drawings for components of the sanitary sewer facilities.

Transition section from existing 33 inch diameter pipe to 30 inch diameter PVC pipe as shown must be specially fabricated.

77-2.01C(2) Product Data

Submit the manufacturer's descriptive and technical data for materials including:

1. Pipe material
2. Pipe fittings including bends, tees, reducers, caps, struts, flanges, flex and expansion fittings, couplings, joints, and pipe fusions of HDPE pipes
3. Pipe appurtenances including marking tape, polyethylene wrapping, gaskets sealants, thread treatments, bolts, nuts, washers, threaded rods, star lugs, strutting assembly and pipe connections
4. Steel casing and steel sleeves including insulators and end caps

77-2.01C(3) Work Plan

Submit your work plan. The work plan must include:

1. Sequence and timeline schedule of detailed sewer construction activities including temporary bypass sewer system and connecting and switching services to and from the existing facilities
2. Description of steps to maintain existing facilities in operation during sewer construction activities including continuous services to affected properties
3. Construction details of:
 - 3.1. Sanitary sewer facilities including thrust blocks
 - 3.2. Connection and disconnection to existing sewer systems
 - 3.3. Temporary bypass sewer plan for the following new sewer systems:
 - 3.3.1 30 inch diameter pressure sewer line on Bayshore Highway
 - 3.3.2 16 inch diameter pressure sewer line on Bayshore Highway

- 3.3.3 8 inch diameter gravity sewer line on Bayshore Highway, including service laterals, pipe bursting, upsizing or replacing (existing 4 inch, 6 inch and 8 inch diameters)
- 3.3.4 6 inch gravity line on Rollins Rd
- 3.3.5 8 inch gravity line on Rollins Rd.
- 3.3.6 24 inch diameter gravity line on Rollins Rd / Broadway
- 3.4 Temporary trench shoring, jacking and receiving pits, including structural calculations signed by an engineer who is registered as a civil engineer in the State
- 4. Dewatering pits and the trenches
- 5. Removing sewage and cleaning existing facilities before connecting or disconnecting
- 5. Switching services over from existing facilities to new facilities
- 6. Description of pipe bursting and pit details and locations

77-2.01C(4) Temporary Bypass Sewer System Plan

Submit your temporary bypass sewer system plan The plan must include:

- 1. Details of bypass pumping system, including temporary manholes, pipes, sizes and capacities of generators, pumps, trash screens, operations and maintenance of the equipment, standby pumps, and standby generators based on shown schematic bypass plans and trench details
- 2. Sizing of the equipment based on actual flow monitoring and measurement or an estimate of flow by an engineer who is registered as a civil engineer in the State using a reasonable methodology
- 3. Standby pumps and generators capable of providing 100 percent redundancy and plans for use in emergency
- 4. Product data of equipment and material showing appropriateness and capability to handle anticipated conditions and work

77-2.01C(5) Sewage Spill Prevention and Contingency Plan

Submit your sewage spill prevention and contingency plan. Include the following:

- 1. Methods and procedure to keep sewage from spilling
- 2. List of emergency equipment to be on hand
- 3. Monitoring schedule and plan
- 4. Containment areas with spill prevention berm and pipe plugs
- 5. Contingency spill cleanup plan
- 6. Contingency notifications procedure
- 7. Contact list, including names and telephone numbers of personnel responsible for the 24 hours operation of the bypass pumping system which may include weekends and holidays

77-2.01C(6) Certificates of Compliance

Submit certificates of compliance for materials, including pipes, precast manhole, cover and frame, coatings, and linings.

77-2.01C(7) Maintenance and Operations Manuals

Submit maintenance and operations manuals of manufactured products.

77-2.01D Quality Control and Assurance

After the new sewer line and appurtenances and the manholes have been installed and the trench has been backfilled, and before connecting to the existing sewer system, conduct hydrostatic testing, low pressure air testing for leaks and videotaping of the sewer line. Test after at least 5 days after the thrust blocks are installed.

Prevent damage to work or adjacent areas during testing. Make repairs of defects that are discovered as a result of testing. Do not caulk screwed joints, cracks, or holes. Retest the sewer lines and appurtenances and the manholes that fail the test.

Conduct hydrostatic testing, air testing, and post television inspection in the presence of the Engineer.

77-2.01D(1) Hydrostatic Testing

Perform hydrostatic testing on the manholes and the following sewer lines:

1. 6 inch diameter pressure line on Bayshore Highway
2. 16 inch diameter pressure line on Bayshore Highway
3. 30 inch diameter pressure line on Bayshore Highway

Use water to test and drain. Do not use direct connections to the existing water supply system. Before testing, dismantle any connections used to fill the pipeline or manhole with water.

Forced sewer lines and pressured manholes may be tested together.

77-2.01D(1)(a) Sewer Line and Appurtenance Testing

Test non-forced sewer line at 5 psi pressure and forced sewer line at 50 psi.

Test connections, valves, blowoffs, and closure pieces with the piping.

Do not use installed valves for shutoff when the specified test pressure exceeds the valve's maximum allowable seat differential pressure. Provide blinds or other means to isolate test sections.

Do not include valves, equipment or piping specialties in test sections if test pressure exceeds the valve, equipment or piping specialty safe test pressure allowed by the item's manufacturer.

Do not test against closed valves. Valves must be opened and blind flanges or bumped heads must be used on the ends of each test section.

Select the limits of testing to sections of piping. Select sections that have the same piping material and test pressure.

Test piping for minimum 4 hours for visible leaks test.

Use the following testing procedures:

1. Fill piping section under test slowly with water while venting air.
2. Before pressurizing for the tests, retain water in piping under slight pressure for a water absorption period of minimum 24 hours.
3. Raise pressure to the specified test pressure and inspect piping visually for leaks. Consider visible leakage testing complete when no visible leaks are observed.

Leakage allowance is zero for piping systems using flanged, National Pipe Thread threaded and welded joints.

When test results indicate failure of selected sections, limit tests to piping:

1. Between valves
2. Between a valve and the end of the piping
3. Less than 500 feet long

Monitor for possible leakage at the onset of testing, all valves, air vacuum assemblies, blow offs and services. Repair leaks before the test proceeds. Monitor appurtenances through the duration of the test.

77-2.01D(1)(b) Manhole Testing

Plug inlets and outlets and fill the manhole with water. Leakage in the manhole must not exceed 0.1 gallon per hour per foot of head above the invert. Repair manholes that do not meet the leakage test or are unsatisfactory from visual inspection.

77-2.01D(2) Low Pressure Air Testing

77-2.01D(2)(a) General

You may test the following sewer lines using low air pressure testing instead of hydrostatic testing:

1. 6 inch diameter lateral
2. 8 inch diameter lateral

3. 12 inch diameter gravity line
4. 24 inch diameter gravity line

77-2.01D(2)(b) Procedure

Use the following procedure for air testing:

1. Before testing, clean the pipe to be tested by propelling a snug fitting inflated rubber ball through the pipe with water and remove any debris.
2. Plug all pipe outlets with suitable test plugs. Brace each plug securely.
3. If the pipe to be tested is submerged in groundwater, insert a pipe probe by boring or jetting into the backfill material adjacent to the center of the pipe and determine the pressure in the probe when air passes slowly through it. This is the backpressure due to groundwater submergence over the end of the probe. Increase all gauge pressures in the test by this amount.
4. Add air slowly to the portion of the pipe being tested until the internal pressure is raised to 5.0 psig.
5. Check exposed pipe and plugs for abnormal leakage by coating with a soap solution. If any leakage is observed, bleed off air and make necessary repairs.
6. After an internal pressure of 5.0 psig is obtained, allow at least 2 minutes for air temperature to stabilize, adding only the amount of air required to maintain pressure.
7. After the 2-minute period, disconnect the air supply.
8. When pressure decreases to 4.5 psig, start stopwatch. Determine the time in seconds that is required for the internal air pressure to reach 3.5 psig. The minimum allowable time in seconds is based on the diameters and lengths of the pipe under test. Use the allowable time in the following table:

MINIMUM SPECIFIED TIME REQUIRED FOR 1.0 PSIG PRESSURE DROP*

*For size and length of pipe indicated for Q=0.0015. Pressure air testing must be done under the "Uni-Bell PVC Pipe Association" Bulletin No. Uni-B-6-98, using table above.

| 1 Pipe diameter (in) | 2 Minimum time (min:sec) | 3 Length for minimum time (ft) | 4 Time for longer length (sec) | Specification time for length (L) shown (min:sec) | | | | | | | |
|-------------------------------|-----------------------------------|--|--|---|--------|--------|--------|--------|--------|--------|--------|
| | | | | 100 ft | 150 ft | 200 ft | 250 ft | 300 ft | 350 ft | 400 ft | 450 ft |
| 6 | 5:40 | 398 | 0.854 L | 5:40 | 5:40 | 5:40 | 5:40 | 5:40 | 5:40 | 5:42 | 6:24 |
| 8 | 7:34 | 298 | 1.520 L | 7:34 | 7:34 | 7:34 | 7:34 | 7:36 | 8:52 | 10:08 | 11:24 |
| 12 | 11:20 | 199 | 3.418L | 11:20 | 11:20 | 11:24 | 14:15 | 17:05 | 19:56 | 22:47 | 25:38 |
| 24 | 22:40 | 99 | 13.674 L | 22:47 | 34:11 | 45:34 | 56:58 | 68:22 | 79:46 | 91:10 | 102:33 |

77-2.01D(3) Post Television Inspection

Conduct post television inspection after completing all of the following work:

1. Sewer lines are installed, backfilled, and compacted
2. Manholes are in place, channeling is complete and pipelines are accessible from structure
3. Roadway sub grading is complete over the new sewer facilities
4. Sewer lines have been preliminarily cleaned and flushed
5. Final hydrostatic or air testing has been completed

77-2.01D(3)(a) Equipment

Use television camera system designed and constructed for sewer inspection. The camera system must have the following capability:

1. Operate in 100 percent humidity conditions
2. A 360-degree radial view rotating head
3. Lighting and camera quality (3 lux) suitable to provide a clear in-focus picture at a minimum of 6 feet of the entire inside periphery of the sewer pipe
4. Lighting controls to minimize reflective glare

5. A variable intensity control of the camera lights and remote control adjustments for focus and iris at the monitoring station
6. Adjustable lens with focal distance ranging from 6 inches to infinity
7. Continuously displayable and recordable monitor suitable to provide live camera feed with:
 - 7.1. Current date and time
 - 7.2. Assigned number designation of the upstream and downstream manholes corresponding to the line section being televised
 - 7.3. A continuous forward and reverse readout of the camera distance from the manhole of reference
 - 7.4. The remote reading footage counter accurate to 2/10 of a foot
8. Producing a minimum 500-line resolution color video picture

77-2.01D(3)(b) Procedure

Perform videotaping of the sewer line by moving the camera through the line in either direction at a uniform rate, stopping when necessary to permit proper documentation of the sewer condition. Do not pull the television camera at a speed greater than 30 feet per minute. Use manual or power winches, TV cable, and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions to move the camera through the sewer line. A self-propelled tractor unit may be necessary for lines with only one entrance access or to prevent set up at high traffic intersections. When the camera approaches a lateral connection, halt the camera progress and pan the camera lens to further view the lateral pipe and connection to thoroughly evaluate its condition.

If the manually operated winches are used to pull the television camera through the line, set up and use walkie-talkie radios or other suitable means of communication between the 2 manholes of the section being inspected.

Check the accuracy of the remote reading footage counter periodically by using a walking meter, roll-a-tape, or other suitable device. Perform an accuracy check after video taping a sewer line in the presence of the Engineer.

If any tape or section of the tape is unsatisfactory to the Engineer, the Engineer may request part or all of that tape be re-televised.

77-2.01D(3)(c) Records

Provide the following records:

1. Television inspection reports (logs): Location records showing the location in relation to the referenced manholes of each service lateral observed during inspection. Laterals may also be referenced by address it serves (i.e., by person above ground following with radio and roll-a-tape).
2. A report on each section of the line televised: Report must include a summary and evaluation as to the general condition of the section and a digital picture of each lateral connection.
3. Television inspection data on DVD disks with the corresponding hard copy reports: Data entry must include: ID number, address number, MH # from, MH # to, page #, TV date, pipe size, map footage, TV footage, tape #, and event photographs. Each photographic image must be saved in a JPEG file format and named with the footage of the event followed by the event (for example, defect BJCM at 107.9' would be named MH#B3001-107.9bjcm.jpg). The files must be stored within a file folder named for the upstream manhole number. Provide a query to list access to codes.
4. 2 master disc indexes: The first master index must be alpha-numerically sorted in the following order: (1) street name, and (2) upstream manhole number. The second master index must be in video number order with each line section listed in the order it appears on each disc. Each disc must have individual disc indexes located at the beginning of the log reports. List individual disc indexes in the same order as televised.
5. Video recordings: Two copies of color video recordings in standard DVD format. Discs must be labeled and individually numbered, beginning with number "FY 2014-2015 #001". Labels must be printed and include "Project Name, CCTV Project," identified as sanitary sewer (SS), date of disc submittal, and disc number.

77-2.02 MATERIALS

77-2.02A Delivery, Storage and Handling

Do not use cable or chain slings. When not being handled, support the pipe on timber cradles or on properly prepared ground, graded to eliminate all rock points and to provide uniform support along the full length. Support pipe at all times during transportation to prevent distort or damage the lining or coating.

Protect the interiors of pipes, fittings and valves against contamination. Transport, store and handle pipe to prevent the entrance of foreign material. Keep pipe, fittings and valves clean and dry.

Inspect each pipe and fitting, including protective coating before it is lowered into the trench. Remove damaged pipe and fitting from the job site and replace with another unit. Clean ends of the pipe thoroughly.

Use proper implements, tools, and facilities for the safe and proper protection of the pipe. Do not drop or dump pipe from trucks or into trenches.

77-2.02B General

77-2.02B(1) Ductile Iron Fittings

Flange joint fittings for PVC pipe must be ductile iron. Ductile iron (DI) pipe fitting must be mechanical joints and must comply with AWWA C110-12 with a rated working pressure matching the specified class of pipes. All tees, crosses, elbows, and reducers used with PVC pipe must have flange joint ends.

77-2.02B(2) Steel Sleeve

Steel sleeve must be welded steel casing and comply with section 77-3.02A.

77-2.02B(3) Trench Backfill

77-2.02B(3)a Controlled Low Strength Material

Controlled low strength material (CLSM) must comply with section 19-3.02F.

77-2.02B(3)b Sand Backfill

Sand backfill must comply with section 19-3.02E(2).

77-2.02B(3)c Filter Fabric

Filter fabric must be Class A and comply with section 88-1.02B.

77-2.02B(3)d Permeable Material

Class 1 permeable material must comply with section 68-2.02F.

77-2.02B(3)e Slurry Cement Backfill

Slurry cement backfill must comply with section 19-3.02D.

77-2.02B(4) Hot Mix Asphalt

Temporary HMA for backfilling trenches must comply with section 39-1.15.

77-2.02B(5) Cement Mortar and Grout

Cement mortar placed around the openings as shown must comply with section 51-1.02F. Grout placed around the openings as shown must comply with section 51-1.02G.

77-2.02B(6) Aggregate Base

Aggregate base for backfilling trenches in paved areas must comply with the material specifications for Class 2 aggregate base, 3/4-inch-maximum grading, under section 26-1.02B.

77-2.02B(7) Portland Cement Concrete

Portland Cement Concrete (PCC) for thrust and anchor blocks, collars, manhole bases, temporary manhole bases, and pipe transition block must comply with sections 51-7 and 90-2, except minor concrete must contain at least 590 pounds of cementitious material per cubic yard of concrete.

77-2.02B(8) Reinforcement

Reinforcement must comply with section 52.

77-2.02B(9) Welded Wire Fabric

Welded wire fabric must comply with section 52-1.02C.

77-2.02C PVC Pipe

PVC pipe and fittings must comply with the following table:

1. 6 inch and 8 inch diameter PVC pipes, fittings and joint materials must comply with AWWA C900, Class 165 DR 25.
2. 16 inch, 24 inch, and 30 inch diameter PVC pipes, fittings and joint materials must comply with AWWA C905, RD 25 Rated 165 psi.

Materials incidental to PVC pipe installations such as gaskets, joint lubricants, cements, etc., must be as recommended by the pipe manufacturer. Rubber gasket must be designed to resist hardening and disintegration from contact with sewage and water. The rubber gasket must fit and securely lock the ring into place over the spigot end of the pipe.

PVC sewer pipes installed in steel casings and steel sleeves must be strapped with insulators. Straps must be 12 inch wide stainless steel band casing with nylon skids. Skids must be adjustable in height to place the pipe in correct grade and to center in the steel casing. Insulators must be "PSI Model W," or equal. You can obtain the Model "W" Wrap Around End Seals from:

MANUFACTURER
GPT
6455 CLARA ROAD
HOUSTON, TX 77041
TELEPHONE: (713) 747-6948

DISTRIBUTOR
DL EQUIPMENT COMPANY, INC.
164 ROBLES WAY A7-134
VALLEJO, CA 94591
TELEPHONE: (707) 853-1676

The price quoted by the distributor for the Model "W" Wrap Around End Seals is \$200.00 each, not including sales tax. The above price is firm for orders placed within 30 days of Contract award, and provided delivery is accepted within 90 days after the order is placed.

The spacing of the stainless steel band spacers must be as recommended by the manufacturer, and must not to exceed 8 feet on centers. When installation and testing is complete, fill the annular space between the sewer pipe and casing or sleeves with sand.

Plastic pipes required in odd lengths must be cut using a proper cutting tool and guide that ensures true line cut on planes perpendicular to the pipe axis.

Joints for the PVC pipes joining standard lengths must comply with AWWA C301, and have bell and spigot ends formed or cylinder couplings.

Lateral connections must have long radius sweeps with minimum radius of 36 inches.

77-2.02D HDPE Pipe

HDPE pipes must comply with ASTM Standard F 714 and D 3035. Pipes must have a cell classification of PE 3408. Jointing must be by thermal butt-fusion process as specified in ASTM D 2657-67 or by other mechanical means as recommended by the manufacturer. No joints are required immediately outside of the structure bases for HDPE pipe installations.

77-2.02E Manhole

Manhole sections must be precast reinforced concrete complying with ASTM C 478, sections 11-2 and 90-4.

Standard precast concrete manholes must consist of cylindrical barrel sections, concentric tapered cones, and grade ring sections. The various shaft sections must fit together readily and all jointing and

connections must be cemented with mortar or joined with rubber gaskets or mastic joint filler. All mortar joints must be trowel smooth on the inside face and must be watertight. RUB'R NEK wrap, 12 inch wide, or equal must be installed around all exterior manhole joints. You can obtain the 12 inch wide RUB'R NEK wrap from:

DISTRIBUTOR
COOK CONCRETE PRODUCTS, INC.
5461 EASTSIDE ROAD
REDDING, CA 96001
TELEPHONE: (350) 243-2562

The price quoted by the distributor for the 12 inch wide RUB'R NEK wrap is \$1.41 per foot, not including sales tax. The above price is firm for orders placed within 30 days of Contract award, and provided delivery is accepted within 90 days after the order is placed.

77-2.02F Miscellaneous Iron and Steel

77-2.02F(1) Manhole and Cleanout Frame and Cover

Manhole and cleanout frame and cover must comply with section 75-1.02.

77-2.02G Air release valve assembly

Provide air release valve assembly at pressured manholes as shown.

77-2.03 CONSTRUCTION

77-2.03A General

Do not perform work on the existing sanitary sewer lines or disconnect the sewer lines without authorization. Notify the Engineer 48 hours before starting work adjacent to existing sanitary sewer mains.

Plan your connection work to reduce and minimize the time for connecting and starting your temporary bypass system and restoring back the sewer service.

Distribute the sewage spill prevention and contingency plan to the personnel on the emergency contact list before starting the sewer work. If sewage spill occurs, notify the Engineer immediately.

City of Burlingame Public Works Department operates all existing sewer lines and valves. Coordinate the following activities with the City of Burlingame Public Works Department through the Engineer:

1. Work on or adjacent to existing sanitary sewer mains
2. Transfer of sewer services
3. Temporary shutdown of existing services

Notify the Engineer 15 days before the connections work to the existing facilities and the existing valve operations.

Notify the Engineer 15 days, 72 hours and 24 hours before the proposed sewer line shutdown and connection work to the existing sewer facilities. The authorization is required before each shutdown. Obtain from the Engineer the list of serviced sewer properties and the owners' contact information. If your work will disrupt the sewer services to the properties, notify, in writing, the property owners, the residents, and the businesses 48 hours before the disruption. The written content of the notification must be authorized by the Engineer. Have complete materials, fittings, supports, equipment, tools, and necessary labor at the job site before starting the connection work.

Notify the Engineer of any conflicts at least 10 days before installation of the sanitary sewer facilities.

Notify the Engineer 10 days before hydrostatic testing or post television inspection.

77-2.03B Temporary Bypass Sewer System

Pumping must be done without damaging public or private property or create nuisance or health menace. The pumped sewage must be in an enclosed pipe. Do not allow sewage to free flow in gutters, streets, or

over sidewalks, etc. Do not allow sewage to flow into the storm inlets or conduits. Restore the flow to normal after the work is completed.

Sewer service shutdowns must be accomplished with temporary bypass sewer system in operation. No stoppage of the sewer flow is allowed during the switchover. Continuous sewer service must be provided to the existing properties.

Where the connection is to be made by constructing a temporary manhole on an existing sewer line, install a temporary plug in the pipe of the new system at the temporary manhole. Installing, securing, and removing temporary plugs must be done in the presence of the Engineer. Temporary plugs must remain in place until immediately before beginning of the cleaning and flushing operation.

77-2.03C Pipe Preparation

Take the following steps to prepare the pipe before the installation:

1. Clean the pipe bell. Remove sand, dirt, grease, and debris. Swab pipe bell with liquid hypochlorite solution as necessary.
2. Check the gasket. Seat gasket uniformly. Clean gasket area as necessary. Do not remove factory-installed gaskets from bells. Swab gasket with liquid hypochlorite solution as necessary.
3. Clean the spigot end of the pipe. Wipe spigot end clean with a clean rag and liquid hypochlorite solution.
4. Lower the pipe into the trench carefully to avoid damage and getting dirt into the bell or spigot.
5. Keep open trenches dry. Conduct the work to avoid contamination through the ends of the open pipe. Pump water that drains from the open ends of the pipe from the open trench.
6. Plug the open ends of pipe to prevent the entrance of foreign material when water is present in the open trench, when water drains from the open ends of pipe, or when work has stopped. Pump water from the open trench.

77-2.03D Trench Excavation and Backfill

Saw cut existing pavement to the width necessary for pipe construction and as shown. Dispose of removed material.

Controlled low strength material (CLSM) must be backfilled 1.5 feet above the top of the pipe for a trench less the 4 feet deep.

77-2.03E Pipe Laying

Install pipe, fittings, and appurtenances in compliance with the manufacturer's instructions. Lay pipe to the lines and grades as shown. Do not lay pipe in water or when trench conditions are unsuitable.

Proceed pipe laying from upgrade with the spigot ends of bell and spigot pipe pointing in the direction of the flow. Lay each piece true to line and grade to form a close concentric joint with the adjoining pipe and to prevent sudden offsets in the flow line. As the work progresses, clean the pipe interior from all dirt and debris. When the work is not in progress, plug or cap open ends of pipe and fittings.

As pipe laying proceeds, the trench may be enlarged at each bell spigot joint site to facilitate the jointing operations. Do not excavate the trench at joint site more than of sufficient size for the purpose. Do not excavate more than 6 joint sites ahead of actual pipe laying. Excavated joint site must provide a uniform bearing under the full length of the pipe to a width of at least 60 percent of the internal diameter of the pipe.

Insert spigot end into the pipe until it contacts the gasket uniformly. Alignment of pipe must be straight. Apply steady pressure by hand or suitable mechanical means, such as bar and block, come-along, hydraulic jack, until the spigot slips through the gasket. Do not use backhoe bucket. Protect bells and gaskets from damage. If resistance is encountered during pipe insertion or if pipe cannot be inserted to the reference mark, disassemble the joint and check the position of the gasket. Inspect pipe and gasket for damage. Replace damaged materials. Replaced materials must be cleaned and reassembled.

If the pipe must be field cut, mark the entire circumference of the pipe. Cut end using a pipe beveling tool or portable sander or abrasive disc. Round off sharp edges. Mark cut end with an insertion line similar to uncut pipe.

Do not use extrusion gun welding, threading and solvent, or epoxy cementing method to join the HDPE pipes. Joining of HDPE pipe to dissimilar material pipe must be done by flange adapters or mechanical couplings as recommended by the manufacturer and authorized by the Engineer.

77-2.03F Pipeline Alignment

Curves on the pipeline alignment will not be allowed. Sewer pipeline must maintain a constant separation from the other utilities in the adjacent trenches as shown. Horizontal and vertical separation of water pipeline and sanitary sewer pipe must comply with the requirements in the CA Health & Safety Code, and the CA Code of Regs, Title 22, and as shown.

Lateral connections must have long radius sweeps with minimum radius of 36 inches.

77-2.03G Manhole and Frame and Cover

Do not connect to the operating existing sewer line until the new manhole has passed the hydrostatic pressure test for the new manholes to be installed on the existing sewer line.

Set manhole segments and rings evenly. For the bottom segment, set in a pre-formed lip section with asphaltic sealant to make a watertight joint.

Install frames and covers on top of manholes to prevent infiltration of surface or groundwater into manholes. Pour concrete against undisturbed material. Set manhole cover approximately 1/8 inch above the surrounding grade to ensure the water does not run toward the manhole but runs away from the manhole. The area around the manhole ring must not flood when it rains.

Place roadway surfacing as shown around the new or modified manholes connecting to existing sewer line immediately after backfilling the trench.

Remove existing pressured manhole covers and frames. If the existing manhole cover and frame is undamaged and authorized by the Engineer, you may reuse the manhole cover and frame by replacing the elastomer gasket. New manhole cover must be Pamrex Manhole Lids, 24 inch diameter, traffic load bearing, with anti theft cover, handling key and raised letter engraved, "SANITARY SEWER." You can obtain the Pamrex Manhole cover from:

DISTRIBUTOR
PLUMBERSSTOCK.COM
506 NORTH 200 WEST
CEDAR CITY, UTAH 84721
TELEPHONE: (435) 868-4020

The price quoted by the distributor for the Pamrex Manhole Lid is \$380.00 each, not including sales tax. The above price is firm for orders placed within 30 days of Contract award, and provided delivery is accepted within 90 days after the order is placed.

77-2.03H Access manhole

Access manhole must be constructed directly above the air release valve.

77-2.03I Cleaning

Do not discharge material other than clear flushing water into the existing system before final acceptance of the new work. Remove splattered mortar and all irregularities from the flow channels, leaving smooth dense uniform surfaces finished.

Before final acceptance, clean the system. Remove accumulated construction debris, rocks, gravel, sand, silt, and other foreign materials from the system. Any cleaned sewer lines that cannot be visually inspected, must be cleaned in the presence of the Engineer.

When the testing and the repairs and adjustments have been made, including setting manhole frames to final elevations, clean the entire new system of sewer lines and manholes. Before beginning the cleaning operation, place a sand trap in the manhole at which the new work connects to the existing system. Use a high pressure jet or hydraulically propelled ball to clean the entire system of new sewer lines. Before the beginning of the work, remove excessive amounts of debris. Remove solid material washed into the lower

manholes from the system. Remove the sand trap between the new work and the existing system after all phases of the work, testing, and final inspection have been authorized.

77-2.04 PAYMENT

Not Used

77-3 JACKED PIPE CASING

77-3.01 GENERAL

77-3.01A Summary

Section 77-3 includes specifications for installing jacked steel casing. Jacked steel casing must be a welded steel pipe of a diameter shown.

77-3.01B Definitions

pipe jacking: Pipe jacking is a trenchless construction method for installing a prefabricated pipe through the ground behind a shield or a tunnel boring machine from a drive shaft to a reception shaft.

auger boring: A trenchless construction method for installing a prefabricated pipe through the ground jacked behind a rotating cutterhead of an auger boring machine from a drive shaft to a reception shaft.

field welding: Welding performed at the job site.

77-3.01C Submittals

77-3.01C(1) General

Submit the MSDS for any proposed chemical additives used with slurry.

77-3.01C(2) Work Plan

Submit your work plan. The work plan must include:

1. Plans and calculations for control and diversion of ground water including:
 - 1.1. Selection of a flow diversion system and equipment based on compatibility with the properties, characteristics, and behavior of the soils as indicated by the Geotechnical Design and Materials Report in the Information Handout.
 - 1.2. Calculations supporting the capacity and sizing of the flow diversion system
 - 1.3. Schedule and duration of the flow diversion
2. Manufacturers' data sheets and specifications for the pipe jacking equipment, jacking frame, and all ancillary equipment to be used in the installation
3. Description of the method for removing and disposing of spoil, including:
 - 3.1. Location of disposal sites
 - 3.2. Sample log of volume of spoil removed relative to the advancement of the pipe
4. Description of the grade and alignment control system, including:
 - 4.1. Indicator of the location of the pipe's leading edge with respect to line and grade
 - 4.2. Intervals for checking line and grade
 - 4.3. Manufacturer's product literature and drawings showing set-up, support provisions, and other details for the water level and laser or theodolite systems
 - 4.4. Surveying methods for confirming that the thrust block, guide rails, and jacking frame are installed on the proper line and grade. Submitting survey results before the launch of each drive to ensure that the thrust block, jacking frame, and guide rails are installed properly.
 - 4.5. Data demonstrating these systems can achieve the line and grade as shown within the specified tolerances
 - 4.6. Samples of grade and alignment progress reports
5. Description of the method for centering the cutting head inside the borehole
6. Design calculations confirming the proposed jacking pipe is capable of supporting the maximum stresses anticipated during jacking work
 - 6.1. Assumptions used in your calculations must be consistent with the information in the Geotechnical Design and Materials Report in the Information Handout.
 - 6.2. Calculations must include earth and hydrostatic loads, jacking forces, external loads such as live loads due to traffic, and any other loads that may be reasonably anticipated during jacking. Describe and show all loads and the assumed maximum drive length.

- 6.3. Provide an estimate of the maximum jacking force expected to complete the drive, accounting for frictional resistance along the pipe.
7. Calculations demonstrating the soils behind the thrust block can transfer the maximum planned jacking forces exerted by the main jacks to the ground with a factor of safety of at least 2.0 without excessive deflection or displacement
8. Methods for preventing voids and for grouting
9. Design and layout drawings of the reception and drive shafts, including:
 - 9.1. Surface construction
 - 9.2. Profile and depth
 - 9.3. Method of excavation
 - 9.4. Shoring and bracing
 - 9.5. Thrust block design
 - 9.6. Dimensions and locations of all jacking equipment
10. Pipe design data and specifications required to withstand the jacking pressure
11. Locations and design of intermediate jacking stations
12. Description of the lubrication injection system, including:
 - 12.1. Manufacturer's product literature and MSDS for the lubricant
 - 12.2. Estimated volume of lubricant that will be pumped
 - 12.3. Lubrication procedures
13. Plan for monitoring ground surface movement caused by the jacking operation, including:
 - 13.1. Method, locations, and frequency of survey measurements
 - 13.2. Preconstruction and postconstruction assessments of any roadways or structures located within 100 feet of the pipe's centerline and the reception and drive shafts
 - 13.3. Procedures for avoiding excessive settlement
 - 13.4. Photographs or video of existing damage to structures near the pipe's alignment
14. Layout plan and description of the pipe jacking sequence
15. Procedures for complying with Cal/OSHA requirements under section 7-1.02K(6), including:
 - 15.1. Safety procedures and equipment for shaft access and exit
 - 15.2. Ventilation and lighting
 - 15.3. Monitoring for hazardous gases
 - 15.4. Protection against soil instability, ground water inflow, and flooding
 - 15.5. Safety procedures for handling mechanical and hydraulic equipment
 - 15.6. Emergency evacuation procedures
16. Contingency plans for the following conditions: damage to the pipe; loss and return to line and grade; sudden or large increase in jacking forces; contact with an unexpected obstruction or utility; boring machine becomes stuck; jacking forces reach design capacity of the pipe, jacking frame, or thrust block, grade tolerances are exceeded.
17. A list with descriptions of similar projects that successfully used the proposed pipe jacking system.

77-3.01D Quality Control and Assurance

77-3.01D(1) General

Plans, working drawings, and calculations for pipe jacking operations work must be sealed and signed by an engineer who is registered as a civil or structural engineer in the State. The Department will schedule a preconstruction meeting with you, your subcontractors, and other involved parties following acceptance of all submittals.

Assign a representative who is knowledgeable about the pipe jacking equipment and work to be present during pipe jacking work and to address concerns and emergencies.

Notify the Engineer 5 business days before starting work.

77-3.01D(2) Daily Operations Logs

By noon the next day after completion of a work shift, submit daily pipe jacking and lubrication logs.

Record observations at intervals of no less than 3 times per pipe, as conditions change, or as directed.

The daily pipe jacking log must include:

1. Date and times of observations
2. Pipe jacking operator's name

3. Tunnel drive identification
4. Installed length of pipe and corresponding tunnel length
5. Rate of advance
6. Jacking forces
7. Problems encountered with the tunnel boring machine or other equipment
8. Durations and reasons for delay

The daily lubrication log must include:

1. Injection locations along the pipe
2. Volume of lubricant pumped throughout a drive
3. Types and amounts of additives used and the time and drive distance when used

77-3.01D(3) Field Leakage Testing

Notify the Engineer and stop work immediately if there is any indication the pipe has been damaged and may leak. If requested, perform a hydrostatic pressure test within 24 hours in the Engineer's presence.

Use one of the following test methods:

1. Field leakage testing for culvert and drainage pipes under section 61-1.01D(2)(a)
2. Water leakage test for leak-resistant joints. A maximum allowable leakage of 1,000 gallons per inch of nominal diameter per mile of pipe length per day is allowed under a hydrostatic head of 6 feet above the crown. If authorized, you may use an air-based joint-by-joint leakage test.

Submit a copy of your test results. Repair and retest the failed joints or pipe sections until they comply with the maximum allowable leakage.

77-3.01D(4) Completed Installation Inspection

Inspect the entire length of the completed pipe-jacking installation using CCTV or human entry. Provide a copy of the inspection video in DVD or MPEG format or a written log with photographs and identification of any problem locations.

77-3.01D(5) Settlement and Heave Monitoring

Install and operate instrumentation to measure surface settlement or heave. The survey accuracy of the settlement monitoring points must be within 0.01 feet.

In asphalt or concrete paved areas, establish surface control points by an inscribed marking or approved surveyor's nail driven flush with the surface.

In unpaved areas, establish surface control points by driving a 2 by 2 by 18 inch long timber stake flush with the ground. Each control point must have a tag or marking indicating the station and offset from centerline.

For each jacked steel casing location and associated surface control points:

1. Submit baseline survey measurements of the control points at least 7 days before any jacking work
2. Take daily survey measurements when you begin the jacking work
3. Submit the daily survey measurements by noon on the following day
4. Continue taking daily survey measurements until the jacking work is completed
5. Take weekly survey measurements of surface control points

Surface settlement points located in traffic lanes must be checked before and after tunneling. If 1/4 inch or more of settlement or heave is measured, take corrective action, including repairing the damage and filling the voids with grout.

77-3.02 MATERIALS

77-3.02A Welded Steel Pipe

Welded steel pipe must comply with section 70-3.02A and meet the following requirements:

1. Spiral or straight seam welded pipe or seamless pipe
2. May be bare inside and out

3. Square cut with dead-even lengths which are compatible with the pipe jacking
4. Strength sufficient to sustain the vertical and jacking loads
5. Meet or exceed the following minimum wall thickness requirements:

| Minimum Wall Thickness | | |
|-------------------------------|-----------------------|----------------------|
| Pipe Diameter | Up to 150 foot length | Over 150 foot length |
| 6–28 in | 3/8 in | 3/8 in |
| 30–38 in | 5/8 in | 5/8 in |

77-3.02B Welded Steel Pipe Couplings and Joints

Couplings and joints must meet the following requirements:

1. Couplings must be flush
2. Pipe lengths may be joined by a mechanical press fit design with no internal or external bells or field welding under section 49-2.02B(1)(b)
3. Joints must be airtight and continuous over the entire circumference of the pipe with a full bead weld equal to or exceeding the minimum thickness when measured at an angle of 45 degrees to the pipe and coupling interface
4. A qualified welder must perform all welding unless non-welded mechanical press fit design is used
5. Welded couplings must provide stress transfer across the joints capable of resisting the jacking forces involved

77-3.02C Slurry

Use a slurry for soil stabilization during tunnel boring. The slurry must:

1. Be a mixture of bentonite clay and potable water
2. Have a minimum pH of 6.0
3. Include only approved chemical additives

77-3.03 CONSTRUCTION

77-3.03A General

Excavation and backfill must comply with section 19-3.

Handle and dispose of wastewater generated by pipe jacking operations work under section 13-13.

Reception and drive shafts must have bottoms of crushed rock or concrete slabs and sumps to clear ground water and water used to clean casings. Line the reception and drive shafts with filter fabric if ground water is encountered.

77-3.03B Jacked Steel Casing

Use thrust blocks designed to distribute loads uniformly such that:

1. Deflection of the thrust block is uniform
2. Excessive loads are not exerted on the shaft
3. Jacking frame does not become misaligned

The jacking system must push the steel casing through the ground in a controlled manner and sustain the anticipated jacking loads. Monitor the jacking force applied to the pipe and do not exceed the pipe manufacturer's recommendations.

Ensure the lubrication injection system is functional at all times and capable of reducing jacking loads. Use pipe lubrication systems and pumps to convey the lubricant to the injection points. Keep sufficient lubricant on site to avoid loss of lubrication.

Once steel casing jacking has started, continue jacking without interruption until the steel casing has reached the specified distance. If authorized, you may use a different jacking sequence and method to ensure continued advancement of the steel casing and stability of the heading at all times.

Protect the driving ends of the steel casing against damage.

Repair or replace any damaged or failed section of steel casing.

If an obstruction prevents completion of the work, plug, abandon the pipe and construct new boring.

Repair or replace any roadways or structures damaged by settlement or heaving caused by jacked steel casing work.

77-3.03C Auger Boring

Simultaneously push auger and steel casing. The rear of the cutting head must not advance in front of the leading edge of the steel casing by more than 1/3 times the steel casing diameter. In stable cohesive conditions the rear of the cutting head must not advance in front of the leading edge of the casing by more than 8 inches.

In unstable conditions, such as granular soil, loose or flowable materials, the cutting head must be retracted into the steel casing a distance that permits a balance between pushing pressure, steel casing advancement and soil conditions. A suitable band welded around the leading edge of the steel casing must be installed to provide additional strength in loose unstable materials when the cutting head has been retracted into the steel casing to reduce skin friction and to provide a method for the slurry lubricant to coat the outside of the steel casing.

If wing cutters are used, use a maximum excavation of 1 inch to the outside diameter of the steel casing.

Provide at least 20 feet of full diameter auger at the leading end of the steel casing. Subsequent auger size may be reduced, but the reduced auger diameter must be at least 75 percent of the full auger diameter. The length of auger strand must be equal to that of the section of steel casing.

Do not leave conduit open ended without the authorization of the Engineer to prevent the conduit from acting as a drainage structure before finished installation.

Auger boring equipment selected for this work must be suitable for advancing through the geologic conditions described in the Geotechnical Design and Materials Report. The machine must be capable of excavating cobbles or boulders or other objects up to 30 percent of the outside diameter of the augers.

Upon completion of the auger boring work, grout voids in excess of 1 inch. Grout must comply with section 15-6.01B(2). Grout ports, when placed inside of the pipe, must include predrilled grout holes filled with threaded fittings placed on 8 foot centers longitudinally and offset 22 degrees from vertical, and staggered to the left and right of the top longitudinal axis of the pipe. Upon completion of grouting, holes must be plugged with steel or PVC caps.

77-3.03D Excess Fluids and Spoil

Monitor the pumping rate, pressure, viscosity, and density of the boring fluids to ensure the stability of the borehole and adequate removal of spoil. Contain excess boring fluids, slurry and spoil at the entry and exit points of the reception and drive shafts.

Dispose of or recycle all boring fluids.

If jacking and boring in suspected contaminated soil, test the boring fluids and soil cuttings for contamination. Notify the Engineer immediately if there is contamination and stop work. Dispose of any contaminated soil and fluids appropriately.

Remove all spoil upon completion of jacking.

77-3.04 PAYMENT

Jacked steel casing is measured parallel with the slope line along the centerline of the steel casing. The Department does not pay for jacked steel casing placed in excess of the designated length.

No additional payment is made for construction of reception shaft, temporary fence, type K temporary railing, failed bore paths, removal of materials installed in a failed bore path, products taken out of service, or incomplete installations.

77-4 WATER DISTRIBUTION SYSTEM

77-4.01 GENERAL

77-4.01A Summary

Section 77-4 includes specifications for constructing water distribution system.

The water distribution system includes:

1. 12 inch PVC waterlines, elbows, wyes, tees, connections, service saddles, hardware, excavation, backfill, bedding, trace wire and warning tape
2. 2 inch lateral waterlines, elbows, wyes, tees, connections, service saddles, hardware, excavation, backfill, bedding, trace wire and warning tape
3. Butterfly and drop in valves including valve boxes
4. Installing water meters
5. Remove fire hydrant
6. Install fire hydrant
7. Connecting to existing waterlines and services
8. Adjusting water valve boxes

Dewatering must comply with section 13-13.

Do not start any construction until all utilities in the construction area have been exposed.

77-4.01B Definitions

Not Used

77-4.01C Notifications

Notify the Engineer and coordinate any disconnection of water lines and fire hydrants with the City of Burlingame Public Works, Water Department (City) and the City of Burlingame Fire Department (Fire).

Notify the Engineer to coordinate the inspection and authorization of water system materials before the installation. Do not install the material unless authorized.

Transfer of water services must be authorized by the Engineer and the City of Burlingame, Department of Public Works, Water Department (City), and the transfer work must be coordinated with the City and Fire.

Notify the Engineer and contact the City for operation of valves on existing waterlines. The City must be notified 48 hours before the work requiring a valve operation by the City.

Do not disconnect existing waterline without the authorization from the Engineer and the City and Fire.

Notify the Engineer and contact the City for hot tap connections. The City must be notified 5 business days before the connection.

Notify the Engineer and coordinate all work that requires temporary shutdown of existing water services, including temporary relocation of the lines, meters and connection to existing services with City and Fire. The Engineer, the City, and the Fire must be notified 15 days before the shut down.

Notify the Engineer, the City, and the Fire 72 hours and 24 hours before planned shutdown of the existing waterline. The City will notify the property owners and the users who will be affected by the shut down. Do not shut down the waterline until authorized.

Notify the Engineer of any utility conflicts at least 10 days before installation of the water distribution systems.

Notify the Engineer and the City at least 48 hours before discharging de-chlorinated water to the City of Burlingame's sanitary sewer system.

77-4.01D Submittals

77-4.01D(1) Shop Drawings

Submit shop drawings, catalogs, and engineering data for each water system. Submit the manufacturer's certified working drawings covering the design, manufacture and fabrication of pipe, fittings, special fittings, and joint details, valves, and temporary blow off assemblies before the start of the fabrication of

the material. The shop drawings must indicate the manufacturer/supplier, model number, type, thickness and grade of steel used, coating and lining thickness, flange details, dished heads, outlets, and special fittings.

Show pipeline stations on centerline of pipe. Include in the working drawings detailed engineering layout sheets detailing the location and elevation of the existing pipes where connections are to be made, line layout and pipe marking diagrams, number of pipe and fittings, stationing of field closure pieces, tracing wire and warning tape, permanent "surface marking" on the pavement, numbering of the order in which the various pieces of the pipe are to be assembled during construction and such other information as may be required by the Engineer.

77-4.01D(2) Cut Sheets

Submit cut sheets. The cut sheets must be prepared by a registered professional Land Surveyor in the State. The cut sheets include pipeline stations at a minimum of 50 feet intervals showing all appurtenances, services, tees, valves, meters, horizontal inverts, and such other information as may be required by the Engineer.

77-4.01D(3) Product Data

Submit the manufacturer's descriptive and technical data for materials including:

1. Pipe material
2. Pipe fittings including bends, tees, reducers, caps, struts, flanges, stub outs, blow-off assembly, fire hydrant, and couplings
3. Pipe appurtenances including marking tape, polyethylene wrapping, gaskets sealants, thread treatments, bolts, nuts, washers, threaded rods, star lugs, and pipe connections

77-4.01D(4) Work Plan

Submit your work plan. The work plan must include:

1. Sequence and timeline schedule of detailed water distribution system construction activities including connecting and switching services to and from the existing water main and laterals
2. Description of steps to maintain existing facilities in operation during water distribution system construction activities including continuous services to affected properties
3. Construction details of:
 - 3.1. Water distribution system including thrust blocks
 - 3.2. Connection and disconnection to existing water main and laterals
 - 3.3. Temporary trench shoring
4. Procedures for wire connection, system check-out, and before and after backfill testing for insulating joints, casing insulators, and joint bond
5. Trench dewatering
6. Hydrostatic test plan including complete details of test procedures with test locations, equipment, material and a timetable for completing each procedure
7. Flushing and disinfecting plan including complete details on materials, procedures, locations, and means of disposal
8. Contact list, names and telephone numbers of people and agencies to be notified of shutdown, including the Engineer, City of Burlingame Department of Public Works Water Department, and City of Burlingame Fire Marshal

77-4.01D(5) Certificates of Compliance

Furnish certificates of compliance for all materials, including pipe, coatings, and linings, where applicable, for each water system.

77-4.01D(6) Installation, Maintenance, and Operations Manuals

Submit installation, maintenance, and operations manuals of manufactured products.

77-4.01E Quality Control and Assurance

77-4.01E(1) Hydrostatic Test

Perform hydrostatic test on the waterlines and appurtenances.

Conduct the test after the trench has been backfilled and the thrust block concrete has reached its design strength. Test concurrently with the applicable retention period for disinfection of the new waterline.

The hydrostatic test must be a combined pressure and leakage test. Furnish the necessary equipment and material including the closure pieces and make the taps as required for the testing. Provide the temporary blocking of the pipeline at the tie-in points. No hydrostatic test is allowed against a closed valve connected to the existing system.

Use the following testing procedure:

1. Slowly fill the pipe with water at a rate such that the velocity does not exceed 3 inches per second applied over full area of the pipe
2. Expel all air from the pipe and allow to stand for minimum of 24 hours under a slight pressure
3. After the pipe is filled with water, but prior to applying test pressure, maintain a pressure up to the operating pressure to allow for absorption by the pipe lining for 10 hours minimum
4. Apply and maintain the specified test pressure by continuous pumping for the entire test period
5. Test the pipe for 2 hours at 200 psi
6. Measure accurately, within $1 \pm$ gallon, the amount of water required to maintain the test pressure by using a barrel or similar device or metered to suction the water from the pump
7. The pressure must not drop more than 5 psi below the test pressure
8. Allowable leakage is determined by the following formula:

$$L = (ND\sqrt{P})/28$$

Where:

L = allowable leakage, cubic gallons/hr

N = number of joints in the tested pipeline (including pipe and fittings)

D = nominal diameter of pipe, inches

P = average test pressure, psi

If any hydrostatic test discloses leakage greater than that allowed, locate and repair the defective joint, pipe, or appurtenances. Retest the system after repair. The system must be free of all detectable leaks.

All pipes, joints, and appurtenances must pass hydrostatic test before connecting to the existing water distribution system.

77-4.01E(2) Bacteriological Testing

After disinfecting and flushing the waterlines, collect water samples and send samples to a laboratory certified by California Department of Public Health (CDPH) for bacteriological testing. Submit results of bacteriological testing to the Engineer and the City of Burlingame, Department of Public Works and Utilities (City) for authorization.

Sample point must be along every street block and at least every 1,000 feet along the length of the new waterline and one at the end of the new main and at least 1 at each branch line. Submit proposed locations of the sample points before bacteriological testing to the Engineer and the City for authorization.

The temporary sampling taps must consist of a 1/2 inch unthreaded bib/faucet installed on a pipe riser, minimum of 12 inch above grade.

If a sample test fails, repeat the disinfection procedure and retest the waterline.

77-4.02 MATERIALS

77-4.02A Delivery, Storage and Handling

Lifting and handling of pipe must be done to prevent damage to the pipe coating. Do not use cable or chain slings. When not being handled, support the pipe on timber cradles or on properly prepared ground, graded to eliminate all rock points and to provide uniform support along the full length. Support pipe at all times during transportation to prevent distort, or damage the lining or coating.

Protect the interiors of pipes, fittings and valves against contamination. Pipe must be transported, stored and handled in a manner to prevent the entrance of foreign material. Keep pipe, fittings and valves clean and dry.

Inspect each pipe and fitting, including protective coating before they are lowered into the trench. Any pipe or fitting, damaged must be removed from the job site and replaced with another unit. Clean ends of the pipe thoroughly.

Use proper implements, tools, and facilities for the safe and proper protection of the pipe. Do not drop or dump pipe from trucks or into trenches.

77-4.02B General

Materials for water distribution system must comply with NSF/ANSI Standard 61.

77-4.02B(1) Hardware

Bolts, nuts, washers, and tie rods installed below grade must be Type 316 ASTM Stainless Steel. Teflon anti-seize compound must be used on bolt or tie-rod threads.

End of bolts and nuts on fittings and valves used with 12 inch and smaller pipe must be covered with SAP-SEALS.

77-4.02B(2) Trench Backfill

77-4.02B(2)a Controlled Low Strength Material

Controlled low strength material (CLSM) must comply with section 19-3.02F.

77-4.02B(2)b Sand Backfill

Sand backfill must comply with section 19-3.02E(2).

77-4.02B(2)c Pipe Bedding

Pipe bedding must be Class 1 Permeable Material, Type A complying with section 68-2.02F.

77-4.02B(2)d Tracer Wire and Warning Tape

Tracer wire must be 12 gauge copper wire.

Warning tape must be 2 inch wide, inert, fade-resistant plastic film resistant to acids, alkalis and other components likely to be encountered in soil. Tape must be marked "Water" and be installed 12 inches above the pipe in the trench.

77-4.02B(3) Service Saddle

Service saddles must provide full support around the circumference of the pipe. The saddle must have a bearing area of sufficient width along the axis of the pipe and the pipe will not be distorted when the saddle is tightened.

The service clamp must not have:

1. Lugs or other protrusions that digs into the pipe when the saddle is tightened
2. U-bolt type strap that does not provide sufficient bearing area
3. Clamping arrangement not fully contoured to pressure rating of 200 psi

Saddles must have a minimum working pressure rating of 200 psi. Saddles must have a wedge or taper type gasket for a watertight installation. Metallic components must be of bronze.

77-4.02C Pipe

Twelve inch diameter and larger PVC pipes must comply with the requirements of AWWA C905, DR 14. Smaller than 12 inch diameter PVC pipes must comply with the requirements of AWWA C900, DR 14.

PVC pipe must be with either bell and spigot ends or couplings.

Ductile iron pipe must comply with ISO standards.

Polyethylene pipe encasement for ductile iron pipe must be a minimum of 1/64 inch thick complying with ANSI/AWWA C105/A21.5.

77-4.02C(1) Pipe Fittings

Pressure pipe fittings must be of ductile iron.

Ductile iron pipe fitting must comply with ISO Standards and must be of mechanical joint, unless otherwise shown.

Ductile iron fittings must comply with the requirements of ANSI/AWWA C110/A21.10 through ANSI/AWWA C153/A21.53-06, and must have the proper type of ends to match the type of pipe used.

Gaskets for flange fittings must comply with the requirements of ANSI/AWWA C115/A21.15.

Ductile iron fittings must be fusion-bonded epoxy coated minimum of 12 mil thick, in compliance with the requirements in ANSI/AWWA C104/A21.4 and 316 stainless steel bolts and nuts, and must be double polyethylene wrapped per AWWA 105. Tape to seal seams and overlaps must be plastic adhesive tape of at least 4 mils thick and at least 2 inches wide. Ductile iron fittings must have a minimum pressure rating of 250 psi and must otherwise meet or exceed the pressure rating of the pipe to be installed, and must have a minimum Class 53 thickness rating.

77-4.02D Valves

77-4.02D(1) General

Valves must have a working pressure rating equal to or greater than the pressure class for the connecting waterline.

Valves must be furnished with operating keys.

Buried valves must be fusion epoxy-coated and wrapped in 12-mil polyethylene.

77-4.02D(2) Butterfly Valves

Butterfly valves must comply with AWWA C504.

77-4.02E(3) Valve Boxes

Valve boxes must be 1 inch in height with an inside diameter of 8 inch. Top section, including cover and extension must be Christie G5 or equal. Covers must be cast iron and marked "WATER", and accompany every valve box. The extension must be 8 inch PVC pipe. Extension length must be as required for valve.

You can obtain the Christie G5 valve boxes from:

DISTRIBUTOR
R & B COMPANY
1240 NORTH 13TH STREET
SAN JOSE, CA 95112
TELEPHONE: (408) 297-7935

The price quoted by the distributor for the Christie G5 valve box is \$60.00 each, not including sales tax. The above price is firm for orders placed within 30 days of Contract award, and provided delivery is accepted within 90 days after the order is placed.

77-4.02E Service Lateral

Service lateral pipes 2 inches or less in diameter must be copper tubing, Type K complying with the requirements of ANSI/AWWA C901. Connections must be compression type with stainless steel or plastic inserts. Tubing must be installed per manufacturer's recommendations.

77-4.02F Fire Hydrant Assemblies

Fire hydrant assemblies must be wet barrel type hydrants meeting AWWA C503 standards. Hydrants must be Clow/Rich No. 76, or City approved equal and be supplied with two 2-1/2 inch and one 4-1/2 inch outlets. Outlets must have National Hose Threads. Hydrant must have a break off as manufactured by Clow Valve, Model LBI 400A, or equal. Hydrant riser must be flange by flange with integral snap-ring groove meeting, ANSI/AWWA C110/A21.10 and must be 6 inches or longer in length to meet the 2 inch ground clearance. Hydrant bury must be cast iron and meet ANSI C110/A21.10 standards and joints must be mechanical joint by flange conforming to ANSI/AWWA C111/A21.11-80.

You can obtain the Clow No.76 Fire Hydrant and the fire hydrant apparatus Model LBIW #400A from:

DISTRIBUTOR
FERGUSON WATERWORKS
27750 INDUSTRIAL BOULEVARD
HAYWARD, CA 94545
TELEPHONE: (510) 786-3333

The price quoted by the distributor for the Clow No. 76 Fire Hydrants is \$3300.00 each, not including sales tax and fire hydrant apparatus Model LBIW #400A is \$260.00 each, not including sales tax. The above prices are firm for orders placed within 30 days of Contract award, and provided delivery is accepted within 90 days after the order is placed.

77-4.02G Water Meter Box

Water meter box for 1 inch service line must be Christy B-16 with Christy FL16P-F reading lid, or City approved equal.

Water meter box for 1-1/2 to 2 inch service line must Christy B-36 with FL36P-F reading lid, or City approved equal.

You can obtain the Christy B-16 with Christy FL16P-F reading lid and the Christy B-36 with FL36P-F reading lid from:

DISTRIBUTOR
R & B COMPANY
1240 NORTH 13TH STREET
SAN JOSE, CA 95112
TELEPHONE: (510) 297-7935

The price quoted by the distributor for the Christy B-16 with Christy FL16P-F reading lid is \$80.00 each, not including sales tax and Christy B-36 with FL36P-F reading lid is \$160.00each, not including sales tax. The above prices are firm for orders placed within 30 days of Contract award, and provided delivery is accepted within 90 days after the order is placed.

For water meters located on driveways, water meter box must be either:

1. Electric Traffic Pull box No. 5T
2. Christy B1324 Box H/20 Loading with Steel lid B1324-61JH and 2 inch probe hole

77-4.02H Water Meter

The City of Burlingame furnishes you the water meters at City of Burlingame Corporation Yard, 1361 North Carolan Avenue, Burlingame, CA 94010. At least 48 hours before you pick up the materials, inform the Engineer of what you will pick up and when you will pick it up.

Salvaged water meter must comply with section 15-2.03A(2)(b).

77-4.03 CONSTRUCTION

77-4.03A General

Excavation must comply with section 19-3.

Do not use water from City of Burlingame's' existing water system without authorization. Operation of existing gate valves or fire hydrants on the City system is not allowed without authorization. If you violate the City Resolution, you must pay the fines levied by the City. Only City Department of Public Works and Utilities personnel are authorized to operate valves on existing waterline or water service.

Coordinate water main shutdown with affected water customers. Water main shutdown is only allowed during non-business hours. Shutdown period must not exceed 4 hours.

Following completion of hydrostatic testing and after the disinfection, waterline must be flushed and must comply with the requirement of AWWA C651. New water mains must be flushed until chlorine

measurements show that the concentration of chlorine in the water discharged from the main is not higher than what is acceptable by the City's standard.

77-4.03B Pipe Preparation

Take the following steps to prepare the pipe before the installation:

1. Clean the pipe bell. Remove sand, dirt, grease, and debris. Swab pipe bell with liquid hypochlorite solution as necessary.
2. Check the gasket. Seat gasket uniformly. Clean gasket area as necessary. Do not remove factory-installed gaskets from bells. Swab gasket with liquid hypochlorite solution as necessary.
3. Clean the spigot end of the pipe. Wipe spigot end clean with a clean rag and liquid hypochlorite solution.
4. Lower the pipe into the trench carefully to avoid damage and getting dirt into the bell or spigot.
5. Keep open trenches dry. Conduct the work to avoid contamination through the ends of the open pipe. Pump water that drains from the open ends of the pipe from the open trench.
6. Plug the open ends of pipe to prevent the entrance of foreign material when water is present in the open trench, when water drains from the open ends of pipe, or when work has stopped. Pump water from the open trench. Place hypochlorite tablets in the bottom of the open trench as necessary.

77-4.03C Pipe Laying

Install pipe, fittings, and appurtenances in compliance with the manufacturer's instructions. Lay pipe to the lines and grades as shown. Do not lay pipe in water or when trench conditions are unsuitable.

Proceed pipe laying from upgrade with the spigot ends of bell and spigot pipe pointing in the direction of the flow. Lay each piece true to line and grade as to form a close concentric joint with the adjoining pipe and to prevent sudden offsets in the flow line. As the work progresses, clean the pipe interior from all dirt and debris. When the work is not in progress, plug or cap open ends of pipe and fittings.

As pipe laying proceeds, the trench may be enlarged at each bell spigot joint site to facilitate the jointing operations. Do not excavate the trench at joint site more than of sufficient size for the purpose. Do not excavate more than six joint sites ahead of actual pipe laying. Excavated joint site must provide a uniform bearing under the full length of the pipe to a width of at least 60 percent of the internal diameter of the pipe.

Insert spigot end into the pipe until it contacts the gasket uniformly. Alignment of pipe must be straight. Apply steady pressure by hand or suitable mechanical means, such as bar and block, come-along, hydraulic jack, until the spigot slips through the gasket. Do not use backhoe bucket. Protect bells and gaskets from damage.

77-4.03D Pipeline Alignment

Curves on the pipeline alignment must be constructed by deflections at the joints. The deflections must not exceed 75 percent of the maximum allowable by the pipe manufacturer.

Where horizontal or vertical curves in the alignment cannot be constructed by joint deflection of standard pipe lengths, select and use one of the following options:

1. Shorter pipe lengths and allowable joint deflection as specified
2. Special mitered joints
3. Standard or special fabricated bends

Maintain a distance from the sewer in the adjacent trench as shown.

Horizontal and vertical separation between the waterline and the sanitary sewer line must comply with the requirements of the California Health and Safety Code, the CA Code of Regs, Title 22, and as shown.

77-4.03E Valve

77-4.03E(1) General

Install butterfly valves or drop-in valves for pipe as shown.

Valves must be thoroughly cleaned of foreign material, and inspected for proper operation, both opening and closing, before installation. Valves must be properly set and installed with the stems set vertical. Jointing must comply with the requirements in ANSI/AWWA C600.

Epoxy-coated valves must be wrapped in polyethylene bags before backfilling.

Valve joints must be tested with the adjacent pipeline. If the test shows leaking joint, disconnect and reconnect the valve. Retest the valve with the adjacent pipeline

Clean the faces of flanges thoroughly before flanged joints are assembled. After cleaning, insert the gasket and tighten the nuts uniformly around the flange. If the test shows leaking flange, loosen the nuts and reset or replace the gasket and retighten the nuts. Retest the flange and the valve with the adjacent pipeline.

77-4.03E(2) Valve Box

Center and set plumb the valve box over the valve nuts. Set valve box must not transmit shock or stress to the valve. Cut the stem extensions to the proper length where the valve box set at grade does not ride on the stem extension.

Concrete collar must comply with minor concrete of section 51.

Use pipe trench backfill shown for the backfill around the valve box. Backfill must be compacted as described for pipe trench backfill and must not damage or displace the valve box from proper alignment or grade. Misaligned valve boxes must be excavated, plumbed, and backfilled

Backfill must be the same as specified for the adjacent pipe. Backfill around the valve boxes must be compacted to a density equal to that described for the adjacent trench and to prevent damage or displace the valve box from proper alignment or grade. Misaligned valve boxes must be removed, reset, and backfilled.

Adjust water valve box by lowering before cold planing and raising after paving or surfacing. Before opening the lane to traffic, either (1) complete permanent paving or surfacing or (2) temporarily fill any depressions with HMA.

77-4.03F Pipeline Connection

Use a cut-in tee where additional valves are required on the existing waterline. If the new lateral is larger than the existing waterline, the tee must be the size of the new lateral and reduced to the size of the existing water pipeline.

Use mechanical joint (MJ) coupling enclosed in a continuous sleeve for spigot-to-spigot pipe connection.

77-4.03G Blow off Assembly

Temporary blow off assemblies must be constructed as shown.

77-4.03H Remove Fire Hydrant Assembly

Remove fire hydrant assembly including hydrant, pipe, fittings, tee, valves, and thrust block. Remove fire hydrant assembly must comply with section 15-1.

Replace the removed tee fitting with a pipe of the same size with equal or better material as the existing water main. The replacement piece of pipe must be connected to the existing water main by mechanical joints, as authorized by the Engineer.

Do not reuse removed fire hydrant assemblies.

77-4.03I Flushing and Disinfection

Waterlines must be flushed and disinfected under AWWA C651 before placed in service.

Foreign matter from the waterlines must be flushed before disinfection. Hoses, temporary pipes, ditches must be provided as required to dispose of flushing water without damage to adjacent properties. The disinfection must be conducted concurrently with the hydrostatic pressure testing.

Following disinfection, flush the water mains thoroughly under ANSI/AWWA C651. De-chlorinate heavily chlorinated water before discharging to the sanitary sewer system.

When the results of the bacteriological test are authorized by the Engineer and the City, remove the temporary sampling taps.

Where it is necessary to cut, repair, or make connection to main waterline, disinfection procedure must comply with ANSI/AWWA C651, Section 9.

If the Engineer authorizes, closure sections of water pipelines and cut-in fittings may be surface disinfected.

77-4.04 PAYMENT

Not Used

77-5 LOCAL ARCHITECTURAL ITEMS

77-5.01 GENERAL

77-5.01A General

Section 77-5 includes specifications for constructing stone veneer masonry, CIP architectural concrete, and precast architectural landscape concrete as shown.

77-5.01B Materials

Not Used

77-5.01C Construction

Not Used

77-5.01D Payment

Not Used

77-5.02 STONE VENEER

77-5.02A General

Section 77-5.02 includes specifications for constructing stone veneer masonry including metal letters to stone veneer walls and water jet cut metal bands in medallions shown.

The Engineer determines the acceptability of the surface textures. Any cutting or patching made necessary to comply with this injunction must be done at your expense.

You are responsible for the proper installation of all accessories embedded in the stone and core concrete wall and for the provision of holes, sleeves, openings, etc., necessary to the execution of the work of the trades.

Before start of work, wrap completely and protect adjacent precast concrete column surfaces against damage.

77-5.02A(1) Submittals

Submittals for stone veneer includes:

1. Five representative stone units: straight, curved, corner, edge without corner, and top unit.
2. Product Data: Supplier's specifications and technical data including performance, construction and fabrication.
3. Shop Drawings: Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures, including specific requirements indicated.

Submittals for metal letters and bands include:

1. Product Data: Manufacturer's product data for all items to produce this work.
2. Shop Drawings: Include drawing to scale of letters showing Trajan Pro font, spacing, height, width and alignment. Submit shop drawings before fabrication of samples
3. Samples:
 - 3.1. Cast Bronze: Submit 6 by 6 by 3/4 inch thick square casting of metal, with polished smooth surfaces and edges to demonstrate color, 90 degree angle, polished surface finish and edge finish.

- 3.2. Water Jet Cut Bronze: Submit 6 by 6 by 3/8 inch thick square sheet of metal, with polished smooth surfaces and edges to demonstrate color, water jet cut 90 degree edges, surface and edge finishes before fabrication of sample letter.
- 3.3. Bronze Ring: Submit an 18 inch long by 3/8 inch thick water jet cut ring curved to the radius shown. The 18- inch length must be constructed of two 9- inch long pieces bronze-welded together. Sample must demonstrate weld, radius, color, edges and finish of ring.

Submit one full sized sample each of finished letter "R" in cast bronze and water jet cut bronze upon authorization of each 6 by 6 inch square sample in cast bronze and water jet cut bronze.

After authorization of samples, submit all bronze letters, bands and studs-anchors. Each letter and band must be wrapped separately in protective plastic wrap by manufacturer before delivery.

Cardboard Submittal: Make cardboard letters for each letter for stone veneer wall. Before drilling mounting holes in wall, attach cardboard letters to stone veneer wall with non-disfiguring tape for Engineer to review layout of all letters. Letters must match font style, height and widths of letters but not the thickness of the letters.

77-5.02A(2) Quality Control and Assurance

Assign a superintendent to provide the day to day construction oversight of the masonry work. The superintendent must have a minimum of 8 years of experience in supervising masonry work similar to the project.

Stone mason must have a minimum of 8 years of experience shaping and installing granite stones and working on stone projects similar to the requirement of this Contract. Granite supplier must have a minimum of 10 years of experience selling, cutting and shaping granite stones similar to the requirements of this project.

Prepare field samples for Engineer's review and to establish requirements for finished appearance. Correct areas, modify method of application and installation, or adjust finish texture as directed by Engineer. Maintain approved field samples in an accessible location to serve as a standard of quality.

Provide a field sample of minimum 100 square foot section of adhered stone work indicating proposed construction including reveals, corners, special shapes, and treatment of mortar joints.

Guarantee metal letters and bands against defects in materials for a period of three years against defects in manufacturing, materials, installation, construction and fabrication starting the first calendar day following project acceptance

Replace defective work within 10 days after notification by the Engineer with new materials matching the original installation requirements at your expense. Ensure that the replacement elements are constructed as described in this Contract and match the installed elements.

77-5.02B Materials

77-5.02B(1) Stone veneer

Materials must include:

1. Stone: Granite with bush hammered finish. Match field sample.
2. Mortar: Premixed Type N or mortar using components and proportions complying with masonry manufacturer's installation instructions.
3. Mortar Color: Match lightest tan background color of natural stone. Use iron oxide pigments.

77-5.02B(2) Metal letters and bands

Metal letters and bands must be uniformly smooth throughout all surfaces with no pits, dips, bulges, scratches, divits, patch marks, burrs, or discoloration.

Water jet cut letters and bands must be from 3/8 inch thick bronze sheet.

Cast bronze letters spelling "Burlingame" for stone veneer walls must be 1-1/2 inch deep from front to back. Font and heights must be as shown.

Cast bronze letters spelling "City of" for stone veneer walls must be 3/4 inch deep from front to back. Font and heights must be as shown.

Finish must be polished US9 Finish, hand-polished faces, bead-blasted returns, sprayed with 2-part hardened acrylic polyurethane clear coat, lead and mercury-free bronze alloy, baked.

Bronze studs and anchors for bands must be 5/8 inch in diameter as shown and with finely ridged or textured finish to resist being dislodged from concrete.

Bronze studs for wall mounted letters must be 3/8 inch diameter as shown and with finely ridged or textured finish to resist being dislodged from mounting hole filled with non-sag epoxy.

All welds must be bronze welds.

Cast metal letters and bands must have flat surfaces on top of letter face and on top surface of band and with high polish finish. Edges must be 90 degrees to face of letter and polished smooth with no sharp edges. Polished edges must be consistent throughout all letters and throughout bands and have a high polish matching face of letters and top surface of bands.

Epoxy must be non-sag epoxy.

Metal must be bronze with alloy. Color must be warm copper-colored bronze to match referee sample. Paint color must be "Antique Bronze" XME204 by MM Modern Masters. Finish must be smooth and highly polished.

Do not use lead or mercury bronze metal.

77-5.02C Construction

77-5.02C(1) General

Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion. Do not proceed until unsatisfactory conditions have been corrected. Wrap completely and protect adjacent surfaces against damage before the start of work.

Stud and anchor placement and final quantity must keep surface finish grade of bands flush with adjacent surface finish grade of concrete without displacement and under heavy truck loading conditions, and wall mounted letters firmly in place without displacement.

77-5.02C(2) Installation

Install stone veneer complying with supplier's guidelines for natural stone veneer.

Install stone veneer as shown.

Allow mortar to become thumb-print hard. Brush joints within 2 hours before tooling the mortar grout.

Cast metal letters for stone veneer walls must be flush mounted. Bronze welded bronze studs must be on back surface of letters. Length of stud must match mounting drill hole depth and must penetrate entire depth of granite block, mortar and 5 inches into concrete core wall. Stud must be of length to extend the full depth of mounting hole minus 1/4 inch to allow for epoxy between end of stud and end of drill hole.

Deliver letters and bands to job site wrapped tightly in plastic. Remove plastic for Engineer's review and authorization. Wrap letters and bands again with plastic of a weight to protect surfaces from being damaged from construction. Remove plastic at Contract acceptance.

Before starting letters work at stone veneer walls, wrap completely and protect adjacent surfaces against damage.

Before starting metal bands work at medallions, cover and protect completely adjacent surfaces against damage.

For bronze letters mounted to stone veneer wall, mounting drill hole depth must penetrate entire depth of granite block, mortar and 5 inch into concrete core wall.

For bronze letters mounted to stone veneer wall, mounting drill holes must be 90 degrees to face of stone blocks.

For installation of letters to stone veneer walls use epoxy sealer and completely fill all spaces within drill holes around studs.

Top of finish grades of metal bands in medallions must match finish grades of adjacent concrete paving.

Installed letters mounted on stone veneer wall must have matched alignment throughout faces of words and have exact horizontal and vertical alignment as shown. Rotation must be 90 degrees to overall alignment of face of stone veneer. Faces of letters must have consistent distance away from face of stone veneer and match one another with a variation tolerance of not more than 1/32 inch in 10 feet in all directions.

Bronze letters attached to stone veneer walls must be flush-mounted. Construct as shown. Spacing of letters must be as shown and must be consistent with spacing typical for the style of the font.

Coordinate metal letters and bands installation with the stone veneer wall and medallion work.

77-5.02C(3) Repair and Cleaning

Correct all defects in work as directed by the Engineer.

Wash and rinse surfaces according to supplier's recommendations.

Protect other work from staining or damage due to cleaning operations. Do not use cleaning materials or processes that could change the appearance of the stone finish.

77-5.02C(4) Guarantee

Replace defective work within 10 days after notification by the Engineer with new materials matching the original installation requirements. The Department does not pay for corrective work.

Ensure that replacement elements match the installed elements.

77-5.02D Payment

Not Used

77-5.03 CAST-IN-PLACE ARCHITECTURAL CONCRETE

77-5.03A General

77-5.03A(1) Summary

Section 77-5.03 includes specifications for installing cast in place concrete planter wall as shown.

77-5.03A(2) Submittals

Action submittals include:

1. Product Data: Manufacturer's product data for all items to produce this work.
2. Specifications: Architectural concrete aggregate and mix design.
3. Two, 24 by 24 by 3 inch square finished concrete samples to demonstrate integral color, surface texture, consistent and even concrete work and anti-graffiti finish before constructing wall mock-up. Apply anti-efflorescent sealer and anti-graffiti finish to one sample only.
4. One 24 by 24 by 3 inch square sample matching the sample described above without the anti-graffiti finish. Damage the concrete with a hammer and chisel and repair it to demonstrate quality of repair. Repair must match undamaged area of sample.
5. Wall mock-up: 5 feet long, height as shown, with at least one construction joint.

77-5.03A(3) Quality Control and Assurance

All inspections of structures must include immediately adjacent visual inspection and tactile contact and evaluation of quality of surface workmanship, at the sole discretion of the Engineer and must prevail over any other industry standard of inspection of cast in place concrete structures.

77-5.03B Materials

77-5.03B(1) General

Reserved

77-5.03B(2) Portland Cement Concrete

Portland cement concrete must be Type 1 white portland cement, integral color, with a minimum 4,000 psi compressive strength at 28 days.

77-5.03B(3) Anti-graffiti Coating

Anti-graffiti coating must comply with section 59-8. Finish must not alter concrete color.

77-5.03B(4) Anti-efflorescence Concrete Sealer

Anti-efflorescence concrete sealer must be clear, matt finish, UV resistant and compatible with the integral colored concrete and anti-graffiti coating. Sealer must have a 10 year life min, an internal epoxy-like bond within the concrete, 1/4 inch deep, and prevent external moisture from entering the concrete and allow internal moisture out at an approximately 20 percent rate.

77-5.03B(5) Form Liner

Comply with section 51-1.03G(2). Form liner texture must match light sand blast finish, for all vertical wall surfaces.

77-5.03C Construction

Obtain Engineer's authorization of samples and wall mock-up before starting construction of wall. Authorized mock-up may be used in completing construction of wall as shown. Rejected mock-up must be demolished and removed from site.

Work must match authorized samples and the following:

1. Curved sections: Single continuous radius and not a series of angled straight sections
2. Straight sections: Perpendicular to adjacent sidewalks as shown

Forms must comply with section 51-1.03C(2).

Form liner must be in single pieces for entire length and height of wall, placed 90 degrees to vertical direction of wall and with seams allowed at control and expansion joints only. Placement of pieces must be identical throughout all pieces to match.

Removal location of form ties must not be visible from 5 feet.

Connections to precast concrete columns must be concealed.

Comply with sections 51-1.03D(1), 51-1.03D(5) and 51-1.03F(3).

Comply with section 51-1.03F(3) Class 1 Surface Finish.

Apply anti-efflorescence sealer and sacrificial anti-graffiti finish. Comply with the manufacturer's recommendations and specifications.

Planter wall must get "Light to Medium Sandblast" surface treatment.

Repair or replace damaged special concrete-finished surfaces. Comply with section 51-1.03F(3) and match undamaged surface.

Protect the finished wall from staining or damage due to cleaning operations. Do not use cleaning materials or processes that could change the appearance of concrete finishes.

77-5.03D Payment

Not Used

77-5.04 PRECAST ARCHITECTURAL LANDSCAPE CONCRETE**77-5.04A General****77-5.04A(1) Summary**

Section 77-5.04 includes specifications for constructing precast architectural landscape concrete.

This work includes:

1. Wall caps on gateway walls
2. Column caps on columns of gateway walls
3. Columns of gateway walls
4. Columns for planter wall
5. Column caps for columns for planter wall
6. Wall caps on cast-in-place planter wall
7. Medallion letters

All work under section 77-5.04 must use integrally colored concrete.

77-5.04A(2) Submittals

Action submittals include:

1. Manufacturer's product data for all items of work.
2. Architectural concrete aggregate and mix design.
3. Two, 24 by 24 by 3 inch square finished concrete samples to demonstrate integral color, surface texture, consistent and even concrete work and anti-graffiti finish before constructing column and cap samples. Apply anti-efflorescent sealer and anti-graffiti finish to 1 sample only.
4. One 24 by 24 by 3 inch square sample matching the sample described above without the anti-graffiti finish. Damage the concrete with a hammer and chisel and repair it to demonstrate quality of repair. Repair must match undamaged area of sample.
5. Samples including 1 short column, 1 tall column, 1 column cap and one 3 foot long section of stone veneer wall cap. These submittals will be reviewed at manufacturer's plant. If a column sample and a column cap sample are authorized, they may be used in the final installation.
6. One concrete letter R complete, with very light sandblast finish. Integral color sample will be supplied.
7. Shop drawings must include layout and elevations.

77-5.04A(3) Quality Control and Assurance

All inspections of structures must include immediately adjacent visual inspection and tactile contact and evaluation of quality of surface workmanship.

77-5.04B Materials

77-5.04B(1) General

Not Used

77-5.04B(2) Portland Cement Concrete

Portland cement concrete must be Type 1 white portland cement, integral color Benjamin Moore, "Boardwalk," #1102, with a minimum 5,000 psi compressive strength at 28 days. Color sample will be provided.

77-5.04B(3) Mortar

Comply with section 51-1.02F. Mortar and color must match integral color sample.

77-5.04B(4) Anti-graffiti Coating

Anti-graffiti coating must comply with section 59-8. Finish must not alter concrete color.

77-5.04B(5) Anti-efflorescence Concrete Sealer

Anti-efflorescence concrete sealer must be clear, matt finish, UV resistant and compatible with the integral colored concrete and anti-graffiti coating. Sealer must have a 10 year life min, an internal epoxy-like bond within the concrete, 1/4 inch deep, and prevent external moisture from entering the concrete.

77-5.04B(6) Form Liner

Comply with section 51-1.03G(2). Form liner texture must match light sand blast finish for all surfaces.

77-5.04B(7) Medallion Letters

Integral color for medallion letters will be provided and will be from a standard color palette.

77-5.04C Construction

77-5.04C(1) General

Work must match approved samples and construct as shown.

Removal location of form ties must not be visible from 5 feet.

77-5.04C(2) Preparation

Before starting installation of precast concrete, examine all surfaces, locations and grades where precast concrete structures are to be installed. Correct site conditions preventing performance of work as shown.

Before the start of work, wrap completely and protect adjacent surfaces against damage.

Before the start of work, wrap completely and protect adjacent surfaces to prevent damage.

77-5.04C(3) Installation

Comply with sections 51-1.03C, 51-1.03D(1), 51-1.03D(5) and 51-1.03F(3).

Tolerance must be 1/8 inch in 10 feet in all directions.

Install light sand blast form liner on all surfaces except surfaces of medallion letters.

Apply very light sandblast finish on tops and edges of medallion letters.

Curved structures are installed as single continuous radius and not a series of angled straight sections. Construct as shown.

Form liner must be in single pieces for entire length and height of structure, placed 90 degrees to vertical direction of structure and with seams allowed at control and expansion joints only. Placement of pieces must be identical throughout so all pieces match.

Apply anti-efflorescence sealer and sacrificial anti-graffiti finish. Comply with the manufacturer's recommendations.

Perform repair and or replace damaged special concrete-finished surfaces under section 51-1.03F(3) and match original specifications..

Protect other Work from staining or damage due to cleaning operations. Do not use cleaning materials or processes that could change the appearance of concrete finishes.

For columns, install plumb as shown.

Replace defective work and match the original specifications with approved installed features.

77-5.04D Payment

Not Used

Replace section 78 with:

78 SPECIAL PIPE INSTALLATIONS

78-1 TRENCHLESS CULVERT INSTALLATION

78-1.01 GENERAL

78-1.01A Summary

Section 78-1 includes specifications for installing trenchless culvert.

78-1.01B Definitions

blasting mat: a heavy rubber mat used for embankment stabilization during work.

casing: A welded steel pipe installed by trenchless culvert methods that provides a stable underground support system.

lubrication/injection system: A port located within the casing pipe fitted with a one-way valve for injection of lubrication material or grout into the annular space between the pipe and the ground.

obstruction: Objects located wholly or partially within the cross-sectional area penetrated by the casing or culvert that prevent the forward movement of the casing or culvert after all diligent efforts to advance past the object have failed.

settlement point: A point with elevation and spatial location established by surveying before construction. The point is re-surveyed periodically to monitor ground movements. The point may be a nail, pin, subsurface settlement rod, borehole extensometer, or other device that can be readily located and surveyed.

78-1.01C Submittals

78-1.01C(1) Action Submittals

For each trenchless culvert installation, submit a 3-ring binder with labeled sections for the following action submittals:

1. Plans and calculations for control and diversion of ground water or flows in existing pipes, including:
 - 1.1. Selection of a flow diversion system and equipment based on compatibility with the properties, characteristics, and behavior of the soils as indicated by the Geotechnical Design report
 - 1.2. Calculations supporting the capacity and sizing of the flow diversion system based on a -year flood event
 - 1.3. Schedule and duration of the flow diversion
2. Description of the methods and equipment to be used including:
 - 2.1. Manufacturers' data sheets and specifications for the trenchless culvert installation equipment and its performance
 - 2.2. All ancillary equipment and its performance
3. Description of the method for removing and disposing of spoil, including:
 - 3.1. Location of disposal sites
 - 3.2. Sample log of volume of spoil removed relative to the advancement of the culvert
 - 3.3. Written agreement from property owner. Comply with section 5-1.20B(4).
4. Description of the grade and alignment control system, including:
 - 4.1. Indicator of the location of the culvert's leading edge with respect to line and grade
 - 4.2. Intervals for checking line and grade
 - 4.3. Manufacturer's product literature and drawings showing set-up, support provisions, and other details for the water level and laser or theodolite systems
 - 4.4. Surveying methods. Submit survey results before the launch of each.
 - 4.5. Data demonstrating these systems can achieve the line and grade as shown at any point in the drive
 - 4.6. Samples of grade and alignment progress reports
5. Submit a schedule identifying all major construction activities as independent items. The schedule must include, as a minimum:
 - 5.1. Mobilization
 - 5.2. Stream diversion at upstream work area
 - 5.3. Streambed alteration
 - 5.4. Working slab construction
 - 5.5. Equipment setup
 - 5.6. Entry and exist portal stabilization
 - 5.7. Trenchless culvert installation
 - 5.8. Intermediate soil removal
 - 5.9. Existing culvert removal and final abandonment and grouting of portion of existing culvert abandoned in place
 - 5.10. Final soil removal
 - 5.11. Installation and removal of downstream slope stabilization, including blast mats
 - 5.12. Site restoration, cleanup, and demobilization
6. Design calculations confirming the proposed culvert material is capable of supporting the maximum stresses anticipated during trenchless culvert installation
 - 6.1. Assumptions used in your calculations must be consistent with the information in the Geotechnical Design report.

- 6.2. Calculations must include earth and hydrostatic loads, internal forces, external loads such as live loads due to traffic, and any other loads that may be reasonably anticipated during trenchless culvert installation. Describe and show all loads and the assumed maximum drive length.
- 6.3. Provide an estimate of the maximum internal force expected to complete the drive, accounting for frictional resistance along the culvert.
7. Methods for preventing, inspecting and grouting voids
8. Design and layout drawings of the drive and receiving shafts and temporary support during work, including:
 - 8.1. Surface construction
 - 8.2. Profile and depth
 - 8.3. Method of excavation
 - 8.4. Shoring and bracing
 - 8.5. Method of temporary support during work. You must demonstrate that proposed method has been used successfully under like circumstances.
 - 8.6. Dimensions and locations of all equipment
9. Description of the lubrication injection system, including:
 - 9.1. Manufacturer's product literature and MSDS for the lubricant
 - 9.2. Estimated volume of lubricant that will be pumped
 - 9.3. Lubrication procedures
10. Plan for monitoring ground surface movement caused by the installation, including:
 - 10.1. Method, locations, and frequency of survey measurements
 - 10.2. Method and materials for protecting the surface control points
 - 10.3. Proposed schedule for installing the surface control points
 - 10.4. Preconstruction and post-construction assessments of any roadways or structures located within 100 feet of the culvert's centerline and the drive and receiving shafts
 - 10.5. Procedures for avoiding excessive settlement or heave
 - 10.6. Photographs or video of existing condition of structures near the culvert's alignment
 - 10.7. Surveying personnel qualifications
11. Layout plan and description of the installation sequence
12. Procedures for complying with Cal/OSHA requirements under section 7-1.02K(6), including:
 - 12.1. Safety procedures and equipment for shaft access and exit
 - 12.2. Ventilation and lighting
 - 12.3. Monitoring for hazardous gases
 - 12.4. Protection against soil instability, ground water inflow, and flooding
 - 12.5. Safety procedures for handling mechanical and hydraulic equipment
 - 12.6. Emergency evacuation procedures
13. Contingency plans for the following conditions:
 - 13.1. Damage to the culvert
 - 13.2. Loss and return to line and grade
 - 13.3. Contact with an unexpected obstruction or utility
 - 13.4. Equipment becomes stuck
 - 13.5. Strong hydrocarbon smell detected. Combustible gas meter readings in the shaft or tunnel exceed 10 percent of lower explosive limit (LEL) for methane or possible volatile organic compounds
 - 13.6. Stream flows increase significantly as a result of storms, and threaten to overwhelm bypass system

At the preconstruction meeting, submit the action submittals.

78-1.01C(2) Informational Submittals

Submit a list with descriptions of similar projects that successfully used the proposed trenchless culvert installation system.

78-1.01C(3) Leakage Testing Submittals

Comply with third paragraph of section 61-1.01C.

78-1.01D Quality Control and Assurance

78-1.01D(1) General

Assign a representative who is thoroughly knowledgeable about the trenchless culvert installation equipment, work, and proposed temporary support method to be present during work to address concerns and emergencies.

Notify the Engineer 2 business days before starting work.

78-1.01D(2) Preconstruction Meeting

At least 10 days before starting work, you must schedule and attend a preconstruction meeting with the Engineer. Include any subcontractors, manufacturers and other parties involved in the work. Provide a meeting facility that is within 5 miles of the job site or at another location accepted by the Engineer. Select a date and time that is acceptable to the Engineer and so that all participants will attend.

78-1.01D(3) Daily Operations Logs

By noon the next day after completion of a work shift, submit daily pipe trenchless culvert installation and lubrication logs.

Record observations at intervals of no less than 3 times per culvert, as conditions change, or as directed.

The daily trenchless culvert installation log must include:

1. Date and times of observations
2. Operator's name
3. Installation identification
4. Installed length of culvert
5. Rate of advance
6. Installation forces
7. Problems encountered with the equipment
8. Durations and reasons for delay
9. Volume of spoil removed

The daily lubrication log must include:

1. Injection locations along the culvert
2. Volume of lubricant pumped throughout a drive
3. Types and amounts of additives used and the time and drive distance when used

78-1.01D(4) Field Leakage Testing

Notify the Engineer and stop work immediately if there is any indication the culvert has been damaged and may leak. If requested, perform a hydrostatic pressure test within 96 hours in the Engineer's presence. Comply with section 61-1.01D(2)(a).

Leakage must be not more than 1,000 gallons per inch of nominal pipe diameter per mile of pipe length per day, with a minimum test pressure of 6 feet of water column above the pipe crown, at the upper end of the pipe or above the active groundwater table, whichever is higher.

Submit a copy of your test results. Repair and retest the failed joints or culvert sections at your expense until they comply with the maximum allowable leakage.

78-1.01D(5) Subsurface Monitoring

Comply with your authorized plan for monitoring ground surface movement.

The survey accuracy of the settlement monitoring points must be within 0.01 feet and referenced to the same control points and benchmarks established for setting out the work. Control points must be tied to benchmarks and other monuments outside of the zone of influence of the operations.

In paved areas, establish surface control points by an inscribed marking or approved surveyor's nail driven flush with the surface.

In unpaved areas, establish surface control points by driving a 2 by 2 by 18-inch long timber stake flush with the ground. Each control point must have a tag or marking indicating the station and offset from centerline.

Install and operate instrumentation to measure surface settlement or heave.

For each trenchless culvert installation and associated surface control points:

1. Submit baseline survey measurements of the control points at least 7 days before work.
2. Take daily survey measurements when you begin the trenchless installation.
3. Submit the daily survey measurements by noon on the following day.
4. Continue taking daily survey measurements until the work is completed.
5. Take weekly survey measurements of surface control points

If the measured settlement or heave exceeds 1/4 inch, you must notify the Engineer.

If the measured settlement or heave exceeds 1/2 inch or damages structures or the roadway, you must repair the damage.

78-1.01D(6) Field Quality Control

Immediately notify the Engineer, in writing, when any problems are encountered with equipment or materials, or if you believe the conditions encountered are materially and significantly different than those shown.

78-1.01D(7) Completed Installation Inspection

Inspect the entire length of the completed trenchless culvert installation using CCTV or human entry. Provide a copy of the inspection video in DVD or MPEG format or a written log with photographs and identification of any problem locations.

78-1.02 MATERIALS

78-1.02A Reinforced Concrete Pipe

Reinforced concrete pipe must comply with AASHTO M 170 and have:

1. A minimum 5,000 psi concrete compressive strength
2. Multiple layers of steel reinforcing cages, wire splices, laps and spacers permanently secured together by welding in place
3. No elliptical reinforcing steel
4. Tongue and groove, confined O-ring, single offset or banded bell double rubber gasket type joints
5. Strength sufficient to sustain the vertical and internal loads

78-1.02B Slurry

Use a slurry for soil stabilization during trenchless culvert installation. The slurry must:

1. Be a mixture of bentonite clay and potable water
2. Have a minimum pH of 6
3. Include only approved chemical additives

Submit the MSDS for any proposed chemical additives. Identify the source of water for mixing the slurry.

Obtain approvals and permits for using water from sources such as streams, rivers, or ponds. A pH test may be required if you use nonpotable water.

78-1.02C Grout

Grout used to fill voids generated in the course of work must comply with section 15-6.01B(2).

78-1.02D Lubrication

Lubrication materials must include a mixture of water, bentonite, and may include polymers.

78-1.03 CONSTRUCTION

78-1.03A General

Excavation and backfill must comply with section 19-3.

Handle and dispose of wastewater generated by trenchless culvert installation work under section 13-3.

Place a 6 foot chain link fence and Type K temporary railing around the reception and drive shafts. Place fence behind Type K temporary railing.

Driving and receiving shafts must have bottoms of crushed rock or concrete slabs and sumps to clear ground water and water used to clean culvert. You must line the shafts with filter fabric if ground water is encountered.

Upon completion of the trenchless culvert installation, inspect for voids using your authorized method. Voids in excess of 1 inch must be grouted.

Protect the driving ends of the culvert against spalling or other damage.

Repair or replace any damaged or failed section of culvert at your expense.

Distribute axial forces to the culvert to prevent damage to the ends of the pipe. Axial forces applied to the culvert must not exceed your authorized estimate of the maximum internal force expected to complete the drive.

If an obstruction prevents completion of the work, plug and abandon the culvert.

Variations from theoretical alignment and grade at the time of completion of trenchless culvert installation must not exceed 1 foot per 100 feet of casing.

You must use your authorized grade and alignment control system. If the pipe installation does not meet the specified tolerance, comply with your authorized contingency plan.

78-1.03B Field Welding

Not Used

78-1.03C Excess Fluids and Spoil

Monitor the pumping rate, pressure, viscosity, and density of the lubrication to ensure the stability of the borehole and adequate removal of spoil. Contain excess fluids, slurry and spoil at the entry and exit points of the driving and receiving shafts.

Dispose of or recycle all trenchless installation fluids.

In suspected contaminated soil, test the trenchless installation fluids, slurry and spoil for contamination. Notify the Engineer immediately if there is contamination and stop work. Dispose of any contaminated soil and fluids appropriately.

Remove all spoil upon completion of trenchless installation per your authorized method for removing and disposing of spoil.

78-1.03D Cleanup and Restoration

Restore and repair any damage resulting from surface settlement caused by excavation or trenchless culvert installation. You must restore property damaged or destroyed to a condition equal to or better than existing prior to construction. Restoration must be completed no later than 30 days after completed trenchless culvert installation.

78-1.04 PAYMENT

Trenchless culvert is measured along the centerline of the culvert and parallel with the slope line as shown. The Department does not pay for trenchless culvert placed in excess of the designated length.

No payment is made for failed bore paths, removal of materials installed in a failed bore path, products taken out of service, or incomplete installations.

78-2 PIPE JACKING

78-2.01 GENERAL

78-2.01A General

Section 78-2 includes specifications for installing pipe jacking.

78-2.01B Definitions

pipe jacking: a trenchless construction method for installing a prefabricated pipe through the ground behind a shield or a tunnel boring machine, from a drive shaft to a reception shaft.

78-2.01C Submittals

For each pipe jacking installation, submit a 3-ring binder with labeled sections for the following action submittals:

1. Description of the method for centering the cutting head or boring machine inside the borehole
2. Calculations demonstrating the soils behind the thrust block can transfer the maximum planned internal forces exerted by the main jacks to the ground with a factor of safety of at least 2.0 without excessive deflection or displacement
3. Thrust block design
4. Locations and design of intermediate jacking stations
5. Contingency plans for the following conditions: a sudden or large increase in jacking forces; jacking forces reach design capacity of the culvert, jacking frame, or thrust block

78-2.01D Quality Control and Assurance

Not Used

78-2.02 MATERIALS

Not Used

78-2.03 CONSTRUCTION

78-2.03A Jacking Pipe

Use thrust blocks designed to distribute loads uniformly to ensure:

1. Deflection of the thrust block is uniform
2. Excessive loads are not exerted on the shaft
3. Jacking frame does not become misaligned

The jacking system must push the pipe through the ground in a controlled manner and sustain the anticipated jacking loads. Monitor the jacking force applied to the pipe and do not exceed the pipe manufacturer's recommendations.

Install and use a lubrication injection system to inject pipe lubricant around the exterior and interior of the pipe to decrease frictional resistance.

Ensure the lubrication injection system is functional at all times and capable of reducing jacking loads. Use pipe lubrication systems and pumps to convey the lubricant to the injection points. Keep sufficient lubricant on site to avoid loss of lubrication.

Once pipe jacking has started, continue jacking without interruption until the pipe has reached the specified distance. If authorized, you may use a different jacking sequence and method to ensure continued advancement of the pipe and stability of the heading at all times.

78-2.04 PAYMENT

Not Used

83-1.02B(1)(b)(iv) Reinforcing Fibers

Reinforcing fibers for minor concrete must be:

1. Polypropylene fibers with an engineered sinusoidal contoured profile manufactured specifically for use as concrete reinforcement.
2. Blended ratio of 4 parts by weight of coarse monofilament fibers with maximum individual fiber lengths of $2 \pm 1/2$ inch and 1 part by weight of fine fibrillated polypropylene fibers of various lengths and thicknesses. If the coarse and fine reinforcing fibers are supplied by the same manufacturer, they may be premixed in a sealed 5 lb degradable bag.
3. From a commercial source.
4. Concrete ingredient as described in your mix design and as recommended by the manufacturer.

The reinforcing fiber content of minor concrete must be 5 lb/cu yd.

83-1.02B(1)(b)(v) Coloring Agent

If a color for concrete is specified in section 83-1.02B(1)(b)(i), the coloring agent must be integral to the concrete mix and added at the concrete plant.

If the curing compound method is used, use curing compound no. 6.

83-1.02B(1)(b)(vi) Block-Out Material

Use a commercially-available expanded polystyrene foam for the block-out material. The expanded polystyrene foam must have a compressive strength of 13 ± 5 psi at 10 percent deformation when tested under ASTM D1621.

You may substitute any appropriate material that meets the compressive strength requirements of the expanded polystyrene foam if authorized.

83-1.02B(1)(c) Construction

83-1.02B(1)(c)(i) General

Areas to receive vegetation control must be cleared of vegetation, trash, and debris. Dispose of removed material.

83-1.02B(1)(c)(ii) Earthwork

Excavate areas to receive vegetation control. Where vegetation control abuts the existing surfacing, the edge of the existing surfacing must be on a neat line or must be cut on a neat line to a minimum depth of 2 inches before removing the surfacing. The finished elevation of the excavated area to receive vegetation control must maintain planned flow lines, slope gradients, and contours of the job site.

Grade areas to receive vegetation control to a smooth, uniform surface and compact to a relative compaction of not less than 95 percent.

Dispose of surplus excavated material uniformly along the adjacent roadway except as specified in section 14-11.

83-1.02B(1)(c)(iii) Block Out

Install block-out material as shown.

If block-out material is supplied in more than 1 piece, tape the pieces together to make a smooth surface on the top and sides.

Ensure block-out material does not move during concrete placement.

83-1.02B(1)(c)(iv) Placing Minor Concrete

Place minor concrete for vegetation control by hand.

Strike off and compact minor concrete with a mechanical or vibratory screed device. Apply a broom finish. Match the finished grade to the adjacent section of vegetation control, pavement, shoulder, or existing grade.

83-1.02B(1)(d) Payment

Vegetation control (minor concrete) is measured from the actual areas placed. The Department does not pay for vegetation control (minor concrete) placed outside the dimensions shown.

Replace section 83-1.02C(2) with:**83-1.02C(2) Alternative In-Line Terminal System**

Alternative in-line terminal system must be furnished and installed as shown on the plans and under these special provisions.

The allowable alternatives for an in-line terminal system must consist of one of the following or a Department-authorized equal.

1. TYPE SKT TERMINAL SYSTEM - Type SKT terminal system must be a SKT 350 sequential kinking terminal manufactured by Road Systems, Inc., located in Big Spring, Texas, and must include items detailed for Type SKT terminal system shown on the plans. The SKT 350 sequential kinking terminal can be obtained from the distributor, Universal Industrial Sales, P.O. Box 699, Pleasant Grove, UT 84062, telephone (801) 785-0505 or from the distributor, Gregory Highway Products, 4100 13th Street, S.W., Canton, OH 44708, telephone (330) 477-4800.
2. TYPE ET TERMINAL SYSTEM - Type ET terminal system must be an ET-2000 PLUS (4-tube system) extruder terminal as manufactured by Trinity Highway Products, LLC, and must include items detailed for Type ET terminal system shown on the plans. The ET-2000 PLUS (4-tube system) extruder terminal can be obtained from the manufacturer, Trinity Highway Products, LLC, P.O. Box 99, Centerville, UT 84012, telephone (800) 772-7976.

Submit a certificate of compliance for terminal systems.

Terminal systems must be installed under the manufacturer's installation instructions and these specifications. Each terminal system installed must be identified by painting the type of terminal system in neat black letters and figures 2 inches high on the backside of the rail element between system posts numbers 4 and 5.

For Type ET terminal system, the steel foundation tubes with soil plates attached must be, at the Contractor's option, either driven, with or without pilot holes, or placed in drilled holes. Space around the steel foundation tubes must be backfilled with selected earth, free of rock, placed in layers approximately 4 inches thick and each layer must be moistened and thoroughly compacted. The wood terminal posts must be inserted into the steel foundation tubes by hand and must not be driven. Before the wood terminal posts are inserted, the inside surfaces of the steel foundation tubes to receive the wood posts must be coated with a grease that will not melt or run at a temperature of 149 degrees F or less. The edges of the wood terminal posts may be slightly rounded to facilitate insertion of the post into the steel foundation tubes.

For Type SKT terminal system, the soil tubes must be, at the Contractor's option, driven with or without pilot holes, or placed in drilled holes. Space around the steel foundation tubes must be backfilled with selected earth, free of rock, placed in layers approximately 4 inches thick and each layer must be moistened and thoroughly compacted. Wood posts must 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 must be coated with a grease that will not melt or run at a temperature of 149 degrees F or less. The edges of the wood posts may be slightly rounded to facilitate insertion of the post into the steel foundation tubes.

After installing the terminal system, dispose of surplus excavated material in a uniform manner along the adjacent roadway where designated by the Engineer.

Replace section 83-1.02C(3) with:**83-1.02C(3) Alternative Flared Terminal System**

Alternative flared terminal system must be furnished and installed as shown on the plans and under these special provisions.

The allowable alternatives for a flared terminal system must consist of one of the following or a Department-authorized equal.

1. TYPE FLEAT TERMINAL SYSTEM - Type FLEAT terminal system must be a Flared Energy Absorbing Terminal 350 manufactured by Road Systems, Inc., located in Big Spring, Texas, and must include items detailed for Type FLEAT terminal system shown on the plans. The Flared Energy Absorbing Terminal 350 can be obtained from the distributor, Universal Industrial Sales, P.O. Box 699, Pleasant Grove, UT 84062, telephone (801) 785-0505 or from the distributor, Gregory Industries, Inc., 4100 13th Street, S.W., Canton, OH 44708, telephone (330) 477-4800.
2. TYPE SRT TERMINAL SYSTEM - Type SRT terminal system must be an SRT-350 Slotted Rail Terminal (8-post system) as manufactured by Trinity Highway Products, LLC, and must include items detailed for Type SRT terminal system shown on the plans. The SRT-350 Slotted Rail Terminal (8-post system) can be obtained from the manufacturer, Trinity Highway Products, LLC, P.O. Box 99, Centerville, UT 84012, telephone (800) 772-7976.

Submit a certificate of compliance for terminal systems.

Terminal systems must be installed under the manufacturer's installation instructions and these specifications. Each terminal system installed must be identified by painting the type of terminal system in neat black letters and figures 2 inches high on the backside of the rail element between system posts numbers 4 and 5.

For Type SRT terminal system, the steel foundation tubes with soil plates attached must be, at the Contractor's option, either driven, with or without pilot holes, or placed in drilled holes. Space around the steel foundation tubes must be backfilled with selected earth, free of rock, placed in layers approximately 4 inches thick and each layer must be moistened and thoroughly compacted. The wood terminal posts must be inserted into the steel foundation tubes by hand and must not be driven. Before the wood terminal posts are inserted, the inside surfaces of the steel foundation tubes to receive the wood posts must be coated with a grease that will not melt or run at a temperature of 149 degrees F or less. The edges of the wood terminal posts may be slightly rounded to facilitate insertion of the post into the steel foundation tubes.

For Type FLEAT terminal system, the soil tubes must be, at the Contractor's option, driven with or without pilot holes, or placed in drilled holes. Space around the steel foundation tubes must be backfilled with selected earth, free of rock, placed in layers approximately 4 inches thick and each layer must be moistened and thoroughly compacted. Wood posts must 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 must be coated with a grease that will not melt or run at a temperature of 149 degrees F or less. The edges of the wood posts may be slightly rounded to facilitate insertion of the post into the steel foundation tubes.

After installing the terminal system, dispose of surplus excavated material in a uniform manner along the adjacent roadway where designated by the Engineer.

Replace "Reserved" in section 83-1.02D(2) with:

California ST-10 bridge rail must consist of metal railing mounted on a reinforced concrete parapet.

Stud bolts must comply with the specifications for stud connectors in section 55-1.02C.

Reinforced concrete must comply with sections 51 and 52.

Ferrous metal parts must be galvanized. Galvanizing must comply with section 75-1.05.

Submit shop drawings for the bridge rail.

The shop drawings must include the following:

1. Details for venting and pickup holes in rails and sleeves
2. Railing layout
3. Complete details for the construction of the work including methods of construction, sequence of shop and field assembly, and installation procedures

Submit 9 copies of shop drawings. Allow 25 days for review. Upon certification, the Engineer will stamp or mark the drawings certified and return 2 copies to you for use during construction.

California ST-10 bridge rail is measured from end to end along the face of the railing, including reinforced concrete end blocks and intermediate posts.

Bar reinforcing steel for use in concrete parapets must be epoxy coated under section 52-2.03.

If the project is in a freeze-thaw area, the parapets must comply with the following requirements:

1. Concrete must contain not less than 675 pounds of cementitious material per cubic yard.
2. Bar reinforcing steel must comply with section 52-2.02.
3. Concrete parapets on bridges or walls must be cured by the water method.

Replace section 83-1.02G(3) with:

83-1.02G(3) HANDRAILING

83-1.02G(3)(a) General

83-1.02G(3)(a)(i) Summary

Section 83-1.02G(3) includes specifications for fabricating, furnishing, and installing handrailing.

83-1.02G(3)(a)(ii) Quality Control and Assurance

Single Source Responsibility: Handrailing of each type and material must be obtained from a single manufacturer.

83-1.02G(3)(b) Materials

83-1.02G(3)(b)(i) General

Railing elements must comply with ASTM B 429/B 429M, Type 6061-T6 aluminum alloy pipe, 0.145-inch wall thickness and 1½-inch diameter.

Brackets, Flanges, Fittings and Anchors: Brackets, flanges, fittings and anchors must be the manufacturer's standard for interconnection of handrail and railing members to other work.

Fasteners must be the same basic metal as the fastened metal. Corrosive metals and metals that are incompatible with the metals joined must not be used.

Concealed fasteners must be used for interconnections of handrail and railing components and for their attachments to other work except where exposed fasteners are unavoidable or are the standard fastening method for handrail and railing systems indicated.

Exposed fasteners must be Phillips flat head screws unless otherwise shown.

83-1.02G(3)(b)(ii) Shop Fabrication

Handrailing must be fabricated to the dimensions and details shown.

Items must be preassembled in the shop to the greatest extent possible to minimize field splicing and assembly. Units must be disassembled only as necessary for shipping and handling.

Returns must be made at free ends of handrailing to bring the pipe to within ¼ inch of the wall. Ends of railing elements must be capped. Concealed weeps must be provided at low points.

Expansion joints must have pipe sleeves.

Changes in direction of railing members must be formed by bending members, insertion of prefabricated elbow fittings, radius bends, or by mitering. Elbow bends must be by using mitered joints.

Welding must be by the tungsten inert gas arc welding method or the consumable electrode inert gas method. Welding processes that require the use of flux will not be permitted.

Welding must comply with AWS D 1.2, "Structural Welding Code - Aluminum."

Exposed welds must be ground smooth and flush.

83-1.02G(3)(b)(iii) Shop Finishes

Anodizing: After fabrication, exposed surfaces of aluminum must be given a clear anodic oxide coating complying with the requirements in ASTM B 580, Type B, Architectural Class I. Surfaces to be coated must be free of scratches, porosity, inclusions, roll and die marks, cold-shuts, and cracks that will adversely affect the appearance and performance of the anodic coatings.

83-1.02G(3)(c) Construction**83-1.02G(3)(c)(i) Installation**

The handrailing must be erected to line and grade without welding in the field. Installation must comply with the manufacturer's instructions. Posts must be within 1/8 inch of vertical.

Exposed connections must be accurately fitted to form tight, hairline joints.

The location of expansion joints must comply with the manufacturer's instructions except that joints must be spaced not closer than 15 feet apart and must be coordinated with joint locations in the support structure.

Corrosion Protections:

1. Aluminum surfaces to be in contact with grout or concrete materials must be given a heavy coat of alkali-resistant bituminous paint.
2. An inert washer or gasket must be used on aluminum surfaces in contact with dissimilar metals.

Railing Connections:

1. Railing ends must be anchored to concrete or masonry with manufacturer's standard fittings designed for this purpose, unless otherwise shown.
2. Handrails must be secured to walls with the manufacturer's standard wall brackets and fittings, unless otherwise shown.

83-1.02G(3)(c)(ii) Cleaning

Paint, dirt, stains and grout must be removed without marring or scratching the aluminum surfaces. Solvents and cleaning compounds must be chemically compatible with the anodic coating and aluminum.

83-1.02G(3)(c)(iii) Protection

Finishes of railing systems and handrails must be protected from damage during constructions by use of temporary protective coverings. Coverings are to be removed upon completion of the work.

Finishes damaged during installation and construction must be restored so that no evidence remains of construction work.

83-1.02G(3)(d) Payment

Not Used

Replace "Reserved" in section 83-1.02G(4) with:

Ornamental railing consists of steel frames fabricated from structural tubing, plates, and other required hardware and fittings, and covered with chain link fabric.

Structural tubing, plates, bars, bolts, nuts, and washers must comply with section 55-1.02. Other fittings must be commercial quality.

Chain link fabric must be 11 gage and must comply with AASHTO M 181, Type IV, Class A. The color of vinyl-coated chain link fabric must match the City of Burlingame green.

83-1.02G(4)(a) Painting

All components except chain link fabric must be painted after galvanizing.

The painted railing must match City of Burlingame green. A referee sample of this color is available for inspection by bidders at the City of Burlingame.

83-1.02G(4)(b) Qualifications

Demonstrate at least 5 years of experience fabricating and installing similar railings, including at least three successful projects in California.

83-1.02G(4)(c) Submittals

Submit 3 copies of shop drawings, and allow 20 days for the Department's review. Include the following:

1. Names of the painting contractor and any subcontractors to be used.
2. 1 copy of each applicable ASTM and SSPC specification and qualification procedure.
3. Coating manufacturer's guidelines and instructions for surface preparation, painting, drying, curing, handling, shipping, and storage of painted structural steel. Include testing methods and maximum allowable levels for soluble salts.
4. Materials, methods, and equipment to be used.
5. Methods to control environmental conditions.
6. Methods to protect the coating during curing, shipping, handling, and storage.
7. Rinse water collection plan.
8. Detailed paint repair plan for damaged areas.
9. Examples of proposed daily reports for testing to be performed, including type of testing, location, lot size, time, weather conditions, test personnel, and results.

Deliver to the site a full size painted railing section sample with chain link fabric in place. Approved full size sample may be used for installation provided it is not damaged.

83-1.02G(4)(d) Construction

There must be no chemical treatment of galvanized surfaces before cleaning and painting.

Epoxy powder priming and powder coating must be electrostatically sprayed on by the fabricator in a clean room environment to the manufacturer's specifications.

Clean all surfaces with an alkaline cleaner and iron phosphate pretreatment to etch surface and remove oils, grease and metal particles prior to priming. Sandblast all pieces to completely remove rust and loose mill scale.

Apply a 0.003-inch minimum zinc rich epoxy powder prime coat or approved equal epoxy powder primer immediately after cleaning and sandblasting. Spot prime abraded, bare or insufficiently powder primed areas.

Apply a 4-mil minimum final coat of UV resistant, RAL Polyester Series 38 with smooth glossy finish powder coat matching the City of Burlingame green color. Finished powder coated surface must be smooth and uniform without drips, runs, uneven coloration, pin holes, dust particles or bubbles.

Oven bake fully assembled pieces at the manufacturer's recommended curing temperatures.

Any field welds must be properly primed and painted with two coats of matching and compatible smooth glossy paint.

Add to section 83-2.02D(1):

Bar reinforcing steel for use in concrete barriers must be epoxy coated under section 52-2.03.

Replace the 1st paragraph of section 83-2.02D(3)(b) with:

Concrete barriers constructed using an extrusion or slip form machine or other similar type of equipment must be made of well-compacted, dense concrete, and the exposed surfaces must comply with section 51. You may be required to submit evidence of successful operation of the extrusion or slip form machine or other equipment.

Submit a QC plan for use of the extrusion or slip form construction method if reinforcement is not fixed in place before placing concrete.

The QC plan must include:

1. Contingency plan for correcting problems in production, transportation, or placement
2. Procedure for splicing concrete barrier reinforcement
3. Procedure for positioning reinforcement during extrusion or slip form operations
4. Test procedure for verifying final positions of horizontal reinforcement at 100-foot intervals, evaluated a minimum of 20 feet behind the trailing extrusion or slip form edge
5. Test report forms to be used that shows (1) positions of reinforcement relative to the top of the barrier, (2) clearance cover from the faces of the barrier to the reinforcement, and (3) station of the tests

If a QC plan is submitted, submit the test report forms within 48 hours of constructing the concrete barrier.

The Department rejects concrete barrier with any reinforcement deviating more than 1 inch from the positions shown.

Replace section 83-2.02E(6) with:

83-2.02E(6) SCI100GM Crash Cushion (Type SCI 100 GM)

83-2.02E(6)(a) General

83-2.02E(6)(a)(i) Summary

Section 83-2.02E(6) includes specifications for crash cushion (Type SCI 100 GM).

83-2.02E(6)(b) Submittals

Submit a certificate of compliance for crash cushion (Type SCI 100 GM).

Submit the manufacturer's installation instructions for crash cushion (Type SCI 100 GM).

83-2.02E(6)(b) Materials

You can obtain the crash cushion (Type SCI 100 GM) from:

MANUFACTURER:
WORK AREA PROTECTION CORPORATION
P O Box 4087
ST CHARLES, IL 60174
TELEPHONE (630) 377-9100
FAX (630) 377-9270

DISTRIBUTORS:
D&M TRAFFIC SERVICES, INC.
845 REED STREET
SANTA CLARA, CA 95050
TELEPHONE (408) 436-1127
FAX (408) 436-1675

The price quoted by the manufacturer for the crash cushion (Type SCI 100 GM) is \$25,730.00, not including sales tax.

The above price is firm for orders placed within 30 days of contract award, and provided delivery is accepted within 90 days after the order is placed.

Submit the manufacturer's installation instructions for the crash cushion (Type SCI 100 GM).

83-2.02E(6)(c) Construction

Install the crash cushion under the manufacturer's installation instructions. System drawings are available by contacting the distributor.

Concrete anchorage devices used for attaching the crash cushion to the foundation slab must be limited to those provided by the manufacturer.

Add to the list in the 5th paragraph of the RSS for section 86-1.03:

13. Fiber optic vault
14. Ethernet switch
15. CCTV
16. Informational Message Sign (IMS)
17. 334T Cabinets
18. Pedestrian Overcrossing Light Fixture
19. City Street Light
20. City Pedestrian Light

Replace "Reserved" in section 86-1.06B with:

Traffic Management System (TMS) elements include, but are not limited to ramp metering (RM) system, communication system, traffic monitoring stations, video image vehicle detection system (VIVDS), microwave vehicle detection system (MVDS), loop detection system, changeable message sign (CMS) system, extinguishable message sign (EMS) system, highway advisory radio (HAR) system, closed circuit television (CCTV) camera system, roadway weather information system (RWIS), visibility sensor, and fiber optic system.

Existing TMS elements, including detection systems, shown and located within the project limits must remain in place and be protected from damage. If the construction activities require existing TMS elements to be nonoperational or off line, and if temporary or portable TMS elements are not shown, the Contractor must provide for temporary or portable TMS elements. The Contractor must receive authorization on the type of temporary or portable TMS elements and installation method.

Before work is performed, the Engineer, the Contractor, and the Department's Traffic Operations Electrical representatives must jointly conduct a pre-construction operational status check of all existing TMS elements and each element's communication status with the Traffic Management Center (TMC), including existing TMS elements not shown and elements that may not be impacted by the Contractor's activities. The Department's Traffic Operations Electrical representatives will certify the TMS elements' location and status, and provide a copy of the certified list of the existing TMS elements within the project limits to the Contractor. The status list will include the operational, defined as having full functionality, and the nonoperational components.

The Contractor must obtain authorization at least 72 hours before interrupting existing TMS elements' communication with the TMC that will result in the elements being nonoperational or off line. The Contractor must notify the Engineer at least 72 hours before starting excavation activities.

Traffic monitoring stations and their associated communication systems, which were verified to be operational during the pre-construction operational status check, must remain operational on freeway/highway mainline at all times, except:

1. For a duration of up to 15 days on any continuous segment of the freeway/highway longer than 3 miles
2. For a duration of up to 60 days on any continuous segment of the freeway/highway shorter than 3 miles

If the construction activities require existing detection systems to be nonoperational or off line for a longer time period or the spacing between traffic monitoring stations is more than the specified criteria above, and temporary or portable detection operations are not shown, the Contractor must provide provisions for temporary or portable detection operations. The Contractor must receive authorization on the type of detection and installation before installing the temporary or portable detection.

If existing TMS elements shown or identified during the pre-construction operational status check, except traffic monitoring stations, are damaged or fail due to the Contractor's activity, where the elements are not fully functional, the Engineer must be notified immediately. If the Contractor is notified by the Engineer that existing TMS elements have been damaged, have failed or are not fully functional due to the Contractor's activity, the damaged or failed TMS elements, excluding structure-related elements, must be repaired or replaced, at the Contractor's expense, within 24 hours. For a structure-related elements, the Contractor must install temporary or portable TMS elements within 24 hours. For nonstructure-related

TMS elements, the Engineer may authorize temporary or portable TMS elements for use during the construction activities.

If fiber optic cables are damaged due to the Contractor's activities, the Contractor must install new fiber optic cables from an original splice point or termination to an original splice point or termination, unless otherwise authorized. Fiber optic cable must be spliced at the splice vaults if available. The amount of new fiber optic cable slack in splice vaults and the number of new fiber optic cable splices must be equivalent to the amount of slack and number of splices existing before the damage or as directed by the Engineer. Fusion splicing will be required.

The Contractor must demonstrate that repaired or replaced elements operate in a manner equal to or better than the replaced equipment. If the Contractor fails to perform required repairs or replacement work, the Department may perform the repair or replacement work and the cost will be deducted from monies due to the Contractor.

A TMS element must be considered nonoperational or off line for the duration of time that active communications with the TMC is disrupted, resulting in messages and commands not transmitted from or to the TMS element.

The Contractor must provide provisions for replacing existing TMS elements within the project limits, including detection systems, that were not identified on the plans or during the pre-construction operational status check that became damaged due to the Contractor's activities.

If the pre-construction operational status check identified existing TMS elements, then the Contractor, the Engineer, and the Department's Traffic Operations Electrical representatives must jointly conduct a post construction operational status check of all existing TMS elements and each element's communication status with the TMC. The Department's Traffic Operations Electrical representatives will certify the TMS elements' status and provide a copy of the certified list of the existing TMS elements within the project limits to the Contractor. The status list will include the operational, defined as having full functionality, and the nonoperational components. TMS elements that cease to be functional between pre and post construction status checks must be repaired at the Contractor's expense.

The Engineer will authorize the schedule for final replacement, the replacement methods and the replacement elements, including element types and installation methods before repair or replacement work is performed. The final TMS elements must be new and of equal or better quality than the existing TMS elements.

If no electrical work exists on the project and no TMS elements are identified within the project limits, the pre-construction operational status check is change order work.

Furnishing and installing temporary or portable TMS elements that are not shown, but are required when an existing TMS element becomes nonoperational or off line due to construction activities, is change order work.

Furnishing and installing temporary or portable TMS elements and replacing TMS elements that are not shown nor identified during the pre-construction operational status check and were damaged by construction activities is change order work.

If the Contractor is required to submit provisions for the replacement of TMS elements that were not identified, submitting the provisions is change order work.

Add to section 86-2.03B:

Use sleeve nuts on Type 1-B standards. The bottom of the base plate must be flush with finished grade.

Add to section 86-2.04A:

Where the side tenon detail at the end of the signal mast arm is shown, you may substitute the applicable tip tenon detail.

The sign mounting hardware must be installed at the locations shown.

Install non-illuminated street name signs on signal mast arms using a minimum 3/4 by 0.020-inch round edge stainless steel strap and saddle bracket. Wrap the strap at least twice around the mast arm, tighten, and secure with a 3/4-inch stainless strap seal. Level the sign panel and tighten the hardware securely.

Set the Type 1 standards with the handhole on the downstream side of the pole in relation to traffic or as shown.

Add to section 86-2.05A:

Conduit installed underground must be Type 1 or Type 3.

Add to section 86-2.05B:

The conduit in a foundation and between a foundation and the nearest pull box must be Type 1 or Type 3.

Add to section 86-2.05C:

If a standard coupling cannot be used for joining Type 1 conduit, use a UL-listed threaded union coupling under section 86-2.05C, a concrete-tight split coupling, or a concrete-tight set screw coupling.

If Type 3 conduit is placed in a trench, not in the pavement or under concrete sidewalk, after the bedding material is placed and the conduit is installed, backfill the trench to not less than 4 inches above the conduit with minor concrete under section 90-2, except the concrete must contain not less than 421 pounds of cementitious material per cubic yard. Backfill the remaining trench to finished grade with backfill material.

After conductors have been installed, the ends of the conduits terminating in pull boxes, service equipment enclosures, and controller cabinets must be sealed with an authorized type of sealing compound.

At those locations where conduit is required to be installed under pavement and underground facilities designated as high priority subsurface installation under Govt Code § 4216 et seq. exist, conduit must be placed by the trenching in pavement method under section 86-2.05C.

At other locations where conduit is required to be installed under pavement and if a delay to vehicles will not exceed 5 minutes, conduit may be installed by the trenching in pavement method.

The final 2 feet of conduit entering a pull box in a reinforced concrete structure may be Type 4.

Add before the 1st paragraph in section 86-2.05C with:

86-2.05C(1) General

Add to section 86-2.05C:

86-2.05C(2) Directional Boring Method of Installation

Install conduit by the directional boring method with the approval of the Engineer as shown.

Notify the Engineer 2 working days before starting directional boring operations.

Include the location and the equipment to be used in the advance notice to the Engineer.

Perform directional boring operations in the presence of the Engineer, unless otherwise notified by the Engineer.

Install conduit to a minimum depth of 3 ft below finished grade.

The diameter of the boring tool must not exceed 1.5 times the outside diameter of the conduit. Use only mineral slurry or wetting solution to lubricate the boring tool and to stabilize the soil surrounding the boring path. Mineral slurry or wetting solution must be water based and environmentally safe.

Comply with Section 86-5.01A(4) for disposing residue from directional boring operations.

The directional boring equipment must:

1. Have directional control of the boring tool
2. Have an electronic tool location detection system
3. Be equipped with a tension measuring device that indicates the amount of tension exerted on conduit during conduit pulling operations.

During operation, the directional bore equipment must be able to determine the location of the tool both horizontally and vertically.

Provide a layout and a profile plot to the Engineer showing the location of the bore to a scale of 6 inches.

You must have direct charge and control of the directional bore operation at all times.

Do not use slurry cement backfill where the directional boring method is used.

Reform schedule 40 conduit with a mandrel after installation.

Replace "Reserved" in section 86-2.06B of the RSS for section 86-2.06 with:

86-2.06B(1) General

86-2.06B(1)(a) Summary

Section 86-2.06B includes specifications for installing non-traffic-rated pull boxes.

86-2.06B(1)(b) Submittals

Before shipping pull boxes to the job site, submit a list of materials used to fabricate the pull boxes to METS. Include:

1. Contract number
2. Manufacturer's name
3. Manufacturer's installation instructions
4. Your contact information

Submit reports for pull boxes from an NRTL-accredited laboratory.

Before installing a pull box and cover, submit the manufacturer's replacement warranty for them.

86-2.06B(1)(c) Quality Control and Assurance

86-2.06B(1)(c)(i) Functional Testing

The pull box and cover must be tested under ANSI/SCTE 77, "Specification for Underground Enclosure Integrity."

86-2.06B(1)(c)(ii) Warranty

Provide a 2-year manufacturer's replacement warranty for the pull box and cover. The warranty period starts on the date of Contract acceptance.

Deliver replacement parts within 5 business days after you receive notification of a failed pull box, cover, or both to the Department's Maintenance Electrical Shop at:

CALTRANS MAINTENANCE STATION
30 RICKYARD STREET
SAN FRANCISCO, CA 94134

86-2.06B(2) Materials

The pull box and cover must comply with ANSI/SCTE 77, "Specification for Underground Enclosure Integrity," for tier 22 load rating and must be gray or brown.

Each pull box cover must have an electronic marker cast inside.

A pull box extension must be made of the same material as the pull box and attached to the box to maintain the minimum combined depths.

Include recesses for a hanger if a transformer or other device must be placed in a pull box.

The bolts, nuts, and washers must be a captive design.

The captive bolt must be capable of withstanding a torque from 55 to 60 ft-lb and a minimum pull-out strength of 750 lb. Perform the test with the cover in place and the bolts torqued. The pull box and cover must not be damaged while performing the test.

Hardware must be stainless steel with 18 percent chromium and 8 percent nickel content.

Galvanize ferrous metal parts under section 75-1.05.

The manufacturer's instructions must include:

1. Quantity and size of entries that can be made without degrading the strength of the pull box below the tier 22 load rating
2. Locations where side entries cannot be made
3. Acceptable method for creating the entry

The tier 22 load rating must be labeled or stenciled by the manufacturer on the inside and outside of the pull box and on the underside of the cover.

86-2.06B(3) Construction

Do not install a pull box in curb ramps or driveways.

A pull box for a post or a pole standard must be located within 5 feet of the standard. Place the pull box adjacent to the back of the curb or edge of the shoulder. If this is impractical, place the pull box in a suitable, protected, and accessible location.

Cover the pull box with a plastic sheet and then bury it in soil from 6 to 8 inches below grade.

Plastic sheets must be 20 mil thick and made of HDPE or PVC virgin compounds.

If only the cover is to be replaced, anchor the cover to the pull box.

Add to section 86-2.08A:

Wrap conductors around the projecting end of conduit in pull boxes as shown. Secure conductors and cables to the projecting end of the conduit in pull boxes.

Replace the 1st sentence of the 1st paragraph of section 86-2.08E with:

Signal interconnect cable must be the 6-pair type with stranded tinned copper no. 20 conductors.

Add to section 86-2.08:

86-2.08F Telephone Cable

Telephone cable must comply with RUS Bulletin 1735F-205 (PE-39).

Telephone cable must consist of 6 pairs of no. 22 solid tinned copper conductors.

Run telephone cable from the telephone demarcation point to the controller cabinet without splices.

Terminate and coil 6 feet of cable at each cabinet, including the telephone demarcation point.

Replace the 1st paragraph of section 86-2.09E with:

Splices must be insulated by "Method B."

Delete the 6th and 7th paragraphs of section 86-2.09E.

Add to section 86-2.11A:

Continuous welding of exterior seams in service equipment enclosures is not required.

Circuit breakers must be the cable-in/cable-out type mounted on non-energized clips. All circuit breakers must be mounted vertically with the up position of the handle being the "ON" position.

Each service must be provided with up to 2 main circuit breakers that will disconnect ungrounded service entrance conductors. Where the "Main" circuit breaker consists of 2 circuit breakers as described, each of the circuit breakers must have a minimum interrupting capacity of 10,000 A, rms.

Replace 7th and 8th paragraphs of section 86-2.11A with:

Service equipment enclosures must be the aluminum type.

Replace "Reserved" in section 86-2.11B with:

Electric service (irrigation) must be from the service points to the irrigation controllers (IC) and to the spaces provided in the irrigation controller enclosure cabinets (CEC) for irrigation controllers as shown.

Irrigation Controller Cabinets (ICC) A and B: Electric service (irrigation) must be a metered 120/240 V(ac), single-phase service in a Type III service equipment enclosure.

Future Irrigation Controller Cabinets (ICC): Electric service (irrigation) must be a metered 120/240 V(ac), single-phase service in a Type III service equipment enclosure.

Service disconnects in service equipment enclosures must be 1-pole, 20-A circuit breaker.

Nameplate inscriptions must be as follows:

| Item | Inscription |
|--------------------|-------------|
| Service disconnect | IC "A" |
| Service disconnect | IC "B" |

The inscription on the other nameplates must be the letter designation used on the plans and in the special provisions.

Conductors, conduit, and pull boxes to the pull box adjacent to irrigation controller enclosure cabinets and irrigation controllers are included in the payment for electric service (irrigation).

Replace section 86-2.18 with:

86-2.18 NUMBERING ELECTRICAL EQUIPMENT

The placement of numbers on electrical equipment will be done by others.

Add to section 86-2:

86-2.19

Not Used

86-2.20 AGGREGATION ETHERNET SWITCH

86-2.20A General

86-2.20A(1) Summary

Section 86-2.20 includes specifications for installing Aggregation Ethernet switch (AES) as shown.

86-2.20A(2) Submittals

86-2.20A(2)(a) General

Submit all manuals, software forms with the AES for acceptance before installation.

Furnish, install, configure and test the AES according to the plans, the manufacturer's instructions, and adjust per field conditions with the Engineer's authorization and as shown.

Submit certificate of compliance before procurement of the AES.

Submit warranty documentation before installation.

Submit test plan to the Engineer at least two weeks in advance of testing.

86-2.20A(2)(b) Test Plan

The test plan must include:

1. Power meter tests of SFP gigabit transceivers and fast Ethernet fixed optical ports
2. Functionality tests on all copper Ethernet ports
3. Manufacturer recommended tests

Power meter test must consist of measurements of the SFP transmitter optical output power and SFP receiver optical sensitivity range.

86-2.20A(3) Quality Control and Assurance

86-2.20A(3)(a) General

Perform all tests under the supervision of personnel certified by the manufacturer. Provide all test equipment, including labor, software and auxiliary items required to perform the tests. Document test results and obtain Engineer's authorization.

Cease testing if the equipment fails to pass any performance, and functional test. Determine the cause of the failure and either make repairs or replace components at fault.

All tested components of the AES must meet manufacturer's specifications.

86-2.20A(3)(b) Warranty

Furnish a 5-year replacement warranty from the manufacturer for Aggregation Ethernet Switch against any defects or failures. The effective date of the warranty is the date of acceptance of the installation. Replacement parts must arrive within 10 days after receipt of the failed parts. The Department does not pay for the replacement. Deliver replacement parts to:

CALTRANS
DISTRICT 4
MAINTENANCE ELECTRICAL SHOP
30 RICKARD STREET
SAN FRANCISCO, CA 94134

86-2.20B Materials

86-2.20B(1) General

The AES must be fan-less, industrial-grade, and capable of providing long range Ethernet communications for traffic signal controllers and Intelligent Transportation System devices.

The aggregation Ethernet switch must be mountable on 19-inch rack.

Hardware, firmware, and software must be from the same original equipment manufacturer.

Aggregation Ethernet switch must be compatible with the edge Ethernet switch.

The aggregation Ethernet switch must comply with the following data network standards and protocols:

| |
|--|
| IEEE 802.3-10Base-T Ethernet |
| IEEE 802.3u- Fast Ethernet 100BaseTX, 100BaseFX |
| IEEE 802.3z- Gigabit Ethernet 1000Base LX/SX |
| IEEE 802.3ab- Gigabit Ethernet 1000BaseTX |
| IEEE 802.3x-Flow Control, Back Pressure Flow Control |
| IEEE 802.3ad-Link Aggregation |
| IEEE 802.1D-MAC Bridges |
| IEEE 802.1D-Spanning Tree Protocol |
| IEEE 802.1p-Class of Service, Quality of Service |
| IEEE 802.1Q-VLAN Tagging |
| IEEE 802.1w-Rapid Spanning Tree Protocol |
| IEEE 802.1x-Port Based Network Access Control |
| Auto-MDIX |
| IGMP Multicast group management |
| SNMP V1/V2/V3 |
| Remote Monitoring (RMON) and Port Mirroring |

The aggregation Ethernet switch must comply with the following electrical and mechanical standards:

| |
|--|
| IEC 60068 2-6, 2-27 – Vibration and Shock |
| IEC 61850-3, NEMA TS-2 Environment Rating – EMI Immunity |
| UL508 – Electrical Safety |
| Electric Substations – IEEE 1613 |

86-2.20B(2) Power Requirements

Input voltage Ranges: From 12 to 48 V(dc) and 120 V(ac), with dual redundant power supply connections.

86-2.20B(3) Environmental Requirements

Operating temperature must be from -40 to +74 degrees C.

Storage temperature must be from -40 to 85 degrees C.

Relative humidity (non-condensing) must be from 10 to 90 percent.

86-2.20B(4) Features

Each aggregation Ethernet switch must include:

1. Web browser based network management software with network topology discovery for configuration
2. Front panel diagnostic LED status indicators indicating device power status, port network link connection and data activity status
3. External Ports:
 - 3.1. 16 single-mode fast Ethernet 100Base-FX, 568SC fiber optic ports (25 km range)
 - 3.2. 8 8P8C modular fast Ethernet 100Base-TX twisted pair copper ports
 - 3.3. 4 slots for SFP Gigabit fiber transceivers
 - 3.4. External USB and serial interface ports for local device configuration and management

86-2.20B(5) Components

Furnish each aggregation Ethernet switch with:

1. 2 SFP gigabit fiber transceivers
2. 19-inch rack mounting hardware
3. Power supplies
4. Power cables
5. Configuration cables
6. CD ROM containing user and service manuals

86-2.20C Construction

86-2.20C(1) Installation

Securely mount and connect Aggregation Ethernet switch to equipment as shown. Clearly label all cables and wiring.

Aggregation Ethernet switch is configured by others. After the switch is configured, coordinate with the Engineer, and ensure that the aggregation Ethernet switch is capable of transmitting and receiving data.

Perform acceptance testing and obtain Engineer's authorization.

86-2.20D Payment

Not used

86-2.21 EDGE ETHERNET SWITCH

86-2.21A General

86-2.21A(1) Summary

Section 86-2.21 includes specifications for installing Edge Ethernet Switch (EES) as shown.

86-2.21A(2) Submittals

Submit all manuals, software forms with the EES for acceptance before installation.

Furnish, install, configure and test the EES according to the plans, the manufacturer's instructions, and adjust per field conditions with the Engineers approval and as shown.

Submit certificate of compliance before procurement of the EES.

Submit warranty documentation before installation.

86-2.21A(3) Quality Control and Assurance

86-2.21A(3)(a) General

Submit test plan to the Engineer at least two weeks in advance of testing.

The test plan must include:

1. Power meter tests of Small Form-factor Pluggable (SFP) gigabit transceivers and fast Ethernet fixed optical ports
2. Functionality tests on all copper Ethernet ports
3. Manufacturer recommended tests

Power meter test includes measurements of the SFP transmitter optical output power and SFP receiver optical sensitivity range.

Perform all tests under supervision of personnel certified by the manufacturer. Provide all test equipment, including labor, software and auxiliary items required to perform testing. Test results must be documented and authorized by the Engineer.

Cease testing if the equipment fails to pass any performance and functional tests. Determine the cause of the failure, and either make repairs or replace components at fault.

All tested components of the AES must meet manufacturer's specifications.

86-2.21A(3)(b) Warranty

Furnish a 5-year replacement warranty from the manufacturer for Aggregation Ethernet Switch against defects and failures. The effective date of the warranty is the date of acceptance of the installation. Replacement parts must arrive within 10 days after receipt of the defective or failed parts. The Department does not pay for the replacement. Replacement parts must be delivered to:

CALTRANS DISTRICT 4
MAINTENANCE ELECTRICAL SHOP
30 RICKARD STREET
SAN FRANCISCO CA 94134

86-2.21B Materials

86-2.21B(1) General

The EES must be a fan less, industrial-grade, managed Ethernet switch, capable of providing long range Ethernet communications for traffic signal controllers and Intelligent Transportation System devices.

The Edge Ethernet switch must be din-rail mountable unit.

Hardware, firmware, and software must be from the same original equipment manufacturer.

Edge Ethernet switch must be compatible with the Aggregation Ethernet switch.

86-2.21B(2) Standards Compliance

The edge Ethernet switch must comply with the following data network standards and protocols:

1. IEEE 802.3-10BaseT
2. IEEE 802.3u- Fast Ethernet 100BaseTX, 100BaseFX
3. IEEE 802.3z- Gigabit Ethernet 1000Base LX/SX
4. IEEE 802.3ab- Gigabit Ethernet 1000BaseTX
5. IEEE 802.3x-Flow Control
6. IEEE 802.3ad-Link Aggregation
7. IEEE 802.1D-MAC Bridges
8. IEEE 802.1D-Spanning Tree Protocol
9. IEEE 802.1p-Class of Service, Quality of Service
10. IEEE 802.1Q-VLAN Tagging
11. IEEE 802.1w-Rapid Spanning Tree Protocol
12. IEEE 802.1x-Port Based Network Access Control
13. Auto-MDIX
14. IGMP Multicast group management
15. SNMP V1/V2/V3
16. Remote Monitoring (RMON) and Port Mirroring

The Edge Ethernet switch must comply with the following electrical and mechanical standards:

1. IEC 60068 2-6, 2-27 – Vibration and Shock
2. IEC 61850-3, NEMA TS-2 Environment Rating – EMI Immunity
3. UL508 – Electrical Safety
4. Electric Substations – IEEE 1613

86-2.21B(3) Power Requirements

Input Voltage Range: From 9 to 60 V(dc) or 90 to 277 V(ac), with dual redundant power supply connections.

86-2.21B(4) Environmental Requirements

Operating Temperature must be from -40 to +74 degrees C.

Storage Temperature must be from -40 to 85 degrees C.

Relative Humidity (non-condensing) must be from 10 to 90 percent.

86-2.21B(5) Features

The Edge Ethernet switch must include:

1. Web browser based network management software with network topology discovery for configuration
2. Front panel diagnostic LED status indicators indicating device power status, port network link connection and data activity status
3. External Ports:
 - 3.1. Two slots for SFP gigabit fiber transceivers
 - 3.2. Two slots for SFP fast Ethernet fiber transceivers
 - 3.3. Six RJ45 twisted pair copper ports
 - 3.4. External USB and Serial interface ports for local device configuration and management

86-2.21B(6) Components

Each Edge Ethernet switch must be furnished with:

1. Two SFP fast Ethernet fiber transceivers
2. Din-rail adapter with mounting hardware for nineteen inch racks
3. External industrial power supply
4. Power cables
5. Configuration cables
6. CD ROM containing user and service manuals

86-2.21C Construction

86-2.21C(1) Installation

Securely mount and connect Aggregation Ethernet switch to equipment as shown. Clearly label all cables and wiring.

Aggregation Ethernet switch will be configured by others. After the switch is configured, ensure, in coordination with the Engineer, that the aggregation Ethernet switch is capable of transmitting and receiving data.

Perform acceptance testing to the approval of the Engineer.

86-2.21D Payment

Not used

86-2.22

Not Used

86-2.23 INFORMATIONAL MESSAGE SIGN ASSEMBLY

86-2.23A General

86-2.23A(1) Summary

Section 86-2-23 includes specifications for installing an Informational Message Sign (IMS) assembly as shown.

86-2.23A(2) Submittals

Submit at least 30 days before fabrication of IMS assembly the following:

1. Three sets of shop drawings showing the mechanical and electrical systems and circuits.

Allow 14 days for the Engineer's review.

Submit three updated sets of shop drawings at least 30 days before the IMS assembly installation if any changes to the authorized shop drawings were made during IMS assembly.

Before IMS assembly is shipped to the site, you must submit to the Engineer:

1. Documentation for quality assurance inspection, functional testing and acceptance testing performed by the manufacturer.
2. Two copies of the manuals for each IMS

All pages in the manual must be securely fastened together between protective covers. Loose-leaf ring binding is acceptable.

The manual must include the following sections and sub-sections:

1. General:
 - 1.1. Description of the equipment design features, including any modification of the standard equipment if applicable, performance, and applications
 - 1.2. Equipment specifications summary
 - 1.3. List of assemblies, subassemblies and parts for each specified equipment component
 - 1.4. Equipment installation instructions
2. Theory of Operations of:
 - 2.1 Standard equipment, with unique or unusual circuitry described in detail
 - 2.2 Any modification to the standard equipment
3. Service and Maintenance:
 - 3.1. Recommended test equipment and fixtures, or minimum operational and performance requirements for test equipment
 - 3.2. Troubleshooting information and charts
 - 3.3. Removal and installation procedures for replacing assemblies and subassemblies, if not obvious or if improper procedure may result in damage
4. Replacement Parts:
 - 4.1. Lists of electrical parts, mechanical parts and assemblies, with each semiconductor device identified by the supplier's number and by industry standard part numbers.
5. Diagrams:
 - 5.1. Schematic diagrams identifying all circuit components and showing normal test voltages and levels
 - 5.2. Overall functional block diagram
 - 5.3. Detailed interconnecting diagrams showing wiring between modules, circuit boards and major components
 - 5.4. Pictorial circuit board layout diagrams showing component placement and printed wiring detail
 - 5.5. Diagrams showing location of circuit boards and other subassemblies
 - 5.6. Exploded view diagrams of complex mechanical assemblies

Submit warranty documentation before installation.

86-2.23A(3) Quality Control and Assurance

IMS assembly must operate at a frequency of 60 \pm 3 Hz AC line over a voltage from 90 to 135 V(ac). AC voltage fluctuations must cause no visible flicker or change in pixel luminous intensity. The rated voltage for measurements must be 120 V(ac).

IMS assembly must not conduct or radiate signals adversely affecting other electrical or electronic equipment, including other control systems, data processing, audio, radio and industrial equipment must comply with requirements in Subpart B, "Unintentional Radiators," of Part 15, "Radio Frequency Devices," in Federal Communications Commission Title 47.

The IMS assembly must comply with vibration requirements specified in NEMA Standard TS-1 and TS-4.

All wiring must be No. 22 AWG or larger, and must be color-coded per TEES Section 1.13.3.6. All wiring must be bundled, wrapped, and permanently labeled.

The firmware must support the following diagnostic tests:

1. Pixel Test:
 - 1.1. Operational status of each pixel must be recorded by pixel row (top to bottom) and pixel column (left to right) as one of the following:
 - 1.1.1. working
 - 1.1.2. partial out
 - 1.1.3. full out
 - 1.1.4. partial stuck on
 - 1.1.5. full stuck on

- 1.2. A list of pixels with operational status other than "working" must be transmitted via any communication port upon request. The test must be completed in less than 0.5 seconds, regardless of current IMS message status. The test must be run automatically every 24 hours or upon request.
2. Pixel Read:
 - 2.1. Operational state of each pixel, either "on " or "off", must be recorded by pixel row (top to bottom) and pixel column (left to right) during message downloads and during every sign poll. A separate recording must be made for each page of a multi-page message, or during the blank portion of a flashing message.
 - 2.2. This test must be performed while a message is displayed on the sign. The test must not affect displayed message. Each performance of this test must be independent of previous test results. The results of this test must be transmitted upon request.

86-2.23A(4) Warranty

Furnish a 5-year replacement warranty from the manufacturer for Informational Message Sign Assembly against any defects or failures. The effective date of the warranty is the date of acceptance of the installation. Replacement parts to arrive within 10 days after receipt of the failed parts. The Department does not pay for the replacement. Replacement parts to be delivered to the department maintenance electrical shop:

Caltrans-District 4, Maintenance Electrical Shop, 30 Rickard Street, San Francisco, CA 94134.

Submit warranty documentation before installation.

86-2.23B Materials

IMS assembly must consist of:

1. Sign panel
2. Sign controller assembly
3. NEMA 4 enclosure
4. IMS interface cable
5. Voltage surge protection

86-2.23B(1) Sign Panel

86-2.23B(1)(a) General

The sign panel must consist of:

1. Front face
2. Housing
3. Internal power supply to operate the sign

Sign panel dimensions must not exceed 48 (W) by 32 (H) by 8 (D) inches. Sign panel weight must not exceed 120 pounds. The sign panel power factor must be greater than 90 percent, and current total harmonic distortion must be less than 25 percent. The maximum power consumption of sign panel must be 150 W.

Sign panel must have dimming capability.

The sign panel must be rain-tight.

86-2.23B(1)(b) Front Face

The front face must consist of a pixel module and an outer frame.

The front face must be:

1. Hinged to allow access to the interior of the sign panel housing
2. Equipped with a locking device.

86-2.23B(1)(c) Pixel Module

Pixel module must have a full matrix of pixels, with a minimum of 30 pixels wide by 18 pixels high. The pixels must have a minimum horizontal and vertical pitch of 1.25 inch.

Pixel module must include a lens panel clear glazing made of polycarbonate resin thermoplastic. The polycarbonate resin thermoplastic must meet the following minimum requirements:

1. Minimum thickness: 0.125 inch
2. Color: clear
3. Initial Light Transmittance: 88 percent (average)
4. Change in Light Transmittance, 5 years exposure: less than 5 percent
5. Change in Yellowness Index, 5 years exposure: less than 5 percent

The following pixel module information must be permanently marked on the back of the panel:

1. Manufacturer's name and trademark
2. Model number
3. Serial number
4. Rated voltage, current, power consumption and Volt-Amperes (VA) per pixel

Each pixel shall consist of multiple high-intensity ultra-bright T 1-3/4 light-emitting diodes (LED).

Failure of one LED must not result in the loss of more than 40 percent of the total number of LEDs for that pixel.

The power consumption of each pixel, including its driving circuitry, must not exceed 1.5 W.

Each pixel must have a maximum LED array size:

1. 0.75 inch diameter for circular array
2. 0.75 inch square for square array

The LEDs must be evenly distributed throughout the pixel.

Each pixel must have:

1. Viewing angle: 30 degrees
2. Initial nominal luminous intensity on the maximum setting: 9.5 cd
3. Minimum useful life rating: 48 months
4. Minimum intensity at temperatures from -34 to +165 degrees F: 85 percent

The measured chromatic coordinates of each pixel must conform to the chromaticity requirements in section 5.3.2.1 and Figure C of the Equipment and Materials Standards in the Institute of Transportation Engineers ITE Publication ST-017A.

Each LED must be:

1. Rated for 100,000 hours of continuous operation at temperatures from -34 to + 165 degrees F
2. Emitting yellow color light with wavelength 592 ± 5 nm
3. UV-stabilized
4. From the same manufacturer and color bin

Each LED must be individually mounted directly to a printed circuit board (PCB) and must be easily replaceable and individually removable using conventional electronics repair methods. Each device must:

1. Be black in color
2. Protect the LED from damage during assembly, testing, removal, normal operation, and repair
3. Not block airflow to the LED
4. Not obstruct the light output of the LED at specified viewing angle

86-2.23B(1)(d) Outer Frame

The outer frame must be an aluminum sheet, 0.090-inch minimum thick, with one circular aperture for each pixel in the pixel module. The aperture diameter must be the smallest one that does not obstruct LED light output at specified viewing angle.

The exterior surface of outer frame must be coated with a factory-applied, oven-baked finish based on polyvinylidene fluoride resin. The finish must be:

1. Matte-black in color
2. Applied by an applicator approved by the formulator
3. Meeting the performance criteria of AAMA 2605 specification

The lens panel clear glazing must be laminated and sealed to the interior surface.

86-2.23B(1)(e) Housing

The housing must consist of:

1. Aluminum frame made of extruded aluminum alloy 6061-T6
2. Rear, sides, top and bottom made of sheet aluminum alloy 5052-H32, 0.125 inch minimum thick, with a natural aluminum mill finish on interior and exterior surfaces
3. External and internal hardware made of either stainless steel or cadmium-plated steel

The housing frame must have fully welded seams. The aluminum sheets must be stitch-welded to the housing frame.

Panel manufacturer's name and trademark must be permanently marked on the side of the housing.

Panel model, serial number and shipping date must be stamped on a tag that must be affixed to the side of the housing.

The lettering must have a minimum height of 0.3125 inch. The lettering on a tag may be either depressed or raised, and must be legible and durable.

86-2.23B(2) Sign Controller Assembly

86-2.23B(2)(a) General

Sign controller assembly must consist of:

1. Sign controller
2. Dim test switch
3. Controller reset switch
4. Local communications cable
5. Two NEMA 5-15R GFCI receptacles
6. Field wiring isolation / termination board mounted inside the enclosure
7. Power supply
8. Sign operating software

86-2.23B(2)(b) Sign Controller

Sign controller must have power-up and auto-restart capabilities with a programmable default message, including a blank message, when recovering from a power off condition. A hardware watch dog circuit must be used to provide automatic reset to the sign controller.

Sign controller must include:

1. Communication interface for remote communications
2. Firmware
3. Dimming control

86-2.23B(2)(c) Communications Interface

Communication interface must include:

1. Two configuration ports supporting TIA-232 through DE9 connector.
2. Network communications port supporting Ethernet 10/100 Mbps through 8P8C modular connector.

Sign controller must be controlled via:

1. Local TIA-232 port
2. Either Ethernet or remote TIA-232 port

Commands communicated via the local TIA-232 port must have higher priority.

86-2.23B(2)(d) Firmware

Firmware must allow creating, editing and saving a minimum of 50 messages and 99 pages. These must be stored in non-volatile memory and must remain unaltered for a minimum of 30 days without AC power to the sign controller.

The firmware must be NTCIP (National Transportation Communication for ITS Protocol) compliant including, the following standards:

1. NTCIP 1203, v02.39b "Object Definitions for Dynamic Message Signs" including normative references.
2. NTCIP 1101 "Simple Transportation Management Framework".
3. NTCIP 2103 "Point to Point Protocol over TIA-232 Subnetwork Profile".
4. NTCIP 2201 "Transportation Transport Profile".

The firmware must support the following Tags as defined in NTCIP 1203, v02.39b:

1. Flash
2. Font
3. Graphic
4. Justification – Line
5. Justification – Page
6. New Line
7. New Page
8. Page Time
9. Spacing Character

86-2.23B(2)(e) Dimming Control

The sign controller must automatically adjust the intensity of all pixels by using input from a minimum of 2 photo sensors measuring ambient light and installed in the sign housing. There must be a minimum of three adjustable levels of luminance: 100 percent, 60 percent, and 30 percent luminance.

86-2.23B(2)(f) Dim Test Switch

A single-throw "Dim Test" switch must override the automatic intensity selection and force each activated pixel to 30 percent luminance.

86-2.23B(2)(g) Controller Reset Switch

A single-throw momentary "Controller Reset" switch must generate an automatic reset to the sign controller.

86-2.23B(2)(h) Local Communications Cable

Provide a cable to allow for the connection of a laptop to the local TIA-232 port. The cable must be a minimum of 6 feet in length. The cable must consist of 3 conductors (TxD, RxD and Ground) and must be terminated in a 9-pin D-shell socket connector per TIA-574.

86-2.23B(2)(i) Field Wiring Isolation / Termination Board

All communication and control signals between the sign controller and the sign panel must be terminated on the field wiring isolation / termination board and must be opto-coupled.

86-2.23B(2)(j) Power Supply

Provide one industrial-grade switching DC power supply unit. The power supply voltage must not exceed 24 V(dc) under normal load. The power supply must have an efficiency of 75 percent.

86-2.23B(2)(k) Sign Operating Software

Provide one copy of the Sign Operating Software (SOS) for IMS testing via the local TIA-232 port for each IMS assembly, not to exceed maximum number of 10 copies. Each copy must be on a CD-ROM and must be Windows XP compatible.

IMS assembly must include voltage surge protection to withstand high repetition noise transient and must comply with section 2.1.6.1 of NEMA Standard TS-2.

86-2.23B(3) NEMA 4 Enclosure**86-2.23B(3)(a) General**

NEMA 4 enclosure dimensions must not exceed 28 (W) by 16 (H) by 12 (D) inches. Enclosure weight must not exceed 25 pounds.

86-2.23B(3)(b) Enclosure Construction

The enclosure must be fabricated from galvanized sheet steel, or must be fabricated from sheet steel and zinc- or cadmium-plated after fabrication, or must be fabricated from aluminum.

Furnish the enclosure with a rear mounting board made of 0.5-inch thick, grade ACX, plywood or 0.08-inch thick aluminum.

Mounting board must be centered on the enclosure wall and must have 0.5 inch clearance to the adjacent walls.

Each listed component of the sign controller assembly must be mounted on the rear mounting board.

The enclosure must have one door, which must be side-hung with a continuous stainless steel piano hinge. The hinge must be mounted so that it is not accessible from the outside when the enclosure door is closed.

The door and hinges must be able to withstand a vertical load of 100 pounds per foot of door height applied to the outer edge of the open door without permanent deformation of the door or cabinet body.

The door opening must be double flanged on all four sides.

Dust and weather resistant seal at the enclosure door must be created by installing closed-cell neoprene gasket.

The enclosure must be equipped with a draw latch welded to the enclosure and the door. The latch must have a padlock hole with a minimum diameter of 0.4375 inch.

Manufacturer's name and trademark must be permanently marked inside the enclosure. Model, serial number and shipping date must be stamped on a tag that must be affixed inside the cabinet. The lettering must have a minimum height of 0.3125 inch. The lettering may be either depressed or raised, and must be legible and durable.

86-2.23B(3)(c) IMS Interface Cable

The IMS interface cable (IIC) must connect the sign panel to sign controller assembly and must be continuous without splicing, with 50 feet minimum length. The IIC must be approved for use by the sign manufacturer. The manufacturer's identification must be printed in white ink every foot along the surface of the IIC. The IIC must be certified for outdoor use.

86-2.23C Construction**86-2.23C(1) Installation**

The IMS assembly must be installed as shown. Configure the sign controller assembly to make IMS assembly operational and ready to accept communications.

Provide to the Engineer documentation detailing the configuration of each IMS assembly.

86-2.23C(2) Testing After Installation

After installation at the site, a minimum of 5 different messages composed of text and graphics must be displayed. Conduct any other tests recommended by the manufacturer.

86-2.23D Payment

Not used

86-2.24

Not Used

86-2.25 OUTDOOR FIBER OPTIC CABLE PLANT

86-2.25A General

86-2.25A(1) Summary

Section 86-2.25 includes specifications for installing outdoor fiber optic cable plant.

86-2.25A(2) Definitions

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 (i.e., patch panel).

Connectorized: Termination point of a fiber after connectors have been affixed.

Connector Module Housing (CMH): A patch panel used in the fiber distribution unit to terminate fibers with most common connector types. It may include a jumper storage shelf and a hinged door.

Couplers: 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 FDUs mounted in panels. They may also be used unmounted, to join two simplex fiber runs.

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. This number will determine the amount of optical power (in dB) needed to meet the System Performance Margin.

Fiber Distribution Unit (FDU): A rack mountable enclosure containing both a connector module housing and a splice module housing in one enclosure.

FO: Fiber optic

FOOP: Fiber optic outside plant cable.

FOTP: Fiber optic test procedure(s) as defined by ANSI/TIA standards.

FPC: Fiber pigtail cable

Light Source: A portable 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. It also couples light from the source into the fiber to be received at the far end by the receiver.

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 data link may be from video FO transmitter to video FO receiver.

Link Loss Budget: A calculation of the overall permissible attenuation from the fiber optic transmitter (source) to the fiber optic receiver (detector).

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.

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.

MM: Multimode

MMFO: Multimode fiber optic cable

Optical Time Domain Reflectometer (OTDR): A 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 over the corresponding distance. It provides a visual and printed display of the relative location of system components such as fiber sections, splices and connectors as well as the losses that are attributed to each component and or defects in the fiber.

Patch cord: A short jumper used to join two components.

Pigtail: Relatively short length of fiber optic cable that is connectorized on only one end. All pigtails must be tight buffered cable.

Power Meter: A 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 power injected by the light source that arrives at the receiving end of the link.

SM: Singlemode.

SMFO: Singlemode Fiber Optic Cable.

Splice: The permanent joining of fiber ends to identical or similar fibers.

Splice Enclosure: An environmentally sealed container used to organize and protect splice trays. The container allows splitting or routing of fiber cables from and to multiple locations.

Splice Module Housing (SMH): Stores splice trays as well as pigtails and short cable lengths.

Splice Tray: A container used to organize and protect spliced fibers.

Segment: A section of fiber optic cable that is not connected to any active device and may or may not have splices per the design.

Splice or Fiber Optic Vault: An underground container used to house excess cable and splice enclosures.

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.

Tight Buffered Cable: Type of non-breakout cable construction where each glass fiber is tightly buffered (directly coated) with a protective thermoplastic coating to 900 μm with the exception of the protective thermoplastic coating. The tight buffered cable must meet all the characteristics of the fiber in the fiber optic outside plant cable.

86-2.25A(3) Submittals

Submit the following:

1. Shipping record in a weatherproof envelope showing the manufacturer's name, the cable type, the actual length of cable on the reel, your name, the contract number, and the reel number. Include the date of manufacture, cable characteristics such as size, attenuation, bandwidth, factory test results, cable identification number and any other pertinent information.
2. Certificate of Compliance with the "Fiber Characteristics" tables before ordering the material that shows factory test results.
3. Factory testing documentation including attenuation test before shipment, but while on the shipping reel.

4. Manufacturer's recommended installation procedures and technical support information for FO cable and splice enclosures 20 or more working days before installation.
5. Detailed test procedure a minimum of 15 working days before arrival of the cable at the job site, for all field testing for the Engineer's review and approval. The procedure must include:
 - 5.1. Test date and description
 - 5.2. Test plan
 - 5.3. Test equipment manufacturer and production date
 - 5.4. Test equipment operating procedures

86-2.25A(4) Quality Control and Assurance

86-2.25A(4)(a) Fiber Optic Cable Testing

Test the cable under ICEA S-87-640 and NECA/FOA 301.

1. Perform the following tests after installation and splicing:
 - 1.1. End to end attenuation, using optical power meter and light source.
 - 1.2. Optical anomalies by OTDR in both directions.
2. Test the cable under ICEA S-87-640 Part 7 'Testing, Test methods, and Requirement.
 - 2.1 Jacket print test
 - 2.2 Length and marking accuracy
 - 2.3 Cable high and low temperature bend
 - 2.4. Compound flow (drip) for gel filled cables
 - 2.5. Water penetration
 - 2.6. Cable impact
 - 2.7. Cable compressive loading
3. Test the cable under ICEA S-87-640 Part 8 "Finished cable optical performance requirements"
 - 3.1. Attenuation coefficient
 - 3.2. Point discontinuity
 - 3.3. Multimode optical bandwidth
 - 3.4. Singlemode cable cutoff wavelength
4. FO system components must be tested:
 - 4.1 At the factory
 - 4.2 After delivery to the project site but before installation
 - 4.3 During final system testing

Notify the Engineer 2 working days before field tests. The notification must include the exact location of the system or components to be tested.

86-2.25A(4)(a)(i) Factory Testing

Before shipment, but while on the shipping reel, test 100 percent of all fibers for attenuation. Copies of test results must be:

1. Maintained on file with a file identification number by the manufacturer for a minimum of seven years
2. Attached to the cable reel in a waterproof pouch
3. Submitted to the Engineer

86-2.25A(4)(a)(ii) Testing on Delivery at Site

Inspect physically FO cable and reels on delivery and test 100 percent of the fibers for compliance with attenuation requirements. Perform attenuation tests with an OTDR capable of recording and displaying anomalies of 0.02 dB as a minimum. Test Singlemode fibers (SM) at 1310 nm and at 1550 nm.

Record of site test results must include dates of testing and a copy of factory test results accompanying the shipping reel. Notify Engineer of attenuation deviations from the shipping records greater than 5 percent. If the test results are unsatisfactory, consider the cable reel unacceptable and mark accordingly all records corresponding to that reel of cable. Replace the unsatisfactory reels of cable with new reels of cable at no additional cost to the Department. Test the new reels of cable as specified above.

Submit copies of test results in graphic and tabular form to the Engineer for authorization. Do not install the FO cable until the Engineer authorizes test results.

86-2.25B Materials

86-2.25B(1) General

The FO cable must comply with TIA-492 and ICEA S-87-640.

FO cable identification and marking must comply with ICEA S-87-640 Part 6. Markings must be placed on the cable jacket.

86-2.25B(2) Fiber Optic Cable

The FO multimode cable detail specifications must comply with TIA-492AAAAXBBCD and as shown in the following table:

| Property | FOTP(s) | Test conditions | Requirement | Units |
|--------------------------------------|------------------------|-----------------|------------------|--------|
| Core diameter | 58 with 29 or 43 or 44 | | 62.5±3.0 | µm |
| Core non-circularity | 176 | | < 6 | % |
| Cladding diameter µm | 45 or 48 or 176 | | 125±2.0 | µm |
| Cladding non-circularity | 45 or 48 or 176 | | < 2 | % |
| core/cladding concentricity error | 45 or 176 | | <3 | µm |
| Coating diameter | 55 or 163 or 173 | | 250±15 | µm |
| Coating/cladding concentricity error | 55 or 163 or 173 | | < 20 | µm |
| Tensile strength proof test | 31 | | 0.69 | GPa |
| Coating strip force | 178 | 30 mm length | 1.0 min, 9.0 max | N |
| Attenuation coefficient | 46 or 53 or 61 | @ 850 nm | 3.0 | dB/km |
| | 46 or 53 or 61 | @ 1300 nm | 0.9 | |
| Bandwidth length product minimum | 30 or 51 | @ 850 nm | 200 | MHz·km |
| | 30 or 51 | @ 1300 nm | 400 | |
| Point discontinuity | 59 | | <0.2 | dB/pt |

Detail specifications for Class IVa dispersion unshifted singlemode optical fibers as described in TIA-492CAAAXBBQB as shown in the following table:

| Property | FOTP(s) | Test conditions | Requirement |
|---|-------------------|-----------------|------------------|
| Cladding diameter µm | 45 or 48 or 176 | | 125±1.0 |
| Cladding non-circularity | 45 or 48 or 176 | | < 1.0 % |
| Core/cladding concentricity error µm | 45 or 176 | | < 1.0 |
| Coating diameter µm | 55 or 163 or 173 | | 250±15 |
| Coating/cladding concentricity error µm | 55 or 163 or 173 | | < 20 |
| Tensile strength proof test | 31 | | 0.69 GPa |
| Coating strip force N | 178 | 30 mm length | 1.0 min, 9.0 max |
| Attenuation coefficient dB/km | 78 or 61 or 120 | @ 1310 nm | 0.5 |
| | 78 or 61 or 120 | @ 1500 nm | 0.4 |
| Mode field diameter | 164 or 165 or 167 | @ 1310 nm | 9.1±0.5 |
| Point discontinuity dB | | | <0.10 |

86-2.25B(3) Cable Layup

86-2.25B(3)(a) Outdoor Fiber Optic Cable

Outdoor FO cable includes the following components:

1. Central strength member
2. Color coded buffer tubes containing color coded coated fibers and hydrocarbon blocking gel

3. Outer strength member
4. Core wrap
5. Ripcord
6. Jacket

86-2.25B(3)(b) Buffer Tubes

Buffer tube must contain one of the following flooding material:

- 1 Hydrocarbon blocking gel
- 2 Water blocking swellable polymer yarn or tape

Buffer tubes containing fibers must also be color coded with distinct and recognizable colors according to the following:

| | |
|----------------|-----------------|
| 1. Blue (BL) | 7. Red (RD) |
| 2. Orange (OR) | 8. Black (BK) |
| 3. Green (GR) | 9. Yellow (YL) |
| 4. Brown (BR) | 10. Violet (VL) |
| 5. Slate (SL) | 11. Rose (RS) |
| 6. White (WT) | 12. Aqua (AQ) |

86-2.25B(3)(c) Ripcord

The cable must contain at least one ripcord under the jacket for easy sheath removal.

86-2.25B(4) Post-installation Cable Labelling

Labels must be made of a material designed for permanent labeling. Metal tags must be stainless steel. Use non-metal label materials only if authorized. At vaults and other underground locations, all labels and imprinting must be weatherproof.

86-2.25B(5) Sealing Plugs for FO Conduits

Sealing plugs must be removable and reusable. Sealing plugs must be the split type that permits installation or removal without removing cables. Sealing plugs must seal the conduit simultaneously with one self contained assembly having an adjustable resilient filler of neoprene or silicone rubber clamped between backing ends and compressed with stainless steel hardware.

To provide suitable sealing between future varying size cables and the plugs, split neoprene or silicone adapting sleeves used singularly or in multiples must be inserted within the body of the plugs. Sealing plugs used to seal the FO conduit must be capable of withstanding a pressure of 5 psi. A sealing plug that seals an empty conduit must have an eye or other type of capturing device on the side of the plug that enters the conduit to attach onto the pull tape so that the pull tape will be easily accessible when the plug is removed.

86-2.25B(6) Innerduct for FO Conduit

Innerduct must be as described. A separate pull tape must be installed in each innerduct.

Innerduct must be made of one of the following:

1. An extruded flexible, smooth, or ribbed high density polyethylene (HDPE) tubing
2. Fabric mesh pouch

Innerduct within a conduit run must be continuous without splices or joints.

Innerduct must be color coded for cables used, in following color sequence:

| | |
|-----------------------|------------------------|
| Cable 1 - Blue (BL) | Cable 7 - Red (RD) |
| Cable 2 - Orange (OR) | Cable 8 - Black (BK) |
| Cable 3 - Green (GR) | Cable 9 - Yellow (YL) |
| Cable 4 - Brown (BR) | Cable 10 - Violet (VL) |
| Cable 5 - Slate (SL) | Cable 11 - Rose (RS) |
| Cable 6 - White (WT) | Cable 12 - Aqua (AQ) |

The innerducts must be shipped on reels marked with the manufacturer's name, contract number, and the size and length of the innerduct. The product on reels must be covered to protect colors from UV deterioration during shipment and storage.

86-2.25B(7) Conduit Concrete Backfill

Colored concrete backfill for installation of duct bank must be a medium to dark, red or orange color. The concrete must comply with sections 51 and 90-2.

The concrete backfill must be colored by a coloring agent specifically manufactured for coloring concrete.

86-2.25B(8) Cable Marker

Comply with section 82.

86-2.25B(9) Anchors for Conduits

Anchors used to attach communication conduits (electrical conduits) to the exterior surfaces of existing concrete structures and walls must comply with section 75-1.03.

When communication conduits are installed vertically on a structure for a distance of 2 feet or more, but less than 10 feet, install an anchor at the top and bottom of the pipe within 0.5 foot of the conduit sweeps. Vertical distances of 10 feet or more must have anchors installed at 5 feet on centers unless otherwise shown. Install anchors to support vertically installed conduit as shown.

86-2.25B(10) Warning Tape

The warning tape must have:

| Description | Parameters |
|---------------------------------------|---|
| Thickness | Minimum 4 mil |
| Width | 4 inches |
| Material | Orange color polyolefin film |
| Tensile strength of material | Minimum of 2800 psi |
| Elongation | Minimum of 500 percent elongation before breakage |
| Printed message content | CAUTION: BURIED FIBER OPTIC CABLE CALTRANS RADIO ROOM (xxx) xxx-xxxx |
| Printed message text height and color | 1 inch, black color text over bright orange background |
| Message spacing intervals | 3 feet |

The printed message content must not be removed by the normal handling and burial of the tape and must be rated to last the service life of the tape. Warning tape must not delaminate when it is wet. It must be resistant to insects, acid, alkaline and other corrosive elements in the soil.

Warning tape must be as manufactured by Condux International, Inc.; Allen System, Inc.; Reef Industries, Inc.; or approved equal.

86-2.25B(11) FO Pull Box

Comply with section 86-2.06.

86-2.25B(12) FO Vault

FO vaults must be as shown and must comply with section 86-2.06.

Vault cover must be furnished and installed. Vault, cover and extensions may be constructed of non-PCC material in (concrete) gray color. Pull boxes must comply with section 86.

All FO vaults and covers must have an AASHTO HS 20-44 rating. Metallic or non-metallic cable racks must be installed on the interior of both long sides of the FO vaults. The racks must be capable of supporting a load of 100 pounds minimum per rack arm. Racks must be supplied in lengths appropriate to the box in which they will be placed. All metallic cable racks must be fabricated from ASTM A 36 steel plate and must be hot-dipped galvanized after fabrication. Steel plate, hardware and galvanizing must comply with section 75. Metallic cable racks must be bonded and grounded.

86-2.25B(13) Grounding and Bonding

Grounding and bonding metallic hardwares including wall mounted termination boxes, racks and patch panels must comply with NEC and NECA/FOA 301.

86-2.25B(14) Splice Enclosure

The splice enclosure must be suitable for a direct burial or splice vault application.

The splice enclosure must comply with the following:

1. Non-filled thermoplastic case
2. Rodent proof, waterproof, re-enterable and moisture proof
3. Expandable from 2 cables per end to 8 cables per end by using adapter plates
4. Cable entry ports must accommodate from 1/4 to 1 inch diameter cables
5. Multiple grounding straps
6. Accommodate up to 8 splice trays
7. Suitable for "butt" or "through" cable entry configurations

86-2.25B(15) Splice Trays for FO Cable

Splice trays must accommodate a minimum of 12 fusion splices in FDU and up to 24 fusion splices in splice enclosure. Splice tray must allow a minimum bend radius of 2 inches. The splice tray cover may be transparent.

Splice trays in splice enclosure must be stackable with a snap on or hinged cover.

86-2.25B(16) Fiber Distribution Units

FDU must include:

1. A patch panel to terminate the appropriate number of singlemode fibers with ST type connectors feed through couplers
2. Splice trays
3. Storage for splice trays
4. A slide out metal drawer for storage of spare jumpers

Cable accesses must have rubber grommets or similar material to prevent cables from contacting bare metal.

Patch panels must have hinges or have coupler plates to provide easy access and maintenance.

FDUs must not exceed 10 inches in height and 15 inches in depth.

Cable trays for termination and distribution must accommodate FO cables and must have sufficient tray areas for excess optical fiber storage to assure that optical fibers must have minimum 2 inch bend radius. Cable trays for termination and distribution must include a designation strip for identification of optical fibers. Splice drawers must include splice trays capable of accommodating fusion type splices. Splice drawers must allow storage of excess lengths of optical fibers.

86-2.25B(17) FO Pigtails and Jumpers

86-2.25B(17)(a) General

Cable assemblies (jumpers and pigtails) must be products of the same manufacturer. The cable used for cable assemblies must be made of optical fibers meeting the performance requirements.

86-2.25B(17)(b) Pigtails

Pigtails must be of simplex (one fiber) construction, in 900- μ m tight buffer form, surrounded by Aramid yarn for strength, with a PVC jacket with manufacturer's identification information, and a nominal outer jacket diameter no more than 1/8 inch. Pigtails must be factory terminated and tested and at least 3 feet long.

86-2.25B(17)(c) Jumpers

Jumpers may be of simplex or duplex design. Duplex jumpers must be of duplex round cable construction and must not have zipcord (siamese) construction. All jumpers must be at least 6 feet in length, sufficient to avoid stress and allow orderly routing.

86-2.25B(17)(d) Connectors

Connectors must be one of the following types:

1. ST for normal applications
2. SC for normal applications
3. 586SC for network applications
4. LC for network applications

Associated couplers must be the same material as connector housings.

ST and SC type FO connectors must be 1 inch ferrule type in Zirconia ceramic material with a physical contact pre-radiused tip.

The connector must be suitable for operating temperature range of -34 to +74 degree C. Insertion loss must not exceed 0.4 dB for singlemode, and the return reflection loss on singlemode connectors must be at least -35 dB. Connection durability must be less than a 0.2 dB change per 500 mating cycles per TIA-455-21A (FOTP-21). All terminations must provide a minimum 50 lbf pull out strength. Factory test results must be documented and submitted before installing any of the connectors.

Field terminations must be limited to splicing of adjoining cable ends or cables to pigtails.

All connectors must be factory-installed and tested. Do not install connectors in the field.

86-2.25B(18) Packaging and Shipping

Completed cable must be packaged for shipment on reels. The cable must be wrapped in weather and temperature resistant covering. Both ends of the cable must be sealed to prevent the ingress of moisture.

Both ends of the cable must be securely fastened to the reel to prevent the cable from coming loose during transit. Two meters of cable length on each end of the cable must be accessible for testing.

Each cable reel must have a durable weatherproof label or tag showing the manufacturer's name, the cable type, the actual length of cable on the reel, your name, the contract number, and the reel number. Provide a shipping record in a weatherproof envelope showing the above information and also include the date of manufacture, cable characteristics such as size, attenuation, bandwidth, factory test results, cable identification number and any other pertinent information.

The minimum hub diameter of the reel must be at least thirty times the diameter of the cable. The FO cable must be in one continuous length per reel with no factory splices in the fiber. Each reel must be marked to indicate the direction the reel should be rolled to prevent loosening of the cable.

86-2.25C Construction

86-2.25C(1) Pulled Cable Installation

Install FO cable in conduit system or cable tray system. FO conduit system consists of conduits, communication pull boxes, FO splice vaults and cabinets.

Comply with cable installation procedures specified by the manufacturer. Use mechanical aids and place tension measuring device to the end of the cable. The tension applied must not exceed 600 lbf or the manufacturers recommended pulling tension, whichever is less.

Provide strain relief for incoming FO cables.

Provide brackets to spool incoming fibers a minimum of 2 turns. Keep turns not less than 1 foot before separating out individual fibers to splice trays

Install FO cable using a cable pulling lubricant recommended by the cable manufacture and a non-abrasive pull tape. Station your personnel at each pull box, vault, and cabinet through which the cable is pulled to lubricate and prevent kinking or other damage.

During cable installation, maintain the bend radius not less than twenty times the outside diameter of the cable. The cable grips for installing the FO cable must have a ball bearing swivel to prevent the cable from twisting during installation.

86-2.25C(2) Air Blown Installation

You may install the fiber cable using air blown method. If integral innerduct is used, the duct splice points or any temporary splices of innerduct must withstand a static air pressure of 110 psi.

The fiber installation equipment must incorporate a mechanical drive unit or pusher that 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 0.625 to 2-inch 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. 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.

86-2.25C(3) Splices and Termination

Install the cable without splices except where specifically allowed a minimum 12 feet slack of the cable at each cable access location without a cable splice. Store a minimum of 30 feet slack of each cable at FO splice vault.

Splice field cable either in splice vaults or in cabinets.

Use fusion type cable splices unless otherwise allowed. The mean splice loss must not exceed 0.07 dB per splice. Obtain the mean splice loss by measuring the loss through the splice in both directions and then averaging the resultant values.

Use the mid-span access method to access the individual fibers in a cable for splicing to another cable. Use cable manufacturers recommended procedures and approved tools perform a mid-span access. Only the fibers to be spliced may be cut. Take all measures to avoid damaging buffer tubes and individual fibers including those not being used in the mid-span access.

Use the breakout method to access individual fiber as follows:

1. Remove the jacket just beyond the last tie-wrap point.
2. Expose 3 to 6 feet of the cable buffers, aramid strength yarn and central fiberglass strength member.
3. Cut aramid yarn, central strength member and the buffer tubes to expose the individual glass fibers for splicing or connection to the device.

You are allowed to splice up to 5 fibers to repair any damage done during mid-span access splicing without penalty. You will be assessed \$300.00 penalty for each additional splice. Any single fiber must not have more than 3 unplanned splices. If the fiber needs to be spliced more than 3 times, replace the entire length of FO cable at no additional cost to the Department.

The termination splices must connect the cable span ends with pigtails. Place termination splices in splice trays and place the splice trays in the FDU.

Accommodate a minimum of 12 fusion splices in splice trays. The individual fibers must have at least 1 full turn within the splice tray to avoid micro bending. Maintain a 2 inch minimum bend radius during installation and after final assembly in the optical fiber splice tray. Retain individually each bare fiber in a splice tray. The optical fibers in buffer tubes and the placement of the bare optical fibers in the splice tray must be such that there is no discernible tensile force on the optical fiber.

Protect all splices with a metal reinforced thermal shrink sleeve. Install protective caps for all unmated connectors.

86-2.25C(4) Grounding and Bonding

Ground and bond metallic hardware (like wall mounted termination boxes, racks and patch panels).

86-2.25C(5) Post-installation Cable Labeling

86-2.25C(5)(a) General

Label all FO cables with tags as specified. All tags placed along one cable must contain the same cable identification code unique for that cable.

Place tags on the cables at the following points:

1. FO vault entrance and exit
2. Splice enclosures entrance and exit
3. FDU entrance

Affix labels to the cables per manufacturer's recommendations in a manner that must not cause damage to the cable.

86-2.25C(5)(b) Cable Identification Code

Cable identification code on a tag must consist of the following groups:

| Group No. | Description | Code | Number of Characters |
|-----------|--------------------------------|---|----------------------|
| 1 | Fiber Type | S: Singlemode | 1 |
| 2 | Fiber Count | 048 (example): Actual number of fibers or conductor pairs | 3 |
| 3 | Begin Point | T: TMC H: Hub V: Video Node D: Data Node C: Cable Node TV: CCTV Camera CM: CMS E: Traffic Signal RM: Ramp Meter TM: Traffic Monitoring/ Count Station/Vehicle Count Station (VDS, TMS) SV: Splice Vault or FO Vault SC: Splice Cabinet | 1 or 2 |
| 4 | Begin Point County Code Number | 35: San Mateo | 2 |
| 5 | Begin Point Route Number | 101 | 3 |
| 6 | Begin Point Post Mile | 02470 (example): Actual Post Mile value | 5 |
| 7 | End Point | In the same manner as for Begin Point | 1 or 2 |
| 8 | End Point County Code Number | In the same manner as for Begin Point County Code Number | 2 |
| 9 | End Point Route Number | In the same manner as for Begin Point Route Number | 3 |
| 10 | End Point Post Mile | In the same manner as for Begin Point Post Mile | 5 |
| 11 | Cable ID number | 03 (example): Actual cable number in a vault or pullbox | 2 |

Begin point must be associated with the lower numbered item in the following table. End point must be associated with the higher numbered item. When both points are associated with the same item, begin point must be associated with the lower equipment number.

| | |
|----|----------------------------------|
| 1 | TMC |
| 2 | HUB |
| 3 | Video Node (VN) |
| 4 | Data Node (DN) |
| 5 | Cable Node |
| 6 | CCTV Camera |
| 7 | CMS |
| 8 | Traffic Signal |
| 9 | Ramp Meter |
| 10 | Traffic Monitoring Count Station |
| 11 | HAR |
| 12 | EMS |
| 13 | Weather Station |
| 14 | Weight In Motion |
| 15 | Splice Vault or Cabinet |

86-2.25C(5)(c) Cable Code Example

The cable code 04 S 048 SV 35 084 02470 SV 37 082 02510 03 must be interpreted as located in District 04 and identified as a singlemode, 48 strand, cable starting at a FO vault in San Mateo County on Route 84 at post mile 24.70, and ending at another FO vault in Santa Clara County on Route 82 at postmile 25.10. Cable ID number indicates that the cable is the 3rd of the FO cables in the vault.

86-2.25C(5)(d) Begin and End Point Determination Criteria

A cable between:

1. HUB and TMC must begin at TMC and end at HUB
2. Vault and CMS must begin at CMS and end at Vault
3. HUB-03 and HUB-01 must begin at HUB-01 and end at HUB-03

86-2.25C(5)(e) Labeling Jumpers and Pigtails

Labeling jumpers and pigtails must 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 XXXTMC (Sample-LARTMC)Numbers or Alphanumeric or both | 2 |
| From (Source) Device | FD: FDU (Fiber Distribution Unit) | 2 |
| From (Source) Device Identifier | Numbers or Alphanumeric or both | 2 |
| Transmitter or Receiver | T or R | 1 |
| To (Destination) Device | FD: FDU (Fiber Distribution Unit) | 2 |
| To (Destination) Device Identifier | Numbers or Alphanumeric or both | 2 |
| Connector Identifier | Connector ID | 2 |
| Total | | 13 |

A pigtail labeled 01MU01TFD0203 would contain the following information:

| Hub | Multiplexer | Transmitting to | To Patch Panel Position (Connector) |
|-----|-------------|-----------------|-------------------------------------|
| 01 | MU01 | TFD02 | 03 |

86-2.25C(5)(f) Pigtail Code Example

This pigtail code 01MU01TFD0203 is interpreted as: Located in Hub 1, from multiplexer 01, transmitting to FDU 02 to patch panel position (connector) 03.

86-2.25C(5)(g) Label Placement

Place label as follows:

1. Cables: Label the cables with the unique identification code element method at terminations, even if no connections or splices are made, and at splice vault entrances and exits.
2. Cable to Cable Splices: Label cable jackets entering splice enclosures under the identification method.
3. Cable to Fiber Distribution Units: Label cable jackets at entries to FDUs under the unique identification code element method. Label fibers with Fiber and pigtails at connectors with Fiber IDs. Label FDUs with Cable IDs on faces of FDUs. If multiple cables are connected to FDUs, identify each block of connectors relating to individual cables by a single label with Cable IDs. Mark individual connections on the face of FDUs in the designated area with Fiber IDs.
4. Fiber: Place fiber labels next to connectors of individual fibers.
5. Jumpers: Label equipment to FDU jumpers as to equipment type connected at both ends. Label FDU to FDU jumpers at each end under the unique identification code element method.
6. Pigtails: Label pigtails at the connector under the unique identification code element method.
7. Copper Cable Labels: Label twisted-pair communications cables under the unique identification code element method.

86-2.25C(6) Conduit Sealing Plugs

Install conduit sealing plugs in all FO conduits and innerducts.

86-2.25C(7) Conduit Innerduct

Install innerducts in conduits as shown. Install FO cables in innerducts.

86-2.25C(8) Conduit Concrete Backfill

Provide adequate spacers, tie-downs and bracing to maintain conduits in place during pouring of the concrete. For trenches in paved areas, only the top 4 inch of concrete backfill must be pigmented concrete. At your option, the full depth of the trench may have the pigment.

86-2.25C(9) Cable Marker

Install cable markers for FO conduits constructed in unpaved locations and placed at 50 feet spacing.

86-2.25C(10) Warning Tape

Place the warning tape as shown.

86-2.25C(11) Fiber Optic Pull Box

Conduits must not protrude more than 2 inches inside the pull box and must enter the pull box at no more than 20 degrees in both the vertical and horizontal directions.

86-2.25C(12) Fiber Optic Vault

Install FO vaults as shown.

The top of the vault cover must be within 1 ±0.5 inch of adjacent finished grade.

Install vault outside of the pavement maintaining 5 feet distance from the cover centerline to the edge of the pavement or back of the dike, unless otherwise shown or as directed by the Engineer. Install vault farther from or closer to the roadway to accommodate buried objects, existing conduits, or similar items.

Maintain minimum distance of 18 inches from any part of the vault or backfill material to the edge of the pavement or back of the dike. When FO vaults are installed in paved areas:

1. Distance from the centerline of the vault to the edge of pavement or back of dike must not exceed 3 feet
2. Top of vault cover must be 0.1 ± 0.05 inch below the adjacent pavement finished grade

Conduits must not protrude more than 2 inches inside the vault and must enter the vault at no more than 20 degrees in both the vertical and horizontal directions.

86-2.25C(13) Splice Enclosure for Fiber Optic Cable

Place the splice enclosure where a splice is required as shown.

Bolt the splice enclosure to the side wall of the splice vault.

86-2.25C(14) Splice Trays for Fiber Optic Cable

Loop individual fibers one full turn within the splice tray to allow for future splicing. There must be no stress on the fiber and the finished splice when located in its final position in splice tray.

Secure only one single splice tray by a bolt through the center of the tray in the fiber termination unit. Secure multiple trays held in place as per the manufacturer's recommendation.

Secure buffer tubes and pigtails entering the tray.

Label after splicing is completed.

86-2.25C(15) Fiber Distribution Units

Install components to terminate incoming FO communication cables.

Install sufficient quantity of fiber distribution units to terminate fibers in the largest cable. Mount fiber distribution in equipment racks as shown. Terminate optical fibers at fiber distribution units. Optical fibers must be fusion spliced to optical fiber cable assemblies within splice trays.

Terminate and individually identify the fibers in FDUs and on patch panels.

Provide cable clamps in FDUs to secure FO cables to the chassis.

Provide appropriate lengths of optical fibers to allow future splicing with splice drawers and identify fibers.

Use fusion type splices and arrange them within splice trays of fiber distribution units under the organizational design of splice trays. Apply protective reinforced moisture-proof coverings to fusion splices.

86-2.25D Payment

Not Used

Add after the 1st paragraph of section 86-3.04:

Where shown cabinet must be Model 334T and consist of a housing 1B, a Cabinet cage 1, and the following listed equipment. The equipment must comply with chapter 6 of TEES.

1. Service panel Assembly no. 1
2. Power distribution assembly (PDA) no. 3L
3. Three equipment shelves with brackets as specified in section 86-4.06
4. Dual fan assembly with thermostatic control

Before shipping to the job site, submit each Model 334T cabinet to METS for acceptance testing.

Notify the Engineer when each Model 334T cabinet is ready for functional testing. Functional testing will be conducted by the Department.

Furnish 3 shelves as shown.

Wire cabinet per the application, as shown.

Add to section 86-3.04:

86-3.04F Global Positioning System Clock Assembly (GPSCA)

86-3.04F(1) General

86-3.04F(1)(a) Summary

Install a Global Positioning System Clock Assembly (GPSCA) for the Model 2070 traffic signal controllers. The GPSCA must provide accurate Coordinated Universal Time (UTC) to the Model 2070 controllers. The GPSCA must consist of a standalone Universal Time Base (UTB) processing unit containing a Global Positioning System (GPS) receiver with associated inputs, outputs and controller interface cable, weatherproof antenna unit, antenna cable, configuration software and user manual.

86-3.04F(1)(b) Certificate of Compliance

Provide a Certificate of Compliance from the manufacturer. The certificate must include a copy of applicable test reports on the universal time base module.

86-3.04F(1)(c) Warranty

Provide a manufacturer's written warranty against defects in materials and workmanship for the GPSCA for a period of 12 months after installation for parts and labor. A replacement GPSCA must be provided within 5 days after receipt of the failed GPSCA at no cost to the State, except the cost of shipping the failed GPSCA. Provide all warranty documentation to the Engineer before installation. Deliver replacement GPSCA to Caltrans Maintenance Electrical Shop at:

30 RICKARD STREET
SAN FRANCISCO CA 94134
TELEPHONE: (415) 330-6500

86-3.04F(1)(d) Configuration Software and User Manual

Provide a software package with required connection cables and an instruction manual with the GPSCA.

The GPSCA must be programmable with Windows-based software. The software package must include applications and drivers compatible with a Windows 7/XP or newer compatible computer or laptop.

86-3.04F(2) Materials

86-3.04F(2)(a) Standalone UTB Processing Unit

The standalone UTB processing unit must:

1. Automatically calculate the local time (offset of UTC) based on user location and daylight savings time.
2. Acquire the UTC from the United States Government's Global Positioning System (GPS) and transmit the local time and date to the Model 2070 traffic signal controllers.
3. Provide the time and date information as an ASCII data stream via an RS232C serial communication input/output data port.
4. Provide 24 hour backup for time keeping.
5. Have the following physical characteristics:
 - 5.1. All components and circuits must be fully encapsulated within an impact resistant environmental stand-alone housing.
 - 5.2. The housing must be ABS plastic enclosure with two mounting flanges with holes.
 - 5.3. The housing must be designed for wall mounting inside or setting on a shelf inside the traffic signal cabinet.
 - 5.4. Weight must be 12 ounces or less.
 - 5.5. Size must not exceed 7 inches in length (including mounting flanges), 6 inches in width, and 3 inches in height.

6. Have the following environmental characteristics:
 - 6.1. Storage Temperature must be from -40 to +85 degrees C
 - 6.2. Operating Temperature must be from -30 to +80 degrees C
 - 6.3. Humidity: From 0 to 95 percent non-condensing.
7. The standalone UTB processing unit must be powered by one of the following methods:
 - 7.1. Serial cable connected to the existing Model 2070 traffic signal controllers
 - 7.2. +12 to -24 V(dc) via external adapter
 - 7.3. Combination power supply/data cable
8. Connectors must be as follows:
 - 8.1. The standalone UTB processing unit must have exterior access connections for TIA-232 data communications, GPS signal via antenna and optional power adapter.
9. Controller Interface Cables must be as follows:
 - 9.1. All cables required for operation of the GPSCA with the Model 2070 traffic signal controllers utilizing C2S connectors must be included with each GPSCA unit.
 - 9.2. All cables must be at least 3 feet in length.
10. Data Communication Interface must be as follows:
 - 10.1. Provide date, time, day of week, and day of year information to the Model 2070 traffic signal controllers.
 - 10.2. Transmit time and date information to the Model 2070 traffic signal controllers as an ASCII data stream using TIA-232 serial communications.
 - 10.3. Provide True Time, Traconex 1020 WWV, or compatible protocol.
 - 10.4. Use TIA-232 serial communication with user selectable 1200 and 9600 baud rate.
 - 10.5. Retain user selectable parameters in memory in the event the unit loses power.
 - 10.6. Provide local time accuracy of \pm second to the Model 2070 traffic signal controllers.

86-3.04F(2)(b) Weatherproof Antenna Unit

The antenna unit must meet the following requirements:

1. Provide the standalone UTB processing unit the means of acquiring signal from GPS satellites.
2. Be low profile, through bolt-mounted and fully enclosed in UV resistant weatherproof material.
3. Require only a single mounting hole on the exterior of a traffic signal cabinet.
4. Not require an external power source.
5. Have an integrated antenna cable that is at least 3 feet long and terminated with a connector that will attach to a mating connector on the standalone processing unit.

86-3.04F(3) Construction

Install the Model GPSCA in the Model 2070 traffic signal controller assemblies under the direction of the Engineer.

86-3.04F(4) Payment

Not Used

Add to section 86-3:

86-3.05 GENERAL PACKET RADIO SYSTEM MODEM ASSEMBLY

86-3.05A General

86-3.05A(1) Summary

Section 86-3.05 includes specifications for installing the general packet radio system (GPRS) modem assembly at the controller cabinet.

86-3.05A(2) Submittals

Submit warranty documentation before installation.

86-3.05A(3) Quality Control and Assurance

Furnish a 1-year replacement warranty from the manufacturer of the modems and power supplies against any defects and failures. The effective date of the warranty is the date of installation. Furnish replacement

modems and power supplies within 5 days after receipt of the defective and failed parts. The Department does not pay for the replacement parts. Deliver replacement modems and power supplies to:

CALTRANS-DISTRICT 4
 MAINTENANCE ELECTRICAL SHOP
 30 RICKARD STREET
 SAN FRANCISCO, CA 94134

86-3.05B Materials

86-3.05B(1) General

The GPRS modem assembly consists of a modem, power supply, mounting bracket and hardware, serial communication cable, and antenna.

86-3.05B(2) Modem

The modem must:

1. Be configurable either remotely through the wireless network or through the modem serial port.
2. Be configured before acceptance.
3. Have a minimum 53.6 Kbps raw data transfer rate.
4. Have a full duplex transceiver.
5. Have 1900/850 MHz dual band networking.
6. Have an integrated TCP/IP stack with user datagram protocol (UDP).
7. Have a user-settable password to prevent unauthorized access.
8. Include a DC power cable at least 3 feet long with a connector compatible with the modem power connector.
9. Have a packet buffering and forwarding feature that provides discipline to the output of the serial port. The packet forwarding time interval must be configurable from a rate of 0 (undisciplined) to 400 ms in increments of 100 ms or less.
10. Have a choice of "Friends Only" access mode.
11. Comply with TIA-678.
12. Have an operating temperature range from -30 to +70 degrees C with humidity from 5 to 95 percent (non-condensing) and have transmissions at 10 percent duty cycle above 60 degrees C.
13. Weigh less than 2 pounds and have overall dimensions of less than 7-1/8 by 3-1/2 by 1-1/8 inches. The housing must be constructed of anodized aluminum.
14. Have the following status indicators:
 - 14.1. Power on
 - 14.2. Channel acquired
 - 14.3. Link status
 - 14.4. Network registration
 - 14.5. Received signal strength indicator
 - 14.6. Transmit and receive data
 - 14.7. Block errors
15. Operate in a dynamic IP addressing environment of GPRS networks at 1900/850 MHz and meet the operational parameters shown in the following table:

| (Operational parameter | Requirements) |
|--------------------------------|---|
| Transmit power at antenna port | 1.0 W for 1900 MHz 0.8 W for 850 MHz |
| Receiver sensitivity | -107 dBm (2.439 % bit error rate) |
| Input voltage | 10 to 28 V (dc) |
| Input current | 40 to 200 mA |

16. Have the following standard interfaces:
 - 16.1. Host communicates with modem using either UDP or TCP packet modes.
 - 16.2. Computer terminal platform using dial-up networking communicates with the modem using point to point protocol (PPP).

Provide the Engineer with the modem serial, SIM and international mobile equipment identification (IMEI) numbers 30 days before requiring the packet data protocol (PDP) context. The Engineer will provide the PDP context comprising of the assigned IP and access point name (APN) obtained from service provider.

The modem and associated firmware, software, hardware, protocol, and other features must be fully compatible with the existing GPRS network. Demonstrate the compatibility to the Engineer by actual installation or by other authorized means.

The existing GPRS network utilizes the AT&T Wireless cellular system and the AirLink Gateway.

86-3.05B(3) Power Supply

The power supply must:

1. Be vertically mountable on a 19-inch standard rack rail using two machine screws and two wing nuts
2. Have provisions to attach the modem power cable securely without the modifying the cable
3. Meet the requirements shown in the following table:

| (Characteristics | Requirements) |
|---------------------------|---|
| Power cord | Standard 120 V(ac), 3 prong cord, at least 3 feet long (may be added by Contractor) |
| Type | Switching type |
| Power rated | 40 W minimum with no minimum load required |
| Input voltage | From 85 to 264 V (ac) or 120 to 370 V (dc) |
| Input frequency | From 47 to 63 Hz |
| Inrush current | Cold start, 25 A at 115 V |
| Output voltage | 12 V (dc), adjustable over a ± 10 percent range |
| Overload protection | From 105 to 150 percent in output pulsing mode |
| Over voltage protection | From 115 to 135 percent of output voltage |
| Setup, rise, hold up time | 800 ms, 50 ms, 15 ms at 115 V (ac) |
| Withstand voltage | I/P-0/P:3 kV, I/P-FG:1.5 kV, for 60 seconds |
| Safety standards | UL 1012, UL 60950 |

86-3.05B(4) Mounting Bracket and Hardware

The mounting bracket must:

1. Be stainless steel
2. Securely hold the modem in a vertical position with all cables and conductors installed
3. Contain the modem using a method that allows the removal of the modem without tools or without removing the bracket from its attachment to the cabinet frame

86-3.05B(5) Serial Communication Cable

If the modem is designed to interface with a Department-furnished Model 170E controller, provide a C2 cable. The C2 cable interfaces the controller C2 connector and the GPRS modem and includes all conductors and connectors required for that purpose. The GPRS modem connector must comply with TIA-232 standard using a 9-pin D shell miniature connector. The Department-furnished controller end connector must comply with AMP 201360-2 or equivalent. All pins in both connectors must be gold plated. The cable must have 4 no. 20 AWG conductors with (UL) Type CM shielded or AWM 2464 80C 300 Volts. The cable must be at least 3 feet long. The cable wiring must comply with the following:

1. AMP 201360-2-ND -L to DE9-P - 2
2. AMP 201360-2-ND -K to DE9-P - 3
3. AMP 201360-2-ND -N to DB9-P - 5
4. AMP 201360-2-ND -D to AMP 201360-2-ND - H
5. AMP 201360-2-ND -J to AMP 201360-2-ND - M

86-3.05B(6) Antenna

The antenna must:

1. Be the low profile disc type, and adhere to the cabinet using a factory installed double-sided waterproof acrylic foam adhesive. The coax cable must be at least 3 feet long and have a 50 Ω TNC connector on the modem end.
2. Meet the requirements as shown in the following table:

| Parameter | Requirements |
|--------------------------|-------------------------------|
| VSWR (at resonant point) | 2:1 or less |
| Frequency | 1850-1990 MHz and 824-894 MHz |
| Nominal impedance | 50 Ω |
| Gain | 2 dB |
| Radiation pattern | Omni-directional |
| Polarization | Vertical |
| Ground plane | Required ^a |

^a The antenna requires a reflective ground plane to function properly. The required ground plane must extend beyond the antenna at least 8 inches in all directions.

86-3.05C Construction

Install the modem under the manufacturer's instructions.

You may adjust the modem installation for field conditions if authorized.

86-3.05D Payment

Not Used

Replace section 86-4.01D(1)(c)(ii) with:

86-4.01D(1)(c)(ii) Warranty

The manufacturer must provide a written warranty against defects in materials and workmanship for LED signal modules for a minimum period of 48 months after installation of LED signal modules. Replacement LED signal modules must be provided within 15 days after receipt of failed LED modules at your expense. The Department pays for shipping the failed modules to you. All warranty documentation must be submitted to the Engineer before installation. Replacement LED signal modules must be delivered to State Maintenance Electrical Shop at 30 Rickard Street, San Francisco, CA 94134.

Add to section 86-4.01D(2)(a):

LED signal module must be manufactured for 12-inch circular and arrow sections.

Replace section 86-4.03H with:

86-4.03H LED Countdown Pedestrian Signal Face Modules

86-4.03H(1) General

86-4.03H(1)(a) Summary

Section 86-4.03H includes specifications for installing a LED countdown PSF module into a standard Type A pedestrian signal housing. Comply with TEES.

86-4.03H(1)(b) Definitions

Not Used

86-4.03H(1)(c) Submittals

Before shipping LED countdown PSF modules to the job site, submit all modules and the following items to METS:

1. Delivery form with Contract number and contact information
2. Installation manual and schematic wiring diagram
3. Product information, including manufacturer's name and month and year of manufacture
4. List of model, lot, and serial numbers

Submit documentation of the manufacturer's production QA, including test data showing the modules comply with the following requirements:

1. Luminous intensity as shown in the table titled "Luminance Values."
2. Power factor after burn-in.
3. Test current flow measurements in amperes after burn-in. The measured values must comply with the design qualification figures. Record the measured ampere values with rated voltage on the product labels.

Submit the manufacturer's warranty before installing LED countdown PSF modules.

86-4.03H(1)(d) Quality Control and Assurance

86-4.03H(1)(d)(i) General

The Engineer rejects a module if a visual inspection reveals any of the following defects:

1. Exterior physical damage
2. Assembly anomalies
3. Scratches
4. Abrasions
5. Cracks
6. Chips
7. Discoloration
8. Other surface defects

The Department tests LED countdown PSF modules under ANSI/ASQ Z1.4 and California Test 606. The module submitted for testing must be representative of typical production units.

Comply with testing requirements for electrical material and equipment under section 86-2.14.

86-4.03H(1)(d)(ii) Warranty

Provide a 5-year manufacturer's replacement warranty against defects or failures. The warranty period starts on the date of Contract acceptance. Furnish replacement parts within 15 days after notification of a failed module. The Department does not pay for replacement modules. Deliver replacement modules to the Department's Maintenance Electrical Shop at:

CALTRANS-DISTRICT 4
MAINTENANCE ELECTRICAL SHOP
30 RICKARD STREET
SAN FRANCISCO, CA 94134

86-4.03H(2) Materials

A LED countdown PSF module must:

1. Use LED as the light source.
2. Be made of material complying with ASTM D 3935.
3. Be designed to mount behind or to replace face plates of a standard Type A housing as specified in the ITE publication *Equipment and Material Standards*, chapter 3, "Pedestrian Traffic Control Signal Indications," and the *California MUTCD*.
4. Have a minimum power consumption of 10 W for the "Upraised Hand."

5. Have internal components supported such that they withstand mechanical shock and vibration from high winds and other sources.
6. Use the required color and be the ultra-bright type rated for 100,000 hours of continuous operation for a temperature range from -40 to +74 degrees C.
7. Have replaceable signal lamp optical units.
8. Fit into the housing of a pedestrian signal section without modification.
9. Be a single, self-contained device that does not require on-site assembly for installation.
10. Have the following information permanently marked on the back of the module:
 - 10.1. Manufacturer's name
 - 10.2. Trademark
 - 10.3. Model number
 - 10.4. Serial number
 - 10.5. Lot number
 - 10.6. Month and year of manufacture
 - 10.7. Required operating characteristics, including:
 - 10.7.1. Rated voltage
 - 10.7.2. Power consumption
 - 10.7.3. Volt-ampere
 - 10.7.4. Power factor
11. Have prominent and permanent vertical markings for accurate indexing and orientation within the signal housing if a specific mounting orientation is required. Markings must be a minimum of 1 inch in height and include an up arrow and the word "up" or "top."

The circuit board and the power supply must be contained inside of the LED countdown PSF module. The circuit board must comply with TEES, chapter 1, section 6.

The enclosure containing the power supply or the electronic components of the module, except the lens, must be made of UL 94 V-0 flame-retardant material.

Each symbol must be at least 9 inches high and 5-1/4 inches wide. The lens' signal output for the "Walking Person" and "Upraised Hand" symbols and the countdown display must not exceed a ratio of 5 to 1 for the highest and lowest luminance values. The symbols must comply with ITE publication *Equipment and Material Standards*, chapter 3, "Pedestrian Traffic Control Signal Indications," and the *California MUTCD*. The 2-digit countdown timer, "Upraised Hand," and "Walking Person" indications must be electronically isolated from each other. The 3 indications must not share a power supply or interconnect circuitry.

The module must maintain an average luminance value for at least 5 years of continuous signal operation for a temperature range from -40 to +74 degrees C.

The module must operate over the specified ambient temperature and voltage range and be readable both day and night at distances up to the full width of the area to be crossed. Upon initial testing at 25 degrees C, the module must have at least the luminance values shown in the following table:

Luminance Values

| PSF module symbol | Luminance |
|---|-----------|
| "Upraised Hand" and 2-digit countdown timer | 1,094 fL |
| "Walking Person" | 1,547 fL |

The color output of the module must comply with chromaticity requirements in section 5.3 of ITE publication *Equipment and Material Standards* chapter 3, "Pedestrian Traffic Control Signal Indications."

When operating over a temperature range from -40 to +74 degrees C, the measured chromaticity coordinates of the module must comply with the following requirements for 5 years after Contract acceptance:

Chromaticity Standards (CIE Chart)

| | |
|--|--|
| "Upraised Hand" and 2-digit countdown timer (portland orange) | $0.600 \leq X \leq 0.659$ Y: Not greater than 0.390 or less than 0.331 or less than 0.990 - X |
| "Walking Person" (lunar white) | X: Not less than 0.280 or greater than 0.400 Y: Not less than $0.0483 + 0.7917 * X$ or greater than $0.0983 + 0.7917 * X$ |

The module must not exceed the power consumption requirements shown in the following table:

Maximum Power Consumption Requirements

| PSF module display | At 24 °C | At 74 °C |
|-------------------------|----------|----------|
| "Upraised Hand" | 10.0 W | 12.0 W |
| "Walking Person" | 9.0 W | 12.0 W |
| 2-digit countdown timer | 6.0 W | 8.0 W |

The wiring and terminal block must comply with section 13.02 of ITE publication *Equipment and Material Standards*, chapter 2, "Vehicle Traffic Control Signal Heads." The PSF module must have spade lugs and 3 secured, jacketed copper wires that comply with NEC and are:

1. Color coded
2. 3 feet long
3. 600 V(ac)
4. 20 AWG minimum stranded
5. Rated for service at +105 degrees C

The module must operate:

1. At a frequency of 60 ± 3 Hz over a voltage range from 95 to 135 V(ac) without flicker perceptible to the unaided eye. Fluctuations of the line voltage must have no visible effect on the luminous intensity of the indications. The rated voltage for measurements must be 120 V(ac).
2. With currently-used Department controller assemblies, including solid-state load switches, flashers, and conflict monitors. Comply with TEES, chapters 3 and 6. If an alternating current of 20 mA or less is applied to the unit, the voltage read across the 2 leads must not exceed 15 V(ac).
3. With a smart control and regulation mode that exhibits countdown displays automatically adjusted to the traffic controller's programmed intervals.

The countdown PSF module must operate during the pedestrian change interval. The module must begin counting down when the flashing "Upraised Hand" interval turns on, counting down to 0 and turning off when the steady "Upraised Hand" interval turns on.

The module's on-board circuitry must:

1. Include voltage surge protection to withstand high-repetition noise transients. The voltage surge protection must comply with NEMA Standard TS, section 2.1.6.
2. Comply with Class A emission limits for electronic noise under 47 CFR 15, subpart B.

The module must provide a power factor of 0.90 or greater.

The total harmonic distortion from a current and voltage induced in an alternating-current power line by a PSF module must not exceed 20 percent at an operating temperature of 25 degrees C.

The module's circuitry must prevent light emission perceptible to the unaided eye when a voltage of 50 V(ac) or less is applied to the unit.

When power is applied to the module, light emission must occur within 90 ms.

86-4.03H(3) Construction

Use LED countdown PSF modules from the same manufacturer.

Install the module in a standard Type A pedestrian signal housing. Special tools must not be required for installing the modules.

The installation of the module into the pedestrian signal face must require only the removal of the lens, reflector, and existing LED module.

86-4.03H(4) Payment

Not Used

Add to section 86-4.03I(1)(b):

Submit warranty documentation as an informational submittal before installing LED PSF modules.

Replace section 86-4.03I(1)(c)(ii) with:**86-4.03I(1)(c)(ii) Warranty**

Submit a 5-year manufacturer's warranty against defects in materials and workmanship for LED PSF modules. The 5-year warranty period starts on the date of Contract acceptance. Furnish replacement modules within 15 days after receiving the failed modules. The Department does not pay for replacement modules. Deliver replacement modules to the Department's Maintenance Electrical Shop at:

Caltrans-District 4
Maintenance Electrical Shop
30 Rickard Street
San Francisco, CA 94134

Add to section 86-4.03J:

The "Meter On" sign must be a Type A pedestrian signal modified such that the reflector is a single chamber.

Add to section 86-4:**86-4.06 CLOSED CIRCUIT TELEVISION (CCTV) SYSTEM****86-4.06A General****86-4.06A(1) Summary**

Section 86-4.06 includes specifications for installing closed circuit television (CCTV) system at:

1. Fixed camera station
2. Integrated camera station

CCTV system includes:

1. CCTV pole and camera mounting adapter
2. CCTV (PTZ) integrated camera unit
3. Fixed camera unit
4. Hybrid Camera Cable
5. Connectors and fittings, as required
6. Interface cable, and conductors
7. Camera Control Unit
8. Video Encoder Unit
9. Equipment shelf with brackets
10. Rack-mount power strip.

86-4.06A(2) Definitions

APA: Aluminum polymer and aluminum with adhesive foil for shield layers in cables.

CAT 5e cable: A Category 5e network cable manufactured to TIA-568 requirements.

CCU: The Camera Control Unit is a part of a live television transmission "chain". It is responsible for powering the video camera, handling signals sent over the camera control cable to and from the camera and pan/tilt unit.

CLI: A Command-Line Interface is a means of interaction with a computer program where the user issues commands to a program in the form of successive lines of text.

DE9: D shell subminiature 9 contact position male and female connectors for network cable connection.

DHCP: The Dynamic Host Configuration Protocol is a network protocol to configure network devices so that they can communicate on an IP network.

HCC: Hybrid Camera Cable is a power and communication cable for CCTV system.

MPEG-4-ISO/IEC 14496-2: A Moving Picture Expert Group is a method of defining compression of audio and visual digital data.

PE: Polyethylene is an insulation material for the cables and conductors.

PTZ: Pan, Tilt, and Zoom are functions of the remotely controlled CCTV camera.

SD: Secure Digital memory card format.

SMPTE-170M: Society of Motion Picture and Television Engineers Committee on Television Technology. SMPTE 170M is used for analog TV transmission.

SNMP: Simple Network Management Protocol is an Internet-standard protocol for managing devices on IP networks.

TELNET: Network protocol used on the Internet or local area networks to provide a bidirectional interactive text-oriented communication facility using a virtual terminal connection.

TIA: Telecommunications Industry Association is an organization which owns and maintains common interface standards for data communications equipment.

TDR: A Time-Domain Reflectometer is an electronic instrument used to characterize and locate faults in metallic cables. It can also be used to locate discontinuities in a connector, printed circuit board, or any other electrical path.

UTP: Unshielded Twisted Pair cable. UTP cable is a 100 ohm copper cable that consists of 2 to 1800 unshielded twisted pairs surrounded by an outer jacket. They have no metallic shield. This makes the cable small in diameter but minimally against electrical interference. The twist provides much of its immunity to electrical noise.

VDU: Video Decoder Unit is a device that converts a digitized compressed video stream into SMPTE-170 analog video.

VEU: Video Encoder Unit is a device that digitizes analog video and compresses it to a lower bit rate stream.

86-4.06A(3) Submittals

86-4.06A(3)(a) Service Manuals

Submit a minimum of 3 copies of service manuals for the CCTV (PTZ) integrated camera unit, fixed camera unit, CCU, MCTU, and VEU.

The manual must include:

1. General information
 - 1.1 A list of applicable subassemblies that comprise the specified equipment
 - 1.2. Overall description of the equipment design features (including all enhanced features if applicable), performance, and applications
 - 1.3. Equipment installation instructions
2. Theory of operations
 - 2.1. Theory of operation of the standard equipment, with unique or unusual circuitry described in detail
 - 2.2. Theory of operation reflecting any modifications to the standard equipment
3. Maintenance
 - 3.1. Recommended test equipment and fixtures, and minimum operational and performance requirements for appropriate test equipment
 - 3.2. Trouble shooting information and charts
 - 3.3. Removal and installation procedures for replacing assemblies and subassemblies, if not obvious or if improper sequencing of steps may result in component damage
4. Replacement parts
 - 4.1. Each manual must contain an equipment replacement parts list including electrical parts, mechanical parts and assemblies
 - 4.2. All semiconductors must be identified by the supplier's numbers and by Joint Electron Device Engineering Council (JEDEC), Pro-Electron, and JIS-C-7012 numbers if applicable
5. Diagram and physical requirements
 - 5.1. Schematic diagram(s) identifying all circuit components and showing normal test voltages and levels
 - 5.2. An overall functional block diagram
 - 5.3. Detailed interconnecting diagram(s) showing wiring between modules, circuit boards and major components
 - 5.4. Pictorial circuit board layout diagram(s) showing both component placement and printed wiring detail
 - 5.5. Diagram(s) showing location of circuit boards and other subassemblies
 - 5.6. Exploded view diagram(s) of complex mechanical assemblies
6. Physical requirements
 - 6.1. All pages, including latest revisions, securely fastened together between protective covers (loose-leaf ring binding is acceptable)
 - 6.2. No page must be subject to fading from exposure to any normal source of ambient lighting (dialo reproduced pages are not acceptable)

86-4.06A(4) Quality Control and Assurance

86-4.06A(4)(a) Camera Station Equipment

Deliver the following items to METS at Caltrans-District 4, Maintenance Electrical Shop, 30 Rickard Street, San Francisco, CA 94134, for acceptance testing:

1. CCTV PTZ Integrated Camera Unit and fixed camera unit
2. CCU, unless integrated into the camera unit
3. VEU, unless integrated into the camera unit
4. High Mast Camera Lowering Device System
5. Fiber Optic Transmitter and Receiver
6. MCTU

86-4.06A(4)(b) Testing for Existing CCTV PTZ Integrated and Fixed Camera Station

Before removal of existing CCTV equipment including cables, pole, camera, pan and tilt unit, controller cabinet, etc., you must test the camera station in the field in the presence of the Engineer. Existing equipment that fail during this test period will be replaced or repaired by you, and such work will be paid for as extra work. Notify the Engineer fifteen days before the scheduled testing.

86-4.06A(4)(c) Testing for CCTV PTZ Integrated and Fixed Camera Station

Upon completion of work, each CCTV (PTZ) integrated and fixed camera station will be subjected to post-installation tests as outlined herein. All software must be provided and loaded before the start of testing.

The District Electrical Systems Branch personnel, arranged by the Engineer and in your presence, will perform all tests. You must provide all necessary equipment required to access the CCTV equipment for testing.

The testing consists of five consecutive days of continuous satisfactory operation of each camera station. If any material or equipment you furnished and installed, found to be defective or unsuitable, or the workmanship does not conform to the accepted standards, are considered defective and must be replaced. The Department does not pay for replacement of defective parts.

You may offer rejected material or equipment for consideration provided all non-compliance has been corrected and pretested. After all defects have been corrected, the camera station must be re-tested until five consecutive days of continuous satisfactory operation is obtained.

Inspection must consist of verification of correct wiring terminations, correct cable interconnections, good workmanship.

Functional Testing for CCTV (PTZ) Integrated Camera Station must include:

1. Verification of all local mode CCTV operations using the CCU front panel controls.
2. Verification of video signal output from CCU with NTSC monitor.
3. Verification of the correct operation of the auto/manual iris and focus, and manual zoom functions.
4. Verification of the correct operation of the pan/tilt function. The pan/tilt function must be tested over 355 degrees in the horizontal plane and +20 to -90 degrees in the vertical plane.
5. Verification of the correct operation of the preset positions.

Functional Testing for CCTV Fixed Camera Station must include:

1. Verification of video signal output from fixed camera with a NTSC monitor.
2. Verification of the correct operation of the auto/manual iris and focus, and manual zoom functions with a laptop PC software.
3. Verification of the correct operation of the preset positions.

86-4.06A(4)(d) Inspection and Testing Cable and Connectors

Before beginning of work, test the entire length of HCC for attenuation and faults using a TDR. One or more of the following defines a fault in a long length of cable:

1. Return loss measurements indicating that attenuation exceeds 3 dB in the band from 5 MHz to 30 MHz in a portion of cable less than 10 feet long.
2. A return loss measurement indicating that there is a short in the cable.
3. A return loss measurement indicating a cut or open circuit in the cable.
4. A visual inspection that reveals exposure of or damage to the cable shielding.

Testing of HCC and connectors must comply with section 86-2.14B. Any cable lengths found to have faults must be replaced and retested. Dispose of the removed faulty cable. The cable termination must be randomly inspected for contact crimping quality control. Any contact found not crimped with the correct crimping tool is defected, and will be rejected. Redo the termination until all defects are corrected.

86-4.06A(4)(e) Laboratory Testing

Allow 30 days for the camera station equipment testing. You will be notified upon satisfactory completion of the testing. You must pick up the equipment from the Laboratory and deliver it to a Department owned storage location designated by the Engineer. You are responsible for the costs of shipping, handling and the transportation of equipment to and from METS.

86-4.06A(5) Warranty

Furnish a 2 year replacement warranty from the manufacturer of the camera station equipment against any defects or failures. The effective date of the warranty is the date of installation. Replacement of the camera station equipment must be furnished within 10 days after receipt of the failed equipment. The Department does not pay for the replacement. Replacement of the camera station must be delivered to the following Department maintenance electrical shop:

CALTRANS-DISTRICT 4
 MAINTENANCE ELECTRICAL SHOP
 30 RICKARD STREET
 SAN FRANCISCO CA 94134

86-4.06B Materials

86-4.06B(1) CCTV PTZ Integrated and Fixed Camera Unit

Each camera must meet the following specifications at a minimum:

| | |
|----------------------------|--|
| Imager | Interline transfer Progressive Scan CCD with mosaic-type color compensating filter |
| Image Area | 1/4" Format, 0.14" (H) x 0.11" (V) |
| Resolution | 540 horizontal; 350 vertical |
| Video Output | NTSC, 1 V p-p at 75 ohms, unbalanced |
| Lens | Aperture: f/1.4 (wide angle) to f/4.2 (telephoto) |
| Optical Zoom Range | 35X, 0.13" to 4.68" |
| Digital Zoom Range | 1X (Off) through 10X, Smooth transition from Optical to Digital Zoom |
| Horizontal Angle of View | Optical: From 55.8 to 1.7 degrees; At 10X Digital: From 5.58 to 0.17 degrees. |
| Focus Distance. | 40" in telephoto, 0.4" in wide angle |
| Digital Compass | 8 or 16 direction point compass annotation with primary direction spelled out and intermediate directions abbreviated with two letters |
| Auto Focus | Selectable Auto/Manual |
| Manual Focus Speed | Approximately 2 seconds to full range |
| Minimum Scene Illumination | For Reliable Auto Focus, 30 percent video |
| Zoom & Focus Presets | 64 preset positions with auto focus and ID |
| Flash Memory | Update firmware and new features via serial communication |
| Shutter speeds | 1/60; 1/120; 1/180; 1/250; 1/500; 1/1,000; 1/2,000; 1/4,000; 1/10,000; 1/30,000 second |
| Auto Iris | Automatically adjusts to compensate for changes in scene illumination to maintain constant video level output within sensitivity specifications |
| Manual Iris | Changing the video level to give the effect of open iris/close iris |
| Gamma | 0.45 |
| AGC | From 0 to 28 dB |
| Color Balance | Auto Tracking Color Balance/Manual with adjustable Red and Blue Levels |
| Signal to Noise Ratio | >50 dB |
| Synchronization | Crystal or Phase-Adjust Line Lock on 60 Hz |
| Sensitivity | At F1.4, Wide Angle 35 IRE 0.5-Lux at 1/60 s, F1.4, Shutter, Color I.R. Cut On 0.05-Lux at 1/2 s, F1.4, Shutter, Color I.R. Cut On 0.2-Lux at 1/60 s, F1.4, Shutter, monochrome mode I.R. Cut Off 0.01-Lux at 1/4 s, F1.4, Shutter, monochrome mode I.R. Cut Off |

Pan and tilt function must meet the following specifications:

| | |
|---|---|
| 1 | Continuous rotation capability in either direction |
| 2 | 110 degrees of tilt movement, +20 to – 90 degree unobstructed |
| 3 | Pan Speed (Operator Control): Variable from 0.1 to 80 degree/s |
| 4 | Pan Speed (Preset Control): >140 degree/s |
| 5 | Tilt Speed (Operator Control): Variable from 0.1 to 40 degree/s |
| 6 | Tilt Speed (Preset Control): 140 degree/s |
| 7 | 64 Pan and Tilt preset positions with repeatability within ± 0.5 degree |
| 8 | The positioning system must be invertible if inverse mounting is required |

86-4.06B(2) CCTV Camera unit

86-4.06B(2)(a) General

Each CCTV camera unit consists of a camera, lens, receiver/driver, pan/tilt assembly, environmental housing, sunshield and pigtail cable with connector. The CCTV camera unit must automatically switch to monochrome mode when ambient light level is at 20 foot-candles and switch back to color at 180 foot-candles.

The CCTV camera unit must have eight programmable camera movement sequences. Each sequence is programmed by selecting the preset position by number, and then selecting a dwell time. The presets can be used in any order, and the same preset may be used more than once as long as the total number of preset positions used does not exceed 32. The dwell time defines the length of time paused at each preset position. It can be from 1 to 60 seconds. The dwell time can be changed individually for all stops on the sequence. If the appropriate preset ID is programmed, it must be displayed for each preset position used on the sequence. The sequence must stop upon receipt of a pan command. All programmable functions must be stored in non-volatile memory.

Preset ID must be 1 line, up to 24 characters long, user programmable for each of the 64 preset positions. When a preset position is recalled, the corresponding preset ID must be displayed. The preset ID must remain displayed until a pan, tilt, zoom, manual focus, auto focus select, or another preset command is received.

86-4.06B(2)(b) CCTV (PTZ) Integrated Camera Pigtail Cable and Connector

The camera pigtail cable must comply with the specifications for HCC. The length of the camera pigtail cable must not be less than 32 inch.

The contact pin assignment of the connector is as shown in the following table:

| Position | Function | Position | Function |
|----------|---------------|----------|---------------------|
| 1 | Video, 75 ohm | 9 | Not Used |
| 2 | Video Ground | 10 | Not Used |
| 3 | Data Ground | 11 | Not Used |
| 4 | Tx- | 12 | 115 V(ac) Line, Hot |
| 5 | Tx+ | 13 | 115 V(ac), Neutral |
| 6 | Rx+ | 14 | Not Used |
| 7 | Rx- | 15 | 115 V(ac), Ground |
| 8 | Not Used | 16 | Not Used |

Furnish a mating connector and sixteen contact crimping sockets for each CCTV (PTZ) integrated camera unit supplied in the contract.

86-4.06B(2)(c) CCTV (PTZ) Integrated Camera Physical and Mechanical Requirements

Each CCTV (PTZ) integrated camera unit must weigh less than 20 pounds. Its dimensions must be less than 14 inches in length, 7 inches in width and 12 inches in height, including mounting base. The CCTV (PTZ) integrated camera unit must be a pole mount version. There must be four equal spaced mounting holes on the mounting base. Each CCTV (PTZ) integrated camera unit must be provided with four stainless steel hex head bolts to secure the CCTV (PTZ) integrated camera unit to the camera mounting

plate. All fasteners and nuts used in attaching the CCTV (PTZ) integrated camera unit to the mounting plate must be of grade 18-8 stainless steel. A camera-mounting adapter must be provided as shown.

86-4.06B(2)(d) CCTV Fixed Camera Unit Connector

Camera connector must be mounted on the backplate of the camera housing.

The contact pin assignment of the connector must be:

| Position | Function | Position | Function |
|----------|--------------|----------|---------------------|
| S | Video, 75 Ω | J | Not Used |
| H | Video Ground | K | Not Used |
| G | Data Ground | R | Not Used |
| F | Tx- | T | Not Used |
| E | Tx+ | L | Not Used |
| M | Rx+ | D | 115 V(ac) Line, Hot |
| N | Rx- | C | 115 V(ac), Neutral |
| A | Not Used | P | 115 V(ac), Ground |
| B | Not Used | U | Overall Shield |

Furnish a mating connector with 90 degree back shell.

86-4.06B(2)(e) Fixed Camera Unit Physical and Mechanical Requirements

Each CCTV fixed camera unit must weigh less than 10 pounds. Each camera and lens must be mounted in a sealed, cylindrical, environmental housing, which must be less than: 5 inches in diameter and 15 inches in length. The CCTV fixed camera unit must have three equally spaced mounting holes on the mounting base. Each CCTV fixed camera unit must be provided with three stainless steel hex head bolts to secure the CCTV fixed camera unit to the camera mounting plate. All fasteners and nuts used in attaching the CCTV fixed camera unit to the mounting plate must be of grade 18-8 stainless steel. A camera-mounting bracket must be provided as shown.

86-4.06B(2)(f) Camera Unit Features Common for PTZ Integrated and Fixed Camera Unit

The camera housing must be a corrosion resistant and tamper proof sealed and pressurized housing with five pounds dry nitrogen with purge fitting and 20 psi relief valve for each camera. The size of the housing must be 3-1/2 inches in diameter, or smaller. The housing exterior must be finished by pre-treatment with conversion coating and baked enamel paint. The camera enclosure must be designed to withstand the effects of sand, dust and hose-directed water.

The internal humidity of the housing must be less than 10 percent, when sealed and pressurized. Desiccant packs must be securely placed inside the housing to absorb any residual moisture and maintain internal humidity at 10 percent or less. The housing must include a thermostatically controlled heating pad rated at 115 V(ac) 100 W maximum.

A sun shield or visor must be provided to shield the lens from direct sunlight.

The camera unit must include a character generator. The text characters must be uppercase white with black border impose on the video stream. A maximum of six lines of user programmable alphanumeric text must be displayed through serial communications. Messages may be positioned at either the top or the bottom of display. The right side positioning is accomplished by padding left side of message with spaces. Blank lines must not be displayed. Any programmed line being displayed must fill in toward the top if top positioning is selected, or toward the bottom if bottom position is selected.

Camera ID must be used for upper 2 lines with each up to 24 characters long. If both lines are programmed, line 1 of camera ID must always appear above line 2 of camera ID regardless of top or bottom selection.

An 8-point or 16-point compass annotation must be settable for a true north position. Display must include North, NE, East, SE, South, SW, West and NW. Position must be able to be grouped with the site location or separated from site location. Azimuth must be displayed in 0 to 359 degrees and elevation position must be displayed in +95 to -95 degrees. All display must be user selectable for enable/disable, 3-second

time out or permanent display. Sector message of up to 16 sectors in 360 degrees must be defined with up to 24 characters long.

Low-pressure indicator must use 1 line with messages displayed in "blinking" or "non-blinking" mode when activated by low internal pressure. Adjustable set points by altitude must be provided via the serial port to activate low-pressure. Message must be enabled or disabled. In maintenance mode readings of the internal pressure of the camera housing must be displayed from 5 psi down to 1 psi, in 0.1-psi increments.

Internal temperature indicator must use 1 line with messages displayed in "blinking" or "non-blinking" mode. Message must be enabled or disabled. In maintenance mode, camera readings of the internal temperature of the camera housing must be in 1-degree increments.

Video blanked for up to 8 privacy zones must be provided. One line numeric messages must be displayed. Message must be displayed in "blinking" or "non-blinking" mode and be enabled or disabled. Privacy zones must be programmed through serial communications.

Control and addressing the camera unit must be done through TIA-422 optically isolated serial communications. Additional protocols must consist of Cohu, American Dynamics, Javelin, Philips/Bosch, Vicon and Pelco-D. The National Transportation Communications for ITS Protocol (NTCIP) 1205 protocol communications protocol must be included as an option.

The camera unit must respond in less than 1 second upon receipt of any given command.

All programmable functions including camera last operating position must be stored in non-volatile memory and must not be lost if a power failure occurs. Upon power restoration, the camera must go through a series of self-testing/calibration and return to the same position it left before the power interruption. System configurations such as video privacy zones, and preset text and sector I.D. must be able to be stored in a computer file and uploaded into a camera in the event that a camera replacement is necessary.

86-4.06B(2)(g) Power Requirements

The camera unit must operate between 89 to 135 V(ac), 120 V(ac) nominal voltage and 60 Hz (± 3 Hz). The camera unit must comply with the requirements of Section 2.1.6 "transients, power service" of the NEMA standard TS-2 The line variation and surge performance must be tested to meet these specifications The power consumption must not exceed a total of 200 watts, in which 100 watts are for camera, receiver, pan/tilt driver and 100 watts are for heater on.

86-4.06B(2)(h) Environmental Requirements

The camera unit must operate in ambient temperature range from -34 to +74 degrees C, in relative humidity up to 100 percent. The unit must operate when exposed to sand, dust, fungus and salt atmosphere per MIL-E-5400T, and with shock for up to 10 Gs, 11 ms, in any axis under non-operating conditions, per MIL-E-5400T. The unit must not be damaged with sine vibration from 5 to 30 Hz, $\frac{1}{2}$ G, 3 axis in one hour.

86-4.06B(2)(i) Hybrid Camera Cable and Connectors

HCC is applicable to both PTZ Integrated Camera Station and Fixed Camera Stations. The Connectors are different for PTZ integrated and the fixed cameras.

HCC consists of 1 RG-59/U type analog video coaxial cable, 1 group of 6-No. 22 AWG conductor, 1 group of 8-No. 26 AWG conductor and a 2-twist pair 4-No. 26 AWG conductor group in a common outer jacket.

86-4.06B(2)(j) Electrical Requirements

The coaxial cable must comply with the following table:

| Electrical | Coaxial |
|-------------------------------------|------------|
| Capacitance (picofarads/ft nominal) | 17.3 |
| Impedance (ohms-nominal) | 75 |
| Velocity of propagation (nominal) | 78 percent |
| Nominal Diameter (inch) | 0.242 |
| Insulation Rating | 300 V |

The cable attenuation at 20 degrees C must comply with the following table:

| Frequency (MHz) | Nominal dB/ 100 ft |
|-----------------|--------------------|
| 1 | 0.30 |
| 10 | 0.90 |
| 50 | 2.10 |

The coaxial cable must comply with the following physical measurements:

| Component | Nominal OD (inches) |
|--|---------------------|
| Copper center conductor | 0.040 |
| Foam polyethylene dielectric | 0.180 |
| Sealed APA tape with 0.06-inch overlap | 0.216 |
| Woven aluminum braid | 0.241 |
| PVC outer jacket | 0.297 |

The 6-No. 22 AWG must be stranded 7 x 30, tinned copper insulated with 0.009 inch nominal wall of S-R PVC and a nominal OD of 0.048 inch. The 6 conductors must be color coded as follows:

1. Black
2. Red
3. Green
4. White
5. Blue
6. Yellow

The 8-No. 26 AWG must be stranded 7 x 34, tinned copper insulated with 0.009 inch nominal wall of S-R PVC and a nominal OD of 0.037 inch. The 8 conductors must be color coded as follows:

1. Brown
2. Blue
3. Orange
4. Yellow
5. Purple
6. Gray
7. White with Black Stripe
8. Red with Green Stripe

The 4-No. 26 AWG in 2 twisted pairs must be stranded 7 x 34, tinned copper insulated with 0.009 inch nominal wall of S-R PVC and a nominal OD of 0.037 inch. The 4 conductors must be color coded as pair no. 1, black and white, and pair no. 2, red and green.

The HCC must:

1. Have a 36 AWG tinned copper braid with 90 percent coverage
2. Have an O/A binder of 0.001 inch polyester 25 percent overlap

3. Have an outer jacket color complying with Fed-Std-595 color #No.24091
4. Have material 0.032 inch dark gray UV resistant PVC to 0.425 inch OD
5. Have filters to be used as required to form a uniform round cable
5. Pass the VW-1 vertical flame test.

The insulation rating of the overall cable jacket must be 300 V.

The manufacture identification must be surface printed in white ink every foot along the length of the cable.

86-4.06B(2)(k) Interface Cables

All interface cables must be:

1. Commercially made high quality type with appropriate connectors on the cable ends as shown
2. Minimum 6 feet in length when required to interface with other equipment as shown

86-4.06B(2)(l) Network Straight Through Data Cable

The network straight through data cable must be made of Category 5e cable and terminated with an 8P8C modular plug on both ends. The insulated conductors must be tightly twisted into individual pairs and jacketed with PE or PVC.

86-4.06B(2)(m) Video Patch Cable

The video patch cable must be RG-59/U coaxial cable terminated at both end with BNC connectors. The coaxial cable must comply with the following:

| Electrical | Coaxial |
|-------------------------------------|------------|
| Capacitance (picofarads/ft nominal) | 17.3 |
| Impedance (ohms-nominal) | 75 |
| Velocity of propagation (nominal) | 78 percent |
| Nominal Diameter (inch) | 0.242 |

The cable attenuation at 20 degrees C must measure at maximum as follows:

| Frequency (MHz) | Nominal dB/ 100 ft |
|-----------------|--------------------|
| 1 | 0.30 |
| 10 | 0.90 |
| 50 | 2.1 |

The coaxial cable physical measurements is shown in the following table:

| Component | Nominal OD (inches) |
|--|---------------------|
| Copper center conductor | 0.040 |
| Foam polyethylene dielectric | 0.146 |
| Sealed APA tape with 0.06-inch overlap | 0.216 |
| Bare copper braid | 0.241 |
| PVC outer jacket | 0.297 |

86-4.06B(2)(n) TIA-232 Data Patch Cable

The TIA-232 data patch cable must comply with TIA-232 standard. The data cable must have multiple No. 20 AWG conductors with Type CM shielded or AWM 2464 80C 300 Volts. One end of data cable must be terminated with a DE9 female connector. All contact socket pins must be gold plated. The contact pin assignment is as shown. The other end of the data cable must be either terminated with an 8P8C modular plug per TIA-561, or not terminated. When there is no connector required on the other end of

cable, each conductor's insulation must be stripped 1/4 inch long from the end of cable and the bare conductor must be tinned with solder.

86-4.06B(2)(o) Camera Control Unit

Install CCU to laptop PC cable at each CCTV (PTZ) integrated camera station. The CCU consists of a rack-mounted field unit. The CCU must have the same manufacturer as the CCTV (PTZ) integrated camera unit. The CCU must be designed to provide on-site camera control functions. The control functions include pan/tilt positioning, zoom in/out control, auto/manual focus, and auto/manual iris.

CCU must include a local/remote switch that transfers control from the remote system to local. This allows the remote control system and the CCU to remain connected while transferring the control function without disconnection of the camera site equipment. The local function must time-out and return to remote mode in 10 minutes.

LED indicators on the CCU must provide positive feedback of the automatic and manual mode status of the camera focus and iris functions, and the manual mode status of the pan/tilt function.

86-4.06B(2)(p) Physical and Mechanical Requirements

Each CCU must mount in 2 inches (1 rack unit) of EIA-310 rack space with a maximum depth of 14 inches. The front panel must be black gloss color Number 17986 as per Federal Standard Color Chart 595B. The front and rear panel lettering must be white color Number 17886 as per Federal Standard Color Chart 595B.

A high-impedance front and rear panel jack BNC must be installed on the front and rear panel as shown. These connectors must provide video input to a test monitor without affecting the remainder of the CCTV system. These connectors must be directly monitoring the video input from the camera. The connectors must be of copper material with bright nickel (tarnish resistant) finish for the body and silver finish for the contact.

An automobile glass (AG), size 1/4 by 1-1/4 inch, slow blow fuse must be installed and replaceable from the outside of the unit.

Each LED must be High Intensity Untinted, Non-diffused LED. Mount each LED as shown.

Provide an on/off switch to turn the CCU on/off. Provide an LED to indicate the AC power is on.

Each CCU must not weight more than 5 pounds.

86-4.06B(2)(q) Electrical Requirements

86-4.06B(2)(q)(1) Camera Control Functions

Each CCU must have circuitry to detect the absence and presence of video sync on its video input. Each CCU must have auto-iris override. Each CCU must have a transfer switch between local and remote mode. The local function must time-out and return to the remote mode within 5 minutes. A system-reset switch with momentary-pushbutton type must be mounted on the front panel to function as external reset input to the microprocessor. The system-reset must exercise the pan and tilt movements through their ranges and return the camera to the prior position. The system-reset function must allow remote execution.

The CCU must have, as a minimum, control and drive circuits for the following camera control functions:

| Control Function | Switch Position |
|--|----------------------------|
| Pan momentary toggle switch | Left-Stop-Right |
| Tilt momentary toggle switch | Up-Stop-Down |
| Zoom In/Out momentary toggle switch | Telephoto-Stop-Wide Angle |
| Focus Automatic/Manual momentary toggle Switch | Auto Focus -Manual |
| Manual Focus toggle Switch | Near-Stop-Far |
| Iris Automatic/Manual toggle Switch | Auto Iris -Manual Override |
| Manual Iris toggle Switch | Open-Stop-Close |
| Remote/Local momentary toggle Switch (Local function must time-out and return to remote mode in 10 minutes) | Remote-Local |
| Reset momentary push button switch | Reset |

Camera Connector Contact Assignment is as follows:

| Position | Function | Position | Function |
|----------|--------------------|----------|--------------------|
| 1 | Video, 75 Ω | 9 | Not Used |
| 2 | Video Ground | 10 | Not Used |
| 3 | Data Ground | 11 | Not Used |
| 4 | Rx- | 12 | 115 V(ac), Hot |
| 5 | Rx+ | 13 | 115 V(ac), Neutral |
| 6 | Tx+ | 14 | Not Used |
| 7 | Tx- | 15 | 115 V(ac), Ground |
| 8 | Not Used | 16 | Not Used |

TIA-232 Connector Contact Assignment (DE9 Pins) is as follows:

| Position | Function | Position | Function |
|----------|-------------------|----------|----------|
| 1 | Not Used | 6 | Not Used |
| 2 | Receive Data, Rx | 7 | RTS |
| 3 | Transmit Data, Tx | 8 | CTS |
| 4 | Not Used | 9 | Not Used |
| 5 | Signal Ground | | |

TIA-422 Connector Contact Assignment (DE9 Sockets) is as follows:

| Position | Function | Position | Function |
|----------|---------------|----------|---------------|
| 1 | Tx+ | 6 | Signal Ground |
| 2 | Tx- | 7 | Not Used |
| 3 | Signal Ground | 8 | Not Used |
| 4 | Rx+ | 9 | Not Used |
| 5 | Rx- | | |

86-4.06B(2)(q)(2) Communication and Camera Addressing Protocol

The execution of CCU functions, other than the hardware controls on the front panel, must be done through either TIA-232 or TIA-422 optically isolated serial communication ports on the back panel. A minimum 9,600-baud data rate must be used. The CCU must have a front panel TIA-232 port for connection to a local laptop computer. The (NTCIP) 1205 MIB communications protocol must be included.

The communications between CCU and the CCTV (PTZ) integrated camera unit must be conducted through a TIA-422 circuit with full handshake support. A minimum 9,600-baud data rate must be used.

86-4.06B(2)(r) Power Consumption

The maximum power consumption for the CCU must not exceed 45 W. Power consumption of equipment attached to CCU must not exceed 250 W.

86-4.06B(2)(s) Environmental Requirements

Each CCU must operate in an ambient temperature environment from -34 to +74 degrees C and up to 90 percent relative humidity. Each CCU must pass 5 Gs, 11 ms, in any axis under non-operating conditions, MIL-E-5400T. Each CCU must pass vibration tests:

1. Sine vibration from 5 to 60 Hz with 0.082-inch total excursion without damage
2. Random vibration from 60 to 1,000 Hz, 5 Gs RMS ($0.027\text{-G}^2/\text{Hz}$) without damage

86-4.06B(3) Video Encoder Unit

86-4.06B(3)(a) General

A prototype of the VEU is not acceptable. All equipment must be off-the-shelf production units. All equipment must be new. Provide all necessary interface cables to connect communication equipment and the CCU for a complete and successful installation and operation of the VEU, and as shown. VEU must be compatible with existing video system.

86-4.06B(3)(b) Abbreviations

| | |
|----------------|--|
| LED | Light Emitting Diode |
| AC | Alternating Current |
| SNMP | Simple Network Management Protocol |
| TELNET | Network Virtual Terminal |
| CLI | Command Line Interface |
| NTSC | National Television System Committee |
| SIF | Source Input Format |
| QSIF | Quarter Source Input Format |
| CIF | Common Intermediate Format |
| QCIF | Quarter Common Intermediate Format |
| BNC | Bayonet Neill-Councilman Connector |
| RJ | Registered Jack |
| IP | Internet Protocol |
| DHCP | Dynamic Host Configuration Protocol |
| bps | Bits Per Second |
| fps | Frame Per Second |
| MPEG | Motion Picture Experts Group |
| ISO | International Organization for Standardization |
| IEC | International Electrotechnical Commission |
| DiffServ (QoS) | DIFFerentiated SERVices (Quality Of Service) |
| UDP | User Datagram Protocol |
| RTP | Real-time Transport Protocol |
| RTSP | Real Time Streaming Protocol |
| RTCP | Real-time Transport Control Protocol |
| HTTP | HyperText Transfer Protocol |
| MIL | MILitary |

86-4.06B(3)(c) Physical and Mechanical Requirements

The VEU must be mountable in a standard EIA-310 equipment rack. The VEU and shelf if any must fit in 5.25 inches of a standard EIA-310 equipment rack space. Each VEU must have all the cable connections on the rear of the unit. Provide a main power switch to turn the unit on/off. Provide an LED to indicate the AC power is on.

86-4.06B(3)(d) Electrical Requirements

The VEU must be able to be remotely managed, configured and maintained without the use of any third party software with the management and performed using SNMP, TELNET and CLI. The VEU must operate with both color and black/white video input signal without modification to the hardware.

The input video resolution of the VEU must be as follows:

| Video Resolution | NTSC |
|------------------|-----------|
| SIF | 352 x 240 |
| QSIF | 176 x 128 |
| CIF | N/A |
| QCIF | N/A |
| Custom | 64 x 48 |
| Custom | 128 x 96 |
| Custom | 192 x 144 |
| Custom | 256 x 192 |
| Custom | 352 x 240 |

The input video formats of the VEU must be composite NTSC with 525 lines at 60 Hz. The VEU must have four composite video input channels and be compatible with existing video system. The input video connector must be compatible with SMPTE-170M at 75 Ω impedance with BNC type.

The network communication interface of the VEU must be Ethernet 10/100 Mbps through 8P8C connector port, either in static IP or assigned through DHCP.

The camera control data interface must include a maintenance serial port for local maintenance and a control serial port for data transport. The port must be TIA-232 at a user selectable data rate from 1,200 to 56,000 bps, asynchronous. The connector type for the port must be a DE9 pin type.

The VEU must provide bandwidth for camera control within the bandwidth allocated for video only when bandwidth is needed for camera control/status data transmission.

The video compression of the VEU must meet MPEG 4-ISO/IEC 14496-2 standard and H.264 standard. The MPEG-4 compliant levels are:

1. Level 1 – up to 64 kbps
2. Level 2 – up to 128 kbps
3. Level 3 – up to 384 kbps

The video rates of the VEU must be scalable from 1 to 30 fps and from 8 kbps to 2 Mbps. User selectable options are:

1. Constant bit rate at constant frame rate
2. Variable bit rate at constant frame rate
3. Constant bit rate at variable frame rate

The video delivery options of the VEU are either unicast or multicast with protocols DiffServ (QoS), UDP, IP, RTP, RTSP, RTCP, HTTP, SNMP, and TELNET.

86-4.06B(3)(e) Power Requirements

The VEU must operate from 89 to 135 V(ac), 120 V(ac) nominal voltage and 60 Hz (± 3 Hz). The VEU must comply with NEMA standard TS-2 for Traffic Control System 2.1.2. The VEU must comply with the requirements of Section 2.1.6 "Transients, Power Service," of the NEMA standard TS-2.

86-4.06B(3)(f) Environmental Requirements

Each VEU must operate in an ambient temperature environment range from -20 to $+70$ degrees C and up to 90 percent relative humidity. Each VEU must pass 5 Gs, 11 ms, in any axis under non-operating conditions, MIL-E-5400T shock test. Each VEU must pass vibration tests:

1. Sine vibration from 5 to 60 Hz with 0.082-inch total excursion without damage
2. Random vibration from 60 to 1,000 Hz, 5 G's RMS ($0.027\text{-G}^2/\text{Hz}$) without damage

86-4.06B(4) Equipment Shelf with Brackets

Furnish and install each equipment shelf as shown.

Furnish each shelf with 2 mounting brackets.

Each mounting bracket must extend from the front to back mounting rails of the controller cabinet rack cage. Each bracket must be designed to support a minimum of 50 pounds. The horizontal side of each bracket must be a minimum of 3 inches. Each bracket must be attached to front and rear of the rack cage with four 10-32 stainless steel Phillips round head bolts.

Each shelf must be fabricated of 0.125-inch cold rolled sheet or 0.125-inch aluminum sheet. Each shelf must be the width of the control cabinet rack cage and 18 inches deep. Each shelf must have equally distributed holes or slots throughout the shelf that must provide 40 percent minimum open area for vertical flow-through ventilation. Each hole or slot must not exceed 0.75 square inches in area. Each shelf must be cadmium-plated or zinc-plated after cutting and drilling.

Each shelf must be attached to the top of its pair of brackets in all four corners with stainless steel hardware, with the front of the shelf abutting against the front rail of the control cabinet rack cage.

86-4.06B(5) Rack-mount Power Strip

86-4.06B(5)(a) Electrical

Each rack-mount power strip must meet the following requirements:

1. A maximum rating of 15 A, 120 V(ac), 60 Hz
2. A surge protection with UL 1449 Clamping Level of 400 V, an IEEE Let-Through Voltage rating of less than 336 V, a single-pulse energy rating of 210 J and EMI/RFI noise protection rating of 40 dB
3. One 15 A circuit breaker
4. One internally illuminated switch to cut off power to all outlets
5. Six NEMA 5-15R outlets

86-4.06B(5)(b) Mechanical

Each rack-mount power strip must meet the following requirements:

1. Dimensions of 2 by 19 by 2-4/5 inches (HWD) maximum and must not weigh more than 4.5 pounds.
2. The front plate of the rack-mount power strip must have two cut-off EIA mounting screw holes on each end.
3. Each outlet must have 1-1/2 inches minimum spacing center-to-center to its adjacent outlet.
4. The power cord must enter from the rear with a length of 7 feet minimum.
5. The clearance between the power cord entrance and the nearest outlet must be 3-3/8 inches minimum.
6. Both the circuit breaker and the switch must be front-mounted.
7. Each outlet must be rear-mounted.

86-4.06C Construction

86-4.06C(1) General

Not used

86-4.06C(2) Installation of CCTV (PTZ) Integrated Camera Station

Install CCTV pole with foundation, conduits and pull boxes as required and as shown. The type of CCTV pole is shown. Install and terminate the HCC with connectors as shown. The HCC must connect to camera pigtail cable and secure to the pole as shown for strain-relief.

The CCTV (PTZ) integrated camera unit must be installed on camera mounting plate as shown. The CCTV (PTZ) integrated camera unit must be secured to the mounting plate using the stainless steel bolts provided with the CCTV (PTZ) integrated camera unit. Before each bolt is fastened, a locking type coating must be applied to the threads. The coating must lock the bolt and nut in place, making it impossible to turn the bolt or nut without tools. This coating must last through and be effective through at least ten insertions and withdrawals of the bolt or nut.

Install CCU, VEU, router, rack-mount power strip, equipment shelves and all the interface cables in the controller cabinet as shown. The rack-mount power strip must be mounted on the rear mounting rack of the controller cabinet.

86-4.06C(3) Installation of CCTV Fixed Camera Station

Install fixed camera with mounting hardware as shown. Install and terminate the HCC with connectors as shown.

Install VEU, router, rack-mount power strip, equipment shelves and all the interface cables in the controller cabinet as shown. The rack-mount power strip must be mounted on the rear mounting rack of the controller cabinet.

86-4.06C(4) Installation of HCC

The HCC must be continuous from the CCTV (PTZ) integrated camera unit to CCU and from a fixed camera unit to multiple camera termination unit (MCTU) in the controller cabinet without splicing, unless shown. The maximum length of HCC is 750 feet.

For the CCTV (PTZ) integrated camera unit, the HCC must be terminated with cable connectors on both ends. Each connector must be provided with a full set crimp contact pins and strain relief back shell and a crimp contact socket and strain relief back shell. All connector contact must be constructed with brass contact body material and with stainless steel spring that are sub-plated with 0.000050-inch nickel and plated with 0.000030-inch gold. Contact size must be 16.

For a fixed camera unit, the camera end of HCC must be terminated with a cable connector which will mate with the connector on the fixed camera.

86-4.06C(5) Installation of Camera Control Unit

86-4.06C(5)(a) General

Install CCU and CCU to laptop PC cable at each CCTV (PTZ) integrated camera station.

Switches must protrude no more than 0.5 inch from the front panel and must be mounted as shown. Each switch must be labeled according to its function.

The rear panel connectors must be mounted as shown and must meet the following requirements:

1. Camera connector must be square-flange type. The socket contacts for camera connector must be constructed with brass contact body material and with stainless steel spring that is sub-plated with 0.000050-inch nickel and plated with 0.000030-inch gold. Contact size must be No.16. Contact extraction tool must be used to replace contact.
2. The TIA-232 connectors must be a DE9 pin connector and TIA-422 connector must be a DE9 socket connector.
3. One mating connector with a full set crimp contact pins and strain relief back shell must be provided with each CCU supplied in the contract.

Provide all necessary interface cables for CCU to connect to all other camera equipment.

86-4.06C(5)(b) CCU to Laptop PC Cable

Install a USB to TIA-232 serial adapter at each PTZ integrated camera location. The adapter must have a DE9 socket connector for TIA-232 and Type A plug connector for USB. Provide a 6-foot straight through USB extension cable. The USB function must be version 2.0. Furnish the adapter software in 1 GB Secure Digital (SD) memory card format.

86-4.06C(6) Rack-mount Power Strip

The rack-mount power strip must be plugged into the non-GFCI duplex outlet normally labeled with "Controller Unit Receptacle" in the back of the Power Distribution Assembly (PDA). The rack-mount power strip must be mounted on the rear of the standard EIA-310 rack cage and across the two vertical back rails with four stainless steel EIA mounting screws, two on each side. The rack-mount power strip must not hinder the accessibility to the back of all existing electrical equipment. All power cords for permanently field installed electrical equipment must be plugged into the power strip.

86-4.06D Payment

Not used

Add to section 86-5.01A(1):

Loop wire must be Type 2.

Loop detector lead-in cable must be Type B.

Slots must be filled with elastomeric sealant or hot-melt rubberized asphalt sealant.

You may use a Type E loop where a Type A or a Type B loop is shown.

For Type E detector loops, sides of the slot must be vertical and the minimum radius of the slot entering and leaving the circular part of the loop must be 1-1/2 inches. Slot width must be a maximum of 5/8 inch. Loop wire for circular loops must be Type 2. Slots of circular loops must be filled with elastomeric sealant or hot-melt rubberized asphalt sealant.

The depth of the loop sealant above the top of the uppermost loop wire in the sawed slots must be 2 inches, minimum.

Fill slots in concrete with elastomeric, hot-melt rubberized asphalt or epoxy sealant for loop detectors.

Add to section 86-5.01:

86-5.01E Video Image Vehicle Detection System

86-5.01E(1) General

86-5.01E(1)(a) Summary

Section 86-5.01E includes specifications for installing video image vehicle detection system (VIVDS) for traffic signal.

86-5.01E(1)(b) Definitions

Video Detection Unit (VDU): Processor unit that converts the video image from the camera and provides vehicle detection in defined zones. Unit includes an image processor, extension module, and communication card.

Video Image Sensor Assembly (VIS): An enclosed and environmentally-protected camera assembly used to collect the video image.

Video Image Vehicle Detection System (VIVDS): A system that detects video images of vehicles in defined zones and provides video output.

86-5.01E(1)(c) Submittals

Submit documentation within 30 days after Contract approval but before installing VIVDS equipment.

The documentation submittal must include:

1. Certificate of Compliance: As specified in section 6-3.05E.
2. Site Analysis Report: Written analysis for each detection site, recommending the optimum video image sensor assembly placement approved by the manufacturer.
3. Lane Configuration: Shop drawing showing:
 - 3.1. Detection zone setback
 - 3.2. Detection zone size
 - 3.3. Camera elevation
 - 3.4. Selected lens viewing angle
 - 3.5. Illustration of detection zone mapping to reporting contact output
 - 3.6. Illustration of output connector pin or wire terminal for lane assignment.
4. Configuration Record: Windows PC compatible CD containing
 - 4.1. Proposed zone designs
 - 4.2. Calibration settings

5. Mounting and Wiring Information: Manufacturer approved wiring video cable and service connection diagrams.
6. Communication Protocol: Industry standard available in public domain. Document defining:
 - 6.1. Message structure organization
 - 6.2. Data packet length
 - 6.3. Message usability
 - 6.4. Necessary information to operate a system from a remote windows based personal computer.
7. Programming Software: CD containing set up and calibration software that observes and detects the vehicular traffic, including bicycles, motorcycles, and sub-compact cars, with overlay of detection zones and allows adjustment of the detection sensitivity for a traffic signal application.
8. Detector Performance DVD Recordings and Analysis: Performance analysis based on 24-hour DVD recording of contiguous activity for each approach. Include:
 - 8.1. Two contiguous hours of sunny condition, with visible shadows projected a minimum of 6 feet into the adjacent lanes
 - 8.2. Two 1-hour night periods with vehicle headlights present
9. Preventative Maintenance Parts Documentation: List of equipment replacement parts for preventative maintenance, including:
 - 9.1. Electrical parts, wiring and video cable
 - 9.2. Mechanical parts
 - 9.3. Assemblies

Allow 7 days for the Engineer to review the documentation submittal.

If the Engineer requires revisions, submit a revised submittal within 5 days of receipt of the Engineer's comments and allow 5 days for the Engineer to review. If agreed to by the Engineer, revisions may be included as attachments in the resubmittal. The Engineer may conditionally approve resubmittals that include revisions submitted as attachments, in order to allow construction activities to proceed.

Upon the Engineer's approval of the resubmittal, submit copies of the final documents with approved revisions incorporated to the Engineer.

Submit an acceptance testing schedule for approval 15 days before starting acceptance testing.

When starting acceptance testing of VIVDS and detector performance and analysis, submit approved copies of the following:

1. Configuration Record: Windows PC compatible CD containing:
 - 1.1. Final zone designs
 - 1.2. Calibration settings to allow reinstallation.
2. Mounting and Wiring Information: Final wiring and service connection diagrams:
 - 2.1. One copy for the Engineer
 - 2.2. A second copy wrapped in clear self-adhesive plastic, placed in a heavy duty plastic envelope, and secured to the inside of the cabinet door

86-5.01E(1)(d) Quality Control and Assurance

86-5.01E(1)(d)(i) General

VIVDS and support equipment required for acceptance testing must be new and as specified in the manufacturer's recommendations. Date of manufacture, as shown by date codes or serial numbers of electronic circuit assemblies, must not be older than 12 months from the scheduled installation start date. Material substitutions must not deviate from the material list approved by the Engineer.

86-5.01E(1)(d)(ii) Training

Provide a minimum of 16 hours of training by a factory-authorized representative for a maximum of 10 Department employees. Submit training material to the Engineer for approval at least 30 days before the proposed training. Training material content must include instructions for aligning, programming, adjusting, calibrating, and maintaining VIVDS. Provide all materials and equipment for the training. Notify the Engineer 20 days in advance of the proposed training to obtain approval of place and time of the training. If agreement cannot be reached, the Engineer will determine the time and place.

86-5.01E(1)(d)(iii) Warranty

Furnish a 3-year replacement warranty from the manufacturer of VIS and VDU against defects in materials and workmanship or failures. The effective date of the warranty is the date of acceptance of the installation. Submit all warranty documentation before installation.

Furnish replacement VIS and VDU within 10 days of receipt of a failed unit. The Department does not pay for replacement.

Deliver replacement VIS and VDU at:

CALTRANS
DISTRICT 4
MAINTENANCE ELECTRICAL SHOP
30 RICKARD STREET
SAN FRANCISCO, CA 94134

86-5.01E(2) Materials

86-5.01E(2)(a) General

VIVDS must include necessary firmware, hardware, and software for designing the detection patterns or zones at the intersection or approach. Detection zones must be created with a graphic user interface designed to allow to anyone trained in VIVDS system setup to configure and calibrate a lane in less than 15 minutes.

System elements must comply with the manufacturer's recommendations and be designed to operate continuously in an outdoor environment.

All equipment, cables, and hardware must be part of an engineered system that is designed by the manufacturer to fully interoperate with all other system components. Mounting assemblies must be corrosion resistant. Connectors installed outside the cabinets and enclosures must be corrosion resistant, weather proof, and watertight. Exposed cables must be sunlight and weather resistant.

86-5.01E(2)(b) Physical and Mechanical Requirements

VIVDS must include:

1. VIS and mounting hardware. Use a clamping device as mounting hardware on a pole or mast-arm.
2. VDU.
3. Power supply.
4. Surge suppression.
5. Cables.
6. Connectors.
7. Wiring for connecting to the Department-furnished Model 332L traffic controller cabinet.
8. Communication card with multi-display port.
9. Flat panel video display.
10. DIN Rail mounted AC power assembly that includes a minimum of one convenience receptacle, four camera chassis ground connections, four camera AC neutral (AC-) connections, four 2 amp camera circuit breakers for hot (AC+) connections, and one AC source connection for Line, Neutral and Ground wires.
11. DIN Rail video surge suppression protection assembly that can accommodate up to six surge suppression modules.

86-5.01E(2)(c) Electrical

VIVDS must operate between 90 to 135 V(ac) service as specified in NEMA TS-1. VIS, excluding the heater circuit, must draw less than 10 W of power. Power supply or transformer for the VIVDS must meet the following minimum requirements:

Minimum Requirements for Power Supply and Transformers

| Item | Power Supply | Transformer |
|--------------------------|--|--|
| Power Cord | Standard 120 V(ac), 3 prong cord, 3 feet minimum length (may be added by Contractor) | Standard 120 V(ac), 3 prong cord, 3 feet minimum length (may be added by Contractor) |
| Type | Switching mode type | Class 2 |
| Rated Power | Two times (2x) full system load | Two times (2x) full system load |
| Operating Temperature | From -37 to 74 °C | From -37 to 74 °C |
| Operating Humidity Range | From 5 to 95 percent | From 5 to 95 percent |
| Input Voltage | From 90 to 135 V(ac) | From 90 to 135 V(ac) |
| Input Frequency | 60 ± 3 Hz | 60 ± 3 Hz |
| Inrush Current | Cold start, 25 A Max. at 115 V(ac) | N/A |
| Output Voltage | As required by VIVDS | As required by VIVDS |
| Overload Protection | From 105 to 150 percent in output pulsing mode | Power limited at >150 percent |
| Over Voltage Protection | From 115 to 135 percent of rated output voltage | N/A |
| Setup, Rise, Hold Up | 800ms, 50ms, 15ms at 115 V(ac) | N/A |
| Withstand Voltage | I/P-0/P:3kV, I/P-FG:1.5kV, for 60 s. | I/P-0/P:3kV, I/P-FG:1.5kV, for 60 s |
| Working Temperature | Not to exceed 70 °C at 30 percent load | Not to exceed 70 °C at 30 percent load |
| Safety Standards | UL 1012, UL 60950 | UL 1585 |

Field terminated circuits must include transient protection as specified in IEEE Standard 587-1980, Category C. Video connections must be isolated from ground.

86-5.01E(2)(d) Technical Requirements

Camera and zoom lens assembly must be housed in an environmentally sealed enclosure that complies with NEMA 4 standards. Enclosure must be watertight and protected from dust. Enclosure must include a thermostat controlled heater to prevent condensation and to ensure proper lens operation at low temperatures. Adjustable sun shield that diverts water from the camera's field of view must be included. Connectors, cables and wiring must be enclosed and protected from weather. A gas tight (protected from dust and moisture ingress) connector must be used at the rear plate of the housing. Wiring to the connector must be sealed with silicone or potting compound.

The camera and its mounting hardware must be less than 10 pounds and less than 1 square foot equivalent pressure area. Only 1 camera must be mounted on traffic signal or luminaire arm. Top of camera must not be more than 12 inches above top of luminaire arm or 30 inches above top of traffic signal arm.

VIS must use a charge-coupled device (CCD) element, support National Television Standards Committee (NTSC) and RS170 video output formats, and have a horizontal resolution of at least 360 lines. VIS must include an auto gain control (AGC) circuit, have a minimum sensitivity to scene luminance from 0.01 to 930 foot-candle, and produce a usable video image of vehicular traffic under all roadway lighting conditions regardless of the time of day. VIS must have a motorized lens with variable focus and zoom control with an aperture of f/1.4 or better. Focal length must allow ±50 percent adjustment of the viewed detection scene.

A flat panel video display with a minimum 17-inch screen and that supports NTSC video output must be enclosed in the Model 332L controller cabinet for viewing video detector images and for performing diagnostic testing. Display must be viewable in direct sunlight. Each VIVDS must have video system

connections that support the NTSC video output format, can be seen in each camera's field of view, and has a program to allow the user to switch to any video signal at an intersection. A metal shelf or pull-out document tray with metal top capable of supporting the VDU and monitor must be furnished and placed on an EIA 19-inch rack with 10-32 "Universal Spacing" threaded holes in the Model 332L controller cabinet. System must allow independent viewing of a scene while video recording other scenes without interfering with the operation of the system's output.

Mounting hardware must be powder-coated aluminum, stainless steel, or treated to withstand 250 hours of salt fog exposure as specified in ASTM B 117 without any visible corrosion damage.

VDU must operate between -37 to +74 degrees C and from 0 to 95 percent relative humidity.

VDU front panel must have indicators for power, communication, presence of video input for each VIS, and a real time detector output operation. Hardware or software test switch must be included to allow the user to place either a constant or momentary call for each approach. Indicators must be visible in daylight from 5 feet away.

VDU must have a serial communication port, EIA 232/USB 2.0 that supports sensor unit setup, diagnostics, and operation from a local PC compatible laptop with Windows XP or later version operating system. VIVDS must have an Ethernet communication environment, including Ethernet communication card. VIVDS must include central and field software to support remote real-time viewing and diagnostics for operational capabilities through wide area network (WAN).

VDU, image processors, extension modules, and video output assemblies must be inserted into the controller input file slots using the edge connector to obtain limited 24 V(dc) power and to provide contact closure outputs. Cabling the output file to a "D" connector on the front of the VDU is acceptable. No rewiring to the standard Model 332L controller cabinet is allowed. Controller cabinet resident modules must comply with the requirements in Chapter 1 and Sections 5.2.8, 5.2.8.1, 5.2.8.2, 5.4.1, 5.4.5, 5.5.1, 5.5.5, and 5.5.6 of TEES.

86-5.01E(2)(e) Functional Requirements

VIVDS must support normal operation of existing detection zones while a zone is being added or modified. Zone must flash or change color on a viewing monitor when vehicular traffic is detected. Length and width of each detection zone for each lane must be approved by the Engineer.

Software and firmware must detect vehicular and bicycle traffic presence, provide vehicle counts, set up detection zones, test VIVDS performance, and allow video scene and system operation viewing from the local traffic management center/office. VIVDS must support a minimum of 2 separate detection patterns or zones that can be enacted by a remote operator at the signal controller cabinet.

VIVDS detection zone must detect vehicles and bicycles by providing an output for presence and pulse. At least one detection output must be provided for each detection zone. One spare detection output must be provided for each approach. Detection performance must be achieved for each detection zone with a maximum of 8 user-defined zones for every camera's field of view.

VIVDS must detect the presence of vehicles and bicycles under all types of adverse weather and environmental conditions, including snow, hail, fog, dirt, dust or contaminant buildup on the lens or faceplate, minor camera motion due to winds, and vibration. Under low visibility conditions, the VIVDS must respond by selecting a fail-safe default pattern and placing a constant call mode for all approaches. VIVDS outputs must assume a fail-safe "on" or "call" pattern for presence detection if video signal or power is not available and must recover from a power failure by restoring normal operations within 3 minutes without manual intervention. If powered off for more than 90 days, system must maintain the configuration and calibration information in memory.

Detection algorithm must be designed to accommodate naturally occurring lighting and environment changes, specifically the slow moving shadows cast by buildings, trees, and other objects. These changes must not result in a false detection or mask a true detection. VIVDS must not require manual interventions for day-night transition or for reflections from poles, vehicles or pavement during rain and weather changes. VIVDS must suppress blooming effects from vehicle headlights and bright objects at night.

Vehicle and bicycle detection must call service to a phase only if a demand exists and extend green service to the phase until the demand is taken care of or until the flow rates have reduced to levels for phase termination. VIVDS must detect the presence of vehicular traffic at the detection zone positions and provide the call contact outputs to the Model 2070L controller assembly with the following performance:

| Detector Performance | | |
|--|---|-----------------------------------|
| Requirements | Performance during AMBER and RED interval | Performance during GREEN interval |
| Average response time after vehicle or bicycle enters 3 feet into detection zone or after exiting 3 feet past detection zone | ≤ 1 s | ≤ 100 ms |
| Maximum number of MISSED CALLS in 24-hour duration, where MISSED CALLS are greater than 5 s during AMBER and RED intervals and greater than 1 s during GREEN intervals (upon entering 3 feet of detection zone or after exiting 3 feet past detection zone). | 0 | 10 |
| Maximum number of FALSE CALLS in 24-hour duration (calls greater than 500ms without a vehicle present) | 20 | 20 |

VIVDS must be able to locally store, for each lane, vehicle and bicycle count data in 5, 15, 30, and 60 minute intervals for a minimum period of 7 days and be remotely retrievable. VIVDS must count vehicular traffic in detection zone with a 95 percent accuracy or better for every hour counted over a morning or an evening peak hour. VIVDS detection zone tested must have a minimum range of 50 feet behind the limit line for each approach. Testing period will be pre-approved by the Engineer 48 hours in advance.

86-5.01E(3) Construction

Install VDU in a Department-furnished Model 2070 controller assembly. Install VIS power supply or transformer on a standard DIN rail using standard mounting hardware and power conductors wired to DIN rail mounted terminal blocks in the controller cabinet. Each VIS must be connected to an individual circuit breaker in the DIN Rail mounted power assembly.

Wiring must be routed through end caps or existing holes and sealed. New holes for mounting or wiring must be shop-drilled.

Wire each VIS to the controller cabinet with a wiring harness that includes all power, control wiring, and coaxial video cable. Attach harness with standard MIL type and rated plugs. Cable type, connectors and wire characteristics must comply with manufacturer's recommendations for the VIS to cabinet distance. Wiring and cables must be continuous, without splices, between the VIS and controller cabinet. Coil a minimum of 7 feet of slack in the bottom of the controller cabinet. For setup and diagnostic access, terminate serial data communication output conductors at TB-0 and continue for a minimum of 10 feet to a DB9F connector. Tape ends of unused and spare conductors to prevent accidental contact to other circuits.

Label conductors inside the cabinet for the functions depicted in the approved detailed diagrams. Label cables with permanent cable labels at each end.

Adjust the lens to view 110 percent of the largest detection area dimension. Zones or elements must be logically combined into reporting contact outputs that are equivalent to the detection loops and with the detection accuracy required.

Verify the performance of each unit, individually, and submit the recorded average and necessary material at the conclusion of the performance test. Determine and document the accuracy of each unit,

individually, so that each unit may be approved or rejected separately. Failure to submit necessary material at the conclusion of testing invalidates the test. The recorded media serves as acceptance evidence and must not be used for calibration. Calibration must have been completed before testing and verification.

Verify the detection accuracy by observing the VIVDS performance and recorded video images for a contiguous 24-hour period. The recorded video images must show the viewed detection scene, the detector call operation, the signal phase status for each approach, the vehicular traffic count, and time-stamp to 1/100 of a second, all overlaid on the recorded video. Transfer the 24-hour analysis to DVD.

VIVDS must meet the detection acceptance criterion specified in table titled "Detector Performance."

Calculate the VIVDS's vehicular traffic count accuracy as:

$$100[1-(|TC-DC|/TC)]$$

Where:

DC = the detector's vehicular traffic count

TC = the observed media-recorded vehicular traffic count and where the resulting fraction is expressed as an absolute value

The Engineer reviews the data findings and accepts or rejects the results within 7 days. Vehicle anomalies or unusual occurrences are decided by the Engineer. Data or counts not agreed by the Engineer are considered errors and counts against the unit's calibration. If the Engineer determines that the VIVDS does not meet the performance requirements, re-calibrate and retest the unit, and resubmit new test data within 7 days. After 3 failed attempts, replace the VIVDS with a new unit.

Notify the Engineer 20 days before the unit is ready for acceptance testing. Acceptance testing must be scheduled to be completed before the end of a normal work shift. You must demonstrate that all VIS and VDUs satisfy the functional requirements.

86-5.01E(4) Payment

Not Used

Replace "Reserved" in section 86-5.03 of the RSS with:

86-5.03A General

86-5.03A(1) Summary

Section 86-5.03 includes specifications for installing accessible pedestrian signals (APS). Comply with TEES.

86-5.03A(2) Definitions

accessible pedestrian signal: Accessible pedestrian signal as defined in the *California MUTCD*.

accessible walk indication: Activated audible and vibrotactile action during the walk interval.

ambient sound level: Background sound level in dB at a given location.

ambient sound sensing microphone: Microphone that measures the ambient sound level in dB and automatically adjusts the APS speaker's volume.

APS assembly: Assembly that includes a pushbutton to actuate the APS components.

audible speech walk message: Audible prerecorded message that communicates to pedestrians which street has the walk interval.

programming mechanism: Device to program the APS' operation.

pushbutton information message: Pushbutton information message as defined in the *California MUTCD*.

pushbutton locator tone: Pushbutton locator tone as defined in the *California MUTCD*.

vibrotactile pedestrian device: Vibrotactile pedestrian device as defined in the *California MUTCD*.

86-5.03A(3) Submittals

Before shipping the APS units to the job site, submit the units with the following to METS:

1. Delivery form including Contract number and your contact information
2. Manufacturer's name
3. Model, lot, and serial numbers
4. Month and year of manufacture
5. Wiring diagram
6. Product data
7. Programming mechanism if not integral to the APS

Submit two copies of APS user and operator manuals for each signalized location as informational submittals. Each manual must have a master item index that includes:

1. Descriptions of the APS and its associated equipment and cables
2. Illustrative block diagrams
3. Manufacturer's contact information
4. Technical data specifications
5. Parts list, descriptions, and settings
6. Fault diagnostic and repair procedures
7. Preventative maintenance procedures for maintaining APS performance parameters

Submit the manufacturer's warranty documentation as an informational submittal before installing the APS.

Submit a record of completed field tests, the APS' final configuration, audible sound level and threshold, and a list of all parameter settings.

86-5.03A(4) Quality Control and Assurance

86-5.03A(4)(a) General

The APS must be compatible with the Department-furnished Model 170E/2070L controller assembly.

The power to the APS must be connected to the pedestrian signal's terminal blocks.

86-5.03A(4)(b) Functional Testing

Perform 2 field tests on the APS: (1) when traffic is noisy during peak traffic hours and (2) when traffic is quiet during off-peak hours. Notify the Engineer 15 days before testing the APS.

86-5.03A(4)(c) Warranty

The APS must have a 2-year manufacturer's warranty against any defects or failures. The 2-year warranty period starts at Contract acceptance. Deliver a replacement within 10 days after you receive notification of a failed APS. The Department does not pay for the replacement. Deliver the replacement to the Department's Maintenance Electrical Shop at:

CALTRANS-DISTRICT 4
MAINTENANCE ELECTRICAL SHOP
30 RICKARD STREET
SAN FRANCISCO, CA 94134

86-5.03A(4)(d) Training

Provide a minimum of 8 hours of training by a certified manufacturer's representative for up to 8 Department employees selected by the Engineer. The training must include instruction in installing, programming, adjusting, calibrating, and maintaining the APS.

Furnish materials and equipment for the training.

86-5.03B Materials

The housing for the APS assembly must be made of corrosion-resistant material. Theft proof bolts used for mounting the APS housing to the standard must be stainless steel with a chromium content of 17 percent and a nickel content of 8 percent.

The color of metallic housing must match color no. 33538 of FED-STD-595.

The color of plastic housing must match color no. 17038, 27038, or 37038 of FED-STD-595.

The APS assembly must be rainproof and shockproof in any weather condition.

The APS assembly must include:

1. Pushbutton actuator with a minimum diameter of 2 inches. If a mechanical switch is used, it must have:
 - 1.1. Operating force of 3.5 lb
 - 1.2. Maximum pretravel of 5/64 inch
 - 1.3. Minimum overtravel of 1/32 inch
 - 1.4. Differential travel from 0.002 to 0.04 inch
2. Vibrotactile device on the pushbutton or on the arrow.
3. Enclosure with an ambient-sound-level-sensing microphone and weatherproof speaker. The enclosure must:
 - 3.1 Weigh less than 7 lb.
 - 3.2 Measure less than 16 by 6 by 5 inches.
 - 3.3 Fit the Signal and Lighting and Type 1 standards.
 - 3.4 Have a wiring hole with a diameter not exceeding 1-1/8 inches.
 - 3.5 Be attached to the pole with 2 screws with a diameter from 1/4 to 3/8 inch suitable for use in tapped holes. The clear space between any 2 holes in the post must be at least twice the diameter of the larger hole.
4. Pushbutton sign.

The APS speakers and electronic equipment must be installed inside the APS assembly's enclosure. The speaker grills must be located on the surface of the enclosure.

Speakers must not interfere with the housing or its mounting hardware.

The conductor cable between the APS assembly and the pedestrian signal head must be a no. 9. 20-conductor cable complying with MIL-W-16878D. The wiring must comply with section 13.02 of ITE publication *Equipment and Material Standards* chapter 2, "Vehicle Traffic Control Signal Heads," and be NEC rated for service at +105 degrees C.

The APS must:

1. Include a mechanism for enabling and disabling its operation.
2. Have electronic switches, a potentiometer, or a handheld device for controlling and programming the volume level and messaging. Deliver any handheld programming device to the Engineer.
3. Provide information using:
 - 3.1 Audible speech message that plays when the pushbutton is actuated. The message must include the name of the street to be crossed. The APS must have at least 5 audible message options. The Engineer selects the message. The message must have a percussive tone consisting of multiple frequencies with a dominant component of 880 Hz. If the tone is selected as the message, it must repeat 8 to 10 ticks per second.
 - 3.2. Pushbutton locator tone that clicks or beeps. The pushbutton must produce the locator tone at an interval of 1 tone per second. Each tone must have a maximum duration of 0.15 second. The tone volume must adjust in response to the ambient sound level and be audible up to 12 feet from the pushbutton or to the building line, whichever is less.
4. Have a pushbutton that remains functional during an APS failure.

For signalized intersections, the APS must:

1. Have a pushbutton that when actuated activates the pedestrian walk signal's timing during an APS failure.
2. Provide information using:
 - 2.1. Audible speech walk message. The message must be activated from the beginning of the walk interval and repeated for its duration. An example of the message is "Peachtree. Walk sign is on to cross Peachtree."
 - 2.2. Pushbutton information message that provides the name of the street to be crossed. The message must play when the pushbutton is actuated. An example of the message is "Wait to cross Howard at Grand. Wait."
3. Have a functional pushbutton that activates the pedestrian walk signal whenever actuated, even if the audible speech walk message, the pushbutton information message, the pushbutton locator tone, and the vibrating surface features are disabled.

For unsignalized pedestrian crossings, the APS must have an audible speech message such as "Peachtree. Cross with caution."

86-5.03C Construction

Arrange to have a manufacturer's representative at the job site when the APS is installed, modified, connected, or reconnected. The APS must not interfere with the Department-furnished controller assembly, the signal installation on signal standards, the pedestrian signal heads, or the terminal compartment blocks. The APS electronic control equipment must reside inside the APS assembly and the standard pedestrian signal head.

You are responsible for the compatibility of the components and for making the necessary calibration adjustments to deliver the performance specified. Furnish the equipment and hardware, and then set up, calibrate, and verify the performance of the APS.

Point arrows on the pushbutton signs in the same direction as the corresponding crosswalk. Attach the sign to the APS assembly.

Do not install an APS on a standard smaller than Type 1.

86-5.03D Payment

Not Used

Replace section 86-6.02 with:

86-6.02 LED LUMINAIRES

86-6.02A General

86-6.02A(1) Summary

Section 86-6.02 includes specifications for installing LED luminaires.

86-6.02A(2) Definitions

CALiPER: Commercially Available LED Product Evaluation and Reporting. A U.S. DOE program that individually tests and provides unbiased information on the performance of commercially-available LED luminaires and lights.

correlated color temperature: Absolute temperature in kelvin of a blackbody whose chromaticity most nearly resembles that of the light source.

house side lumens: Lumens from a luminaire directed to light up areas between the fixture and the pole, such as sidewalks at intersection or areas off the shoulders on freeways.

International Electrotechnical Commission (IEC): Organization that prepares and publishes international standards for all electrical, electronic, and related technologies.

junction temperature: Temperature of the electronic junction of the LED device. The junction temperature is critical in determining photometric performance, estimating operational life, and preventing catastrophic failure of the LED.

L70: Extrapolated life in hours of the luminaire when the luminous output depreciates 30 percent from initial values.

LM-79: Test method from the Illumination Engineering Society of North America specifying test conditions, measurements, and report format for testing solid state lighting devices, including LED luminaires.

LM-80: Test method from the Illumination Engineering Society of North America specifying test conditions, measurements, and report format for testing and estimating the long-term performance of LEDs for general lighting purposes.

National Voluntary Laboratory Accreditation Program (NVLAP): U.S. DOE program that accredits independent testing laboratories.

power factor: Ratio of the real power component to the complex power component.

street side lumens: Lumens from a luminaire directed to light up areas between the fixture and the roadway, such as traveled ways and freeway lanes.

surge protection device (SPD): Subsystem or component that protects the unit against short-duration voltage and current surges.

total harmonic distortion: Ratio of the rms value of the sum of the squared individual harmonic amplitudes to the rms value of the fundamental frequency of a complex waveform.

86-6.02A(3) Submittals

Submit a sample luminaire to METS for testing after the manufacturer's testing is completed. Include the manufacturer's test data.

Product submittals must include:

1. LED luminaire checklist.
2. Product specification sheets, including:
 - 2.1. Maximum power in watts.
 - 2.2. Maximum designed junction temperature.
 - 2.3. Heat sink area in square inches.
 - 2.4. Designed junction to ambient thermal resistance calculation with thermal resistance components clearly defined.
 - 2.5. L70 in hours when extrapolated for the average nighttime operating temperature.
3. LM-79 and LM-80 compliant test reports from a CALiPER-qualified or NVLAP-approved testing laboratory for the specific model submitted.
4. Photometric file based on LM-79 test report.
5. Initial and depreciated isofootcandle diagrams showing the specified minimum illuminance for the particular application. The diagrams must be calibrated to feet and show a 40 by 40 foot grid. The diagrams must be calibrated to the mounting height specified for that particular application. The depreciated isofootcandle diagrams must be calculated at the minimum operational life.
6. Test report showing SPD performance as tested under ANSI/IEEE C62.41.2 and ANSI/IEEE C62.45.
7. Test report showing mechanical vibration test results as tested under California Test 611 or equal.
8. Data sheets from the LED manufacturer that include information on life expectancy based on junction temperature.
9. Data sheets from the power supply manufacturer that include life expectancy information.

Submit documentation of a production QA performed by the luminaire manufacturer that:

1. Ensures the minimum specified performance level
2. Includes a documented process for resolving problems

Submit the QA documentation as an informational submittal.

Submit the manufacturer's warranty documentation as an informational submittal before installing LED luminaires.

86-6.02A(4) Quality Control and Assurance

86-6.02A(4)(a) General

The Department may test random samples of the luminaires under section 86-2.14A. The Department tests luminaires under California Test 678 and may test any parameters specified in section 86-6.01.

Fit 1 sample luminaire with a thermistor or thermocouple temperature sensor. A temperature sensor must be mounted on the:

1. LED solder pad as close to the LED as possible
2. Power supply case
3. Light bar or modular system as close to the center of the module as possible

Other configurations must have at least 5 sensors per luminaire. The Engineer provides advice on sensor location. Thermocouples must be either Type K or C. Thermistors must be a negative-temperature-coefficient type with a nominal resistance of 20 k Ω . Use the appropriate thermocouple wire. The leads must be a minimum of 6 feet. Submit documentation with the test unit describing the type of sensor used.

Before performing any testing, energize the sample luminaires for a minimum of 24 hours at 100 percent on-time duty cycle and a temperature of +70 degrees F.

Depreciate the luminaire lighting's performance for the minimum operating life by using the LED manufacturer's data or the data from the LM-80 test report, whichever results in a higher lumen depreciation.

Failure of the luminaire that renders the unit noncompliant with section 86-6.02 specifications is cause for rejection.

86-6.02A(4)(b) Warranty

Provide a 7-year manufacturer's warranty against any defects or failures. The warranty period begins on the date of Contract acceptance. Furnish a replacement luminaire within 10 days after receipt of the failed luminaire. The Department does not pay for the replacement. Deliver replacement luminaires to the Department's Maintenance Electrical Shop at:

CALTRANS-DISTRICT 4
MAINTENANCE ELECTRICAL SHOP
30 RICKARD STREET
SAN FRANCISCO, CA 94134

86-6.02B Materials

86-6.02B(1) General

The luminaire must include an assembly that uses LEDs as the light source. The assembly must include a housing, an LED array, and an electronic driver. The luminaire must:

1. Be UL listed under UL 1598 for luminaires in wet locations or an equivalent standard from a recognized testing laboratory
2. Have a minimum operational life of 63,000 hours
3. Operate at an average operating time of 11.5 hours per night
4. Be designed to operate at an average nighttime operating temperature of 70 degrees F
5. Have an operating temperature range from -40 to +130 degrees F
6. Be defined by the following applications:

| Application | Replaces |
|-------------|--|
| Roadway 1 | 200 W high-pressure sodium luminaire mounted at 34 ft |
| Roadway 2 | 310 W high-pressure sodium luminaire mounted at 40 ft |
| Roadway 3 | 310 W high-pressure sodium luminaire mounted at 40 ft with back side control |
| Roadway 4 | 400 W high-pressure sodium luminaire mounted at 40 ft |

The individual LEDs must be connected such that a catastrophic loss or a failure of 1 LED does not result in the loss of more than 20 percent of the luminous output of the luminaire.

86-6.02B(2) Luminaire Identification

Each luminaire must have the following identification permanently marked inside the unit and outside of its packaging box:

1. Manufacturer's name
2. Trademark
3. Model number
4. Serial number
5. Month and year of manufacture
6. Lot number
7. Contract number
8. Rated voltage
9. Rated wattage
10. Rated power in VA

86-6.02B(3) Electrical Requirements

The luminaire must operate from a 60 ± 3 Hz AC power source. The fluctuations of line voltage must have no visible effect on the luminous output. The operating voltage may range from 120 to 480 V(ac). The luminaire must operate over the entire voltage range or the voltage range must be selected from either of the following options:

1. Luminaire must operate over a voltage range of 95 to 277 V(ac). The operating voltages for this option are 120 V(ac) and 240 V(ac).
2. Luminaire must operate over a voltage range of 347 to 480 V(ac). The operating voltage for this option is 480 V(ac).

The power factor of the luminaire must be 0.90 or greater. The total harmonic distortion, current, and voltage induced into an AC power line by a luminaire must not exceed 20 percent. The maximum power consumption allowed for the luminaire must be as shown in the following table:

| Application | Maximum consumption (watts) |
|-------------|-----------------------------|
| Roadway 1 | 165 |
| Roadway 2 | 235 |
| Roadway 3 | 235 |
| Roadway 4 | 300 |

86-6.02B(4) Surge Suppression and Electromagnetic Interference

The luminaire's on-board circuitry must include an SPD to withstand high repetition noise transients caused by utility line switching, nearby lightning strikes, and other interferences. The SPD must protect the luminaire from damage and failure due to transient voltages and currents as defined in Tables 1 and 4 of ANSI/IEEE C64.41.2 for location category C-High. The SPD must comply with UL 1449. The SPD must be tested under ANSI/IEEE C62.45 based on ANSI/IEEE C62.41.2 definitions for standard and optional waveforms for location category C-High.

The luminaires and associated on-board circuitry must comply with the Class A emission limits under 47 CFR 15, subpart B, for the emission of electronic noise.

86-6.02B(5) Compatibility

The luminaire must be operationally compatible with currently-used lighting control systems and photoelectric controls.

86-6.02B(6) Photometric Requirements

The luminaire must maintain a minimum illuminance level throughout the minimum operating life. The L70 of the luminaire must be the minimum operating life or greater. The measurements must be calibrated to standard photopic calibrations. The minimum maintained illuminance values measured at a point must be as shown in the following table:

| Application | Mounting height (ft) | Minimum maintained illuminance (fc) | Light pattern figure (isofootcandle curve) |
|-------------|-------------------------|--|---|
| Roadway 1 | 34 | 0.15 | <p>Pattern defined by an ellipse with the equation:</p> $\frac{x^2}{(82)^2} + \frac{(y - 20)^2}{(52)^2} = 1$ <p>where: x = direction longitudinal to the roadway y = direction transverse to the roadway and the luminaire is offset from the center of the pattern by 20 feet to the house side of the pattern.</p> |
| Roadway 2 | 40 | 0.2 | <p>Pattern defined by an ellipse with the equation:</p> $\frac{x^2}{(82)^2} + \frac{(y - 20)^2}{(52)^2} = 1$ <p>where: x = direction longitudinal to the roadway y = direction transverse to the roadway and the luminaire is offset from the center of the pattern by 20 feet to the house side of the pattern.</p> |
| Roadway 3 | 40 | 0.2 | <p>Pattern defined by an ellipse with the equation:</p> $\frac{x^2}{(82)^2} + \frac{(y - 20)^2}{(52)^2} = 1$ <p>for $y \geq 0$ (street side)</p> <p>where: x = direction longitudinal to the roadway y = direction transverse to the roadway and the luminaire is offset from the center of the pattern by 20 feet to the house side of the pattern.</p> |
| Roadway 4 | 40 | 0.2 | <p>Pattern defined by an ellipse with the equation:</p> $\frac{x^2}{(92)^2} + \frac{(y - 23)^2}{(55)^2} = 1$ <p>where: x = direction longitudinal to the roadway y = direction transverse to the roadway and the luminaire is offset from the center of the pattern by 23 feet to the house side of the pattern.</p> |

The luminaire must have a correlated color temperature range from 3,500 to 6,500 K. The color rendering index must be 65 or greater.

The luminaire must not allow more than:

1. 10 percent of the rated lumens to project above 80 degrees from vertical
2. 2.5 percent of the rated lumens to project above 90 degrees from vertical

86-6.02B(7) Thermal Management

The passive thermal management of the heat generated by the LEDs must have enough capacity to ensure proper operation of the luminaire over the minimum operation life. The LED maximum junction temperature for the minimum operation life must not exceed 221 degrees F.

The junction-to-ambient thermal resistance must be 95 degrees F per watt or less. The use of fans or other mechanical devices is not allowed. The heat sink material must be aluminum or other material of equal or lower thermal resistance.

The luminaire must contain circuitry that automatically reduces the power to the LEDs so the maximum junction temperature is not exceeded when the ambient outside temperature is 100 degrees F or greater.

86-6.02B(8) Physical and Mechanical Requirements

The luminaire must:

1. Be a single, self-contained device not requiring job-site assembly for installation
2. Have an integral power supply
3. Weigh no more than 35 lb
4. Have a maximum-effective projected area of 1.4 sq ft when viewed from either side or end
5. Have a housing color that matches color number from 26152 to 26440, from 36231 to 36375, or 36440 of FED-STD-595.

The housing must be fabricated from materials designed to withstand a 3,000-hour salt spray test under ASTM B 117. All aluminum used in housings and brackets must be made of a marine-grade alloy with less than 0.2 percent copper. All exposed aluminum must be anodized.

Each refractor or lens must be made from UV-inhibited high-impact plastic such as acrylic or polycarbonate or heat- and impact-resistant glass and be resistant to scratching. Polymeric materials except lenses of enclosures containing either the power supply or electronic components of the luminaire must be made of UL94VO flame retardant materials. The housing's paint must comply with section 86-2.16. A chromate conversion undercoating must be used underneath a thermoplastic polyester powder coat.

Provide each housing with a slip fitter capable of mounting on a 2-inch pipe tenon. This slip fitter must fit on mast arms with outside diameters from 1-5/8 to 2-3/8 inches. The slip fitter must be capable of being adjusted a minimum of ± 5 degrees from the axis of the tenon in a minimum of 5 steps: +5, +2.5, 0, -2.5, -5. The clamping brackets of the slip fitter must not bottom out on the housing bosses when adjusted within the designed angular range. No part of the slip fitter's mounting brackets must develop a permanent set in excess of 1/32 inch when the bracket's two or four 3/8-inch-diameter cap screws are tightened to 10 ft-lb. Two sets of cap screws may be furnished to allow the slip fitter to be mounted on the pipe tenon in the acceptable range without the cap screws bottoming out in the threaded holes. The cap screws and the clamping brackets must be made of corrosion-resistant materials or treated to prevent galvanic reactions and be compatible with the luminaire housing and the mast arm.

The LED luminaire must be assembled and manufactured such that its internal components are adequately supported to withstand mechanical shock and vibration from high winds and other sources. When tested under California Test 611, the luminaire to be mounted horizontally on the mast arm must be capable of withstanding the following cyclic loading for a minimum of 2 million cycles without failure of any luminaire part:

Cyclic Loading

| Plane | Power supply | Minimum peak acceleration level |
|-------------------------|--------------|---|
| Vertical | Installed | 3.0 g peak-to-peak sinusoidal loading (same as 1.5 g peak) |
| Horizontal ^a | Installed | 1.5 g peak-to-peak sinusoidal loading (same as 0.75 g peak) |

^aPerpendicular to the direction of the mast arm

The housing must be designed to prevent the buildup of water on top of the housing. Exposed heat sink fins must be oriented to allow water to freely run off of the luminaire and carry dust and other accumulated debris away from the unit. The optical assembly of the luminaire must be protected against

1. 20 percent natural pozzolan or fly ash with a CaO content of up to 10 percent, 5 percent silica fume, and 75 percent portland cement
2. 12 percent silica fume, metakaolin, or UFFA, and 88 percent portland cement
3. 50 percent GGBFS and 50 percent portland cement

For concrete used in precast piles, bridge decks, barrier slabs, barriers, and for concrete at the Broadway Overcrossing (Replace), the Broadway On-Ramp, and the retaining walls, the ratio of the quantity of free water to the quantity of cementitious material must not exceed 0.40.

Add to section 90-2.02B:

You may use rice hull ash as an SCM. Rice hull ash must comply with AASHTO M 321 and the chemical and physical requirements shown in the following tables:

| Chemical property | Requirement (percent) |
|--|-----------------------|
| Silicon dioxide (SiO ₂) ^a | 90 min |
| Loss on ignition | 5.0 max |
| Total alkalis as Na ₂ O equivalent | 3.0 max |

| Physical property | Requirement |
|--|---|
| Particle size distribution | |
| Less than 45 microns | 95 percent |
| Less than 10 microns | 50 percent |
| Strength activity index with portland cement ^b | |
| 7 days | 95 percent (min percent of control) |
| 28 days | 110 percent (min percent of control) |
| Expansion at 16 days when testing project materials under ASTM C 1567 ^c | 0.10 percent max |
| Surface area when testing by nitrogen adsorption under ASTM D 5604 | 40.0 m ² /g min |

^aSiO₂ in crystalline form must not exceed 1.0 percent.

^bWhen tested under AASHTO M 307 for strength activity testing of silica fume.

^cIn the test mix, Type II or V portland cement must be replaced with at least 12 percent rice hull ash by weight.

For the purpose of calculating the equations for the cementitious material specifications, consider rice hull ash to be represented by the variable *UF*.

**REVISED STANDARD SPECIFICATIONS
APPLICABLE TO THE 2010 EDITION
OF THE STANDARD SPECIFICATIONS**

Add to the 1st table in section 1-1.06:

04-19-13

| | |
|-----|----------------------------------|
| LCS | Department's lane closure system |
| POC | pedestrian overcrossing |
| QSD | qualified SWPPP developer |
| QSP | qualified SWPPP practitioner |
| TRO | time-related overhead |
| WPC | water pollution control |

Delete the abbreviation and its meaning for *UDBE* in the 1st table of section 1-1.06.

06-20-12

Delete "Contract completion date" and its definition in section 1-1.07B.

10-19-12

Delete "critical delay" and its definition in section 1-1.07B.

10-19-12

Replace "day" and its definition in section 1-1.07B with:

10-19-12

day: 24 consecutive hours running from midnight to midnight; calendar day.

1. **business day:** Day on the calendar except a Saturday and a holiday.
2. **working day:** Time measure unit for work progress. A working day is any 24-consecutive-hour period except:
 - 2.1. Saturday and holiday.
 - 2.2. Day during which you cannot perform work on the controlling activity for at least 50 percent of the scheduled work shift with at least 50 percent of the scheduled labor and equipment due to any of the following:
 - 2.2.1. Adverse weather-related conditions.
 - 2.2.2. Maintaining traffic under the Contract.
 - 2.2.3. Suspension of a controlling activity that you and the Engineer agree benefits both parties.
 - 2.2.4. Unanticipated event not caused by either party such as:
 - 2.2.4.1. Act of God.
 - 2.2.4.2. Act of a public enemy.
 - 2.2.4.3. Epidemic.
 - 2.2.4.4. Fire.
 - 2.2.4.5. Flood.
 - 2.2.4.6. Governor-declared state of emergency.
 - 2.2.4.7. Landslide.
 - 2.2.4.8. Quarantine restriction.
 - 2.2.5. Issue involving a third party, including:
 - 2.2.5.1. Industry or area-wide labor strike.
 - 2.2.5.2. Material shortage.
 - 2.2.5.3. Freight embargo.
 - 2.2.5.4. Jurisdictional requirement of a law enforcement agency.
 - 2.2.5.5. Workforce labor dispute of a utility or nonhighway facility owner resulting in a nonhighway facility rearrangement not described and not solely for the Contractor's convenience. Rearrangement of a nonhighway facility includes installation, relocation, alteration, or removal of the facility.
 - 2.3. Day during a concurrent delay.
3. **original working days:**

- 3.1. Working days to complete the work shown on the *Notice to Bidders* for a non–cost plus time based bid.
- 3.2. Working days bid to complete the work for a cost plus time based bid.

Where working days is specified without the modifier "original" in the context of the number of working days to complete the work, interpret the number as the number of original working days as adjusted by any time adjustment.

Replace "Contract" in the definition of "early completion time" in section 1-1.07B with:

work

10-19-12

Replace "excusable delay" and its definition in section 1-1.07B with:

delay: Event that extends the completion of an activity.

10-19-12

1. **excusable delay:** Delay caused by the Department and not reasonably foreseeable when the work began such as:
 - 1.1. Change in the work
 - 1.2. Department action that is not part of the Contract
 - 1.3. Presence of an underground utility main not described in the Contract or in a location substantially different from that specified
 - 1.4. Described facility rearrangement not rearranged as described, by the utility owner by the date specified, unless the rearrangement is solely for the Contractor's convenience
 - 1.5. Department's failure to obtain timely access to the right-of-way
 - 1.6. Department's failure to review a submittal or provide notification in the time specified
2. **critical delay:** Excusable delay that extends the scheduled completion date
3. **concurrent delay:** Occurrence of at least 2 of the following events in the same period of time, either partially or entirely:
 - 3.1. Critical delay
 - 3.2. Delay to a controlling activity caused by you
 - 3.3. Non–working day

Replace "project" in the definition of "scheduled completion date" in section 1-1.07B with:

work

10-19-12

Add to section 1-1.07B:

Contract time: Number of original working days as adjusted by any time adjustment.

10-19-12

Disadvantaged Business Enterprise: Disadvantaged Business Enterprise as defined in 49 CFR 26.5.

06-20-12

Replace "PO BOX 911" in the District 3 mailing address in the table in section 1-1.08 with:

703 B ST

04-20-12

Replace the 1st and 2nd sentences in the 7th paragraph of section 5-1.13B(1) with:

06-20-12

If a DBE is decertified before completing its work, the DBE must notify you in writing of the decertification date. If a business becomes a certified DBE before completing its work, the business must notify you in writing of the certification date.

Replace "90" in the last sentence of the 7th paragraph of section 5-1.13B(1) with:

06-20-12

30

Replace "Underutilized" in "Underutilized Disadvantaged Business Enterprises" in the heading of section 5-1.13B(2) with:

06-20-12

Performance of

Delete *U* in *UDBE* at each occurrence in section 5-1.13B(2).

06-20-12

Replace the 3rd paragraph of section 5-1.13B(2) with:

06-20-12

Do not terminate or substitute a listed DBE for convenience and perform the work with your own forces or obtain materials from other sources without authorization from the Department.

Replace item 6 in the list in the 4th paragraph of section 5-1.13B(2) with:

06-20-12

6. Listed DBE is ineligible to work on the project because of suspension or debarment.

Add to the list in the 4th paragraph of section 5-1.13B(2):

06-20-12

8. Listed DBE voluntarily withdraws with written notice from the Contract.
9. Listed DBE is ineligible to receive credit for the type of work required.
10. Listed DBE owner dies or becomes disabled resulting in the inability to perform the work on the Contract.
11. Department determines other documented good cause.

Add between the 4th and 5th paragraphs of section 5-1.13B(2):

07-20-12

Notify the original DBE of your intent to use other forces or material sources and provide the reasons. Provide the DBE with 5 days to respond to your notice and advise you and the Department of the reasons why the use of other forces or sources of materials should not occur. Your request to use other forces or material sources must include:

1. 1 or more of the reasons listed in the preceding paragraph
2. Notices from you to the DBE regarding the request
3. Notices from the DBE to you regarding the request

Add between "terminated" and ", you" in the 5th paragraph of section 5-1.13B(2):

07-20-12

or substituted

Replace the paragraphs of section 5-1.13C with:

11-15-13

Section 5-1.13C applies to a non-federal-aid contract.

Use each DVBE as shown on the *Certified DVBE Summary* form unless you receive authorization from the Department for a substitution. The substitute must be another DVBE unless DVBEs are not available, in which case, you must substitute with a small business. Any authorization for a substitute is contingent upon the Department of General Services' approval of the substitute.

The requirement that DVBEs be certified by the bid opening date does not apply to DVBE substitutions after Contract award.

The Department authorizes substitutions for any of the reasons provided in 2 CA Code of Regs § 1896.73.

Include in your substitution request:

1. Copy of the written notice issued to the DVBE with proof of delivery
2. Copy of the DVBE's response to the notice
3. Name and certification number of the listed DVBE and the proposed substitute

Requests for substitutions of a listed DVBE with a small business must include documentation of the unavailability of DVBEs, including:

1. Contact with the small business/DVBE advocate from the Department and the Department of Veterans Affairs
2. Search results from the Department of General Services' website of available DVBEs
3. Communication with a DVBE community organization nearest the job site, if applicable
4. Documented communication with the DVBE and small businesses describing the work to be performed, the percentage of the total bid, the corresponding dollar amount, and the responses to the communication

The Department forwards your substitution request to the Department of General Services. The Department of General Services issues a notice of approval or denial. The Department provides you this notice.

If you fail to use a listed DVBE without an authorized substitution request, the Department issues a penalty of up to 10 percent of the dollar amount of the work of the listed DVBE.

Maintain records of subcontracts made with DVBEs. Include in the records:

1. Name and business address of each business
2. Total amount paid to each business

For the purpose of determining compliance with Pub Cont Code § 10115 et seq.:

1. Upon work completion, complete and submit *Final Report - Utilization of Disabled Veteran Business Enterprises (DVBE) State Funded Projects Only* form.
2. Upon reasonable notice and during normal business hours, permit access to its premises for the purposes of:
 - 2.1. Interviewing employees.
 - 2.2. Inspecting and copying books, records, accounts and other material that may be relevant to a matter under investigation.

Replace "Reserved" in section 5-1.20C with:

10-19-12

If the Contract includes an agreement with a railroad company, the Department makes the provisions of the agreement available in the *Information Handout* in the document titled "Railroad Relations and Insurance Requirements." Comply with the requirements in the document.

Add between the 2nd and 3rd paragraphs of section 5-1.23A:

10-19-12

Submit action and informational submittals to the Engineer.

Add between the 5th and 6th paragraphs of section 5-1.23B(1):

07-19-13

For a revised submittal, allow the same number of days for review as for the original submittal.

Delete the 1st sentence in the 10th paragraph of section 5-1.23B(2).

07-19-13

Add to the list in the 1st paragraph of section 5-1.36A:

07-19-13

10. Survey monuments

Add to section 5-1.36C:

07-20-12

If the Contract does not include an agreement with a railroad company, do not allow personnel or equipment on railroad property.

Prevent material, equipment, and debris from falling onto railroad property.

Add to section 5-1.36:

07-19-13

5-1.36E Survey Monuments

Protect survey monuments on and off the highway. Upon discovery of a survey monument not identified and located immediately:

1. Stop work near the monument
2. Notify the Engineer

Do not resume work near the monument until authorized.

Add between the 1st and 2nd paragraphs of section 5-1.37A:

10-19-12

Do not remove any padlock used to secure a portion of the work until the Engineer is present to replace it. Notify the Engineer at least 3 days before removing the lock.

Replace "20 days" in the 14th paragraph of section 7-1.04 with:

09-16-11

25 days

Replace "90 days" in the 14th paragraph of section 7-1.04 with:

09-16-11

125 days

Add between the 18th and 19th paragraphs of section 7-1.04:

09-16-11

Temporary facilities that could be a hazard to public safety if improperly designed must comply with design requirements described in the Contract for those facilities or, if none are described, with standard design criteria or codes appropriate for the facility involved. Submit shop drawings and design calculations for the temporary facilities and show the standard design criteria or codes used. Shop drawings and supplemental calculations must be sealed and signed by an engineer who is registered as a civil engineer in the State.

Replace the 2nd paragraph of section 7-1.11A with:

07-27-12

A copy of form FHWA-1273 is included in section 7-1.11B. The training and promotion section of section II refers to training provisions as if they were included in the special provisions. The Department specifies the provisions in section 7-1.11D of the *Standard Specifications*. If a number of trainees or apprentices is required, the Department shows the number on the *Notice to Bidders*. Interpret each FHWA-1273 clause shown in the following table as having the same meaning as the corresponding Department clause:

FHWA-1273 Nondiscrimination Clauses

| FHWA-1273 section | FHWA-1273 clause | Department clause |
|------------------------|--|---|
| Training and Promotion | In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision. | If section 7-1.11D applies, section 7-1.11D supersedes this subparagraph. |
| Records and Reports | If on-the-job training is being required by special provision, the contractor will be required to collect and report training data. | If the Contract requires on-the-job training, collect and report training data. |

Replace the form in section 7-1.11B with:

07-20-12

**REQUIRED CONTRACT PROVISIONS
FEDERAL-AID CONSTRUCTION CONTRACTS**

- I. General
- II. Nondiscrimination
- III. Nonsegregated Facilities
- IV. Davis-Bacon and Related Act Provisions
- V. Contract Work Hours and Safety Standards Act Provisions
- VI. Subletting or Assigning the Contract
- VII. Safety: Accident Prevention
- VIII. False Statements Concerning Highway Projects
- IX. Implementation of Clean Air Act and Federal Water Pollution Control Act
- X. Compliance with Governmentwide Suspension and Debarment Requirements
- XI. Certification Regarding Use of Contract Funds for Lobbying

3. A breach of any of the stipulations contained in these Required Contract Provisions may be sufficient grounds for withholding of progress payments, withholding of final payment, termination of the contract, suspension / debarment or any other action determined to be appropriate by the contracting agency and FHWA.

4. Selection of Labor: During the performance of this contract, the contractor shall not use convict labor for any purpose within the limits of a construction project on a Federal-aid highway unless it is labor performed by convicts who are on parole, supervised release, or probation. The term Federal-aid highway does not include roadways functionally classified as local roads or rural minor collectors.

ATTACHMENTS

A. Employment and Materials Preference for Appalachian Development Highway System or Appalachian Local Access Road Contracts (included in Appalachian contracts only)

II. NONDISCRIMINATION

The provisions of this section related to 23 CFR Part 230 are applicable to all Federal-aid construction contracts and to all related construction subcontracts of \$10,000 or more. The provisions of 23 CFR Part 230 are not applicable to material supply, engineering, or architectural service contracts.

I. GENERAL

1. Form FHWA-1273 must be physically incorporated in each construction contract funded under Title 23 (excluding emergency contracts solely intended for debris removal). The contractor (or subcontractor) must insert this form in each subcontract and further require its inclusion in all lower tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services).

In addition, the contractor and all subcontractors must comply with the following policies: Executive Order 11246, 41 CFR 60, 29 CFR 1625-1627, Title 23 USC Section 140, the Rehabilitation Act of 1973, as amended (29 USC 794), Title VI of the Civil Rights Act of 1964, as amended, and related regulations including 49 CFR Parts 21, 26 and 27; and 23 CFR Parts 200, 230, and 633.

The applicable requirements of Form FHWA-1273 are incorporated by reference for work done under any purchase order, rental agreement or agreement for other services. The prime contractor shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.

The contractor and all subcontractors must comply with: the requirements of the Equal Opportunity Clause in 41 CFR 60-1.4(b) and, for all construction contracts exceeding \$10,000, the Standard Federal Equal Employment Opportunity Construction Contract Specifications in 41 CFR 60-4.3.

Form FHWA-1273 must be included in all Federal-aid design-build contracts, in all subcontracts and in lower tier subcontracts (excluding subcontracts for design services, purchase orders, rental agreements and other agreements for supplies or services). The design-builder shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.

Note: The U.S. Department of Labor has exclusive authority to determine compliance with Executive Order 11246 and the policies of the Secretary of Labor including 41 CFR 60, and 29 CFR 1625-1627. The contracting agency and the FHWA have the authority and the responsibility to ensure compliance with Title 23 USC Section 140, the Rehabilitation Act of 1973, as amended (29 USC 794), and Title VI of the Civil Rights Act of 1964, as amended, and related regulations including 49 CFR Parts 21, 26 and 27; and 23 CFR Parts 200, 230, and 633.

Contracting agencies may reference Form FHWA-1273 in bid proposal or request for proposal documents, however, the Form FHWA-1273 must be physically incorporated (not referenced) in all contracts, subcontracts and lower-tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services related to a construction contract).

The following provision is adopted from 23 CFR 230, Appendix A, with appropriate revisions to conform to the U.S. Department of Labor (US DOL) and FHWA requirements.

2. Subject to the applicability criteria noted in the following sections, 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.

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, 29 CFR 1625-1627, 41 CFR 60 and 49 CFR 27) 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 provisions of the Americans with 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 contracting agency and the Federal Government to ensure that it has made every good faith effort to provide equal opportunity with respect to all of its terms and conditions of employment and in their review of activities under the contract.

b. The contractor will accept as its 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, pre-apprenticeship, and/or on-the-job training."

2. EEO Officer: The contractor will designate and make known to the contracting officers an EEO Officer who will have the responsibility for and must be capable of effectively administering and promoting an active EEO program 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 minorities and women.

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 minorities and women 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 minorities and women. To meet this requirement, the contractor will identify sources of potential minority group employees, and establish with such identified sources procedures whereby minority and women 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, the contractor is expected to observe the provisions of that agreement to the extent that the system meets the contractor's compliance with EEO contract provisions. Where implementation of such an agreement has the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Federal nondiscrimination provisions.

c. The contractor will encourage its present employees to refer minorities and women as applicants for employment. Information and procedures with regard to referring such 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 its 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 their avenues of appeal.

6. Training and Promotion:

a. The contractor will assist in locating, qualifying, and increasing the skills of minorities and women who are

applicants for employment or current employees. Such efforts should be aimed at developing full journey level status employees in the type of trade or job classification involved.

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. In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision. The contracting agency may reserve training positions for persons who receive welfare assistance in accordance with 23 U.S.C. 140(a).

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 employees who are minorities and women 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 good faith efforts to obtain the cooperation of such unions to increase opportunities for minorities and women. 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 good faith efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minorities and women for membership in the unions and increasing the skills of minorities and women so that they may qualify for higher paying employment.

b. The contractor will use good faith 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 contracting agency 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 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 minorities and women. The failure of a union to provide sufficient referrals (even though it is obligated to provide exclusive referrals under the terms of a collective bargaining agreement) does not relieve the contractor from the requirements of this paragraph. 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 contracting agency.

8. Reasonable Accommodation for Applicants / Employees with Disabilities: The contractor must be familiar

with the requirements for and comply with the Americans with Disabilities Act and all rules and regulations established there under. Employers must provide reasonable accommodation in all employment activities unless to do so would cause an undue hardship.

9. 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. The contractor shall take all necessary and reasonable steps to ensure nondiscrimination in the administration of this contract.

a. The contractor shall notify all potential subcontractors and suppliers and lessors of their EEO obligations under this contract.

b. The contractor will use good faith efforts to ensure subcontractor compliance with their EEO obligations.

10. Assurance Required by 49 CFR 26.13(b):

a. The requirements of 49 CFR Part 26 and the State DOT's U.S. DOT-approved DBE program are incorporated by reference.

b. The contractor 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 contracting agency deems appropriate.

11. 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 the date of the final payment to the contractor for all contract work and shall be available at reasonable times and places for inspection by authorized representatives of the contracting agency and the FHWA.

a. The records kept by the contractor shall document the following:

(1) The number and work hours 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; and

(3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minorities and women;

b. The contractors and subcontractors will submit an annual report to the contracting agency 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](#). The staffing data should represent the project work force on board in all or any part of the last payroll period preceding the end of July. If on-the-job training is being required by special provision, the contractor

will be required to collect and report training data. The employment data should reflect the work force on board during all or any part of the last payroll period preceding the end of July.

III. NONSEGREGATED FACILITIES

This provision is applicable to all Federal-aid construction contracts and to all related construction subcontracts of \$10,000 or more.

The contractor must ensure that facilities provided for employees are provided in such a manner that segregation on the basis of race, color, religion, sex, or national origin cannot result. The contractor may neither require such segregated use by written or oral policies nor tolerate such use by employee custom. The contractor's obligation extends further to ensure that its employees are not assigned to perform their services at any location, under the contractor's control, where the facilities are segregated. The term "facilities" includes waiting rooms, work areas, restaurants and other eating areas, time clocks, restrooms, washrooms, locker rooms, and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing provided for employees. The contractor shall provide separate or single-user restrooms and necessary dressing or sleeping areas to assure privacy between sexes.

IV. DAVIS-BACON AND RELATED ACT PROVISIONS

This section is applicable to all Federal-aid construction projects exceeding \$2,000 and to all related subcontracts and lower-tier subcontracts (regardless of subcontract size). The requirements apply to all projects located within the right-of-way of a roadway that is functionally classified as Federal-aid highway. This excludes roadways functionally classified as local roads or rural minor collectors, which are exempt. Contracting agencies may elect to apply these requirements to other projects.

The following provisions are from the U.S. Department of Labor regulations in 29 CFR 5.5 "Contract provisions and related matters" with minor revisions to conform to the FHWA-1273 format and FHWA program requirements.

1. Minimum wages

a. All laborers and mechanics 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 issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions

of paragraph 1.d. of this section; also, 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 29 CFR 5.5(a)(4). 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. The wage determination (including any additional classification and wage rates conformed under paragraph 1.b. of this section) and the Davis-Bacon poster (WH-1321) 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.

b.(1) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(ii) The classification is utilized in the area by the construction industry; and

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(2) If the contractor and the laborers and mechanics to be employed in the classification (if known), 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 Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The 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.

(3) In the event the contractor, the laborers or mechanics to be employed in the 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. The Wage and Hour 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.

(4) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs 1.b.(2) or 1.b.(3) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

c. 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 shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

d. If the contractor does not make payments to a trustee or other third person, the contractor may consider as 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.

2. Withholding

The contracting agency shall upon its own action or upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor 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, so 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 contracting agency 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.

3. Payrolls and basic records

a. Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of 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. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) 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 shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

b.(1) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the contracting agency. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at <http://www.dol.gov/esa/whd/forms/wh347instr.htm> or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the contracting agency for transmission to the State DOT, the FHWA or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the contracting agency..

(2) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(i) That the payroll for the payroll period contains the information required to be provided under §5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under §5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(ii) That each 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 Regulations, 29 CFR part 3;

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(3) 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 3.b.(2) of this section.

(4) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

c. The contractor or subcontractor shall make the records required under paragraph 3.a. of this section available for inspection, copying, or transcription by authorized representatives of the contracting agency, the State DOT, the FHWA, or the Department of Labor, 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 FHWA may, after written notice to the contractor, the contracting agency or the State DOT, take such action 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.

4. Apprentices and trainees

a. Apprentices (programs of the USDOL).

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 U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or 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 Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice.

The allowable ratio of apprentices to journeymen 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 worker 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 on 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 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's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed.

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 journeymen 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 determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination.

In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

b. Trainees (programs of the USDOL).

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 U.S. Department of Labor, Employment and Training Administration.

The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration.

Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman 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 wage rate on the wage determination which provides for less than full fringe benefits for apprentices. 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.

In the event the Employment and Training Administration withdraws approval of a training program, the contractor 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. Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

d. 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.

5. Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

6. Subcontracts. The contractor or subcontractor shall insert Form FHWA-1273 in any subcontracts and also require the subcontractors to include Form FHWA-1273 in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

7. Contract termination; debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

8. Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

9. Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 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 U.S. Department of Labor, or the employees or their representatives.

10. Certification of eligibility.

a. By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

b. No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

c. The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

V. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT

The following clauses apply to any Federal-aid construction contract in an amount in excess of \$100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by 29 CFR 5.5(a) or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

1. Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

2. Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (1.) of this section, the contractor and any subcontractor responsible therefor shall be liable for the 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 or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (1.) of this section, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (1.) of this section.

3. Withholding for unpaid wages and liquidated damages. The FHWA or the contracting agency shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys 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 (2.) of this section.

4. Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (1.) through (4.) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (1.) through (4.) of this section.

VI. SUBLETTING OR ASSIGNING THE CONTRACT

This provision is applicable to all Federal-aid construction contracts on the National Highway System.

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 contracting agency. 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 635.116).

a. The term "perform work with its own organization" refers to workers employed or leased 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 or lower tier subcontractor, agents of the prime contractor, or any other assignees. The term may include payments for the costs of hiring leased employees from an employee leasing firm meeting all relevant Federal and State regulatory requirements. Leased employees may only be included in this term if the prime contractor meets all of the following conditions:

(1) the prime contractor maintains control over the supervision of the day-to-day activities of the leased employees;

(2) the prime contractor remains responsible for the quality of the work of the leased employees;

(3) the prime contractor retains all power to accept or exclude individual employees from work on the project; and

(4) the prime contractor remains ultimately responsible for the payment of predetermined minimum wages, the submission of payrolls, statements of compliance and all other Federal regulatory requirements.

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 or propose 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 VI 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 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 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 contracting agency has assured that each subcontract is

evidenced in writing and that it contains all pertinent provisions and requirements of the prime contract.

5. The 30% self-performance requirement of paragraph (1) is not applicable to design-build contracts; however, contracting agencies may establish their own self-performance requirements.

VII. SAFETY: ACCIDENT PREVENTION

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

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 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. 3704).

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.3704).

VIII. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

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, Form FHWA-1022 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:

18 U.S.C. 1020 reads as follows:

"Whoever, being an officer, agent, or employee of the United States, or of 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 under this title or imprisoned not more than 5 years or both."

IX. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

By submission of this bid/proposal or the execution of this contract, or subcontract, as appropriate, the bidder, proposer, Federal-aid construction contractor, or subcontractor, as appropriate, will be deemed to have stipulated as follows:

1. That any person who is or will be utilized in the performance of this contract is not prohibited from receiving an award due to a violation of Section 508 of the Clean Water Act or Section 306 of the Clean Air Act.
2. That the contractor agrees to include or cause to be included the requirements of paragraph (1) of this Section X in every subcontract, and further agrees to take such action as the contracting agency may direct as a means of enforcing such requirements.

X. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

This provision is applicable to all Federal-aid construction contracts, design-build contracts, subcontracts, lower-tier subcontracts, purchase orders, lease agreements, consultant contracts or any other covered transaction requiring FHWA approval or that is estimated to cost \$25,000 or more – as defined in 2 CFR Parts 180 and 1200.

1. Instructions for Certification – First Tier Participants:

- a. By signing and submitting this proposal, the prospective first tier 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 first tier 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 first tier 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 contracting agency determined to enter into this transaction. If it is later determined that the prospective participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the contracting agency may terminate this transaction for cause of default.

d. The prospective first tier participant shall provide immediate written notice to the contracting agency to whom this proposal is submitted if any time the prospective first tier 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," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180 and 1200. "First Tier Covered Transactions" refers to any covered transaction between a grantee or subgrantee of Federal funds and a participant (such as the prime or general contract). "Lower Tier Covered Transactions" refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). "First Tier Participant" refers to the participant who has entered into a covered transaction with a grantee or subgrantee of Federal funds (such as the prime or general contractor). "Lower Tier Participant" refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

f. The prospective first 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 entering into this transaction.

g. The prospective first tier 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 Transactions," provided by the department or contracting agency, entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the \$25,000 threshold.

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 is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the Excluded Parties List System website (<https://www.epls.gov/>), which is compiled by the General Services Administration.

i. Nothing contained in the foregoing shall be construed to require the establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of the prospective 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.

2. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion – First Tier Participants:

a. The prospective first tier participant certifies to the best of its knowledge and belief, that it and its principals:

(1) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency;

(2) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment 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;

(3) 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 (a)(2) of this certification; and

(4) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

b. Where the prospective 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 Participants:

(Applicable to all subcontracts, purchase orders and other lower tier transactions requiring prior FHWA approval or estimated to cost \$25,000 or more - 2 CFR Parts 180 and 1200)

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," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180 and 1200. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations. "First Tier Covered Transactions" refers to any covered transaction between a grantee or subgrantee of Federal funds and a participant (such as the prime or general contract). "Lower Tier Covered Transactions" refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). "First Tier Participant" refers to the participant who has entered into a covered transaction with a grantee or subgrantee of Federal funds (such as the prime or general contractor). "Lower Tier Participant" refers to any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

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 exceeding the \$25,000 threshold.

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 is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the Excluded Parties List System website (<https://www.epls.gov/>), which is compiled by the General Services Administration.

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 Participants:

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 participating in covered transactions 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.

XI. CERTIFICATION REGARDING USE OF CONTRACT FUNDS FOR LOBBYING

This provision is 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 its bid or proposal that the participant 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.

Replace "Contract" in the 3rd paragraph of section 8-1.02D(2) with:

10-19-12

work

Replace "Contract" in item 9 in the list in the 4th paragraph of section 8-1.02D(4) with:

10-19-12

work

Replace "Contract completion" in the 4th paragraph of section 8-1.02D(6) with:

10-19-12

work completion

Replace "Contract working days" in the 4th paragraph of section 8-1.02D(6) with:

10-19-12

original working days

Delete items 1.3 and 1.4 in the list in the 1st paragraph of section 8-1.02D(10).

04-20-12

Replace the last paragraph of section 8-1.04B with:

10-19-12

The Department does not adjust time for starting before receiving notice of Contract approval.

Replace the 1st paragraph of section 8-1.05 with:

10-19-12

Contract time starts on the last day specified to start job site activities in section 8-1.04 or on the day you start job site activities, whichever occurs first.

Replace the 2nd paragraph of section 8-1.05 with:

10-19-12

Complete the work within the Contract time.

Delete "unless the Contract is suspended for reasons unrelated to your performance" in the 4th paragraph of section 8-1.05.

10-19-12

Replace the headings and paragraphs in section 8-1.06 with:

10-19-12

The Engineer may suspend work wholly or in part due to conditions unsuitable for work progress. Provide for public safety and a smooth and unobstructed passageway through the work zone during the suspension as specified under sections 7-1.03 and 7-1.04. Providing the passageway is force account work. The Department makes a time adjustment for the suspension due to a critical delay.

The Engineer may suspend work wholly or in part due to your failure to (1) fulfill the Engineer's orders, (2) fulfill a Contract part, or (3) perform weather-dependent work when conditions are favorable so that weather-related unsuitable conditions are avoided or do not occur. The Department may provide for a

Add to the end of section 9-1.04A:

10-19-12

For nonsubcontracted work paid by force account for a contract with a TRO bid item, the markups are those shown in the following table instead of those specified in sections 9-1.04B–D:

| Cost | Percent markup |
|------------------|----------------|
| Labor | 30 |
| Materials | 10 |
| Equipment rental | 10 |

Delete ", Huntington Beach," in the 3rd paragraph of section 9-1.07A.

04-20-12

Replace the formula in section 9-1.07B(2) with:

04-20-12

$$Qh = HMATT \times Xa$$

Replace "weight of dry aggregate" in the definition of the variable Xa in section 9-1.07B(2) with:

04-20-12

total weight of HMA

Replace the formula in section 9-1.07B(3) with:

04-20-12

$$Qrh = RHMATT \times 0.80 \times Xarb$$

Replace "weight of dry aggregate" in the definition of the variable $Xarb$ in section 9-1.07B(3) with:

04-20-12

total weight of rubberized HMA

Replace the heading of section 9-1.07B(4) with:

04-20-12

Hot Mix Asphalt with Modified Asphalt Binder

Add between "in" and "modified" in the introductory clause of section 9-1.07B(4):

04-20-12

HMA with

Replace the formula in section 9-1.07B(4) with:

04-20-12

$$Qmh = MHMATT \times [(100 - Xam) / 100] \times Xmab$$

Replace "weight of dry aggregate" in the definition of the variable $Xmab$ in section 9-1.07B(4) with:

04-20-12

total weight of HMA

Replace the formula in section 9-1.07B(5) with:

04-20-12

$$Qrap = HMATT \times Xaa$$

Replace "weight of dry aggregate" in the definitions of the variables *Xaa* and *Xfa* in section 9-1.07B(5) with:

04-20-12

total weight of HMA

Add after the variable definitions in section 9-1.07B(9):

04-20-12

The quantity of extender oil is included in the quantity of asphalt.

Replace the headings and paragraphs in section 9-1.11 with:

10-19-12

9-1.11A General

Section 9-1.11 applies if a bid item for time-related overhead is included in the Contract. If a bid item for time-related overhead is included, you must exclude the time-related overhead from every other bid item price.

9-1.11B Payment Quantity

The TRO quantity does not include the number of working days to complete plant establishment work.

For a contract with a TRO lump sum quantity on the Bid Item List, the Department pays you based on the following conversions:

1. LS unit of measure is replaced with WDAY
2. Lump sum quantity is replaced with the number of working days bid
3. Lump sum unit price is replaced with the item total divided by the number of working days bid

9-1.11C Payment Inclusions

Payment for the TRO bid item includes payment for time-related field- and home-office overhead for the time required to complete the work.

The field office overhead includes time-related expenses associated with the normal and recurring construction activities not directly attributed to the work, including:

1. Salaries, benefits, and equipment costs of:
 - 1.1. Project managers
 - 1.2. General superintendents
 - 1.3. Field office managers
 - 1.4. Field office staff assigned to the project
2. Rent
3. Utilities
4. Maintenance
5. Security
6. Supplies
7. Office equipment costs for the project's field office

The home-office overhead includes the fixed general and administrative expenses for operating your business, including:

1. General administration

2. Insurance
3. Personnel and subcontract administration
4. Purchasing
5. Accounting
6. Project engineering and estimating

Payment for the TRO bid item does not include payment for:

1. The home-office overhead expenses specifically related to:
 - 1.1. Your other contracts or other businesses
 - 1.2. Equipment coordination
 - 1.3. Material deliveries
 - 1.4. Consultant and legal fees
2. Non-time-related costs and expenses such as mobilization, licenses, permits, and other charges incurred once during the Contract
3. Additional overhead involved in incentive/disincentive provisions to satisfy an internal milestone or multiple calendar requirements
4. Additional overhead involved in performing additional work that is not a controlling activity
5. Overhead costs incurred by your subcontractors of any tier or suppliers

9-1.11D Payment Schedule

For progress payments, the total work completed for the TRO bid item is the number of working days shown for the pay period on the *Weekly Statement of Working Days*.

For progress payments, the Department pays a unit price equal to the lesser of the following amounts:

1. Price per working day as bid or as converted under section 9-1.11B.
2. 20 percent of the total bid divided by the number of original working days

For a contract without plant establishment work, the Department pays you the balance due of the TRO item total as specified in section 9-1.17B.

For a contract with plant establishment work, the Department pays you the balance due of the TRO item total in the 1st progress payment after all non-plant establishment work is completed.

9-1.11E Payment Adjustments

The 3rd paragraph of section 9-1.17C does not apply.

The Department does not adjust the unit price for an increase or decrease in the TRO quantity except as specified in section 9-1.11E.

Section 9-1.17D(2)(b) does not apply except as specified for the audit report below.

If the TRO bid item quantity exceeds 149 percent of the quantity shown on the Bid Item List or as converted under section 9-1.11B, the Engineer may adjust or you may request an adjustment of the unit price for the excess quantity. For the adjustment, submit an audit report within 60 days of the Engineer's request. The report must be prepared as specified for an audit report for an overhead claim in section 9-1.17D(2)(b).

Within 20 days of the Engineer's request, make your financial records available for an audit by the State for the purpose of verifying the actual rate of TRO described in your audit. The actual rate of TRO described is subject to the Engineer's authorization.

The Department pays the authorized actual rate for TRO in excess of 149 percent of the quantity shown on the Bid Item List or as converted under section 9-1.11B.

The Department pays for 1/2 the cost of the report; the Contractor pays for the other 1/2. The cost is determined under section 9-1.05.

Replace the paragraphs of section 9-1.16D with:

07-19-13

9-1.16D(1) General

Section 9-1.16D applies if a bid item for mobilization is shown on the Bid Item List.

Payments for mobilization made under section 9-1.16D are in addition to the partial payments made under Pub Cont Code § 10261.

Section 9-1.16D(2) applies unless the Contract includes a special provision for section 9-1.16D(1) that specifies section 9-1.16D(3) applies.

11-15-13

9-1.16D(2) Mobilization for Projects Except for Those Over Water Requiring Marine Access

07-19-13

The Department makes partial payments for mobilization under Pub Cont Code § 10264(a) except the amount of work completed does not include the amount earned for mobilization. The partial payment amount is reduced by a prorated amount bid in excess of the maximum allowed under Pub Cont Code § 10264(a)(5).

The Department pays the item total for mobilization in excess of the maximum allowed under Pub Cont Code § 10264(a)(5) in the 1st payment after Contract acceptance.

9-1.16D(3) Mobilization for Projects Over Water Requiring Marine Access

The Department makes partial payments for mobilization under Pub Cont Code § 10264(b) except the amount of work completed does not include the amount earned for mobilization. The partial payment amount is reduced by a prorated amount bid in excess of the maximum allowed under Pub Cont Code § 10264(b)(6).

The Department pays the item total for mobilization in excess of the maximum allowed under Pub Cont Code § 10264(b)(6) in the 1st payment after Contract acceptance.

10-19-12

Delete "revised Contract" in item 1 of the 1st paragraph of section 9-1.16E(2).

Replace "2014" in the 1st paragraph of section 9-1.16F with:

10-19-12

2020

Replace the 2nd paragraph of section 9-1.17C with:

10-19-12

Submit either a written acceptance of the proposed final estimate or a claim statement postmarked or hand delivered before the 31st day after receiving the proposed final estimate.

Add between "the" and "final estimate" in the 1st sentence in the 3rd paragraph of section 9-1.17C:

10-19-12

proposed

Replace the 1st sentence in the 6th paragraph of section 9-1.17D(2)(b) with:

07-19-13

The CPA's audit must be performed as an examination-level engagement under the attestation engagements in the *Government Auditing Standards* published by the Comptroller General of the United States.

AA

DIVISION II GENERAL CONSTRUCTION

10 GENERAL

04-19-13

Replace the headings and paragraphs in section 10 with:

04-19-13

10-1 GENERAL

10-1.01 GENERAL

Section 10 includes general specifications for general construction work.

10-1.02 WORK SEQUENCING

Before obliterating any traffic stripes, pavement markings, and pavement markers to be replaced at the same location, reference the stripes, markings, and markers. Include limits and transitions with control points to reestablish the new stripes, markings, and markers.

10-1.03 TIME CONSTRAINTS

Reserved

10-1.04 TRAINING AND MEETINGS

Training and meetings are held at times and locations you and the Engineer agree to.

10-1.05–10-1.10 RESERVED

10-2 SUSTAINABLE DESIGN REQUIREMENTS

10-2.01 GENERAL

10-2.01A General

Reserved

10-2.01B–10-2.01H Reserved

10-2.02 CALGREEN TIER 1

10-2.02A–10-2.02H Reserved

10-2.03 LEED

10-2.03A–10-2.03H Reserved

10-3–10-5 RESERVED

10-6 JOB SITE WATER CONTROL

10-6.01 GENERAL

Section 10-6 includes specifications for controlling water to provide a dry working area at the job site.

10-6.02 WATER-FILLED COFFERDAM

Reserved

10-6.03–10-6.10 RESERVED

10-7–10-20 RESERVED

AA

11 QUALITY CONTROL AND ASSURANCE

07-19-13

Replace section 11-2 with:

07-19-13

11-2 RESERVED

Replace the table in the 3rd paragraph of section 11-3.01A with:

07-19-13

| AWS code | Year of adoption |
|----------|------------------|
| D1.1 | 2010 |
| D1.3 | 2008 |
| D1.4 | 2011 |
| D1.5 | 2010 |
| D1.6 | 2007 |
| D1.8 | 2009 |

Replace "does" in the definition of "continuous inspection" in section 11-3.01B with:

07-19-13

do

Replace "gross nonconformance" and its definition in section 11-3.01B with:

07-19-13

gross nonconformance: Rejectable indications are present in more than 20 percent of the tested weld length.

Replace the introductory clause in the 1st paragraph of section 11-3.01C with:

07-19-13

Replace clause 6.1.3 of AWS D1.1, the 1st paragraph of clause 7.1.2 of AWS D1.4, and clause 6.1.2 of AWS D1.5 with:

Replace the 3rd paragraph of section 11-3.01C with:

07-19-13

For each inspection, including fit-up, WPS verification, and final weld inspection, the QC Inspector must confirm and document compliance with the specifications, AWS welding codes, and any referenced drawings.

Replace the paragraphs in section 11-3.01D with:

07-19-13

The Engineer has the authority to verify the qualifications or certifications of any welder, QC Inspector, or NDT personnel to specified levels by retests or other means determined by the Engineer. If welding will be performed without gas shielding, then qualification must also include welding without gas shielding.

Replace clause 6.14.6.1 of AWS D1.1, clause 7.8 of AWS D1.4, and clause 6.1.3.4 of AWS D1.5 with:

Personnel performing NDT must be qualified and certified under 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 must comply with or exceed the guidelines of the ASNT

Recommended Practice No. SNT-TC-1A. Individuals who perform NDT, review the results, and prepare the written reports must be one of the following:

1. Certified NDT Level II technicians
2. Level III technicians certified to perform the work of Level II technicians

Replace the heading and the 1st through 3rd paragraphs of section 11-3.01E with:

07-19-13

11-3.01E Weld Joint Details

If weld joint details proposed for use in the work are not prequalified under clause 3 of AWS D1.1 or figure 2.4 or 2.5 of AWS D1.5, submit the proposed WPS and the intended weld joint locations.

Upon authorization of the proposed joint detail locations and qualification of the proposed joint details, welders and welding operators using these details must weld an additional qualification test plate using the WPS variables and the weld joint detail to be used in production. The test plate must:

1. Have the maximum thickness to be used in production and a minimum length of 18 inches.
2. Be mechanically and radiographically tested. Mechanical and radiographic testing and acceptance criteria must comply with the applicable AWS codes.

If a nonprequalified weld joint configuration is proposed using a combination of WPSs for work welded under AWS D1.1, you may conduct a single test combining the WPSs to be used in production, if the essential variables, including weld bead placement, of each process are limited to those established in table 4.5 of AWS D1.1.

Replace the 1st paragraph of section 11-3.01F with:

07-19-13

Replace paragraph 3 of clause 6.26.3.2 of AWS D1.5 with:

3. If indications that exhibit these planar characteristics are present at scanning sensitivity, or other evidence exists to suggest the presence of transverse cracks, a more detailed evaluation of the discontinuity by other means must be performed (e.g., alternate UT techniques, RT, grinding, or gouging for visual inspection or MT of the excavated areas.). For welds that have transverse cracks, excavate the full length of the crack plus 2 inches of weld metal on each side adjacent to the crack and reweld.

Replace "section" in the 2nd paragraph of section 11-3.01F with:

07-19-13

clause

Replace the 1st paragraph of section 11-3.02A with:

07-19-13

Except for stud welding, section 11-3.02 applies to (1) work welded under sections 49, 52, 55, and 75-1.03E and (2) work in section 99 that must comply with an AWS welding code.

Replace the 4th through 6th paragraphs of section 11-3.02C(2) with:

07-19-13

Submit an amended welding QC plan or an addendum to the welding QC plan for any changes to:

1. WPSs
2. NDT firms
3. QC personnel or procedures

4. NDT personnel or procedures
5. Systems for tracking and identifying welds
6. Welding personnel

Allow 15 days for the Engineer's review of an amended welding QC plan or an addendum to the welding QC plan.

Submit 7 copies of each authorized QC plan and any authorized addendums. Make 1 copy available at each location where work is performed.

Replace the 1st paragraph of section 11-3.02C(3) with:

07-19-13

Submit a welding report within 7 days following the performance of any welding. The welding report must include:

1. Daily production log for welding for each day that welding is performed
2. Reports of all visual weld inspections and NDT performed, whether specified, additional, or informational
3. Radiographs and radiographic reports, and other required NDT reports
4. Summary of welding and NDT activities that occurred during the reporting period
5. Reports of each application of heat straightening
6. Summarized log listing the rejected lengths of weld by welder, position, process, joint configuration, and piece number
7. Documentation that you have:
 - 7.1. Evaluated all radiographs and radiograph reports and NDT and NDT reports
 - 7.2. Corrected all rejectable deficiencies and that all repaired welds have been reexamined using the required NDT and found acceptable
8. Reports or chart recordings of each application of any stress relieving used
9. Reports and chart recordings for any electroslag welding used

Add between "radiographic" and "envelopes" in the introductory clause in the 3rd paragraph of section 11-3.02C(3):

07-19-13

film

Delete the 3rd sentence in the 5th paragraph of section 11-3.02C(3).

07-19-13

Replace the introductory clause in the 1st paragraph of section 11-3.02D with:

07-19-13

Clauses 6.1.4.1 and 6.1.4.3 of AWS D1.1, the 2nd paragraph of clause 7.1.2 of AWS D1.4, clauses 6.1.3.1 through 6.1.3.3 of AWS D1.5, and clause 7.2.3 of AWS D1.8 are replaced with:

Replace items 1 and 2 in the list in the 2nd paragraph of section 11-3.02D with:

07-19-13

1. Work is welded at a permanent fabrication or manufacturing plant that is certified under the AISC Certification Program for Steel Bridge Fabricators, Intermediate Bridges, and Fracture-Critical Member endorsement if required.
2. Structural steel for building construction work is performed at a permanent fabrication or manufacturing plant that is certified under the AISC Quality Certification Program, Category STD, Standard for Steel Building Structures.

Replace "project" in the 4th paragraph of section 12-3.02C with:

10-19-12

work

Add after "Display" in item 4 in the list in the 2nd paragraph of section 12-3.03B:

04-19-13

or Alternating Diamond

Replace "project" in the 3rd paragraph of section 12-3.07C with:

10-19-12

work

Add to section 12-3:

07-19-13

12-3.18 AUTOMATED WORK ZONE INFORMATION SYSTEM

Reserved

12-3.19–12-3.25 RESERVED

Replace the 7th through 9th paragraphs of section 12-4.02A with:

07-19-13

If pedestrian traffic is allowed to pass through construction areas, provide a temporary pedestrian facility through the construction areas within the highway. Include protective overhead covering as necessary to ensure protection from falling objects and drippings from overhead structures.

At locations where pedestrian openings through falsework are required, provide a temporary pedestrian facility with protective overhead covering during all bridge construction activities.

Temporary pedestrian facilities must comply with section 12-7.

If an activity requires a closure of a walkway, another walkway must be made available nearby, off of the traveled way.

07-19-13

Delete the 12th paragraph of section 12-4.02A.

Replace section 12-4.03 with:

07-19-13

12-4.03 CLOSURE SCHEDULES AND CONDITIONS

12-4.03A General

Submit closure schedule requests and closure schedule amendments using LCS to show the locations and times of the requested closures.

The Department provides LCS training. Request the LCS training at least 30 days before submitting the 1st lane closure request. The Department provides the training within 15 days after your request. The training may be web based.

Except for web-based training, the training is held at a time and location you and the Engineer agree to.

For web-based training, the Engineer provides you the website address to access the training.

Within 5 business days after completion of the training, the Department provides LCS accounts and user identifications to your assigned, trained representatives.

Each representative must maintain a unique password and current user information in the LCS.

12-4.03B Closure Schedules

Every Monday by noon, submit a closure schedule request of planned closures for the next week period. The next week period is defined as Sunday noon through the following Sunday noon.

Submit a closure schedule request not less than 25 days and not more than 125 days before the anticipated start of any activity that reduces:

1. Horizontal clearances of traveled ways, including shoulders, to 2 lanes or less due to activities such as temporary barrier placement and paving
2. Vertical clearances of traveled way, including shoulders, due to activities such as pavement overlays, overhead sign installation, falsework, or girder erection

Submit closure schedule amendments, including adding additional closures, by noon at least 3 business days before a planned closure.

Cancel closure requests using LCS at least 48 hours before the start time of the closure.

You will be notified through LCS of unauthorized closures or closures that require coordination with other parties as a condition for authorization.

The Engineer may reschedule a closure cancelled due to unsuitable weather.

If a closure is not opened to traffic by the specified time, suspend work. No further closures are allowed until the Engineer has reviewed and authorized a work plan submitted by you that ensures that future closures will be opened to traffic by the specified time. Allow 2 business days for review of your proposed work plan. The Department does not compensate you for your losses due to the suspension of work resulting from the late opening of closures.

Notify the Engineer of delays in your activities caused by:

1. Your closure schedule request being denied although your requested closures are within the specified time frame allowed for closures. The Department does not compensate you for your losses due to amendments to the closure schedule that are not authorized.
2. Your authorized closure being denied.

If you are directed to remove a closure before the time designated in the authorized closure schedule, you will be compensated for the delay.

12-4.03C Contingency Plan

Section 12-4.03C applies if a contingency plan is specified in the special provisions or if a contingency plan is requested.

If a contingency plan is requested, submit the contingency plan within 1 business day of the request.

The contingency plan must identify the activities, equipment, processes, and materials that may cause a delay in the opening of a closure to traffic. The plan must include:

1. List of additional or alternate equipment, materials, or workers necessary to ensure continuing activities and on-time opening of closures if a problem occurs. If the additional or alternate equipment, materials, or workers are not on site, specify their location, the method for mobilizing these items, and the required time to complete mobilization.
2. General time-scaled logic diagram displaying the major activities and sequence of planned operations. For each activity, identify the critical event when the contingency plan will be activated.

Based on the Engineer's review, additional materials, equipment, workers, or time to complete activities from that specified in the contingency plan may be required.

Add to section 13-1.01A:

11-15-13

Comply with the Department's general permit issued by the State Water Resources Control Board for *Order No. 2012-0011-DWQ, NPDES No. CAS000003, National Pollutant Discharge Elimination System (NPDES) Permit, Statewide Storm Water Permit and Waste Discharge Requirements (WDRs) for the State of California, Department of Transportation (Caltrans)*. The Department's general permit governs stormwater and nonstormwater discharges from the Department's properties, facilities, and activities. The Department's general permit may be viewed at the Web site for the State Water Resources Control Board, Storm Water Program, Caltrans General Permit.

Add to the list in the 1st paragraph of section 13-1.01D(3)(b):

10-21-11

3. Have completed SWRCB approved QSD training and passed the QSD exam

Add to the list in the 2nd paragraph of section 13-1.01D(3)(b):

10-21-11

3. Have completed SWRCB approved QSP training and passed the QSP exam

Replace "NEL violation" in item 3.6.2 in the list in the 1st paragraph of section 13-1.01D(3)(c) with:

04-19-13

receiving water monitoring trigger

Replace the 1st paragraph in section 13-2.01B with:

04-19-13

Within 7 days after Contract approval, submit 2 copies of your WPCP for review. Allow 5 business days for review.

After the Engineer authorizes the WPCP, submit an electronic copy and 3 printed copies of the authorized WPCP.

If the RWQCB requires review of the authorized WPCP, the Engineer submits the authorized WPCP to the RWQCB for its review and comment. If the Engineer orders changes to the WPCP based on the RWQCB's comments, amend the WPCP within 3 business days.

Replace the 1st paragraph in section 13-3.01B(2)(a) with:

04-19-13

Within 15 days of Contract approval, submit 3 copies of your SWPPP for review. The Engineer provides comments and specifies the date when the review stopped if revisions are required. Change and resubmit a revised SWPPP within 15 days of receiving the Engineer's comments. The Department's review resumes when a complete SWPPP has been resubmitted.

When the Engineer authorizes the SWPPP, submit an electronic copy and 4 printed copies of the authorized SWPPP.

If the RWQCB requires review of the authorized SWPPP, the Engineer submits the authorized SWPPP to the RWQCB for its review and comment. If the Engineer requests changes to the SWPPP based on the RWQCB's comments, amend the SWPPP within 10 days.

Replace "NELs" in item 3.1 in the 3rd paragraph of section 13-3.01B(2)(a) with:

04-19-13

receiving water monitoring triggers

Replace section 13-3.01B(6)(c) with:

04-19-13

13-3.01B(6)(c) Receiving Water Monitoring Trigger Report

Whenever a receiving water monitoring trigger is exceeded, notify the Engineer and submit a receiving water monitoring trigger report within 48 hours after conclusion of a storm event. The report must include:

1. Field sampling results and inspections, including:
 - 1.1. Analytical methods, reporting units, and detection limits
 - 1.2. Date, location, time of sampling, visual observation and measurements
 - 1.3. Quantity of precipitation from the storm event
2. Description of BMPs and corrective actions

Replace "NEL" in the 6th paragraph of section 13-3.01C(1) with:

04-19-13

receiving water monitoring trigger

Replace section 13-3.01C(3) with:

04-19-13

13-3.01C(3) Receiving Water Monitoring Trigger

For a risk level 3 project, receiving water monitoring triggers must comply with the values shown in the following table:

Receiving Water Monitoring Trigger

| Parameter | Test method | Detection limit (min) | Unit | Value |
|-----------|--|-----------------------|------|--|
| pH | Field test with calibrated portable instrument | 0.2 | pH | Lower limit = 6.0 Upper limit = 9.0 |
| Turbidity | Field test with calibrated portable instrument | 1 | NTU | 500 NTU max |

The storm event daily average for storms up to the 5-year, 24-hour storm must not exceed the receiving water monitoring trigger for turbidity.

The daily average sampling results must not exceed the receiving water monitoring trigger for pH.

04-19-13

Delete "and NELs are violated" in the 3rd paragraph of section 13-3.03C.

Replace "working days" at each occurrence in section 13-3.04 with.

10-19-12

original working days

Delete the 1st sentence in the 2nd paragraph of section 13-4.03C(3).

04-19-13

Add between the 2nd and 3rd paragraphs of section 13-4.03C(3):

04-19-13

Manage stockpiles by implementing water pollution control practices on:

1. Active stockpiles before a forecasted storm event
2. Inactive stockpiles according to the WPCP or SWPPP schedule

Replace the paragraph in section 13-4.04 with:

04-20-12

Not Used

Replace "20-7.02D(6)" in section 13-5.02C with:

07-19-13

20-5.03E

Delete "or stockpile" in the 3rd paragraph of section 13-5.02F.

10-19-12

Replace "20-7.03I(10)" in section 13-5.03C with:

07-19-13

20-5.03E(3)

Replace section 13-5.03F with:

04-20-12

13-5.03F Reserved

Delete "or stockpile" in item 1 in the list in the 1st paragraph of section 13-5.03K.

10-19-12

Delete the 3rd paragraph of section 13-5.03K.

10-19-12

Replace the 2nd sentence in the 1st paragraph of section 13-9.01A with:

10-19-12

You may use any of the following systems for temporary concrete washout:

1. Temporary concrete washout facility
2. Portable temporary concrete washout
3. Temporary concrete washout bin

Replace the 2nd paragraph of section 13-9.01B with:

10-19-12

Retain and submit an informational submittal for records of disposed concrete waste.

15-2.02B(5)(b) Saw Cuts

Saw cut using a diamond blade and make cuts perpendicular to the pavement surface. Saw cutting is not required where concrete pavement is adjacent to asphalt concrete pavement.

Saw cut (1) no more than 2 days before removing pavement and (2) such that traffic will not dislodge any pavement piece or segment. Saw cut perpendicular to the traveled way except you may cut parallel or diagonal to the traveled way when removing the pavement during the same lane closure as the saw cutting.

You may make additional saw cuts within the sawed outline.

Saw cuts must be the full depth of the pavement unless otherwise shown.

Saw cut at longitudinal and transverse joints to remove entire slabs. For partial-slab areas, the Engineer determines the exact saw-cut locations.

15-2.02B(5)(c) Reserved

15-2.02B(6) Reserved

15-2.02B(7) Payment

Reserved

Replace section 15-2.02G with:

07-19-13

15-2.02G Remove Guardrail

Where removing guardrail, remove any concrete anchors and steel foundation tubes.

Replace the 1st paragraph of section 15-2.02K with:

07-19-13

Box culverts, concrete pipes, inlets, headwalls, and endwalls must be completely removed if any portion of these structures is (1) within 3 feet of the grading plane in excavation areas, (2) within 1 foot of original ground in embankment areas, or (3) shown to be removed.

Replace "Metal beam guard railing" in the table in the 2nd paragraph of section 15-2.03A(2)(a) with:

07-19-13

Guardrail

Replace the heading of section 15-2.03B with:

07-19-13

Salvage Guardrail

Replace the heading of section 15-2.04D with:

07-19-13

Reconstruct Guardrail

Replace section 15-2.09D with:

07-19-13

15-2.09D Reserved

Replace the 4th paragraph of section 15-2.10B with:

01-18-13

Instead of using new materials similar in character to those in the existing structure, you may use raising devices to adjust a manhole to grade. Before starting paving work, measure and fabricate raising devices. Raising devices must:

1. Comply with the specifications for section 75 except that galvanizing is not required
2. Have a shape and size that matches the existing frame
3. Be match marked by painting identification numbers on the device and corresponding structure
4. Result in an installation that is equal to or better than the existing one in stability, support, and nonrocking characteristics
5. Be fastened securely to the existing frame without projections above the surface of the road or into the clear opening

Replace the heading of section 15-2.10D with:

07-19-13

Adjust Guardrail

Replace the paragraphs of section 15-3.01 with:

07-19-13

Section 15-3 includes specifications for removing all or a portion of a concrete facility.

Concrete facilities include curbs, gutters, gutter depressions, sidewalks, driveways, slope paving, island paving, barriers, retaining walls, sound walls, minor structures, aprons, spillways, and dams.

Where broken-concrete slope protection is shown, use removed concrete for the construction of the broken-concrete slope protection.

Instead of disposing of removed concrete by removing it from the job site, you may dispose of it on the job site by one of the following methods:

1. Burying it in embankments at authorized locations. Removed concrete must be broken into pieces that can be readily handled and incorporated into embankments and placed at a depth of at least 3 feet below finished grade and slope lines. Concrete must not be buried in areas where piling is to be placed or within 10 feet of trees, pipelines, poles, buildings or other permanent objects or structures.
2. Placing it at authorized locations. The removed concrete must not present an unsightly appearance from the highway.

Replace the paragraph of section 15-3.02 with:

07-19-13

Not Used

Delete the 5th paragraph of section 15-3.03.

07-19-13

Add to the end of section 15-4.01A(2):

04-19-13

Allow 20 days for review of the bridge removal work plan.

Replace the 1st paragraph of section 15-5.01C(1) with:

10-19-12

Before starting deck rehabilitation activities, complete the removal of any traffic stripes, pavement markings, and pavement markers.

Replace the 2nd and 3rd paragraphs of section 15-5.01C(2) with:

10-19-12

Perform the following activities in the order listed:

1. Abrasive blast the deck surface with steel shot. Perform abrasive blasting after the removal of any unsound concrete and placement of any rapid setting concrete patches.
2. Sweep the deck surface.
3. Blow the deck surface clean using high-pressure air.

Replace the 2nd paragraph of section 15-5.01C(4) with:

10-19-12

Before removing asphalt concrete surfacing, verify the depth of the surfacing at the supports and midspans of each structure (1) in each shoulder, (2) in the traveled way, and (3) at the roadway crown, if a crown is present.

Delete "and concrete expansion dams" in the 3rd paragraph of section 15-5.01C(4).

04-19-13

Replace the 2nd paragraph of section 15-5.03A(2) with:

10-19-12

For a contract with less than 60 original working days, submit certificates of compliance for the filler material and bonding agents.

Replace "51-1.02C" in the 1st paragraph of section 15-5.03B with:

04-19-13

51-1.02F

Replace the 4th paragraph of section 15-5.03B with:

10-19-12

For a contract with less than 60 original working days, alternative materials must be authorized before use.

Add between the 5th and 6th paragraphs of section 15-5.03C:

10-19-12

The final surface finish of the patched concrete surface must comply with section 51-1.03F.

Delete the 4th paragraph of section 15-5.05C.

10-19-12

Replace "51-1.03F(5)" in the 3rd paragraph of section 15-5.06C(1) with:

51-1.01D(4)(b)

07-19-13

Replace "51-1.03E(5)" in the 5th paragraph of section 15-5.06C(1) with:

51-1.03F(5)

10-19-12

Delete the 9th paragraph of section 15-5.06C(1).

10-19-12

Delete the 15th paragraph of section 15-5.06C(1).

04-19-13

Add between the 18th and 19th paragraphs of section 15-5.06C(1):

Texture the polyester concrete surface before gelling occurs by longitudinal tining under 51-1.03F(5)(b)(iii), except do not perform initial texturing.

07-19-13

Replace section 15-5.06C(2) with:

15-5.06C(2) Reserved

04-19-13

Delete the 3rd paragraph of section 15-5.06D.

04-19-13

Replace the 1st paragraph in section 15-5.07B(4) with:

Payment for furnishing dowels is not included in the payment for core and pressure grout dowel.

10-19-12

Replace section 15-5.09 with:

04-19-13

15-5.09 POLYESTER CONCRETE EXPANSION DAMS

15-5.09A General

Section 15-5.09 includes specifications for constructing polyester concrete expansion dams.

Polyester concrete expansion dams must comply with the specifications for polyester concrete overlays in section 15-5.06, except a trial slab is not required.

Reinforcement must comply with section 52.

15-5.09B Materials

Not Used

15-5.09C Construction

For new asphalt concrete overlays, place the asphalt concrete overlay before starting polyester concrete activities. Saw cut and remove asphalt concrete at expansion dam locations.

For existing asphalt concrete overlays, remove expansion dams and asphalt concrete to the limits shown. Removing expansion dams must comply with section 15-4 except a bridge removal work plan is not required.

Where a portion of the asphalt concrete overlay is to remain, saw cut a 2-inch-deep neat line along the edge to remain in place before removing the asphalt concrete. Do not damage the existing surfacing to remain in place.

Prepare the deck surface under section 15-5.01C(2).

You may use a mechanical mixer to mix the polyester concrete for expansion dams. The mixer capacity must not exceed 9 cu ft unless authorized. Initiate the resin and thoroughly blend it immediately before mixing it with the aggregate. Mix the polyester concrete for at least 2 minutes before placing.

The application rate of methacrylate resin must be approximately 100 sq ft/gal.

You may place and finish expansion dams using hand methods.

Protect expansion dams from moisture, traffic, and equipment for at least 4 hours after finishing.

For expansion dams over 6 feet long, install 1/4-inch-wide joint material at 6-foot intervals across the width of the expansion dam. Joint material must be either expanded polyurethane or expanded polyethylene.

15-5.09D Payment

Not Used

Add to section 15-6.01A(3)(a):

07-19-13

Within 5 days of completing annular space grouting at a culvert, submit the grouting records.

Replace "41-1.01" in item 10.3 in the list in the 2nd paragraph of section 15-6.01A(3)(d) with:

07-19-13

41-2

Replace "41-1.02" in 1st paragraph of section 15-6.01B(2) with:

07-19-13

41-2

Replace the heading of section 15-6.04 with:

01-18-13

INVERT PAVING

Replace the 1st paragraph of section 15-6.13A(1) with:

07-19-13

Section 15-6.13 includes specifications for installing machine spiral wound PVC pipeliners directly into the culvert.

Replace the heading of section 15-6.13B with:

07-19-13

Machine Spiral Wound PVC Pipeliners, Grouted

For ground anchor walls, a wall zone is the entire wall unless otherwise specified in the special provisions.

Delete the 2nd sentence in the 4th paragraph of section 19-3.01A(3)(b).

01-20-12

Replace "90" in the paragraph of section 19-3.02G with:

90-1

01-18-13

Add to section 19-3.02:

19-3.02I Filter Fabric

Filter fabric must be Class A.

07-19-13

Replace the heading of section 19-3.03C with:

19-3.03B(4) Cofferdams

04-19-13

Replace the heading of section 19-3.03D with:

19-3.03B(5) Water Control and Foundation Treatment

04-19-13

Replace the 1st paragraph of section 19-3.03E(3) with:

Compact structure backfill behind lagging of soldier pile walls by hand tamping, mechanical compaction, or other authorized means.

01-20-12

Add to the end of section 19-3.03E(3):

If filter fabric is shown behind the lagging:

07-19-13

1. Immediately before placing the filter fabric, remove any loose or extraneous material and sharp objects from the surface to receive the filter fabric.
2. Handle and place the filter fabric under the manufacturer's instructions. Stretch, align, and place the fabric without wrinkling.
3. Stitch the adjacent borders of filter fabric or overlap the adjacent borders by 12 to 18 inches. If stitching the border, use yarn of a contrasting color. Yarn size and composition must be as recommended by the fabric manufacturer. Use 5 to 7 stitches per inch of seam.
4. Repair any damaged filter fabric by placing a piece of filter fabric large enough to cover the damaged area and comply with the overlapping or stitching requirements.

Replace the 2nd paragraph of section 19-3.03F with:

Do not backfill over or place material over slurry cement backfill until 4 hours after placement. When concrete sand is used as aggregate and the in-place material is free draining, you may start backfilling as soon as the surface water is gone.

01-20-12

Add between the 2nd and 3rd paragraphs of section 19-3.03K:

01-20-12

Before you excavate for the installation of ground anchors in a wall zone:

1. Complete stability testing
2. Obtain authorization of test data

Replace the 2nd sentence of the 7th paragraph of section 19-3.03K:

01-20-12

Stop construction in unstable areas until remedial measures have been taken. Remedial measures must be submitted and authorized.

Add between the 8th and 9th paragraphs of section 19-3.03K:

01-20-12

When your excavation and installation methods result in a discontinuous wall along any soil nail row, the ends of the structurally completed wall section must extend beyond the ends of the next lower excavation lift by a distance equal to twice the lift height. Maintain temporary slopes at the ends of each wall section to ensure slope stability.

Replace the 9th paragraph of section 19-3.03K:

01-20-12

Do not excavate to the next underlying excavation lift until the following conditions have been attained for the portion of the soil nail or ground anchor wall in the current excavation lift:

1. Soil nails or ground anchors are installed and grouted.
2. Reinforced shotcrete facing is constructed.
3. Grout and shotcrete have cured for at least 72 hours.
4. Specified tests are complete for that portion of wall and the results are authorized.
5. Soil nail facing anchorages are attached or ground anchors are locked off.

01-18-13

01-20-12

Replace the 2nd sentence in the 7th paragraph of section 19-3.04 with:

01-18-13

Structure excavation more than 0.5 foot from the depth shown is paid for as a work-character change if you request an adjustment or the Engineer orders an adjustment.

Replace "Contract completion time" in the 8th paragraph of section 19-6.03D with:

10-19-12

work completion date

Add to section 19:

01-18-13

19-10-19-20 RESERVED

AA

20 LANDSCAPE

11-15-13

Replace the headings and paragraphs in section 20 with:

07-19-13

20-1 GENERAL

20-1.01 GENERAL

20-1.01A Summary

Section 20-1 includes general specifications for performing landscaping.

If an irrigation system is to be installed in an existing planting area to be maintained, check for plant deficiencies under section 20-3.02A(4) before starting irrigation work.

Perform a functional test for each irrigation system under 20-2.01A(4)(d):

1. Before planting the plants
2. After planting the plants
3. Before the start of the plant establishment work

If a plant is to be transplanted or an irrigation component is to be relocated, transplant plant or protect irrigation components before performing other construction activities in the area.

Perform roadside clearing:

1. As required to prepare the job site for construction work
2. Until the start of the plant establishment work or Contract acceptance, whichever comes first

20-1.01B Definitions

Reserved

20-1.01C Submittals

At least 15 days before applying any pesticide, submit a copy of the licensed pest control adviser's recommendation.

At the end of each week, submit a report documenting the application of all pesticides as an informational submittal. Use form *Report of Chemical Spray Operations*.

Before mixing a pesticide, submit a copy of the registered label for the pesticide as an informational submittal. If unable to copy, allow the Engineer to read the label on the container.

20-1.01D Quality Control and Assurance

20-1.01D(1) General

Obtain a recommendation from a licensed pest control adviser for the use of all pesticides under the Food & Agri Code. The recommendation must include the pesticides to be used, rates of application, methods of application, and application areas.

The pesticide applicator must have an active and valid qualified applicator license or certificate from the Department of Pesticide Regulation.

20-1.01D(2) Progress Inspections

The Engineer will perform progress inspections before:

1. Cultivating work starts
2. Pressure testing of irrigation pipe on the supply side of control valves
3. Testing of low voltage conductors
4. Planting work starts
5. Completion of planting work

Notify the Engineer at least 4 business days before each inspection is required. Allow at least 3 business days for the Engineer's inspection.

Unless otherwise authorized, do not proceed with the next construction activity until the inspection has been completed and any required corrective work has been performed and authorized.

20-1.02 MATERIALS

20-1.02A General

Reserved

20-1.02B Water

Water available from an existing Department-owned facility within the project limits or an irrigation system to be installed under the Contract is furnished at no charge.

If water is not available, make arrangements for supplying water. Water must be of a quality that will promote plant growth.

20-1.02C Pesticides

Pesticides must comply with the Department of Pesticide Regulation.

Insecticide must be imidacloprid.

Rodenticides must be brodifacoum, bromadiolone, or diphacinone.

Do not use oil or pelleted forms of pesticides for weed control.

For weed control, use a pesticide with a photosensitive dye that produces a contrasting color when sprayed on the ground. The color must disappear between 2 to 3 days after being applied. The dye must not stain surfaces or injure plants or wildlife when applied at the manufacturer's recommended application rate.

20-1.03 CONSTRUCTION

20-1.03A General

Take precautions to prevent irrigation water from:

1. Wetting vehicles, pedestrians, and pavement
2. Eroding soil

Dispose of removed, pruned, and damaged vegetative material.

You may reduce removed vegetative material to chips with a maximum thickness of 1/2 inch and spread within the job site at locations determined by the Engineer. Chipped material must not be substituted for wood mulch, nor must the chipped material be placed within areas to receive wood mulch.

20-1.03B Pesticides

Notify the Engineer of pesticide application times at least 24 hours before each application.

Mix and apply pesticides under the requirements of the Department of Pesticide Regulation and the instructions on the pesticide product label.

Do not apply pesticides:

1. On Saturdays and holidays unless authorized
2. Whenever weather and wind conditions are unsuitable for application
3. Within the plant basin
4. On the foliage and woody parts of the plant

If a granular preemergent is used, it must be covered with mulch on the same work day. Do not apply granular preemergent in plant basins.

Do not apply preemergents:

1. To groundcover plants before the plants have been planted a minimum of 3 days and have been thoroughly watered
2. Within 18 inches of trees, shrubs, and seeded areas

20-1.03C Roadside Clearing

20-1.03C(1) General

Perform roadside clearing by:

1. Removing and disposing of trash and debris
2. Controlling the following pests:
 - 2.1. Rodents
 - 2.2. Insects
 - 2.3. Weeds
3. Removing existing plants as described

Control rodents by using rodenticides or traps.

20-1.03C(2) Remove Existing Plants

Remove existing plants as described. Removal of existing plants includes removing their stumps and roots 2 inches or larger in diameter to a minimum depth of 12 inches below finished grade. Backfill holes resulting from stump removal to finished grade with material obtained from adjacent areas.

If a plant is to be planted within existing groundcover area, remove existing groundcover from within an area 6 feet in diameter centered at each plant location.

20-1.03C(3) Weed Control

Control weeds by the use of pesticides, hand pulling, or mowing.

If pesticides are used to control weeds, apply pesticides before the weeds reach the seed stage of growth or exceed 4 inches in length, whichever occurs first. Do not use pesticides at cutting plant locations.

Where cuttings are to be planted, control weeds by hand pulling within an area 2 feet in diameter centered at each plant location.

If weeds are to be controlled by hand pulling, hand pull weeds before they reach the seed stage of growth or exceed 4 inches in length, whichever occurs first.

Where liner, plug, or seedling plants are to be planted 10 feet or more apart, control weeds by the use of pesticides or hand pulling within an area 2 feet in diameter centered at each plant location. Where liner, plug, or seedling plants are to be planted less than 10 feet apart, control weeds by the use of pesticides within the entire area.

Control weeds by mowing outside of mulched areas, plant basins, groundcover areas, and within areas to be seeded. Mowing must extend to the edges of pavement, dikes, curbs, sidewalks, walls, and fences.

If mowing is to be performed within areas to be seeded, perform mowing as needed until the start of the seeding operation specified in section 21.

Mowing must be performed before the weeds reach the seed stage of growth or exceed 6 inches in length, whichever occurs first. Mow weeds to a height of 3 inches.

20-1.03C(4) Disposal of Removed Groundcover, Weeds, and Mowed Material

Dispose of hand pulled weeds the same day they are pulled. Dispose of removed groundcover within 3 days.

Dispose of mowed material from the initial mowing. Disposal of material from subsequent mowing is not required.

20-1.03D Cultivation

Cultivation must be by mechanical methods and performed until the soil is in a loose condition to a minimum depth of 6 inches. Soil clods must not be larger than 2 inches in maximum dimension after cultivation.

The areas to be cultivated must extend 12 inches beyond the outer limit of each planting area requiring cultivation.

After initial cultivation, place soil amendment and fertilizer at specified rates.

Recultivate to thoroughly mix native soil and amendments.

Do not drive on cultivated areas after cultivation.

Planting areas that have been cultivated and become compacted must be recultivated.

Rocks and debris encountered during soil preparation in planting areas must be brought to the surface of the ground.

Remove rocks and debris as ordered. This work is change order work.

20-1.03E Weed Germination

Reserved

20-1.04 PAYMENT

Items paid for by area are measured parallel to the ground surface.

Planting areas that do not require cultivation but are within the cultivation areas will not be deducted.

20-2 IRRIGATION

20-2.01 GENERAL

20-2.01A General

20-2.01A(1) Summary

Section 20-2 includes specifications for installing irrigation systems.

The irrigation systems shown are diagrammatic.

20-2.01A(2) Definitions

Reserved

20-2.01A(3) Submittals

20-2.01A(3)(a) General

Submit shop drawings for the electrical components of the irrigation system except electrical service 30 days before installation. The drawings must:

1. Include schematic wiring diagrams showing wire sizes and routes between electrical components
2. Show conduit sizes
3. Bear the written approval of the controller manufacturer or the manufacturer's authorized agent
4. Be accompanied by:
 - 4.1. Colored wire and splice samples
 - 4.2. Manufacturer's descriptive and technical literature

After the work shown on the drawing is complete, submit 3 copies of the as-built shop drawings including any wire modifications for each controller installed.

For each controller, laminate and place in an envelope 1 copy of:

1. As-built schematic wiring diagram including wiring modifications
2. 11 by 17 inches as-built irrigation plan

The laminate must be clear, mat-finished plastic that is at least 10 mils thick. The envelope must be heavy-duty plastic.

Attach the envelope to the inside of the controller enclosure or cabinet door. If the door is not large enough to secure the envelope, submit the envelope and its contents.

20-2.01A(3)(b) Manufacturer's Instructions

Submit as an informational submittal the manufacturer's installation instructions 15 days before installing:

1. Couplings for conduits used for irrigation conduits
2. Plastic pipe and fittings
3. Solvent cement for plastic pipe and flexible hose
4. Sprinklers
5. Flow sensors

20-2.01A(3)(c) Maintenance and Operation Manuals

Before Contract acceptance, submit as an informational submittal a manufacturer's maintenance and operation manual for each type of controller installed.

20-2.01A(4) Quality Control and Assurance**20-2.01A(4)(a) General**

Reserved

20-2.01A(4)(b) Pressure Testing**20-2.01A(4)(b)(i) General**

Perform pressure testing for leakage on irrigation supply lines:

1. In the Engineer's presence
2. On business days between 8 a.m. and 5 p.m. unless authorized
3. Before backfilling supply line trenches
4. With irrigation system gate valves open
5. With open ends of the supply line and fittings plugged or capped

Notify the Engineer at least 48 hours before performing a pressure test.

Choose either Method A or B to test supply lines installed by trenching and backfilling and supply lines that are completely visible after installation.

All other supply lines, including those installed in the ground by methods other than trenching and backfilling must be tested by Method A.

Test irrigation supply line in conduit by Method A with the testing period modified to 0.5 hour and no allowable pressure drop.

20-2.01A(4)(b)(ii) Method A

Method A pressure testing procedures for leakage must comply with the following:

1. Pressure gauge must be calibrated from 0 to 200 psi in 5 psi increments and be accurate to within a tolerance of 2 psi.
2. Supply line must be filled with water and connected to a pressure gauge. Place the pipeline under a pressure of 125 psi. Remove the source of pressure and leave the line under the required pressure.
3. Test the supply line under the required pressure for a period of 1 hour. The pressure gauge must remain in place until each test period is complete.
4. Leaks that develop in the tested portion of the system must be located and repaired after each test period if a drop of more than 5 psi is indicated by the pressure gauge. After the leaks have been repaired, repeat the 1 hour pressure test until the drop in pressure is 5 psi or less.

If a system consists of a new supply line connected to an existing line, the new supply line must be isolated from the existing line and tested.

20-2.01A(4)(b)(iii) Method B

Method B pressure testing procedures for leakage must comply with the following:

1. Before any portion of the supply line on the upstream side of a control valve is backfilled, water must be turned on for that portion of the line and maintained at full pressure from the water source for a period not less than 8 consecutive hours after all air has been expelled from the line. Before any

portion of the supply line on the downstream side of the control valve is backfilled, perform the same test for a period not less than 1 hour.

2. Repair leaks that develop in the tested portion of the system. After the leaks have been repaired, repeat the pressure test until no leaks occur as determined by the Engineer.

20-2.01A(4)(c) Sprinkler Coverage Check

After installation of the sprinklers, check and adjust the entire sprinkler system for proper orientation and uniform coverage.

20-2.01A(4)(d) Irrigation System Functional Tests

The functional tests for each irrigation controller or group of controllers and associated irrigation system served by a single electric service point must consist of at least 1 complete cycle of operation. The Engineer determines the length of the cycle.

Notify the Engineer at least 10 days before performing each functional test.

20-2.01A(4)(e) Final Irrigation System Check

Perform the final check of the existing and new irrigation system between 20 and 30 days before Contract acceptance. The Engineer determines the length of the cycle.

Remote control valves connected to existing and new irrigation controllers must be checked for automatic operation when the controllers are in automatic mode.

20-2.01B Materials

20-2.01B(1) General

Use minor concrete for replacing removed concrete facilities.

HMA for replacing removed asphalt concrete surfacing and facilities must comply with section 39. You may use minor HMA if authorized.

20-2.01B(2) Garden Valves

Each garden valve must:

1. Be inverted nose type and of brass or bronze construction with female thread inlet
2. Have a replaceable seat washer, rising valve stem within a protective collar, and male thread hose outlet
3. Have a loose key handle

20-2.01B(3) Recycled Water Identification

Irrigation components used for recycled water must be manufactured or painted purple. Recycled water irrigation pipe and tubing must have a permanent label with the wording "CAUTION RECYCLED WATER" every 24 inches in 2 rows spaced approximately 180 degrees apart in the longitudinal direction of the pipe or tubing.

The recycled water warning sign must be a decal or a decal attached to a 1/16-inch thick aluminum plate or tag.

Each warning sign decal must:

1. Show the phrase "Recycled Water, Do Not Drink" and the drinking glass graphic symbol
2. Be UV fade and weather resistant and manufactured from flexible vinyl with or without mylar
3. Have a purple background, black text, and self-adhesive backing

Each warning tag must:

1. Show the phrase "RECYCLED WATER" and the drinking glass graphic symbol
2. Be UV fade and weather resistant
3. Be purple, double-sided, and manufactured from polyurethane
4. Have an integral neck attachment and attachment hole capable of withstanding 178 lb of pull-out resistance
5. Have hot-stamped black lettering

Posts and hardware for warning signs must comply with section 56-4.

Concrete sprinkler protectors used with recycled water must be painted purple.

20-2.01B(4) Location Markers

Location markers must be schedule 40 white PVC plastic pipe.

20-2.01B(5) Pull Boxes

Pull boxes must comply with section 86-2.06 and be no. 5 or larger unless otherwise shown. Pull boxes for low voltage conductors must not have side openings.

Pull box covers used solely for irrigation electrical service must be marked "IRRIGATION".

20-2.01B(6) Unions

Unions must be brass or malleable iron capable of withstanding the maximum required working pressure.

20-2.01B(7) Valve Boxes and Covers

Valve boxes must be precast concrete.

Covers must be:

1. Concrete, steel, or cast iron.
2. Marked "WATER" in cast-in letters not less than 1 inch high.
3. 1 piece, except 2 pieces are required when the weight of the valve box cover exceeds 35 lb.

The valve box covers must include a polyurethane label with the appropriate controller letter and station number as shown.

20-2.01B(8) Wye Strainers

Wye strainers must:

1. Have a cast iron or all bronze body
2. Have a removable stainless steel strainer screen:
 - 2.1. With an open area equal to at least 3 times the cross-sectional area of the pipe based on an iron pipe size
 - 2.2. With 40-mesh woven wire, except:
 - 2.2.1. For a backflow preventer assembly, the screen must be 20-mesh woven wire mesh or perforated sheet with 0.045-inch diameter holes
 - 2.2.2. For a valve assembly, the screen must be 80-mesh woven wire mesh
3. Be capable of withstanding a working pressure of 150 psi
4. Be equipped with a garden valve at the outlet

The wye strainer filter housing must:

1. Withstand a working pressure of 150 psi
2. Be manufactured of reinforced polypropylene plastic

20-2.01C Construction

20-2.01C(1) General

Repair irrigation systems within 24 hours after a malfunction or damage occurs.

Connect underground metallic pipes, valves, or fittings made of dissimilar metals through a dielectric coupling or bushing.

You may install conduits, conductors, and supply lines by methods other than trenching provided that they are not damaged and are installed at the depths specified.

20-2.01C(2) Trenching and Backfilling

Trench and backfill under section 86-2.01.

Remove plants under 20-1.03C as necessary to perform trenching. If plants are to remain, adjust trench alignment to minimize damage.

If removal of:

1. Turf is required, remove to a maximum width of 12 inches.
2. Groundcover is required, remove to a maximum width of 6 feet. Existing *Carpobrotus* and *Delosperma* may be rototilled if the backfill for the trenches does not contain plants longer than 6 inches in length.

Make a 2-inch deep sawcut along neat lines around the perimeter of the pavement to be removed at locations determined by the Engineer.

The trench must have uniform bearing throughout the entire length and must be free of jagged rubble or sharp objects. Ensure conduit, supply line, and joints are not moved or damaged by backfill operations.

For a project with multiple water service points, excavate and backfill trenches for 1 service point at a time.

11-15-13

Trenches for irrigation supply lines and conduits 3 inches and larger must be 5 times the pipe or conduit diameter deep and 2 times the pipe or conduit diameter wide.

Trenches for irrigation supply lines and conduits 2-1/2 inches or less in diameter must be a minimum of 12 inches below finished grade, measured from the top of the installed pipe.

07-19-13

Trenches must be at least 4 feet from curbs, dikes, and paved shoulders.

Rocks and debris encountered during trenching operations must be brought to the surface of the ground. Remove rocks and debris as ordered. This work is change order work.

If trenching requires the removal of plants, in areas with:

1. Turf, replace turf with sod under section 20-3.03C(3)(e).
2. Groundcover, replace groundcover plants from flats and plant at 12 inches on center under section 20-3.03C. No replacement of *Carpobrotus* and *Delosperma* is required if removed by rototilling.

11-15-13

Where existing surfacing is removed, replace the structural section to match the materials removed. Replacement concrete must be of uniform smoothness, color, and texture equal to the adjacent concrete surface. Dispose of removed material. Install supply line and conduits at the bottom of trenches and backfill with sand to a depth of 2 inches over the top of the supply lines and conduits. Excluding the part of the trench backfilled with surfacing or pavement, the remainder of the trench must be backfilled with material that is excavated from the trench. Rock, broken concrete, asphalt concrete and other particles larger than 2 inches in greatest dimension must not be used.

07-19-13

20-2.01C(3) Pull Boxes

Install pull boxes under section 86-2.06 at the following locations:

1. At all conductor splices except splices made in valve boxes
2. Within 5 feet of irrigation controllers
3. At ends of electrical conduits
4. At other locations shown

20-2.01C(4) Valve Boxes and Covers

Install and identify each valve box as shown.

In walkways and paved areas, install the top of the valve box flush with the surrounding finished grade.

20-2.01C(5) Recycled Water Warning Signs

Install recycled water warning signs on irrigation facilities using recycled water.

Install sign decals directly to clean, smooth surfaces. Clean the surface with alcohol or an equivalent cleaner before applying the decal.

Install a 4 by 4 inch warning sign decal to each:

1. Backflow preventer assembly
2. Irrigation controller enclosure cabinet door

Install a 2 by 2 inch warning tag to the each remote control valve and valve box cover.

Install a 2-1/2 by 3 inches sign decal to each sprinkler riser.

Under local regulations, install a 12 by 12 inch warning sign decal on an aluminum plate and attach to gates, fences, and walls located in the vicinity of a recycled water irrigation system. On gates and fences, install signs with S hooks and C clips or 14-gauge galvanized steel wire. On concrete walls or other rough surfaces, install signs with a silicon-based adhesive.

20-2.01C(6) Garden Valves

Furnish 3 keys for each garden valve before Contract acceptance.

20-2.01D Payment

Not Used

20-2.02 EXISTING IRRIGATION FACILITIES

20-2.02A General

20-2.02A(1) Summary

Section 20-2.02 includes specifications for checking, testing, operating, replacing, and relocating existing irrigation facilities.

20-2.02A(2) Definitions

Reserved

20-2.02A(3) Submittals

Submit a list of irrigation system deficiencies within 7 days after checking the existing facilities.

20-2.02A(4) Quality Control and Assurance

After irrigation facilities have been relocated, demonstrate in the presence of the Engineer that the relocated facilities function properly.

Certify each existing backflow preventer under section 20-2.03A(4).

20-2.02B Materials

Valve box covers must be the same size as the covers they replace.

Control and neutral conductors must be the same size and color as the control and neutral conductors they replace.

20-2.02C Construction

20-2.02C(1) General

Notify the Engineer at least 4 business days before shutting off the water supply to any portion of the existing irrigation system and immediately after restoring the water supply to any portion of the existing irrigation system.

If an irrigation facility to be relocated is determined unsuitable by the Engineer, replace irrigation facility under section 20-2. This work is change order work.

20-2.02C(2) Check and Test Existing Irrigation Facilities

Before performing irrigation system work, check existing irrigation facilities to remain in place or to be relocated. The Engineer determines the test watering cycle lengths. Check for deficiencies including missing parts, damaged components, and improper operation. Correct deficiencies as ordered. The correction of deficiencies is change order work.

20-2.02C(3) Operate Existing Irrigation Facilities

If the Contract includes a bid item for operate existing irrigation facilities, after performing work under section 20-2.02C(2), operate existing irrigation facilities through Contract acceptance.

Operate existing irrigation facilities except for water meters, underground supply lines, control and neutral conductors, and electrical conduits.

Check for proper operation at least once every 30 days. Adjust, repair, or replace existing irrigation facilities within 7 days of finding any deficiency.

Operate irrigation systems using the automatic irrigation controller until Contract acceptance. You may operate irrigation controllers manually during plant replacement, fertilization, weed germination, and repair work.

Program the irrigation controllers for seasonal requirements.

20-2.02C(4) Replace Valve Box Covers

Existing valve box covers shown to be replaced must remain in place until the new covers are ready to be installed.

Dispose of removed valve box covers.

20-2.02C(5) Relocate Backflow Preventer Assemblies

Relocate backflow preventer assembly as shown and install under section 20-2.03C.

20-2.02C(6) Relocate Water Meters

Relocate water meter as shown.

20-2.02C(7) Relocate Irrigation Controllers

Relocate irrigation controller as shown and install under section 20-2.07C.

20-2.02D Payment

Not Used

20-2.03 BACKFLOW PREVENTER ASSEMBLIES

20-2.03A General

20-2.03A(1) Summary

Section 20-2.03 includes specifications for installing a backflow preventer assembly.

20-2.03A(2) Definitions

Reserved

20-2.03A(3) Submittals

Reserved

20-2.03A(4) Quality Control and Assurance

Each backflow preventer assembly must be certified by a backflow preventer tester. The tester must have an active and valid certification from the water purveyor having jurisdiction.

If the local water purveyor does not have a certification program, the tester must be certified by AWWA or a nearby county with a certification program.

Notify the Engineer at least 5 business days before certifying backflow preventer assembly.

Certify each backflow preventer assembly annually and within 10 days before Contract acceptance.

20-2.03B Materials

20-2.03B(1) General

Each backflow preventer assembly must include:

1. Backflow preventer including gate valve, wye strainer, brass or malleable iron unions, fittings, and supports
2. Blanket
3. Enclosure
4. Concrete pad

Concrete for the pad must be minor concrete, except the concrete must not contain less than 463 pounds of cementitious material per cubic yard. Hand mixing of the concrete is allowed.

20-2.03B(2) Backflow Preventers

Each backflow preventer must:

1. Be reduced-pressure principle type.
2. Comply with the requirements of the water purveyor that has jurisdiction.
3. Be factory-assembled with:
 - 3.1. 2 check valves
 - 3.2. 1 pressure differential relief valve
 - 3.3. 4 test cocks
 - 3.4. 2 shut-off valves manufactured from iron or bronze. Shut-off valves must be one of the following:
 - 3.4.1. Resilient wedge gate valves
 - 3.4.2. Resilient seated and fully ported ball valves
 - 3.4.3. Resilient seated butterfly valves

Backflow preventer components must be capable of withstanding a working pressure of 150 psi.

20-2.03B(3) Backflow Preventer Blankets

Each backflow preventer blanket must:

1. Be polyester fabric coated with vinyl or polymeric resin
2. Be resistant to UV light, water, mildew, and fire
3. Have an R-value from R-30 to R-38

Blankets must have a securing mechanism that includes either zippers, hook-pile tape, grommets, snaps, buttons, or any combination of these. Wherever the backflow preventer is not in an enclosure, the securing mechanism must be capable of accepting a padlock.

20-2.03B(4) Backflow Preventer Enclosures

Each backflow preventer enclosure must:

1. Have expanded metal sides, ends, and top panels fabricated from 9-gauge minimum thickness stainless sheet steel with openings of approximately 3/4 by 1-3/4 inches
2. Have expanded metal panels attached to the 3/16-inch thick steel frame by a series of welds not less than 1/4 inch in length and spaced not more than 4 inches on center, along the edges of the enclosure
3. Have Type 304 stainless steel lock guards with a minimum thickness of 12 gauge.
4. Have hexagonal nuts and lock-type washers
5. Be powder coated by the manufacturer to match color no. 20450 of FED-STD-595.
6. Have padlock clasp or latch and lock mechanism

20-2.03C Construction

Finish exposed top surfaces of concrete pad with a medium broom finish applied parallel to the long dimension of pads.

Install hold-downs for the backflow preventer assembly enclosure when concrete is still plastic.

20-2.03D Payment

Not Used

20-2.04 CAM COUPLER ASSEMBLIES

20-2.04A General

Section 20-2.04 includes specifications for installing a cam coupler assembly.

20-2.04B Materials

Each cam coupler assembly must consist of a cam coupler, dust cap, check valve, pipes, fittings, concrete thrust block, and valve box with woven wire cloth and gravel.

Cam couplers and keys must be manufactured of brass or bronze and be able to withstand a working pressure of 150 psi.

Furnish 3 loose cam coupler keys before Contract acceptance.

20-2.04C Construction

Install cam coupler assemblies in valve boxes as shown.

20-2.04D Payment

Not Used

20-2.05 CONTROL AND NEUTRAL CONDUCTORS

20-2.05A General

20-2.05A(1) Summary

Section 20-2.05 includes specifications for installing control and neutral conductors.

20-2.05A(2) Definitions

Reserved

20-2.05A(3) Submittals

Reserved

20-2.05A(4) Quality Control and Assurance

Perform field tests on control and neutral conductors. Field tests must comply with the specifications for lighting circuits in section 86-2.14B.

Where the conductors are installed by trenching and backfilling, perform field tests after a minimum of 6 inches of backfill material has been placed and compacted over the conductors.

20-2.05B Materials

Control and neutral conductors must comply with the requirements in section 86-2.08.

For connections between 24-volt irrigation controllers and valve solenoids, use control and neutral conductors. Conductors must include a control conductor for each valve and a common neutral.

Conductor insulation color, except for the stripes, must be continuous throughout. The color of the conductors must be consistent from the controller to each valve. Neutral conductors must be white. Do not use white for control conductors. Do not use conductors with green insulation except as permitted by the NEC.

Conductors must be:

1. No. 12 AWG or larger or no. 14 AWG or larger for armor-clad
2. Rated for 36 V or 600 V for armor-clad
3. Rated for direct burial
4. Underground feeder cable Type UF and TWU
5. Solid, uncoated copper for armor-clad
6. Not less than 90 percent of the AWG diameter required

No. 10 and smaller conductors must be insulated with a minimum of 56 mils of PVC or a minimum of 41 mils of polyethylene. No. 8 and larger conductors must be insulated with a minimum of 70 mils of PVC.

No. 10 and smaller armor-clad conductors must be insulated with a minimum of 41 mils of polyethylene. No. 8 and larger armor-clad conductors must be insulated with 54 to 60 mils of PVC.

Armor-clad conductors must include:

1. Stainless steel tape armor, Type 304 and helically wrapped with a 33 percent minimum overlap. The tape must be 0.5 inch wide and at least 0.005 inch thick.
2. PVC outer conductor jacket that is UV resistant and complies with the ICEA S-61-402, NEMA standard WC5 and UL listing 1263. The jacket nominal thickness must be 24 to 30 mils thick.

20-2.05C Construction

20-2.05C(1) General

Reserved

20-2.05C(2) In Open Trenches

Do not install control and neutral conductors above each other in an open trench. Wrap conductors together with electrical tape at 5 foot intervals.

Where conductors are installed in the same trench as supply line, install at the same depth as the line. At other locations, install conductors not less than 12 inches below finished grade.

Where conductors are not in a supply line trench, install conductors at least 4 feet from curbs, dikes, and paved shoulders.

20-2.05C(3) In Conduits

Install conductors in electrical conduit if conductors are to be:

1. Surface mounted
2. Installed in or on structures
3. Installed under paved areas
4. Installed in irrigation conduits
5. Placed in concrete

20-2.05C(4) Splicing

Splice low voltage control and neutral conductors under sections 86-2.09C, 86-2.09D, and 86-2.09E, except do not use method B. Tape used for splice insulation must be PVC tape.

Leave at least 2 feet of slack for each conductor at each:

1. Pull box
2. Valve box for each conductor that is connected to other facilities within the box or spliced within the box

Do not splice conductors in irrigation controller cabinets.

Permanent splice connections must be made with freshly cut and skinned conductors. Do not use temporary splices made for testing valve circuits as permanent splices.

20-2.05C(5) Marking

Mark control and neutral conductors in pull boxes, valve boxes, at irrigation control terminals, and at splices.

Mark conductor terminations and splices with adhesive cloth wrap-around markers. Seal markers with clear, heat-shrinkable sleeves.

Mark nonspliced conductors with clip-on C-shaped white extruded PVC sleeves. Sleeves must have black indented legends of uniform depth with transparent overlays over the legends and chevron cuts for the alignment of 2 or more sleeves.

Identify markers for the control conductors with the appropriate irrigation controller and station number.

20-2.05D Payment

Not Used

20-2.06 FLOW SENSORS

20-2.06A General

Section 20-2.06 includes specifications for installing a flow sensor.

20-2.06B Materials

Each flow sensor must be an inline type with a nonmagnetic spinning impeller as the only moving part.

The electronics housing must:

1. Be schedule 80 PVC or cast 85-5-5-5 bronze
2. Include glass-filled polyphenylene sulfide
3. Be easily removable from the meter body and include 2 ethylene-propylene O-rings

The impeller must be tungsten carbide.

The electronics must be rated to withstand prolonged water immersion conditions and include 2 single conductor 18 AWG leads, 48 inches long.

The insulation must be direct burial UF type colored red for the positive lead and black for the negative lead.

The flow sensor must be capable of withstanding:

1. 100 to 400 psi operating pressure depending on sensor size shown
2. Liquid temperatures up to 220 degrees F
3. Flows from 1/2 to 15 ft/sec

20-2.06C Construction

Install flow sensor as shown.

20-2.06D Payment

Not Used

20-2.07 IRRIGATION CONTROLLERS

20-2.07A General

20-2.07A(1) Summary

Section 20-2.07 includes specifications for installing irrigation controllers.

20-2.07A(2) Definitions

irrigation controller: "Smart" irrigation controller as defined by the Irrigation Association.

remote irrigation control system (RICS): Centralized water management system that consists of a base station, centralized server, satellite controllers.

base station: Designated computer located at a Department maintenance facility or District Office that collects data from a series of satellite controllers through a centralized server.

centralized server: Designated server or web-based application that collects data from all base stations.

web-based application: Encrypted managing software that is coded in a browser-supported language and is executable via a common internet web browser (e.g., Microsoft Internet Explorer, Firefox, Safari, etc.).

satellite controller: Irrigation controller that communicates directly to a base station or centralized server.

network communication: Identified means through which satellite controllers, base stations, and a centralized server communicate to one another (i.e., fiber optics, spread spectrum, phone line, etc.).

remote access device: Device (i.e., FCC compliant radio remote, cell phone or wireless, etc.) used to communicate with satellite controllers from a remote location.

20-2.07A(3) Submittals

Submit as an informational submittal, a complete manufacturer's maintenance and operations manual for each type of controller installed. Submit the manual at the time the wiring plans and diagrams are placed inside the controller enclosure or cabinet door.

20-2.07A(4) Quality Control and Assurance

Provide training by a qualified person on the use and adjustment of the irrigation controllers installed 30 days before Contract acceptance.

Modifications to electrical components must be done by the manufacturer before shipment to the job site.

The installation date and expiration date of the manufacturer's guarantee for the controllers must be permanently marked on the inside face of the controller.

20-2.07B Materials

20-2.07B(1) General

Conventional A/C powered irrigation controllers must operate on 110/120 V, 60 Hz(ac) and supply 24 to 30 VAC, 60 Hz(ac) for operating electrical remote control valves.

Concrete for the pad and foundation must be minor concrete, except the concrete must not contain less than 463 pounds of cementitious material per cubic yard. Hand mixing of the concrete is allowed.

20-2.07B(2) Irrigation Controllers

20-2.07B(2)(a) General

The irrigation controllers must:

1. Be A/C, battery, solar, or 2-wire as shown
2. Be from a single manufacturer.
3. Be fully automatic and capable of operating a complete 30-day or longer irrigation program.
4. Have a switch or button on the face of the irrigation control panel showing that the irrigation controller can be turned on or off and provide for automatic or manual operation. Manual operation must allow cycle start at the desired station and allow for the minimum activation of a single station or have the option to operate multiple stations in sequential or simultaneous operation modes.
5. Have non-volatile memory.
6. Have a watering time display on the face of the control panel.
7. Have a panel and circuit board connected to the low voltage control and neutral conductors by means of a plug and receptacle connectors located within the cabinet enclosure.
8. Have a variable or incremental timing adjustment ranging from 1 minute to 360 minutes per station.
9. Be capable of operating at least 3 program schedules.
10. Be capable of having at least 4 start times per program schedule.
11. Have an output that can energize a pump start circuit or a remote control master valve.
12. Be protected by fuses and circuit breakers.
13. Display a program and station affected by a sensory alert without altering other watering schedules not affected by the alert.
14. Be capable of global manual and automatic seasonal adjustments to all valves in any given program.
15. Automatically alter watering schedule in accordance with evapotranspiration data provided by a local weather station or have an internal programmed default of historical evapotranspirational data for a given region.
16. Support a flow sensor, rain sensor, or weather station and have automatic shut-off capability.
17. Be capable of communicating with the remote access device.

If the irrigation controller is installed in an enclosure cabinet, the cabinet must be stainless steel and must comply with section 86-3.04A.

Irrigation controllers not installed in enclosure cabinets must be weatherproof, constructed of fiberglass or metal and have a door lock with 2 keys provided.

RICS must meet the requirements of an irrigation controller and be capable of being accessible only through a secured and encrypted server that is password and firewall protected by the Department or be accessible through a firewall secure remote server that is independent from any Department servers. The Department will set up and manage the network communication.

20-2.07B(2)(b) Battery Powered Irrigation Controllers

Reserved

20-2.07B(2)(c) Solar Powered Irrigation Controllers

Reserved

20-2.07B(2)(d) Two-wire Irrigation Controllers

Reserved

20-2.07B(3) Irrigation Controller Enclosure Cabinets

The irrigation controller enclosure cabinet must:

1. Be stainless steel.
2. Include a mounting panel. Fabricate mounting panels with one of the following:
 - 2.1. 3/4-inch exterior AC grade veneer plywood. Paint panels with 1 application of an exterior, latex based, wood primer and 2 applications of an exterior, vinyl acrylic enamel, white in color. Paint panels on all sides and edges before installation of the panels in the cabinets and the equipment on the panels.
 - 2.2. 3/16-inch thick aluminum sheets.
 - 2.3. 10-gauge cold-rolled steel sheets.
 - 2.4. 0.157-inch stainless steel metal sheets.
3. Provide cross ventilation, roof ventilation, or a combination of both. Ventilation must not compromise the weather resistance properties of the cabinet and must be fabricated by the cabinet manufacturer.
4. Include protection against lightning damage.
5. Have an area inside the cabinet doors for storage of the as-built schematic wiring diagram and irrigation plans.
6. Have padlock clasp or latch and lock mechanism.

20-2.07B(4) Rain Sensors

A rain sensor unit must be a solid state, automatic shut-off type, and compatible with the irrigation controller. The rain sensor unit must automatically interrupt the master remote control valves when approximately 1/8 inch of rain has fallen. The irrigation controller must automatically be enabled again when the accumulated rainfall evaporates from the rain sensor unit collection cup.

Rain sensor units must be one of the following:

1. Rated 24 V(ac) to 30 V(ac)
2. Wireless and FCC compliant

20-2.07C Construction

Finish exposed top surface of concrete pad with a medium broom finish applied parallel to the long dimension.

Locate irrigation controllers in pedestal or wall mounted enclosures as shown.

Install electrical components for automatic irrigation systems under section 86-1.02.

Install irrigation controllers under the manufacturer's instructions and as shown.

If 2 or more irrigation controllers operate the same remote master control valve, furnish and install an isolation relay under the controller manufacturer's instructions.

Where direct burial conductors are to be connected to the terminal strip, connect the conductors with the open-end-crimp-on wire terminals. Exposed wire must not extend beyond the crimp of the terminal and the wires must be parallel on the terminal strip.

Install rain sensor units for irrigation controllers on the irrigation controller enclosure cabinets. Provide protection against lightning damage.

20-2.07D Payment

Payment for electrical service for 120-volt or higher is not included in the payment for irrigation controller.

20-2.08 IRRIGATION CONDUIT

20-2.08A General

20-2.08A(1) Summary

Section 20-2.08 includes specifications for installing irrigation conduit under a roadway or other facility to accommodate electrical conduit for control and neutral conductors and irrigation supply lines.

Before performing work on irrigation systems, locate existing conduits shown to be incorporated into the new work.

Before removing or disturbing existing Type A pavement markers that show the location of the existing conduit, mark the location of the existing conduit on the pavement.

20-2.08A(2) Definitions

Reserved

20-2.08A(3) Submittals

Reserved

20-2.08A(4) Quality Control and Assurance

Demonstrate the conduits are free of obstructions after placement of base and surfacing.

Before and after extending the irrigation supply line in a conduit, pressure test the supply line under section 20-2.01A(4)(b).

After conductors are installed in a conduit, test the conductors under section 20-2.05A(4).

Assign a technical representative to direct and control the directional bore activities. The representative must be present during directional bore activities. Unless otherwise authorized, perform directional bore activities in the presence of the Engineer.

20-2.08B Materials

20-2.08B(1) General

Reserved

20-2.08B(2) ABS Composite Pipe Conduit

ABS composite pipe and couplings must comply with ASTM D 2680. Couplings must be solvent cement type.

20-2.08B(3) Corrugated High Density Polyethylene Pipe Conduit

Corrugated high density polyethylene pipe must comply with ASTM F 405 and F 667 or be Type S and comply with AASHTO M252 and M294. Couplings and fittings must be as recommended by the pipe manufacturer.

20-2.08B(4) Corrugated Steel Pipe Conduit

Corrugated steel pipe conduit must comply with section 66. The nominal thickness of metal sheets for pipe must be 0.064 inch for corrugated steel pipe and 0.060 inch for corrugated aluminum pipe. Coupling bands and hardware must comply with section 66.

20-2.08B(5) Polyvinyl Chloride Pipe Conduit

PVC pipe conduit must be schedule 40 and comply with ASTM D 1785.

Fittings must be schedule 80.

20-2.08B(6) Welded Steel Pipe Conduit

Welded steel pipe must comply with ASTM A 53. Pipe must be black and have either welded or threaded joints.

The minimum wall thickness for the various sizes of welded steel pipe must comply with the dimensions shown in the following table:

| Pipe size, nominal (inch) | Minimum wall thickness (inch) |
|---------------------------|-------------------------------|
| 3 | 0.216 |
| 4 | 0.237 |
| 6 | 0.280 |
| 8 | 0.277 |
| 10 | 0.279 |
| 12 | 0.330 |

20-2.08C Construction

20-2.08C(1) General

When existing conduits are to be incorporated in new work, excavate exploratory holes for locating existing conduits at the locations indicated by existing markers or as directed. Excavate and backfill exploratory holes to a maximum size of 2-1/2 feet in width, 5 feet in depth, and 5 feet on each side of the marker or directed location parallel to the roadway. If the conduit is not found and if ordered, increase the size of the exploratory holes beyond the dimensions specified. The additional excavation and backfill is change order work.

If extending an existing conduit, remove conductors from the conduit.

Use a coupling band if the new conduit matches the existing conduit diameter, otherwise overlap the conduit at least 12 inches.

After extending existing conduits, install conductors that match the color and size of the existing conductors without splices. Splice conductors in adjacent pull boxes.

If installing a control and neutral conductor and electrical conduit through the irrigation conduit, install a no. 5 pull box at each end.

Remove debris found in the conduit before performing other work. Debris found more than 3 feet from the ends of the conduits is removed as change order work.

Extend conduit 2 feet beyond all paving unless otherwise shown.

Cap the ends of unused conduit.

Designate the location of each conduit by cementing a Type A pavement marker as shown. Type A pavement markers and adhesive must comply with section 85.

20-2.08C(2) Welded Steel Pipe Conduit

20-2.08C(2)(a) General

Install welded steel pipe by directional boring or jack and drill.

Install top of conduits:

- 1. 18 to 30 inches below the finished surface in sidewalk areas
- 2. 40 to 52 inches below the finished grade in other paved areas

20-2.08C(2)(b) Directional Boring

Notify the Engineer 2 business days before starting directional bore activities.

The diameter of the boring tool for directional boring must be only as large as necessary to install the conduit.

Mineral slurry or wetting solution may be used to lubricate the boring tool and to stabilize the soil surrounding the boring path. The mineral slurry or wetting solution must be water based.

The directional bore equipment must have directional control of the boring tool and have an electronic boring tool location detection system. During operation, the directional bore equipment must be able to determine the location of the tool both horizontally and vertically.

20-2.08C(2)(c) Jack and Drill

Notify the Engineer 2 business days before starting jack and drill activities.

Jacking or drilling pits must be no closer than 2 feet from pavement edge whenever possible.

If authorized, small holes may be cut in the pavement to locate or remove obstructions.

Do not use excessive water that will soften subgrade or undermine pavement.

20-2.08C(3) Schedule 40 Pipe Conduit

Where schedule 40 pipe conduit 2 inches or less in outside diameter is installed under surfacing, you may install by directional boring under section 20-2.08C(2)(b).

For conduit 2 inches or less in diameter, the top of the conduit must be a minimum of 18 inches below surfacing.

Extend schedule 40 pipe conduit 6 inches beyond surfacing. Cap ends of conduit until used.

20-2.08D Payment

Schedule 40 PVC pipe conduit is paid for as plastic pipe (schedule 40) (supply line).

20-2.09 IRRIGATION SUPPLY LINE

20-2.09A General

20-2.09A(1) Summary

Section 20-2.09 includes specifications for installing irrigation supply line.

If the supply line location interferes with the excavation of plant holes, relocate the plant hole to clear the supply line. Do not install supply lines through plant holes unless shown.

Supply lines, control and neutral conductors and electrical conduits installed in common trenches must not be installed above each other.

20-2.09A(2) Definitions

Reserved

20-2.09A(3) Submittals

Submit a certificate of compliance for polyethylene pipe and plastic pipe supply line.

20-2.09A(4) Quality Control and Assurance

Solvent cement must comply with the local Air Quality Management District requirements.

20-2.09B Materials

20-2.09B(1) General

Irrigation supply pipe must be metal or plastic as shown.

PCC for thrust blocks must be produced from commercial-quality aggregates. The concrete must contain at least 295 pounds of cementitious material per cubic yard.

20-2.09B(2) Copper Pipe Supply Line

Copper pipe must be Type K rigid pipe and comply with ASTM B 88. Fittings must be wrought copper or cast bronze either soldered or threaded.

Solder must be 95 percent tin and 5 percent antimony.

20-2.09B(3) Galvanized Steel Pipe Supply Line

Galvanized steel pipe supply line and couplings must be standard weight and comply with ASTM A 53, except that the zinc coating must not be less than 90 percent of the specified amount. Except for couplings, fittings must be galvanized malleable iron, banded and threaded, and comply with ANSI B16.3, Class 150.

Joint compound must be nonhardening and noncorrosive. Do not use pipe thread sealant tape.

20-2.09B(4) Drip Irrigation Tubing

Drip irrigation tubing must be virgin polyethylene plastic and comply with ASTM D 2737.

The drip irrigation tubing must be distribution tubing with preinstalled in-line emitters.

If preinstalled in-line drip irrigation tubing is not shown, you may install emitters that match the distribution requirements shown. The emitters must be barbed or threaded-type outlet devices with dual silicone diaphragms and installed under the manufacturer's instructions.

The emitters must meet the flow rate and operating pressure range shown.

The wall thickness of polyethylene tubing must comply with the following requirements when tested under ASTM D 2122:

| Pipe size, nominal (inch) | Minimum wall thickness (inch) | Maximum wall thickness (inch) |
|---------------------------|-------------------------------|-------------------------------|
| 1/2 | 0.050 | 0.070 |
| 5/8 | 0.055 | 0.075 |
| 3/4 | 0.060 | 0.080 |

The polyethylene tubing fittings must be leak-free, compression type and have female sockets with an internal barb to provide a positive pipe-to-fitting connection that will not separate at the designed pressure.

20-2.09B(5) Plastic Pipe Supply Line

Plastic pipe supply line must be PVC pipe that is NSF approved.

Schedule 40 plastic pipe supply line must comply with ASTM D 1785.

Class 315 plastic pipe supply line must comply with ASTM D 2241.

PVC gasketed bell joints must comply with ASTM D 2672, ASTM D2241, ASTM D 3139, and ASTM F 477.

For solvent-cemented type joints, the primer and solvent cement must be made by the same manufacturer. The primer color must contrast with the color of the pipe and fittings.

Solvent-cemented fittings must be injection molded PVC, schedule 40, and comply with ASTM D 2466.

Fittings for supply line placed in irrigation conduit must be schedule 80.

Fittings for plastic pipe supply line larger than 4 inches must be ductile iron under section 20-2.14C(2)(b).

If UV-resistant plastic pipe supply line is required, the pipe must be homogeneous, uniform color and be manufactured of:

1. At least 80 percent vinyl chloride resin with UV stabilizers
2. Non-PVC resin modifiers and coloring ingredients
3. Coloring ingredients with UV stabilizers

20-2.09C Construction

20-2.09C(1) General

Cut pipe straight and true. After cutting, ream out the ends to the full inside diameter of the pipe.

Prevent foreign material from entering the irrigation system during installation. Immediately before assembling, clean all pipes, valves, and fittings. Flush lines before attaching sprinklers, emitters, and other terminal fittings.

Pipe supply lines installed between the water meter and backflow preventer assembly must be installed not less than 18 inches below finished grade measured to the top of the pipe.

Where a connection is made to existing supply lines, bell and gasketed fittings or compression fittings may be used.

Install a thrust block at each change in direction on the main supply line, terminus run, and at other locations shown.

Where supply lines cross paved ditches more than 3 feet deep at their flow line, install galvanized steel pipe for the entire span of the ditch.

Secure UV resistant plastic pipe supply line on grade as shown.

20-2.09C(2) Galvanized Steel Pipe Supply Line

Coat male pipe threads on galvanized steel pipe according to the manufacturer's instructions.

20-2.09C(3) Drip Irrigation Tubing

Install drip irrigation tubing on grade and under manufacturer's instructions.

Install a flush valve and an air-relief valve if recommended by the drip valve assembly manufacturer.

20-2.09C(4) Plastic Pipe Supply Line

For PVC pipe 1-1/2 inches in diameter or smaller, cut the pipe with PVC cutters.

For solvent-cemented type joints, apply primer and solvent-cement separately under the manufacturer's instructions.

Wrap the male portion of each threaded plastic pipe fitting with at least 2 layers of pipe thread sealant tape.

Install plastic pipe supply line mains with solvent-cemented type joints not less than 18 inches below finished grade measured to the top of the pipe.

Install plastic pipe supply line laterals with solvent-cemented type joints not less than 12 inches below finished grade measured to the top of the pipe.

Snake plastic pipe installed by trenching and backfilling methods.

20-2.09D Payment

Supply line pipe and drip irrigation tubing are measured along the slope.

20-2.10 SPRINKLER ASSEMBLIES

20-2.10A General

Section 20-2.10 includes specifications for installing sprinkler assemblies.

20-2.10B Materials

20-2.10B(1) General

Each sprinkler assembly must meet the characteristics shown in the irrigation legend.

Where shown, a sprinkler assembly must have a flow shut-off device that automatically stops the flow of water on the downstream side of the device when the assembly is broken. You may use a sprinkler assembly with a preinstalled flow shut-off device or you must install a flow shut-off device under the manufacturer's instructions.

Flexible hose for sprinkler assembly must be leak-free, nonrigid and comply with ASTM D 2287, cell Type 6564500. The hose wall thickness must comply with ASTM D 2122 for the hose diameters shown in the following table:

| Hose diameter, nominal (inch) | Minimum wall thickness (inch) |
|----------------------------------|----------------------------------|
| 1/2 | 0.127 |
| 3/4 | 0.154 |
| 1 | 0.179 |

Solvent cement and fittings for flexible hose must comply with section 20-2.09B(5).

20-2.10B(2) Pop-Up Sprinkler Assemblies

Each pop-up sprinkler assembly must include a body, nozzle, swing joint, pressure compensation device, check valve, sprinkler protector, and fittings as shown.

20-2.10B(3) Riser Sprinkler Assemblies

11-15-13

Each riser sprinkler assembly must include a riser or flexible hose, threaded nipple, swing joint, check valve, and nozzle as shown. The riser must be UV resistant schedule 80, PVC 1120 or PVC 1220 pipe and comply with ASTM D 1785.

20-2.10B(4) Tree Well Sprinkler Assemblies

Each tree well sprinkler assembly must include a body, riser, swing joint, perforated drainpipe, and drain cap.

07-19-13

The perforated drainpipe must be commercial grade, rigid, PVC pipe with holes spaced not more than 6 inches on center on 1 side of the pipe.

Drain cap must be commercially available, 1 piece, injection molded drain grate manufactured from structural foam polyolefins with UV light inhibitors. Drain grate must be black.

Gravel for filling the drainpipe must be graded such that 100 percent passes the 3/4-inch sieve and 100 percent is retained on the 1/2-inch sieve. Gravel must be clean, washed, dry, and free from clay or organic material.

20-2.10C Construction

Install pop-up and riser sprinkler assembly:

1. 6-1/2 to 8 feet from curbs, dikes, and sidewalks
2. 10 feet from paved shoulders
3. 3 feet from fences and walls

If sprinkler assembly cannot be installed within these limits, the location will be determined by the Engineer.

Set sprinkler assembly riser on slopes perpendicular to the plane of the slope.

Install tree well sprinkler assembly as shown.

20-2.10D Payment

Not Used

20-2.11 VALVES

20-2.11A General

Section 20-2.11 includes specifications for installing valves.

20-2.11B Materials

20-2.11B(1) General

Valves must:

1. Include a valve box and cover
2. Be the same size as the supply line that the valve serves unless otherwise shown

3. Be bottom, angled, or straight inlet configuration

20-2.11B(2) Ball Valves

Ball valve must be a two-piece brass or bronze body and comply with the requirements shown in the following table:

| Property | Requirements |
|--------------------------------|--------------|
| Nonshock working pressure, min | 400 psi |
| Seats | PTFE |
| O-ring seals | PTFE |

Ball valve must be the same size as the supply line that the valve serves.

20-2.11B(3) Check Valves

Each check valve must:

1. Be schedule 80 PVC and factory set to 5 psi for adjustable spring check valve
2. Be Class 200 PVC for swing check valves on non pressurized plastic irrigation supply line

20-2.11B(4) Drip Valve Assemblies

Each drip valve assembly must include:

1. Remote control valve
2. Wye filter with:
 - 2.1. Filter housing that:
 - 2.1.1. Can withstand a working pressure of 150 psi
 - 2.1.2. Is manufactured of reinforced polypropylene plastic
 - 2.2. Reusable stainless steel filter cartridge with a 200 mesh size filtration
3. Ball valve under 20-2.11B(2)
4. Schedule 80 PVC pipes and fittings
5. Pressure regulator

20-2.11B(5) Garden Valve Assemblies

Each garden valve assembly must have:

1. Garden valve
2. Location marker

20-2.11B(6) Gate Valves

Gate valves must be:

1. Flanged or threaded type
2. Iron or bronze body
3. Bronze trimmed with one of the following:
 - 3.1. Internally threading rising stem
 - 3.2. Nonrising stem
4. Able to withstand a working pressure of 150 psi
5. Same size as the pipeline that the valves serves unless otherwise shown

Gate valves smaller than 3 inches must have a cross handle.

Gate valves 3 inches or larger must be flanged type with a square nut. Furnish 3 long shank keys before Contract acceptance.

Gate valves attached to the outlets of a wye strainer must have seating rings on the discharge side of the gate valves must be PTFE. Valve wedges must be driven obliquely by cam action into the seating rings.

20-2.11B(7) Pressure Regulating Valves

Pressure regulating valve must be:

1. Flanged or threaded type
2. Brass, bronze, cast iron, or plastic body
3. Spring diaphragm type
4. Pilot controlled

Pressure regulating valve must have no internal filter screens.

20-2.11B(8) Pressure Relief Valves

Pressure relief valve must have a brass or bronze body, stainless steel springs, bronze nickel chrome seats, composition seat discs, female bottom inlets, and female side outlets.

20-2.11B(9) Quick Coupling Valves

Quick coupling valve must be 3/4 inch double slotted with a self-closing cap, 3/4-inch brass key and 3/4-inch brass hose swivel unless otherwise shown. Except for the cap, quick coupling valve must be brass or bronze construction. Furnish 3 loose quick coupling brass keys and brass hose swivels before Contract acceptance.

20-2.11B(10) Remote Control Valves

20-2.11B(10)(a) General

Each remote control valve must:

1. Be normally closed type.
2. Be glass filled nylon, brass, or bronze.
3. Be completely serviceable from the top without removing the valve body from the system.
4. Be equipped with a device that regulates and adjusts the flow of water and be provided with a manual shut-off. The manual shut-off for valves larger than 3/4 inch must be operated by a cross handle.
5. Have solenoids compatible with the irrigation controller.
6. Have a manual bleed device.
7. Be capable of withstanding a pressure of 200 psi
8. Have replaceable compression discs or diaphragms.
9. Have threaded fittings for inlets and outlets.
10. Have DC latching solenoids when used with solar or battery controllers. Solenoids must operate on 3.5 V.

20-2.11B(10)(b) Remote Control Valves with Flow Sensor

Reserved

20-2.11B(10)(c) Remote Control Valves with Pressure Regulator

Each remote control valve with pressure regulator must be factory assembled as 1 unit.

20-2.11B(11) Wye Strainer Assemblies

Each wye strainer assembly must include:

1. Wye strainer
2. Garden valve

20-2.11C Construction

20-2.11C(1) General

Install control valves:

1. 6-1/2 to 8 feet from curbs, dikes, and sidewalks
2. 10 feet from paved shoulders
3. 3 feet from fences, walls, or both

If a control valve cannot be installed within these limits, the location will be determined by the Engineer.

20-2.11C(2) Check Valves

Unless otherwise shown, install spring-action check valves as necessary to prevent low head drainage.

20-2.11C(3) Garden Valve Assemblies

Install a location marker 8 to 10 inches from the back of each garden valve.

20-2.11C(4) Pressure Regulating Valves

Install pressure regulating valves with threaded connections and a union on the inlet side of the valves.

20-2.11C(5) Wye Strainer Assemblies

Unless shown, install wye strainer assembly on the upstream side of the remote control valves.

Install garden valve so that when the system is flushed, the discharge sprays out of the valve box.

20-2.11D Payment

Not Used

20-2.12 WATER METERS

Reserved

20-2.13 RESERVED**20-2.14 SUPPLY LINE ON STRUCTURES****20-2.14A General****20-2.14A(1) General****20-2.14A(1)(a) Summary**

Section 20-14 includes specifications for installing water supply lines through bridges and on the exterior of concrete structures.

20-2.14A(1)(b) Definitions

Reserved

20-2.14A(1)(c) Submittals

Submit a work plan for temporary casing support at the abutments as an informational submittal.

20-2.14A(1)(d) Quality Control and Assurance**20-2.14A(1)(d)(i) General**

Before installing seismic expansion assemblies or expansion assemblies, the Engineer must authorize the extension setting.

20-2.14A(1)(d)(ii) Regulatory Requirements

Piping materials must bear the label, stamp, or other markings of the specified standards.

20-2.14A(1)(d)(iii) Site Tests

Test water supply lines before:

1. Backfilling
2. Beginning work on box girder cell decks
3. Otherwise covering the water supply lines

Furnish pipe anchorages to resist thrust forces occurring during testing.

Test the water supply lines as 1 unit. The limits of the unit must be 5 feet beyond the casing at each end of the bridge.

Cap each end of the water supply lines before testing. Caps must be rated for the test pressure.

Test water supply lines under section 20-2.01A(4)(b), except that the testing period must be 4 hours with no pressure drop.

For water supply lines 4 inches and larger testing must meet the following additional requirements:

1. Testing pressure must be at least 120 psi
2. Air relief valve must not be subjected to water pressure due to testing

If water supply lines fail testing, retest the lines after repair.

20-2.14A(2) Materials

20-2.14A(2)(a) General

Protect stored piping from moisture and dirt. Elevate piping above grade. Support piping to prevent sagging and bending.

Protect flanges, fittings, and assemblies from moisture and dirt.

20-2.14A(2)(b) Air Release Valve Assemblies

Air release valve assemblies include an air release valve, ball valve, tank vent, nipples, and pipe saddle. Assemblies must comply with the following:

1. Air release valves must have a cast iron body with stainless steel trim and float, 1-inch NPT inlet, 1/2-inch NPT outlet, and 3/16-inch orifice.
2. Ball valves must have a 2-piece bronze body with chrome plated or brass ball, 1-inch full-size port, and be rated for at least 400 psi.
3. Tank vents must have a 1/2-inch NPT inlet and downward-facing double openings with screened covers.
4. Nipples must be schedule 40 galvanized steel pipe.
5. Pipe saddle must be rated for at least 150 psi and compatible with water supply line. Pipe saddle must be (1) single strap pipe saddle for water supply lines smaller than 4 inches or (2) double strap pipe saddle for water supply lines 4 inches and larger. You may use a tee fitting for galvanized steel water supply lines.

20-2.14A(2)(c) Casings

Casings must be welded steel pipe casing complying with section 70-7.

20-2.14A(2)(d) Pipe Wrap Tape

Pipe wrap tape must be pressure sensitive tape made from PVC or polyethylene. Pipe wrap tape must be at least 50 mils thick and not wider than 2 inches.

20-2.14A(2)(e) Pipe Hangers

Pipe hangers must comply with section 70-7.02C.

The pipe hanger must be rated for the water supply line. If casings are shown, include the casings weight.

20-2.14A(2)(f) Epoxy Adhesives

Epoxy used for anchoring concrete pipe supports must comply with section 70-7.02D.

20-2.14A(2)(g) Concrete Pipe Supports

Concrete pipe supports must comply with section 70-7.02D.

20-2.14A(2)(h) Pipe Clamps and Anchors

Metal clamps must be commercial quality steel complying with section 75-1.02. Anchors must comply with the specifications for concrete anchorage devices in section 75-1.03C.

20-2.14A(2)(i) Pull Boxes

Pull boxes and covers must comply with section 20-2.01B(5).

20.2.14A(3) Construction

20-2.14A(3)(a) General

Support water supply lines as described.

Where water supply lines penetrate bridge superstructure concrete, either form or install pipe sleeves at least 2 pipe sizes larger than the pipe.

20-2.14A(3)(b) Preparation

Clean the interior of the pipe before installation. Cap or plug openings as pipe is installed to prevent the entrance of foreign material. Leave caps or plugs in place until the next pipe section is installed.

20-2.14A(3)(c) Installation**20-2.14A(3)(c)(i) General**

Reserved

20-2.14A(3)(c)(ii) Casings

Install casings under section 70-7.03.

Seal casing end with 8 inches of polyurethane foam at dirt stop or pipe end seal.

20-2.14A(3)(c)(iii) Wrapping Water Supply Line

Wrap damaged supply line coatings with pipe wrap tape. Wrap field joints and fittings that are in contact with the earth.

Wrapping must comply with the following:

1. Clean and prime area as recommended by the tape manufacturer.
2. Tightly wrap tape with 1/2 uniform overlap, free from wrinkles and voids, to provide not less than a 100 mil thickness.
3. The tape must conform to joint or fitting contours.
4. Extend tape at least 6 inches over adjacent pipe.

20-2.14A(3)(c)(iv) Pipe Clamps and Anchors

Install water supply lines on the exterior surfaces of bridges or other concrete structures with metal clamps and anchors.

Drilling of holes for anchors must comply with the following:

1. Drill holes to manufacturers recommended depth.
2. Drilling tools must be authorized.
3. Do not drill holes closer than 6 inches to the edge of a concrete structure.
4. Relocate holes if reinforcing steel is encountered. Fill abandoned holes with mortar. Mortar must comply with section 51-1.02F.

Where water supply lines are mounted vertically for more than 2 feet, install clamps and anchors within 6 inches of the elbows.

Where water supply lines are mounted vertically for more than 10 feet, install additional clamps and anchors at 10 foot centers unless otherwise shown.

20-2.14A(3)(d) Sequences of Operation

If the bridge superstructure is to be prestressed do not place mortar around casings in abutments and hinges until bridge superstructure prestressing has been completed.

20-2.14A(4) Payment

Supply line on structures is measured from end to end, along the centerline.

The Department does not pay for failed tests.

20-2.14B Supply Line on Structures, Less than 4 Inches**20-2.14B(1) General****20-2.14B(1)(a) Summary**

Section 20-2.14B includes specifications for installing water supply lines smaller than 4 inches.

20-2.14B(1)(b) Definitions

Reserved

20-2.14B(1)(c) Submittals

Product data for materials includes catalog cuts, performance data, and installation instructions.

Submit product data for:

1. Water supply line
2. Expansion assemblies
3. Casing insulators
4. Pipe end seals
5. Pipe anchorages
6. Air release valve assemblies
7. Casings
8. Pipe hangers
9. Epoxy adhesives
10. Concrete pipe supports

20-2.14B(1)(d) Quality Control and Assurance

Reserved

20-2.14B(2) Materials**20-2.14B(2)(a) General**

Reserved

20-2.14B(2)(b) Water Supply Line

Water supply lines must comply with section 20-2.09.

20-2.14B(2)(c) Expansion Assemblies

Expansion assemblies must consist of a hose with ends, insulated flange connections, and elbows. Expansion assemblies must have the same nominal inside diameter as the water supply line. Working pressure must be at least 150 psi.

Hose must be medium or heavy weight, crush and kink resistant, rated for at least 150 psi. Cover must be flexible, oil resistant rubber or synthetic, reinforced with at least 2-ply synthetic yarn or steel wire. The inner tube must meet FDA and USDA Standards for potable water. Hose ends must be stainless steel flanged connections with stainless steel crimped bands or swaged end connectors. Do not use barbed ends with band clamps.

Elbows must be 45 degree, standard weight galvanized steel fittings.

20-2.14B(2)(d) Casing Insulators

Casing insulators must be:

1. 2-piece, high-density, injection-molded polyethylene, nonconductive inner liner, with cadmium-plated nuts and bolts.
2. Factory constructed to ensure the water supply line is centered in the casing. Insulators must not allow any contact between pipe and casing and have at least 2 runners seated on the bottom of the casing.
3. Sized for the casing and water supply line shown.

20-2.14B(2)(e) Pipe Anchorages

Pipe anchorages must consist of an I-beam, U-bolts, anchors, and double nuts.

Use concrete anchorage devices for anchors on existing bridges. Use L-anchor bolts for anchors on new bridges.

Fabricate the I-beam from 1/2-inch steel plate. Steel plate, U-bolts, L-anchors, and nuts must comply with section 75-1.02. Concrete anchorage devices must comply with section 75-1.03C.

20-2.14B(2)(f) Pipe End Seals

Pipe end seals must consist of a pipe end seal, stainless steel bands, and polyurethane foam.

Pipe end seal must be factory constructed from seamless neoprene and sized for the casing and water supply line shown. Neoprene must be at least 1/8 inch thick. Stainless steel bands must be crimped.

Polyurethane foam must be expanding foam spray that is water resistant and moisture cured.

20-2.14B(3) Construction

Locate pipe anchorage halfway between expansion assemblies.

Pipe end seal must be pulled onto the casing during pipe installation. Do not use wrap-around type end seals.

20-2.14B(4) Payment

Supply line on structures is paid for as galvanized steel pipe (supply line on bridge).

20-2.14C Supply Line on Structures, 4 Inches and Larger

20-2.14C(1) General

20-2.14C(1)(a) Summary

Section 20-2.14C includes specifications for installing water supply lines 4 inches and larger.

20-2.14C(1)(b) Definitions

Reserved

20-2.14C(1)(c) Submittals

Product data for materials includes catalog cuts, performance data, and installation instructions.

Submit product data for:

1. Water supply line
2. Expansion assemblies
3. Flange insulating gaskets
4. Casing insulators
5. Seismic expansion assemblies
6. Lateral restraint assemblies
7. Air release valve assemblies
8. Casings
9. Pipe hangers
10. Epoxy adhesives
11. Concrete pipe supports

Submit the maximum range and preset dimension for each expansion assembly or seismic expansion assembly as an informational submittal.

Submit at least 5 sets of product data to OSD, Documents Unit. Each set must be bound together and include an index stating equipment names, manufacturers, and model numbers. Two sets will be returned. Notify the Engineer of the submittal. Include in the notification the date and contents of the submittal.

20-2.14C(1)(d) Quality Control and Assurance

Reserved

20-2.14C(2) Materials

20-2.14C(2)(a) General

Reserved

20-2.14C(2)(b) Water Supply Line

Water supply lines must consist of ductile iron pipe and fittings. Pipe must comply with ANSI/AWWA C151/A21.51, Class 350. Fittings must comply with ANSI/AWWA C110/A21.10, rated for a working pressure of 350 psi.

Ductile iron pipe connections to expansion assemblies must be a flanged joint complying with ANSI/AWWA C115/A21.15. Flange gaskets must be rated for a working pressure of 350 psi. Fasteners must comply with section 75-1.02, except that stainless steel fasteners must not be used.

All other ductile iron pipe and fitting joints must be push-on, restrained type complying with ANSI/AWWA C111/A21.11. Push-on, restrained type joints may use proprietary dimensions and proprietary restrained joint locking systems.

Ductile iron pipe and fittings must have an asphaltic coating complying with ANSI/AWWA C151/A21.51, and a cement mortar lining complying with ANSI/AWWA C104/A21.4.

20-2.14C(2)(c) Expansion Assemblies

Expansion assemblies must be a sleeve type expansion joint. The expansion assembly must have:

1. Ductile iron body complying with ANSI/AWWA C153/A21.53
2. Flanged ends complying with ANSI/AWWA C110/A21.10
3. Fusion bonded epoxy internal lining complying with ANSI/AWWA C213 at least 15 mils thick
4. Internal expansion sleeve limiting stop collars and be pressure balanced
5. Working pressure of at least 350 psi for sizes 24 inches and smaller and 250 psi for sizes larger than 24 inches
6. NSF 61 certification

The expansion assembly must be factory set at 1/2 the extension capacity.

20-2.14C(2)(d) Flange Insulating Gaskets

Flange insulating gaskets must consist of a dielectric flange gasket, insulating washers and sleeves, and commercial quality steel bolts and nuts. Dielectric flange gasket must have a dielectric strength of at least 500 vpm.

20-2.14C(2)(e) Casing Insulators

Casing insulators must be:

1. 2-piece, 8-inch, 14-gauge epoxy-coated or galvanized steel band, four 2-inch-wide glass-reinforced polyester or polyethylene runners, with cadmium-plated nuts and bolts.
2. Coated with at least 15-mils heat-fused PVC to provide a nonconductive inner liner.
3. Factory constructed to ensure the water supply line is centered in the casing. Insulators must not allow any pipe to casing contact and have at least 2 runners seated on the bottom of the casing.
4. Sized for the casing and water supply line shown.

20-2.14C(2)(f) Dirt Stops

Dirt stops must consist of a redwood cover with polyurethane foam.

Use construction heart grade redwood complying with 57-2.01B(2). Construct cover to fit snugly around the water supply line. The cover must be 2 inches taller and 2 inches wider than the casing.

Polyurethane foam must be expanding foam spray that is water resistant and moisture cured.

20-2.14C(2)(g) Seismic Expansion Assemblies

Seismic expansion assemblies must be a sleeve type expansion joint with integral ball joints at each end.

Seismic expansion assemblies must have:

1. Ability to withstand at least 15 degree angular deflection at each end and maximum movement in all 3 planes at the same time
2. Ductile iron body complying with ANSI/AWWA C153/A21.53
3. Flanged ends complying with ANSI/AWWA C110/A21.10
4. Fusion bonded epoxy internal lining complying with ANSI/AWWA C213 at least 15 mils thick
5. Internal expansion sleeve limiting stop collars and pressure balanced
6. Ball joints contained in flanged retainers with seal gaskets
7. Working pressure of at least 350 psi for sizes 24 inches and smaller and 250 psi for sizes larger than 24 inches

8. NSF 61 certification

The seismic expansion assembly must be factory set at 1/2 the extension capacity.

20-2.14C(2)(h) Lateral Restraint Assemblies

Lateral restraint assemblies must be (1) constructed from commercial quality steel components complying with section 75-1.02, (2) adjustable, and (3) able to resist a horizontal force of 10 percent of the contributory dead load.

20-2.14C(3) Construction

Each ductile iron pipe must be connected and fully extended (pulled out) after joint assembly before the next pipe section is added.

Install flange insulating gaskets on the outside flange of seismic expansion assemblies and expansion assemblies.

20-2.14C(4) Payment

Supply line on structures is paid for as supply line (bridge).

20-2.15 TEMPORARY IRRIGATION SYSTEMS

Reserved

20-2.16–20-2.19 RESERVED

20-3 PLANTING

20-3.01 GENERAL

20-3.01A General

20-3.01A(1) Summary

Section 20-3 includes specifications for performing planting work in new and existing landscapes.

20-3.01A(2) Definitions

Reserved

20-3.01A(3) Submittals

20-3.01A(3)(a) General

Submit nursery invoices showing species or variety and inspection certificates for plants.

Submit documentation of clearance from the county agricultural commissioner for plants obtained from a county outside the project limits.

If a root stimulant is required, submit a copy of the root stimulant manufacturer's product sheet and instructions for the application of the root stimulant.

If cuttings are to be taken from outside the right-of-way, submit proof of permits and payment of associated fees. Notify the Engineer of the location at least 15 days before taking cuttings.

20-3.01A(3)(b) Vendor Statements

At least 60 days before planting the plants, submit a statement from the vendor that the order for the plants required, including sample plants used for inspection, has been received and accepted by the vendor. The statement from the vendor must include the plant names, sizes, and quantities and the anticipated delivery date.

20-3.01A(3)(c) Certificates of Compliance

Submit a certificate of compliance for:

1. Sod
2. Soil amendment

20-3.01A(4) Quality Control and Assurance

Plants must comply with federal and state laws requiring inspection for diseases and infestations. Inspection certificates required by law must accompany each shipment of plants.

Obtain clearance from the county agricultural commissioner before planting plants delivered from a county outside the project limits.

The Engineer inspects the roots of container-grown sample plants by removing earth from the rootball of not less than 2 plants, nor more than 2 percent of the total number of plants of each species or variety. If container-grown plants are purchased from several sources, the Engineer inspects the roots of not less than 2 of each sample plant species or variety from each source. The rootball of container grown plants must not show evidence of being underdeveloped, deformed, or having been restricted.

If the Engineer finds noncompliant plants, the entire lot represented by the noncompliant sample plants will be rejected.

Cuttings with mature or brown stems and cuttings that have been trimmed will be rejected.

20-3.01B Materials

20-3.01B(1) General

Notify the Engineer at least 10 days before the plants are shipped to the job site.

20-3.01B(2) Plants

20-3.01B(2)(a) General

Plants must be the variety and size shown and true to the type or name shown. Plants must be individually tagged or tagged in groups identifying the plants by species or variety. Tagging is not required for cuttings.

Plants must be healthy, well-formed, not root-bound, free from insect pests and disease, and grown in nurseries inspected by the Department of Food and Agriculture.

The plants must comply with the size and type shown in the following table:

| Plant group designation | Description | Container size (cu in) |
|-------------------------|-----------------------|------------------------|
| A | No. 1 container | 152–251 |
| B | No. 5 container | 785–1242 |
| C | Balled and burlapped | -- |
| E | Bulb | -- |
| F | In flats | -- |
| H | Cutting | -- |
| I | Pot | -- |
| K | 24-inch box | 5775–6861 |
| M | Liner ^a | -- |
| O | Acorn | -- |
| P | Plugs ^{a, b} | -- |
| S | Seedling ^c | -- |
| U | No. 15 container | 2768–3696 |

^aDo not use containers made of biodegradable material.

^bGrown in individual container cells.

^cBare root.

Trucks used for transporting plants must be equipped with covers to protect plants from windburn.

Handle and pack plants in an authorized way for the species or variety.

20-3.01B(2)(b) Cuttings

20-3.01B(2)(b)(i) General

Take cuttings at random from healthy, vigorous plants. Make cuts with sharp, clean tools. Do not take more than 25 percent of an individual plant and not more than 50 percent of the plants in an area.

Keep cuttings covered and wet until planted. Do not allow cuttings to dry or wither.

Plant cuttings no more than 2 days after being cut.

20-3.01B(2)(b)(ii) *Carpobrotus* and *Delosperma* Cuttings

You may take cuttings for new *Carpobrotus* and *Delosperma* groundcover from the existing highway planting areas, but these areas may not provide enough material to complete the work. Contact the local District's encroachment permit office to obtain a permit to harvest cuttings, identify acceptable cutting harvest areas, and to determine acceptable quantities to take.

Take tip cuttings from healthy, vigorous *Carpobrotus* and *Delosperma* plants that are free of pests and disease.

Carpobrotus cuttings must be 10 inches or more in length and not have roots.

Delosperma cuttings must be 6 inches or more in length and not have roots.

20-3.01B(2)(b)(iii) Willow Cuttings

Take willow cuttings from areas shown or designated by the Engineer.

Willow cuttings must be:

1. Reasonably straight
2. 20 to 24 inches in length
3. 3/4 to 1-1/2 inch in diameter at the base of the cutting

Cut the top of each willow cutting square above a leaf bud. Cut the base below a leaf bud at approximately a 45 degree angle. Trim off leaves and branches flush with the stem of the cutting.

20-3.01B(2)(b)(iv) Cottonwood Cuttings

Cottonwood cuttings must comply with the requirements for willow cuttings in section 20-3.01B(2)(b)(iii).

20-3.01B(2)(b)(v)–20-3.01B(2)(b)(viii) Reserved

20-3.01B(2)(c) Sod

Sod must:

1. Be grown to comply with the Food & Agri Code
2. Be free from weeds and undesirable types of grasses and clovers
3. Be field-grown on soil containing less than 50 percent silt and clay
3. Have less than 1/2-inch-thick thatch
4. Not be less than 8 months or more than 16 months old
5. Be machine-cut to a uniform soil thickness of $5/8 \pm 1/4$ inch, not including top growth and thatch

Protect sod with tarps or other protective covers during delivery. Do not allow sod to dry out during delivery or before placement.

20-3.01B(3) Soil Amendment

Soil amendment must comply with the requirements in the Food & Agri Code. Soil amendment must be one or a combination of the following:

1. Sphagnum peat moss
2. Nitrolized fir bark
3. Vermiculite
4. Perlite

20-3.01B(4) Fertilizers

20-3.01B(4)(a) General

Deliver fertilizer in labeled containers showing weight, chemical analysis, and manufacturer's name.

Fertilizer must comply with the requirements of the Food & Agri Code.

20-3.01B(4)(b) Slow-release Fertilizers

Slow-release fertilizer must be a pelleted or granular form with a nutrient release over an 8 to 12 month period and must comply with the chemical analysis ranges shown in the following table:

| Ingredient | Content (percent) |
|--------------------------|-------------------|
| Nitrogen (N) | 16–21 |
| Phosphoric acid (P) | 6–8 |
| Water soluble potash (K) | 4–10 |

20-3.01B(4)(c) Packet Fertilizers

Packet fertilizer must be a biodegradable packet with a nutrient release over a 12 month period. Each packet must have a weight of 10 ± 1 grams and must comply with the chemical analysis shown in the following table:

| Ingredient | Content (percent) |
|--------------------------|-------------------|
| Nitrogen(N) | 20 |
| Phosphoric acid (P) | 10 |
| Water soluble potash (K) | 5 |

20-3.01B(4)(d) Organic Fertilizers

Organic fertilizer must be pelleted or granular with a cumulative nitrogen release rate of no more than 70 percent for the first 70 days after incubation at 86 degrees F with 100 percent at 350 days or more. Organic fertilizer must comply with the chemical analysis shown in the following table:

| Ingredient | Content (percent) |
|--------------------------|-------------------|
| Nitrogen (N) | 5–7 |
| Phosphoric acid (P) | 1–5 |
| Water soluble potash (K) | 1–10 |

20-3.01B(5) Root Stimulants

Root stimulant must be a commercial quality product.

20-3.01B(6) Plaster Sand

Backfill material for the transplant palm tree planting holes must be 100 percent commercial quality washed plaster sand.

20-3.01B(7) Root Barrier

Root barrier must be an injection molded or extruded modular panel made of high-density polypropylene or polyethylene plastic.

Each panel must:

1. Be at least 1/16-inch thick
2. Have at least 4 molded root-deflecting vertical ribs 0.5- to 0.8-inch wide, 6 to 8 inches apart
3. Have a locking strip or an integral male-female sliding lock designed to resist slippage between panels
4. Be at least 2 feet wide and 2 feet in depth

20-3.01B(8) Root Protectors

Each root protector must be:

1. Fabricated from 1-inch, hexagonal pattern, 20-gauge mesh wire
2. Closed bottom design with a height and diameter that provides a minimum of 6 inches of clearance between the root ball and the sides and bottom of the wire cylinder

Wire edges at the top of the cylinder must be the uncut manufactured finished edge free of sharp points.

20-3.01B(9) Foliage Protectors

Each foliage protector must be:

1. Fabricated from 1-inch, hexagonal pattern, 20-gauge mesh wire
2. Approximately 4 feet high and 2 feet in diameter

Wire edges at the top of the cylinder must be the uncut manufactured finished edge free of sharp points. Other wire edges that are cut must be free of sharp points.

Support stakes must be one of the following:

1. 3/4-inch reinforcing steel bar a minimum of 5 feet long with an orange or red plastic safety cap that fits snugly onto the top of the reinforcing steel bar
2. 2 inch nominal diameter or 2 by 2 inch nominal size wood stakes a minimum of 5 feet long. Wood stakes must be straight

The jute mesh cover must comply with section 21-1.02O(2). Twine required to hold the jute mesh cover in place must be 1/8-inch diameter manila hemp twine.

20-3.01B(10) Wood Plant Stakes

Each plant stake must be nominal 2 by 2 inch or nominal 2-inch diameter and of sufficient length to keep the plant in an upright position.

Plant stakes for vines must be nominal 1 by 1 inch, 18 inches long.

20-3.01B(11) Plant Ties

Plant ties must be extruded vinyl-based tape, 1 inch wide and at least 10 mils thick.

20-3.01C Construction

20-3.01C(1) General

Apply a root stimulant under the manufacturer's instructions to the plants specified in the special provisions.

Before transporting the plants to the planting area, thoroughly wet the root ball.

20-3.01C(2) Pruning

Prune plants under the latest edition of ANSI A300 part 1, *Pruning*, published by the Tree Care Industry Association.

Do not use tree seal compounds to cover pruning cuts.

20-3.01C(3) Watering

Water existing plants to be maintained, transplanted trees, and new plants as needed to keep the plants in a healthy growing condition.

20-3.01C(4) Replacement Plants

Plants that show signs of failure to grow at any time or are so injured or damaged as to render them unsuitable for the purpose intended, must be removed, replaced, and replanted. Replace unsuitable plants within 2 weeks after the Engineer marks or indicates that the plants must be replaced.

Replacement planting must comply with the original planting requirements, spacing, and size provisions described for the plants being replaced.

Replacement planting for transplanted trees must comply with the work plan and be planted in the same planting hole.

Replacement ground cover plants must be the same species specified for the ground cover being replaced. Other replacement plants must be the same species as the plants being replaced.

Place orders for replacement plants with the vendor at the appropriate time so that the replacement plants are not in a root-bound condition.

The Department does not pay for replacement plants or the planting of replacement plants.

20-3.01C(5) Maintain Plants

Maintain plants from the time of planting until Contract acceptance if no plant establishment period is specified or until the start of the plant establishment period.

20-3.01D Payment

Reserved

20-3.02 EXISTING PLANTING

20-3.02A General

20-3.02A(1) Summary

Section 20-3.02 includes specifications for pruning existing plants, transplanting trees, and maintaining existing planted areas.

Transplant palm trees between March 15 and October 15.

20-3.02A(2) Definitions

Reserved

20-3.02A(3) Submittals

Submit a work plan for:

1. Transplanting trees. The work plan must include methods for lifting, transporting, storing, planting, guying, and maintaining each tree to be transplanted. Include root ball size, method of root ball containment, and a maintenance program for each tree.
2. Maintaining existing planted areas. The work plan must include weed control, fertilization, mowing and trimming of turf areas, watering, and controlling rodents and pests.

Submit a copy of the manufacturer's product sheet for root stimulant including application instructions.

20-3.02A(4) Quality Control and Assurance

Inspect for deficiencies of existing planted areas in the presence of the Engineer. Complete the inspection within 15 days after the start of job site activities.

Deficiencies requiring corrective action include:

1. Weeds
2. Dead, diseased, or unhealthy plants
3. Missing plant stakes and tree ties
4. Inadequate plant basins and basin mulch
5. Other deficiencies needing corrective action to promote healthy plant life
6. Rodents and pests

20-3.02B Materials

Not Used

20-3.02C Construction

20-3.02C(1) General

Correct deficiencies of existing planted areas as ordered within 15 days of the order. Correction of deficiencies is change order work.

After deficiencies are corrected, perform work to maintain existing planted areas in a neat and presentable condition and to promote healthy plant growth through Contract acceptance.

20-3.02C(2) Prune Existing Plants

Prune existing plants as shown.

If no bid item for prune existing plants is included, prune existing plants as ordered. Pruning existing plants is change order work.

20-3.02C(3) Transplant Trees

Prune each tree to be transplanted immediately before lifting.

If the tree to be transplanted is a palm, prune by removing dead fronds and frond stubs from the trunk. Remove green fronds up to 2 rows of fronds away from the center of growth. Tie the remaining 2 rows of fronds in an upright position with light hemp or manila rope. Remove fronds and frond stubs at the trunk in a manner that will not injure the trunk. Remove fronds and frond stubs for *Phoenix dactylifera* (Date Palm) approximately 4 inches from the trunk.

Prepare each hole in the new location before lifting the tree to be transplanted.

Lift tree to be transplanted as described in the work plan.

Comply with section 20-3.03C(3) for handling and planting each tree to be transplanted.

Until replanted, cover exposed root ball with wet burlap or canvas and cover the crown with 90 percent shade cloth.

Replant each tree on the same day it is lifted if possible. If the transplant location is not ready to receive the tree, store and maintain the tree to be transplanted until the transplant location is authorized. Store tree in an upright position.

Replace damaged transplanted tree under 20-3.01C(4) and with the number of trees specified in the special provisions.

The replacement trees must be planted in individual plant holes at the location determined by the Engineer within the area of the tree being replaced. Comply with section 20-3.03C(2) for the planting of the replacement trees.

20-3.02C(4) Maintain Existing Planted Areas

If a bid item for maintain existing planted areas is included, the existing plant basins must be kept well-formed and free of sediment. If the existing plant basins need repairs, and the basins contain mulch, replace the mulch after the repairs are done.

Control weeds within the existing planted area and:

1. From the existing planted area limit to the adjacent edges of paving and fences if less than or equal to 12 feet
2. From the existing planted area limit to 6 feet beyond the outer limit of the existing planted area if the adjacent edge of paving or fence is more than 12 feet away
3. Within a 3-foot radius from each existing tree and shrub

If no bid item for maintain existing planted areas is included, maintain existing planted areas as ordered. Maintain existing planted areas is change order work.

20-3.02D Payment

Not Used

20-3.03 PLANTING WORK

20-3.03A General

Section 20-3.03 includes specifications for planting plants.

20-3.03B Materials

Not Used

20-3.03C Construction

20-3.03C(1) General

Do not begin planting until authorized.

If an irrigation system is required, do not begin planting in an area until the functional test has been completed and authorized for the irrigation system serving that area.

20-3.03C(2) Preparing Planting Areas

The location of each plant is as shown unless the Engineer designates otherwise. If the Engineer designates the location, it will be marked by a stake, flag, or other marker.

Conduct work so the existing flow line in drainage ditches is maintained. Material displaced by your operations that interferes with drainage must be removed.

Where a minimum distance to a drainage ditch is shown, locate the plant so that the outer edge of its basin wall is at least the minimum distance shown for each plant involved.

Excavate each planting hole by hand digging or by drilling. The bottom of each planting hole must be flat. Do not use water for excavating the hole.

Unless a larger planting hole is specified, the planting hole must be large enough to receive the root ball or the total length and width of roots, backfill, amendments, and fertilizer. Where rock or other hard material prohibits the hole from being excavated, a new hole must be excavated and the abandoned hole backfilled.

20-3.03C(3) Planting Plants

20-3.03C(3)(a) General

Do not plant plants in soil that is too wet, too dry, not properly conditioned as specified, or in an unsatisfactory condition for planting.

Do not distribute more plants than can be planted and watered on that day.

Water plants immediately after planting. Apply water until the backfill soil around and below the roots or ball of earth around the roots of each plant is thoroughly saturated. When watering with a hose, use a nozzle, water disbursement device, or pressure reducing device. Do not allow the full force of the water from the open end of the hose to fall within the basin around any plant. Groundcover plants in areas with an irrigation system must be watered by sprinklers. Several consecutive watering cycles may be necessary to thoroughly saturate the soil.

If shown, install root barriers between trees and concrete sidewalk or curb. Install panels flush with finished grade and join with locking strips or integral male-female sliding locks. Install barriers with root deflectors facing inward.

If a tree grate is shown, install root barrier panels 0.5 inch above finish grade or as shown.

Adjust planting locations so that each tree or shrub is at least 8 feet away from any sprinkler.

Where a tree, shrub, or vine is to be planted within a groundcover area or cutting planting area, plant it before planting groundcover or cuttings.

Where shrubs and groundcovers are shown to be planted in groups, the outer rows directly adjacent to the nearest roadway or highway fence must be parallel to the nearest roadway or highway fence. Stagger shrubs and groundcovers in adjacent rows. Adjust the alignment of the plants within the outer rows.

Core holes in concrete masonry block wall as shown.

Where a vine is to be planted against a wall or fence, plant it as close as possible to the wall or fence. If a vine planted next to a wall is to be staked, stake and tie the vine at the time of planting. A vine planted next to a fence must be tied to the fence at the time of planting.

Protect tree trunks from injury. Do not:

1. Drag tree
2. Use chains to move a tree
3. Lay tree on the ground

20-3.03C(3)(b) Trees, Shrubs, and Vines

After preparing holes, thoroughly mix soil amendment and granular fertilizer at the rate shown with native soil to be used as backfill material. Remove containers from plants in such a manner that the ball of earth surrounding the roots is not broken. Do not cut plant containers before delivery of the plants to the planting area. Plant and water plants immediately after removal from their containers.

Place packet fertilizer in the backfill within 6 to 8 inches of the ground surface and approximately 1 inch from the root ball. If more than 1 packet is required per plant, distribute the packets evenly around the root ball.

If a root stimulant is to be used, apply it according to the manufacturer's instructions.

If required, install root protectors in the plant holes as shown.

Ensure roots are not restricted or distorted.

Distribute backfill uniformly throughout the entire depth of the plant hole without clods or lumps. After the planting holes have been backfilled, jet water into the backfill with a pipe or tube inserted into the bottom of the hole until the backfill material is saturated for the full depth. If the backfill material settles below this level, add additional backfill to the required level. If a plant settles deeper than shown, replant it at the required level.

Remove nursery stakes after planting.

Install 2 plant stakes for each plant to be staked at the time of planting as shown. Ensure the rootball is not damaged.

Tie the plant to the stakes with 2 plant ties, 1 tie to each stake. Each tie must form a figure 8 by crossing the tie between the plant and the stake as shown. Install ties at the lowest position that will support the plant in an upright position. Ties must provide trunk flexibility but not allow the trunk to rub against the stakes. Wrap each end of the tie 1-1/2 turns around the stake and securely tie.

Construct a watering basin around each plant as shown.

If required, install a foliage protector:

1. Over the plant within 2 days after planting.
2. Vertically and centered over the plant as shown

If foliage protectors are required:

1. Cut the bottom of the wire cylinder to match the slope of the ground. Do not leave sharp points of wire after cutting. Sharp points must be bent over or blunted.
2. Install 2 support stakes for foliage protectors vertically and embed in the soil on opposite sides of the plant as shown and in a transverse direction to the prevailing wind.
3. Either weave the support stakes through the wire cylinder mesh at 6 inch maximum centers or fasten the wire cylinder to the support stakes at 6 inch maximum centers.
4. Wire cylinder must be snug against the support stakes but loose enough to be raised for pesticide application or to perform weeding within the plant basin.
5. Install jute mesh cover over the foliage protector and secure with twine as shown.

20-3.03C(3)(c) Groundcover Plants

Each groundcover planting area irrigated by a single control valve must be completely planted and watered before planting other groundcover planting areas.

Plant groundcover plants in moist soil, and in neat, straight rows, spaced as shown.

Apply fertilizer to groundcover plants and water into the soil immediately after planting.

20-3.03C(3)(d) Cuttings, Liners, Plugs, and Seedling Plants

20-3.03C(3)(d)(i) General

Apply fertilizer to cuttings, liners, plugs, and seedling plants and water immediately after planting.

Ensure the soil is moist to a minimum depth of 8 inches before planting cuttings.

If a root stimulant is to be used, apply it according to the manufacturer's instructions.

20-3.03C(3)(d)(ii) Willow Cuttings

Unless otherwise shown, for willow cuttings excavate planting holes perpendicular to the ground line by using a steel bar, auger, post hole digger, or similar tools. Holes must be large enough to receive the cuttings and fertilizer packet. Plant willow cuttings to the specified depths without damaging the bark.

Where rock or other hard material prohibits the excavation of the planting holes, excavate new holes and backfill the unused holes.

Plant willow cuttings during the period specified in the special provisions.

Apply root stimulant according to the manufacturer's instructions.

Plant the base of the cutting 10 to 12 inches deep with 3 to 5 bud scars exposed above the ground. If more than 5 bud scars are exposed, trim off the excess willow cutting length.

Place 1 fertilizer packet in the backfill of each cutting, 6 to 8 inches below the ground surface and approximately 1 inch from the cutting.

Backfill the plant holes with excavated material after planting. Distribute the excavated material evenly within the hole without clods, lumps, or air pockets. Compact the backfill so that the cutting cannot be easily removed from the soil. Do not damage the cutting's bark.

Dispose of trimmings and unused cuttings.

20-3.03C(3)(d)(iii) Cottonwood Cuttings

Reserved

20-3.03C(3)(d)(iv) *Carpobrotus* and *Delosperma* Cuttings

Plant *Carpobrotus* cuttings to a depth so that not less than 2 nodes are covered with soil. The basal end of *Delosperma* cuttings must not be less than 2 inches below the surface of the soil and the basal end of *Carpobrotus* cuttings must not be less than 4 inches below the surface of the soil.

Apply root stimulant to *Delosperma* cuttings before planting.

Do not plant *Carpobrotus* or *Delosperma* cuttings in soil that does not contain sufficient moisture at an average depth of 2 inches below the surface.

20-3.03C(3)(d)(v) Liner Plants

Plant liner plants during the period specified in the special provisions.

If a foliage protector is required, install under section 20-3.03C(3)(b).

20-3.03C(3)(d)(vi) Plug Plants

Plant plug plants during the period specified in the special provisions.

20-3.03C(3)(d)(vii) Seedling Plants

Plant seedling plants during the period specified in the special provisions.

20-3.03C(3)(e) Sod

After all other planting is performed, grade sod areas to drain and to a smooth and uniform surface. Fine grade and roll sod areas before placing sod.

Areas adjacent to sidewalks, edging, and other paved borders and surfaced areas must be 1 inch below the finished surface elevation of the facilities, after fine grading, rolling, and settlement of the soil.

Place sod such that the end of each adjacent strip is staggered a minimum of 2 feet. Place the edge and end of sod firmly against adjacent sod and against sidewalks, edging, and other paved borders and surfaced areas.

Lightly roll the entire sodded area to eliminate air pockets and ensure close contact with the soil after placement of sod. Water the sodded areas so that the soil is moist to a minimum depth of 4 inches after rolling. Do not allow the sod to dry out.

If irregular or uneven areas appear in the sodded areas, restore to a smooth and even appearance.

Trim sod to a uniform edge at sidewalks, edging, and other paved borders and surfaced areas. Trimming must be repeated whenever the edge of sod extends 1 inch beyond the edge of the edging, sidewalks, and other paved borders and surfaced areas. Remove and dispose of trimmed sod.

Mow sod when it has reached a height of 4 inches. Mow sod to a height of 2.5 inches.

20-3.03D Payment

Soil amendment is measured in the vehicle at the point of delivery.

Measurement for slow-release fertilizer, organic fertilizer, or iron sulfate is determined from marked weight or sack count.

Various sizes and types of plants are measured by either the product of the average plant density and the total area planted or by actual count of the living plants in place, determined by the Engineer. The average plant density is the number of living plants per sq yd determined from actual count of test areas chosen representing the total planted area. The size and location of the test areas is determined by you and the Engineer, except that the total area tested must be equal to not less than 3 percent nor more than 5 percent of the planted area being determined. The Engineer makes the final determination of the areas to be tested.

20-3.04–20-3.08 RESERVED

20-4 PLANT ESTABLISHMENT WORK

20-4.01 GENERAL

20-4.01A Summary

Section 20-4 includes specifications for performing plant establishment work.

Plant establishment consists of caring for the plants, including watering, fertilizing, pruning, replacing damaged plants, pest control, and operating and repairing of all existing irrigation facilities used and irrigation facilities installed as part of the new irrigation system.

Working days on which no work is required, as determined by the Engineer, will be credited as a plant establishment working day, regardless of whether or not you perform plant establishment work.

Working days whenever you fail to adequately perform plant establishment work will not be credited toward the plant establishment working days.

20-4.01B Definitions

Type 1 plant establishment: Plant establishment period with the number of working days specified for plant establishment beginning after all work has been completed except for plant establishment work and other bid items specified to be performed until Contract acceptance.

Type 2 plant establishment: Plant establishment period with the number of working days specified for plant establishment beginning after all planting work has been completed except for plant establishment work and other bid items specified to be performed until Contract acceptance, provided that the Contract must not be accepted unless the plant establishment work has been satisfactorily performed for at least the number of working days specified for plant establishment.

If maintenance and protection relief is granted for a completed portion of the work under section 5-1.38, Type 2 plant establishment period for the completed portion of the work is the time between

completion of all planting work except for plant establishment work, and the granting of maintenance and protection relief, provided that the relief must not be granted unless the plant establishment work in the completed portion of the work has been satisfactorily performed for at least the number of working days specified for the plant establishment period.

20-4.01C Submittals

20-4.01C(1) General

Submit seasonal watering schedules for use during the plant establishment period within 10 days after the start of the plant establishment period. Remote irrigation control system watering schedule must utilize the remote irrigation control system software program.

Submit updated watering schedules within 5 business days after any changes have been made to the authorized schedules.

Submit a revised watering schedule for each irrigation controller not less than 30 days before completion of the plant establishment period.

20-4.01C(2) Notification

The Engineer will notify you in writing when the plant establishment period begins and will furnish statements regarding the number of working days credited to the plant establishment period after the notification.

Notify the Engineer at least 5 business days before applying each application of fertilizer.

20-4.01D Quality Control and Assurance

Provide training by a qualified person on the use and adjustment of the irrigation controllers installed, 30 days before completion of the plant establishment period.

Perform a final inspection of the plant establishment work in the presence of the Engineer between 20 and 30 days before Contract acceptance.

20-4.02 MATERIALS

20-4.02A General

Reserved

20-4.02B Fertilizers

Fertilizer must comply with section 20-3.01B(5).

20-4.03 CONSTRUCTION

20-4.03A General

Remove trash and debris.

Surplus earth accumulated in roadside clearing and planting areas must be removed.

Trim and mow turf areas as specified for sod in section 20-3.03C(3)(e). Dispose of trimmed and mowed material.

If irregular or uneven areas appear within turf areas, restore to a smooth and even appearance. Reseed turf seed areas.

Remove the tops of foliage protectors if plants become restricted.

Remove foliage protectors, including support stakes, within 30 days before the completion of the plant establishment period.

Keep plant basin walls well formed.

Clean new wye strainers and existing wye strainers that are a part of the new irrigation system annually until the completion of the plant establishment period. The last cleaning must be done within 15 days before the completion of the plant establishment period.

Remove, clean, and reinstall new filters and existing filters that are a part of the new irrigation system annually until the completion of the plant establishment period. The last cleaning must be done within 15 days before the completion of the plant establishment period.

20-4.03B Plant Growth Control

Prune plants planted as part of the Contract as authorized.

Remove plant growth that extends within 2 feet of sidewalks, curbs, dikes, shoulders, walls or fences.

Remove proposed and existing ground cover from within the plant basins, including basin walls, turf areas, and planting areas within edging.

Vines next to walls and fences must be kept staked and tied. Train vines on fences and walls or through cored holes in walls.

20-4.03C Fertilizers

Apply fertilizer to the plants as specified and water into the soil after each application.

Apply fertilizer at the rates shown and spread with a mechanical spreader, whenever possible.

20-4.03D Weed Control

Control weeds under section 20-1.03C(3).

20-4.03E Plant Staking

Replace the plant stakes that are inadequate to support plants with larger stakes.

Remove plant stakes when the Engineer determines they are no longer needed.

20-4.03F Replacement Plants

Replacement plants must comply with section 20-3.01C(4).

Replacement of plants up to and including the 125th plant establishment working day must be with a plant of the same size as originally specified. Plants of a larger container size than those originally specified for replacement plants may be used during the first 125 working days of the plant establishment period.

Replacement of plants after the 125th plant establishment working day must comply with the following size requirements:

| Plant size (Original) | Plant size (Replacement) |
|-------------------------|--------------------------|
| Pot/liner/plug/seedling | No. 1 container |
| No. 1 container | No. 5 container |
| No. 5 container | No. 15 container |

Other replacement plants must be the same size as originally specified.

Replacement ground cover plants must comply with the following spacing requirements:

| Original spacing (inches) | On center spacing of replacement ground cover plants (inches) | | |
|---------------------------|---|---------|---------------------------------------|
| | Number of completed plant establishment working days | | |
| | 1–125 | 126–190 | 191–End of plant establishment period |
| 9 | 9 | 6 | 6 |
| 12 | 12 | 9 | 6 |
| 18 | 18 | 12 | 9 |
| 24 | 24 | 18 | 12 |
| 36 | 36 | 24 | 18 |

20-4.03G Watering

Operate the electric automatic irrigation systems in the automatic mode unless authorized.

If any component of the electric automatic irrigation system is operated manually, the day will not be credited as a plant establishment working day unless the manual operation is authorized.

Water plants utilizing the remote irrigation control system software program unless authorized.

Implement the watering schedule at least 10 days before completion of the plant establishment period.

20-4.04 PAYMENT

Not Used

20-5 LANDSCAPE ELEMENTS

20-5.01 GENERAL

20-5.01A General

Section 20-5 includes specifications for constructing and installing landscape elements.

20-5.01B Materials

Not Used

20-5.01C Construction

Earthwork must comply with section 19.

20-5.01D Payment

Not Used

20-5.02 EDGING

20-5.02A General

Section 20-5.02 includes specifications for constructing landscape edging.

20-5.02B Materials

20-5.02B(1) General

Reserved

20-5.02B(2) Header Board Edging

Lumber for header board edging must be one of the following types:

1. Construction grade cedar
2. Pressure-treated Douglas fir
3. Construction heart grade redwood complying with section 57-2.01B(2)

Lumber must be:

1. Rough cut from sound timber.
2. Straight. Sweep must not exceed 1 inch in 6 feet.
3. Free from loose or unsound knots. Knots must be sound, tight, well spaced, and not to exceed 2 inches in size on any face.
4. Free of shakes in excess of 1/3 the thickness of the lumber.
5. Free of splits longer than the thickness of the lumber.
6. Free of other defects that would render the lumber unfit structurally for the purpose intended.

Edging anchors for header board edging must be stakes of the size and shape shown.

20-5.02B(3) Metal Edging

Metal edging must be commercial quality, made of aluminum or steel, and have an L-shaped design. Edging must be a minimum of 4 inches in height. The thickness must be as recommended by the manufacturer for the use intended.

Edging anchors must be from the same manufacturer as the metal edging.

20-5.02B(4) High Density Polyethylene Edging

HDPE edging must be commercial quality and a minimum of 4 inches in height. The thickness must be as recommended by the manufacturer for commercial installation for the use intended.

Edging anchors must be from the same manufacturer as HDPE edging.

20-5.02B(5) Concrete Edging

Concrete for edging must be minor concrete.

20-5.02B(6)–20-5.02B(10) Reserved

20-5.02C Construction

20-5.02C(1) General

Where edging is used to delineate the limits of inert ground cover or mulch areas, install edging before installing inert ground cover or mulch areas.

Saw cut surfaces where (1) asphalt concrete or concrete surfacing must be removed to permit the installation of edging and (2) no joint exists between the surfacing to be removed and the surfacing to remain in place. The surfacing must be cut in a straight line to a minimum depth of 2 inches with a power-driven saw before the surfacing is removed. Spike or stake spacing must comply with the manufacturer's instructions for use and site conditions.

20-5.02C(2) Header Board Edging

Each stake must be driven flush with the top edge of the header board edging and the stake top must be beveled away from the header board at a 45 degree angle. Attach stake to header board with a minimum of two 12-penny hot dipped galvanized nails per stake.

20-5.02C(3) Metal and High Density Polyethylene Edging

Spike or stake spacing must comply with the manufacturer's instructions for use and site conditions.

20-5.02C(4) Concrete Edging

Construct and finish minor concrete edging under section 73-2.

20-5.02C(5)–20-5.02C(9) Reserved

20-5.02D Payment

Edging is measured parallel to the ground surface.

20-5.03 INERT GROUND COVERS AND MULCHES

20-5.03A General

20-5.03A(1) General

20-5.03A(1)(a) Summary

Section 20-5.03 includes specifications for installing inert ground covers and mulches.

20-5.03A(1)(b) Definitions

Reserved

20-5.03A(1)(c) Submittals

Submit:

1. Filter fabric product data including the manufacturer's product sheet and installation instructions
2. Certificate of compliance for filter fabric at least 5 business days before delivery of the material to the job site

20-5.03A(1)(d) Quality Control and Assurance

Reserved

20-5.03A(2) Materials

Soil sterilant must be oxadiazon granular preemergent and must comply with section 20-1.02C.

Filter fabric must be Class A. Staples for filter fabric must comply with section 21-1.02R.

20-5.03A(3) Construction

20-5.03A(3)(a) General

Before performing inert ground cover and mulch work, remove plants and weeds to ground level.

20-5.03A(3)(b) Earthwork

Excavate areas to receive inert ground cover or mulch to the depth shown. Maintain the planned flow lines, slope gradients, and contours of the job site. Grade subgrade to a smooth and uniform surface and compact to not less than 90 percent relative compaction.

20-5.03A(3)(c) Treatment of Soil

After compaction, apply soil sterilant at the maximum label rate. Do not apply soil sterilant more than 12 inches beyond the inert ground cover or mulch limits. The soil sterilant application and inert ground cover or mulch placement must be completed within the same work day.

20-5.03A(3)(d) Filter Fabric

Immediately before placing filter fabric, surfaces to receive filter fabric must be free of loose or extraneous material and sharp objects that may damage the filter fabric during installation.

Align fabric and place in a wrinkle-free manner.

Overlap adjacent rolls of the fabric from 12 to 18 inches. Spread each overlapping roll in the same direction. Fasten fabric with staples flush with the adjacent fabric to prevent movement of fabric by placement of inert ground cover or mulch.

Repair or replace fabric damaged during placement of inert ground cover or mulch with sufficient fabric to comply with overlap requirements.

20-5.03A(4) Payment

Not Used

20-5.03B Rock Blanket

20-5.03B(1) General

20-5.03B(1)(a) Summary

Section 20-5.03B includes specifications for placing rock blanket.

20-5.03B(1)(b) Definitions

Reserved

20-5.03B(1)(c) Submittals

Submit a 1 sq yd sample of the various rock sizes.

20-5.03B(1)(d) Quality Control and Assurance

Reserved

20-5.03B(2) Materials

20-5.03B(2)(a) General

Do not use filter fabric.

20-5.03B(2)(b) Concrete

Concrete must be minor concrete.

20-5.03B(2)(c) Rock

Rock must be clean, smooth, and obtained from a single source and must comply with the following grading requirements:

Grading Requirements

| Screen size (inches) | Percentage passing |
|----------------------|--------------------|
| 8 | 100 |
| 6 | 50-85 |
| 4 | 0-50 |

20-5.03B(2)(d) Mortar

Mortar must comply with section 51-1.02F.

20-5.03B(3) Construction

Place concrete as shown.

Rock must be placed while concrete is still plastic. Remove concrete adhering to the exposed surfaces of the rock.

Loose rocks or rocks with a gap greater than 3/8 inch must be reset by an authorized method. The rock gap is measured from the edge of the rock to the surrounding concrete bedding.

Place mortar as shown.

20-5.03B(4) Payment

Rock blanket is measured parallel to the rock blanket surface.

20-5.03C Gravel Mulch

20-5.03C(1) General

20-5.03C(1)(a) Summary

Section 20-5.03C includes specifications for placing gravel mulch.

20-5.03C(1)(b) Definitions

Reserved

20-5.03C(1)(c) Submittals

Submit a 5-lb sample of the gravel mulch.

20-5.03C(1)(d) Quality Control and Assurance

Reserved

20-5.03C(2) Materials

Gravel mulch must be:

1. Uniform gray color
2. From a single source only
3. Crushed rock that complies with the following grading requirements:

Grading Requirements

| Sieve size | Percent passing |
|------------|-----------------|
| 1-1/4 inch | 100 |
| 3/4 inch | 60-80 |
| 1/2 inch | 45-65 |
| No. 40 | 5-20 |

20-5.03C(3) Construction

Place gravel and compact by rolling.

The finished gravel mulch surface must be smooth and uniform, maintaining original flow lines, slope gradients, and contours of the job site.

20-5.03C(4) Payment

Gravel mulch is measured parallel to the gravel mulch surface.

20-5.03D Decomposed Granite

20-5.03D(1) General

20-5.03D(1)(a) Summary

Section 20-5.03D includes specifications for placing decomposed granite.

20-5.03D(1)(b) Definitions

Reserved

20-5.03D(1)(c) Submittals

Five business days before delivery of the materials to the job site, submit:

1. Solidifying emulsion product data including the manufacturers' product sheets and installation instructions
2. Certificate of compliance for solidifying emulsion
3. 5-lb sample of the decomposed granite

20-5.03D(1)(d) Quality Control and Assurance

Test plot must be:

1. Constructed at an authorized location
2. At least 3 by 12 feet
3. Constructed using the materials, equipment, and methods to be used in the work
4. Authorized before starting work

Notify the Engineer not less than 7 days before constructing the test plot.

The Engineer uses the authorized test plot to determine acceptability of the work.

If ordered, prepare additional test plots. Additional test plots are change order work.

If the test plot is not incorporated into the work, the Engineer may order you to remove it.

20-5.03D(2) Materials

20-5.03D(2)(a) General

Decomposed granite must be:

1. Uniform gray or tan color
2. From one source only
3. Crushed granite rock that complies with grading requirements shown in the following table:

Grading Requirements

| Sieve size | Percent passing |
|------------|-----------------|
| 3/8 inch | 100 |
| No. 4 | 95–100 |
| No. 8 | 75–80 |
| No. 16 | 55–65 |
| No. 30 | 40–50 |
| No. 50 | 25–35 |
| No. 100 | 20–25 |
| No. 200 | 5–15 |

Note:

Grading based upon AASHTO T11-82 and T27-82

20-5.03D(2)(b) Solidifying Emulsion

Solidifying emulsion must be either a water-based polymer or nontoxic organic powdered binder specifically manufactured to harden decomposed granite. The solidifying emulsion must not alter the decomposed granite color.

20-5.03D(3) Construction

Do not place decomposed granite during rainy conditions.

Mix solidifying emulsion thoroughly and uniformly throughout the decomposed granite and under the manufacturer's instructions. Mix the material in the field using portable mixing equipment, or delivered in mixer trucks from a local ready-mixed plant.

Place decomposed granite uniformly in layers no more than 1-1/2 inch thick. Compact each layer of decomposed granite to a relative compaction of not less than 90 percent. Begin compaction within 6 to 48 hours of placement.

If the material was mixed in the field, apply an application of solidifying emulsion after compaction as recommended by the manufacturer. Prevent runoff or overspray of solidifying emulsion onto adjacent paved or planting areas.

The finished decomposed granite surface must be smooth and uniform, compacted to a relative compaction of not less than 90 percent, maintaining original flow lines, slope gradients, and contours of the job site.

20-5.03D(4) Payment

Not Used

20-5.03E Wood Mulch

20-5.03E(1) General

20-5.03E(1)(a) Summary

Section 20-5.03E includes specifications for placing wood mulch.

20-5.03E(1)(b) Definitions

Reserved

20-5.03E(1)(c) Submittals

Submit a certificate of compliance for mulch.

Submit a 2 cu ft mulch sample with the mulch source listed on the bag and obtain approval before delivery of mulch to the job site.

20-5.03E(1)(d) Quality Control and Assurance

Reserved

20-5.03E(2) Materials

20-5.03E(2)(a) General

Mulch must not contain more than 0.1 percent of deleterious materials such as rocks, glass, plastics, metals, clods, weeds, weed seeds, coarse objects, sticks larger than the specified particle size, salts, paint, petroleum products, pesticides or other chemical residues harmful to plant or animal life.

Do not use filter fabric.

20-5.03E(2)(b) Tree Bark Mulch

Tree bark mulch must be derived from cedar, Douglas fir, or redwood species.

Tree bark mulch must be ground so that at least 95 percent of the material by volume is less than 2 inches and no more than 30 percent by volume is less than 1 inch.

20-5.03E(2)(c) Wood Chip Mulch

Wood chip mulch must:

1. Be derived from clean wood
2. Not contain leaves or small twigs
3. Contain at least 95 percent wood chips by volume with average thickness of 1/16 to 3/8 inch in any direction and 1/2 to 3 inches in length

20-5.03E(2)(d) Shredded Bark Mulch

Shredded bark mulch must:

1. Be derived from trees
2. Be a blend of loose, long, thin wood, or bark pieces
3. Contain at least 95 percent wood strands by volume with average thickness of 1/8 to 1-1/2 inches in any direction and 2 to 8 inches in length

20-5.03E(2)(e) Tree Trimming Mulch

Tree trimming mulch must:

1. Be derived from chipped trees and may contain leaves and small twigs.
2. Contain at least 95 percent material by volume less than 3 inches and no more than 30 percent by volume less than 1 inch

20-5.03E(2)(f)–20-5.03E(2)(j) Reserved

20-5.03E(3) Construction

Spread mulch placed in areas outside of plant basins to a uniform thickness as shown.

Mulch must be placed at the rate described and placed in the plant basins or spread in areas as shown after the plants have been planted. Mulch placed in plant basins must not come in contact with the plant crown and stem.

Spread mulch from the outside edge of the proposed plant basin or plant without basin to the adjacent edges of shoulders, paving, retaining walls, dikes, edging, curbs, sidewalks, walls, fences, and existing plantings. If the proposed plant or plant without basin is 12 feet or more from the adjacent edges of shoulders, paving, retaining walls, dikes, edging, curbs, sidewalks, walls, fences, and existing plantings, spread the mulch 6 feet beyond the outside edge of the proposed plant basin or plant without basin.

Do not place mulch within 4 feet of:

1. Flow line of earthen drainage ditches
2. Edge of paved ditches
3. Drainage flow lines

20-5.03E(4) Payment

Mulch is measured in the vehicle at the point of delivery.

20-5.03F–20-5.03J Reserved

20-5.04 RESERVED

Reserved

20-5.05 SITE FURNISHINGS

20-5.05A General

Section 20-5.05 includes specifications for installing site furnishings.

20-5.05B–20-5.05Z Reserved

20-5.06–20-5.10 RESERVED

AA

21 EROSION CONTROL

07-19-13

Replace ", bonded fiber matrix, and polymer-stabilized fiber matrix" in the 1st paragraph of section 21-1.01B with:

and bonded fiber matrix

04-20-12

Delete the last paragraph of section 21-1.02E.

04-20-12

Replace section 21-1.02F(2) with:

21-1.02F(2) Reserved

04-20-12

Replace "20-7.02D(1)" in the 1st paragraph of section 21-1.02H with:

20-3.01B(4)

07-19-13

Replace section 21-1.02J with:

21-1.02J Reserved

04-20-12

Replace the row for organic matter content in the table in the 4th paragraph of section 21-1.02M with:

01-18-13

| | | |
|------------------------|---|--------|
| Organic matter content | TMECC 05.07-A Loss-on-ignition organic matter method (LOI) % dry weight basis | 30–100 |
|------------------------|---|--------|

Replace section 28-2 with:

07-19-13

28-2 LEAN CONCRETE BASE

28-2.01 GENERAL

28-2.01A Summary

Section 28-2 includes specifications for constructing lean concrete base (LCB).

28-2.01B Definitions

coarse aggregate: Aggregate retained on a no. 4 sieve.

fine aggregate: Aggregate passing a no. 4 sieve.

28-2.01C Submittals

28-2.01C(1) General

At least 25 days before field qualification, submit the name of your proposed testing laboratory.

At least 10 days before field qualification, submit:

1. Aggregate qualification test results
2. Proposed aggregate gradation
3. Mix design, including:
 - 3.1. Proportions
 - 3.2. Types and amounts of chemical admixtures
4. Optional notice stating intent to produce LCB qualifying for a transverse contraction joint waiver under section 28-2.03D

Submittals for cementitious material must comply with section 90-1.01C(3).

Submit QC test results within 24 hours of test completion.

28-2.01C(2) Field Qualification

11-15-13

For each field qualification for each mix design, manufacture 12 specimens under ASTM C 31 and submit six of the specimens from 24 to 72 hours after manufacture. Use one batch for all 12 specimens.

07-19-13

Submit field qualification data and test reports including:

1. Mixing date
2. Mixing equipment and procedures used
3. Batch volume in cu yd, the minimum is 5 cu yd
4. Type and source of ingredients used
5. Age and strength from compression strength results

Field qualification test reports must be signed by the official in responsible charge of the laboratory performing the tests.

28-2.01D Quality Control and Assurance

28-2.01D(1) General

Stop LCB activities and immediately notify the Engineer whenever:

1. Any quality control or acceptance test result does not comply with the specifications
2. Visual inspection shows noncompliant LCB

If LCB activities are stopped, before resuming activities:

1. Inform the Engineer of the adjustments you will make
2. Remedy or replace the noncompliant LCB

3. Obtain authorization

Molds for compressive strength testing under ASTM C 31 or ASTM C 192 must be 6 by 12 inches.

Quality control and assurance for cementitious materials and admixtures must comply with section 90-1.01D(1)

28-2.01D(2) Aggregate Qualification Testing

Qualify the aggregate for each proposed aggregate source and gradation. Qualification tests include (1) sand equivalent and (2) average 7-day compressive strength under ASTM C 39 on 3 specimens manufactured under ASTM C 192. The cement content for this test must be 300 lb/cu yd, and the 7-day average compressive strength must be at least 610 psi. Cement must be Type II portland cement under section 90-1.02B(2).

LCB must have from 3 to 4 percent air content during aggregate qualification testing.

28-2.01D(3) Field Qualification Testing

Before placing LCB, you must perform field qualification testing and obtain authorization for each mix design. Retest and obtain authorization for changes to authorized mixed designs.

Proposed mix designs must be field qualified before you place the LCB represented by those mix designs. Use an American Concrete Institute (ACI) certified "Concrete Laboratory Technician, Grade I" to perform field qualification tests and calculations.

Notify the Engineer at least 5 days before field qualification. Perform field qualification within the job site or a location authorized by the Engineer.

Field qualification testing includes compressive strength, air content, and penetration or slump in compliance with the table titled "Quality Control Requirements."

Field qualification testing for compressive strength must comply with the following:

1. Manufacture 12 cylinders under ASTM C 31 from a single batch
2. Perform 3 tests; each test consists of determining the average compressive strength of 2 cylinders at 7 days under ASTM C 39
3. The average compressive strength for each test must be at least 530 psi

If you submitted a notice to produce LCB qualifying for a transverse contraction joint waiver, manufacture additional specimens and test LCB for compressive strength at 3 days. Prepare compressive strength cylinders under ASTM C 31 at the same time using the same material and procedures as the 7-day compressive strength cylinders except do not submit 6 additional test cylinders. The average 3-day compressive strength for each test must be not more than 500 psi.

28-2.01D(4) Quality Control Testing

Provide a testing laboratory to perform quality control tests. Maintain sampling and testing equipment in proper working condition. Perform sampling under California Test 125.

Testing laboratories and testing equipment must comply with the Department's Independent Assurance Program.

Perform quality control sampling, testing, and inspection throughout LCB production and placement. LCB must comply with the requirements for the quality characteristics shown in the following table:

Quality Control Requirements

| Quality characteristic | Test method | Minimum sampling and testing frequency | Requirement |
|--|------------------------|--|------------------------------------|
| Sand equivalent (min) | ASTM D 2419 | 1 per 500 cubic yards but at least 1 per day of production | 18 |
| Aggregate gradation | ASTM C 136 | | Note a |
| Air content (max, percent) ^b | ASTM C 231 | | 4 |
| Penetration (inches) | ASTM C 360 | | 0 to 1-1/2 nominal ^{c, d} |
| Slump (inches) | ASTM C 143 | | 0-3 nominal ^{c, d} |
| Compressive strength (min, psi at 7 days) | ASTM C 39 ^e | | 530 |
| Compressive strength (max, psi at 3 days) ^f | ASTM C 39 ^e | | 500 |

^a Comply with the table titled "Aggregate Grading" in section 28-2.02C.

^b If no single test in the first 5 air content tests exceeds 1-1/2 percent, no further air content tests are required.

^c Maximum penetration must not exceed 2 inches and maximum slump must not exceed 4 inches

^d Test for either penetration or slump

^e Prepare cylinders under ASTM C 31

^f Only applicable if you (1) submitted a notice stating intent to produce LCB qualifying for a transverse contraction joint waiver and (2) successfully field qualified the LCB for 3-day compressive strength. Make cylinders at the same time using the same material and procedures as QC testing for 7-day compressive strength.

28-2.01D(5) Acceptance Criteria

For acceptance, properties of LCB must comply with values shown in the following table:

Acceptance Criteria Testing

| Property | Test method | Value |
|---|------------------------|------------------|
| Compressive strength (min, psi at 7 days) | ASTM C 39 ^a | 530 ^b |

^a Cylinders prepared under ASTM C 31

^b A compressive strength test represents up to (1) 1,000 cu yd or (2) 1 day's production if less than 1,000 cu yd.

28-2.02 MATERIALS

28-2.02A General

Water must comply with section 90-1.02D.

The air content in LCB must not exceed 4 percent. If the aggregate used for LCB is produced from processed reclaimed asphalt concrete or other material that may cause the air content to exceed 4 percent, reduce the air content with an admixture.

A water-reducing chemical admixture may be used. Water-reducing chemical admixture must comply with ASTM C 494, Type A or Type F.

Air-entraining admixtures must comply with section 90-1.02E.

28-2.02B Cementitious Material

Portland cement must comply with section 90-1.02B. Portland cement content must not exceed 300 lb/cu yd.

SCM must comply with section 90-1.02B except the equations for SCM content under 90-1.02B(3) do not apply.

For aggregate qualification testing, use Type II portland cement under section 90-1.02B(2) without SCM.

28-2.02C Aggregate

Aggregate must be clean and free from decomposed material, organic material, and other deleterious substances. Aggregate samples must not be treated with lime, cement, or chemicals before testing for sand equivalent.

Use either 1-1/2 inch or 1 inch grading. Do not change your selected aggregate grading without authorization.

When tested under ASTM C 136, the percentage composition by weight of the aggregate must comply with the grading requirements for the sieve sizes shown in the following table:

| Sieve sizes | Aggregate Grading | | | |
|-------------|--------------------|---------------------|-----------------|---------------------|
| | Percentage passing | | | |
| | 1-1/2" maximum | | 1" maximum | |
| | Operating range | Contract compliance | Operating range | Contract compliance |
| 2" | 100 | 100 | -- | -- |
| 1-1/2" | 90-100 | 87-100 | 100 | 100 |
| 1" | -- | -- | 90-100 | 87-100 |
| 3/4" | 50-85 | 45-90 | 50-100 | 45-100 |
| 3/8" | 40-75 | 35-80 | 40-75 | 35-80 |
| No. 4 | 25-60 | 20-65 | 35-60 | 30-65 |
| No. 30 | 10-30 | 6-34 | 10-30 | 6-34 |
| No. 200 | 0-12 | 0-15 | 0-12 | 0-15 |

Aggregate must comply with the quality requirements shown in the following table:

| Aggregate Quality | | | |
|---|-------------------------|-----------------|------------------------------------|
| Property | Test Method | Operating range | Contract compliance |
| Sand equivalent (min) | ASTM D 2419 | 21 | 18 |
| Compressive strength (min, psi at 7 days) | ASTM C 192 ASTM C 39 | -- | 610 at 300 lb/cu yd cement content |

Note: Cement must be Type II portland cement under section 90-1.02B(2).

If the aggregate grading or the sand equivalent test results, or both comply with contract compliance requirements but not operating range requirements, you may continue placing LCB for the remainder of the work day. Do not place additional LCB until you demonstrate the LCB to be placed complies with the operating range requirements.

28-2.03 CONSTRUCTION

28-2.03A General

Do not allow traffic or equipment on the LCB for at least 72 hours after the 1st application of the curing compound and completion of contraction joints. Limit traffic and equipment on the LCB to that is required for placing additional layers of LCB or paving.

28-2.03B Subgrade

Immediately before spreading LCB, the subgrade must:

1. Comply with the specified compaction and elevation tolerance for the material involved
2. Be free from loose or extraneous material
3. Be uniformly moist

Areas of subgrade lower than the grade established by the Engineer must be filled with LCB. The Department does not pay for filling low areas of subgrade.

28-2.03C Proportioning, Mixing, and Transporting

Proportion LCB under section 90-1.02F except aggregate does not have to be separated into sizes.

Mix and transport LCB under section 90-1.02G except the 5th and 7th paragraphs in section 90-1.02G(6) do not apply.

28-2.03D Placing

Place LCB under section 40-1.03H(1) except the 3rd paragraph does not apply.

Unless otherwise described, construct LCB in minimum widths of 12 feet separated by construction joints. For LCB constructed monolithically in widths greater than 26 feet, construct a longitudinal contraction joint offset no more than 3 feet from the centerline of the width being constructed.

Contraction joints must comply with section 40-1.03D(3).

Construct transverse contraction joints in intervals that result in LCB areas where the lengths and widths are within 20 percent of each other. Measure the widths from any longitudinal construction or longitudinal contraction joints.

The Engineer waives the requirement for transverse contraction joints if you:

1. Submitted a notice under 28-2.01C(1)
2. Successfully field qualified LCB for 3-day compressive strength testing
3. Submit QC test results for 3-day compressive strength under section 28-2.01D(4).

If concrete pavement will be placed on LCB, construct longitudinal construction and longitudinal contraction joints in the LCB. Provide at least 1 foot horizontal clearance from planned longitudinal construction and longitudinal contraction joints in the concrete pavement.

Do not mix or place LCB when the atmospheric temperature is below 35 degrees F. Do not place LCB on frozen ground.

28-2.03E Finishing

Place LCB under section 40-1.03H(4) or under section 40-1.03H(5) except where there are confined work areas and when authorized:

1. Spread and shape LCB using suitable powered finishing machines and supplement with hand work as necessary
2. Consolidate LCB using high-frequency internal vibrators within 15 minutes after LCB is deposited on the subgrade
3. Vibrate with care such that adequate consolidation occurs across the full paving width and do not use vibrators for extensive weight shifting of the LCB

For LCB to be paved with HMA, before curing operation texture the LCB finished surface by dragging a broom, burlap, or a spring steel tine device. If using a spring steel tine device, the device must produce a scored surface with scores parallel or transverse to the pavement centerline. Texture at a time and in a manner that produces the coarsest texture for the method used.

For LCB to be paved with HMA, the finished surface must not vary more than 0.05 foot from the grade established by the Engineer.

Do not texture LCB that will be covered with concrete pavement. Before applying curing compound, finish LCB to a smooth surface free from mortar ridges and other projections.

For LCB to be paved with concrete pavement, the finished surface must not be above the grade, or more than 0.05 foot below the grade established by the Engineer.

The finished surface must be free from porous areas.

28-2.03F Curing

After finishing LCB, cure LCB with pigmented curing compound under section 90-1.03B(3) and 40-1.03K except for LCB to be paved with concrete pavement, comply with section 36-2. Apply curing compound to the area to be paved with concrete pavement:

1. In 2 separate applications
2. Before the atmospheric temperature falls below 40 degrees F

37 BITUMINOUS SEALS

07-19-13

Replace section 37-1.01 with:

01-18-13

37-1.01 GENERAL

37-1.01A Summary

Section 37-1 includes general specifications for applying bituminous seals.

37-1.01B Definitions

Reserved

37-1.01C Submittals

Reserved

37-1.01D Quality Control and Assurance

37-1.01D(1) General

Reserved

37-1.01D(2) Prepaving Conference

For seal coats and micro-surfacing, schedule a prepaving conference at a mutually agreed upon time and place to meet with the Engineer.

Prepaving conference attendees must sign an attendance sheet provided by the Engineer. The prepaving conference must be attended by your:

1. Project superintendent
2. Paving construction foreman
3. Traffic control foreman

Be prepared to discuss:

1. Quality control
2. Acceptance testing
3. Placement
4. Training on placement methods
5. Checklist of items for proper placement
6. Unique issues specific to the project, including:
 - 6.1. Weather
 - 6.2. Alignment and geometrics
 - 6.3. Traffic control issues
 - 6.4. Haul distances
 - 6.5. Presence and absence of shaded areas
 - 6.6. Any other local issues

37-1.02 MATERIALS

Not Used

37-1.03 CONSTRUCTION

Not Used

37-1.04 PAYMENT

Not Used

Replace section 37-2 with:

07-19-13

37-2 SEAL COATS

37-2.01 GENERAL

37-2.01A General

37-2.01A(1) Summary

Section 37-2 includes specifications for applying seal coats.

37-2.01A(2) Definitions

Reserved

37-2.01A(3) Submittals

Reserved

37-2.01A(4) Quality Control and Assurance

The following personnel must attend the prepaving conference:

1. Aggregate suppliers
2. Chip spreader operators
3. Emulsion and binder distributor
4. Coated chips producer if coated chips are used

37-2.01B Materials

Screenings must be broken stone, crushed gravel, or both. At least 90 percent of screenings by weight must be crushed particles as determined under California Test 205.

Screenings for seal coats must have the properties specified in the following table:

| Seal Coat Screenings | | |
|-----------------------------|-----------------|---------------|
| Properties | Test method | Specification |
| Los Angeles Rattler, %, max | California Test | |
| Loss at 100 revolutions. | 211 | 10 |
| Loss at 500 revolutions. | | 40 |
| Film stripping, %, max | California Test | 25 |
| | 302 | |

37-2.01C Construction

37-2.01C(1) General

Wherever final sweeping or brooming of the seal coat surface is complete, place permanent traffic stripes and pavement markings within 10 days.

If you fail to place the permanent traffic stripes and pavement markings within the specified time, the Department withholds 50 percent of the estimated value of the seal coat work completed that has not received permanent traffic stripes and pavement markings.

37-2.01C(2) Equipment

Equipment for seal coats must include and comply with the following:

1. Screenings haul trucks. Haul trucks must have:
 - 1.1. Tailgates that discharge screenings
 - 1.2. Devices to lock onto the rear screenings spreader hitch
 - 1.3. Dump beds that will not push down on the spreader when fully raised
 - 1.4. Dump beds that will not spill screenings on the roadway when transferred to the spreader hopper
 - 1.5. Tarpaulins to cover precoated screenings when haul distance exceeds 30 minutes or ambient temperature is less than 65 degrees F
2. Self-propelled screenings spreader. The spreader must have:
 - 2.1. Screenings hopper in the rear

- 2.2. Belt conveyors that carry the screenings to the front
- 2.3. Spreading hopper capable of providing a uniform screening spread rate over the entire width of the traffic lane in 1 application.
3. Self-propelled power brooms. Do not use gutter brooms or steel-tined brooms. Brooms must be capable of removing loose screenings adjacent to barriers that prevent screenings from being swept off the roadway, including curbs, gutters, dikes, berms, and railings.
4. Pneumatic-tired rollers. Pneumatic-tired rollers must be an oscillating type at least 4 feet wide. Each roller must be self-propelled and reversible. Pneumatic tires must be of equal size, diameter, type, and ply. The roller must carry at least 3,000 lb of load on each wheel and each tire must have an air pressure of 100 ± 5 psi.

37-2.01C(3) Surface Preparation

Before applying seal coat, cover 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 by tape or adhesive to the facility being covered. Reference the covered facilities with a sufficient number of control points to relocate the facilities after the application of the seal coat.

After completion of the seal coat operation, remove covers from the facilities.

Immediately before applying seal coat, clean the surface to receive seal coat by removing extraneous material and drying. Cleaning the existing pavement includes the use of brooms.

37-2.01C(4) Applying Emulsion and Asphalt Binder

Prevent spray on existing pavement not intended for seal coat or on previously applied seal coat using a material such as building paper. Remove the material after use.

Align longitudinal joints between seal coat applications with designated traffic lanes.

For emulsion, overlap longitudinal joints by not more than 4 inches. You may overlap longitudinal joints up to 8 inches if authorized.

For areas not accessible to a truck distributor bar, apply the emulsion with a squeegee or other authorized means. For asphalt binder, hand spray nonaccessible areas. You may overlap the emulsion or asphalt binder applications before the application of screenings at longitudinal joints.

Do not apply the emulsion or asphalt binder unless there are sufficient screenings at the job site to cover the emulsion or asphalt binder.

Discontinue application of emulsion or asphalt binder early enough to comply with lane closure specifications and darkness. Apply to 1 lane at a time and cover the lane entirely in 1 operation.

37-2.01C(5) Spreading Screenings

Prevent vehicles from driving on asphaltic emulsion or asphalt binder before spreading screenings.

Spread screenings at a uniform rate over the full lane width in 1 application.

Broom excess screenings at joints before spreading adjacent screenings.

Operate the spreader at speeds slow enough to prevent screenings from rolling over after dropping.

If the spreader is not moving, screenings must not drop. If you stop spreading and screenings drop, remove the excess screenings before resuming activities.

37-2.01C(6) Finishing

Remove piles, ridges, or unevenly distributed screenings. Repair permanent ridges, bumps, or depressions in the finished surface. Spread additional screenings and roll if screenings are picked up by rollers or vehicles.

Seal coat joints between adjacent applications of seal coat must be smooth, straight, uniform, and completely covered. Longitudinal joints must be at lane lines and not overlap by more than 4 inches. Blend the adjacent applications by brooming.

A coverage is the number of passes a roller needs to cover the width. A pass is 1 roller movement parallel to the seal coat application in either direction. Overlapping passes are part of the coverage being made and are not part of a subsequent coverage. Do not start a coverage until completing the previous coverage.

Before opening to traffic, finish seal coat in the following sequence:

1. Perform initial rolling consisting of 1 coverage with a pneumatic-tired roller
2. Perform final rolling consisting of 3 coverages with a pneumatic-tired roller
3. Broom excess screenings from the roadway and adjacent abutting areas
4. Apply flush coat if specified

The Engineer may order salvaging of excess screenings.

Dispose of excess screenings the Engineer determines are not salvageable. Dispose of screenings in any of the following ways or locations:

1. Under section 14-10
2. On embankment slopes
3. In authorized areas

Salvaging and stockpiling excess screenings is change order work.

37-2.01C(7) Seal Coat Maintenance

Seals coat surfaces must be maintained for 4 consecutive days from the day screenings are applied. Maintenance must include brooming to maintain a surface free of loose screenings, to distribute screenings over the surface so as to absorb any free asphaltic material, to cover any areas deficient in cover coat material, and to prevent formation of corrugations.

After 4 consecutive days, excess screenings must be removed from the paved areas. Brooming must not displace screenings set in asphaltic material.

The exact time of brooming will be determined by the Engineer. As a minimum, brooming will be required at the following times:

1. On 2-lane 2-way roadways, from 2 to 4 hours after traffic, controlled with pilot cars, has been routed on the seal coat
2. On multilane roadways, from 2 to 4 hours after screenings have been placed
3. In addition to previous brooming, immediately before opening any lane to public traffic, not controlled with pilot cars
4. On the morning following the application of screenings on any lane that has been open to public traffic not controlled with pilot cars and before starting any other activities

For 2-lane 2-way roadways under 1-way traffic control, upon completion of secondary rolling, public traffic must be controlled with pilot cars and routed over the new seal coat for a period of 2 to 4 hours. The Engineer will determine the exact period of time.

Schedule the operations so that seal coat is placed on both lanes of the traveled way each work shift and so that 1-way traffic control is discontinued 1 hour before darkness. At the end of the work shift, the end of the seal coat on both lanes must generally match.

On multilane roadways, initial brooming must begin after the screenings have been in place for a period of 2 to 4 hours. If the initial brooming is not completed during the work shift in which the screenings were placed, the initial brooming must be completed at the beginning of the next work shift.

Public traffic must be controlled with pilot cars and be routed on the new seal coat surface of the lane for a minimum of 2 hours after completion of the initial brooming and before opening the lane to traffic not controlled with pilot cars. When traffic is controlled with pilot cars, a maximum of 1 lane in the direction of travel must be open to public traffic. Once traffic controlled with pilot cars is routed over the seal coat at a particular location, continuous control must be maintained at that location until the seal coat placement and brooming on adjacent lanes to receive seal coat is completed.

37-2.01D Payment

If there is no bid item for a traffic control system, furnishing and using a pilot car is included in the various items of the work involved in applying the seal coat.

If test results for the screenings grading do not comply with specifications, you may remove the seal coat represented by these tests or request that it remain in place with a payment deduction. The deduction is \$1.75 per ton for the screenings represented by the test results.

37-2.02 FOG SEAL

37-2.02A General

37-2.02A(1) Summary

Fog seal coat includes applying a slow-setting asphaltic emulsion.

37-2.02A(2) Definitions

Reserved

37-2.02A(3) Submittals

Submit a 1/2-gallon sample of the asphaltic emulsion in a plastic container. Take the sample from the distributor truck spray bar at mid-load.

37-2.02A(4) Quality Control and Assurance

Reserved

37-2.02B Material

The Engineer selects the grade of slow-setting asphaltic emulsion to be used.

If additional water is added to the asphaltic emulsion, the resultant mixture must not be more than 1 part asphaltic emulsion to 1 part water. The Engineer determines the exact amount of additional water.

37-2.02C Construction

Apply asphaltic emulsion for fog seal coat at a residual asphalt rate from 0.02 to 0.06 gal/sq yd. The Engineer determines the exact rate.

Apply fog seal coat when the ambient air temperature is above 40 degrees F.

Sprinkle water on fog seal coat that becomes tacky in an amount determined by the Engineer.

If fog seal coat and seal coat with screenings are specified on the same project, apply fog seal coat at least 4 days before applying the adjoining seal coat with screenings. The joint between the seal coats must be neat and uniform.

37-2.02D Payment

The Department does not adjust the unit price for an increase or decrease in the asphaltic emulsion (fog seal coat) quantity.

37-2.03 FLUSH COATS

37-2.03A General

Flush coat includes applying a fog seal coat to the surface of a seal coat, followed by sand.

37-2.03B Material

The Engineer selects the grade of slow-setting or quick-setting asphaltic emulsion to be used.

Sand for flush coat must comply with the material specifications for fine aggregate grading in section 90-1.02C(3). Sand must not include organic material or clay.

37-2.03C Construction

Apply asphaltic emulsion for flush coat at a residual asphalt rate from 0.02 to 0.06 gal/sq yd. The Engineer determines the exact rate.

During flush coat activities, close adjacent lanes to traffic. Do not track asphaltic emulsion on existing pavement surfaces.

Apply sand immediately after the asphaltic emulsion application.

Spread sand with a self-propelled screenings spreader equipped with a mechanical device that spreads sand at a uniform rate over the full width of a traffic lane in a single application. Spread sand at a rate from 2 to 6 lb/sq yd. The Engineer determines the exact rate.

37-2.03D Payment

The Department does not adjust the unit price for an increase or decrease in the sand cover for the flush coat quantity.

37-2.04 ASPHALTIC EMULSION SEAL COAT

37-2.04A General

37-2.04A(1) General

37-2.04A(1)(a) Summary

Section 37-2.04 includes specifications for applying asphaltic emulsion seal coat. Asphaltic emulsion seal coat includes applying asphaltic emulsion, followed by screenings, and then a flush coat.

Asphaltic emulsion seal coat includes one or more of the following types:

1. Nonpolymer asphaltic emulsion seal coat
2. Polymer asphaltic emulsion seal coat

A double asphaltic emulsion seal coat is the application of asphaltic emulsion, followed by screenings applied twice in sequence.

37-2.04A(1)(b) Definitions

Reserved

37-2.04A(1)(c) Submittals

Submit a 1/2-gallon sample of asphaltic emulsion in a plastic container. Take the sample from the distributor truck spray bar at mid load.

At least 10 days before starting asphaltic emulsion seal coat application, submit the name of an authorized laboratory that will be performing asphaltic emulsion QC testing.

Submit a sample of asphaltic emulsion to the authorized laboratory and the Engineer. Each sample must be submitted in an insulated shipping container within 24 hours of sampling.

Within 7 days after taking samples, submit the authorized laboratory's test results for asphaltic emulsion.

37-2.04A(1)(d) Quality Control and Assurance

Samples for the screenings grading and cleanness value must be taken from the spreader conveyor belt.

Within 3 business days of sampling, the authorized laboratory must test asphaltic emulsion for:

1. Viscosity under AASHTO T 59
2. Sieve test under AASHTO T 59
3. Demulsibility under AASHTO T 59
4. Torsional recovery under California Test 332 for polymer asphaltic emulsion

Circulate polymer asphaltic emulsion in the distributor truck before sampling. Take samples from the distributor truck at mid load or from a sampling tap or thief. Before taking samples, draw and dispose of 1 gallon. Take two 1/2-gallon samples in the presence of the Engineer.

If test results for asphaltic emulsion are not in compliance with the specifications, you may request that the asphaltic emulsion seal coat represented by the tests remain in place with a payment deduction based on the pay factors.

37-2.04A(2) Materials

Not Used

37-2.04A(3) Construction

The Engineer determines the exact application rate.

At the time of application, the temperature of the asphaltic emulsion must be from 130 to 180 degrees F.

When tested under California Test 339, the application rate for asphaltic emulsion must not vary from the average by more than:

1. 15 percent in the transverse direction
2. 10 percent in the longitudinal direction

37-2.04A(4) Payment

Not Used

37-2.04B Nonpolymer Asphaltic Emulsion Seal Coat

37-2.04B(1) General

37-2.04B(1)(a) Summary

Section 37-2.04B includes specifications for applying a nonpolymer asphaltic emulsion seal coat.

37-2.04B(1)(b) Definitions

Reserved

37-2.04B(1)(c) Submittals

Reserved

37-2.04B(1)(d) Quality Control and Assurance

For nonpolymer asphaltic emulsion seal coat, if a test result for the screenings cleanness value is from 75 to 80, you may request that the asphaltic emulsion seal coat represented by the test remain in place. A payment deduction is made as specified in section 37-2.04D. If the screenings cleanness value is less than 75, remove the asphaltic emulsion seal coat.

37-2.04B(2) Materials

Screenings for nonpolymer asphaltic emulsion seal coat must have the gradation as determined under California Test 202 in the following table.

Nonpolymer Asphaltic Emulsion Seal Coat Screenings Gradation

| Sieve sizes | Percentage passing | | | |
|-------------|--------------------|--------------------|--------------------------|------------------|
| | Coarse 1/2" max | Medium 3/8" max | Medium fine 5/16" max | Fine 1/4" max |
| 3/4" | 100 | -- | -- | -- |
| 1/2" | 95-100 | 100 | -- | -- |
| 3/8" | 50-80 | 90-100 | 100 | 100 |
| No. 4 | 0-15 | 5-30 | 30-60 | 60-85 |
| No. 8 | 0-5 | 0-10 | 0-15 | 0-25 |
| No. 16 | -- | 0-5 | 0-5 | 0-5 |
| No. 30 | -- | -- | 0-3 | 0-3 |
| No. 200 | 0-2 | 0-2 | 0-2 | 0-2 |

The cleanness value determined under California Test 227 must be 80.

37-2.04B(3) Construction

Asphaltic emulsion must be applied within the application rate ranges shown in the following table:

Asphaltic Emulsion Application Rates

| Screenings | Application rate range(gallons per square yard) |
|-------------|---|
| Fine | 0.15–0.30 |
| Medium fine | 0.25–0.35 |
| Medium | 0.25–0.40 |
| Coarse | 0.30–0.40 |

Apply asphaltic emulsion when the ambient air temperature is from 65 to 110 degrees F and the pavement surface temperature is at least 80 degrees F.

Do not apply asphaltic emulsion when weather forecasts predict the ambient air temperature will fall below 39 degrees F within 24 hours after application.

For double asphaltic emulsion seal coat, the asphaltic emulsion must be applied within the application rates shown in the following table:

Asphaltic Emulsion Application Rates

| Screenings | Application rate range (gal/sq yd) |
|-----------------|------------------------------------|
| Double | |
| 1st application | 0.20–0.35 |
| 2nd application | 0.20–0.30 |

You may stockpile screenings for asphaltic emulsion seal coat if you prevent contamination. Screenings must have damp surfaces at spreading. If water visibly separates from the screenings, do not spread. You may redampen them in the delivery vehicle.

Spread screenings before the asphaltic emulsion sets or breaks.

Spread screenings within 10 percent of the rate determined by the Engineer. Screenings must have a spread rate within the ranges shown in the following table:

Screening Spread Rates

| Seal coat type | Range (lb/sq yd) |
|----------------|------------------|
| Fine | 12–20 |
| Medium fine | 16–25 |
| Medium | 20–30 |
| Coarse | 23–30 |

Do not spread screenings more than 2,500 feet ahead of the completed initial rolling.

For double asphaltic emulsion seal coat, screenings must have a spread rate within the ranges shown in the following table:

Screening Spread Rates

| Seal coat type | Range (lb/sq yd) |
|-----------------|------------------|
| Double | |
| 1st application | 23–30 |
| 2nd application | 12–20 |

Remove excess screenings on the 1st application before the 2nd application of asphaltic emulsion.

37-2.04B(4) Payment

If asphaltic emulsion seal coat with screenings does not comply with the cleanness value specifications, you may request that the seal coat remain in place with a pay deduction corresponding to the cleanness value shown in the following table:

Asphaltic Emulsion Seal Coat Cleanness Value Deductions

| Cleanness value | Deduction |
|-----------------|-------------|
| 80 or over | None |
| 79 | \$2.00 /ton |
| 77-78 | \$4.00 /ton |
| 75-76 | \$6.00 /ton |

37-2.04C Polymer Asphaltic Emulsion Seal Coat

37-2.04C(1) General

37-2.04C(1)(a) Summary

Section 37-2.04C includes specifications for applying a polymer asphaltic emulsion seal coat.

37-2.04C(1)(b) Definitions

Reserved

37-2.04C(1)(c) Submittals

At least 10 days before starting polymer asphaltic emulsion seal coat application, submit a signed copy of the test result report of the Vialit test method for aggregate retention in chip seals (french chip) to the Engineer and to:

DEPARTMENT OF TRANSPORTATION
Division of Maintenance, Roadway Maintenance Office
1120 N Street, MS 31
Sacramento, CA 95814

37-2.04C(1)(d) Quality Control and Assurance

The authorized laboratory must test screenings for retention under the Vialit test method for aggregate in chip seals (french chip). The Vialit test results are not used for acceptance. The Vialit test is available at the METS Web site.

If the test results for polymer asphaltic emulsion do not comply with the specifications, the Engineer assesses a pay factor value for the following properties and increments:

Polymer Asphaltic Emulsion Pay Factor Table

| Test method and property | Increment | Pay factor |
|---|---|------------|
| Test on polymer asphaltic emulsion | | |
| AASHTO T 59 (Viscosity, sec Saybolt Furol, at 50 °C) | Each 10 seconds above max or below min | 1 |
| AASHTO T 59 (settlement, 5 days, percent) | Each 1.5 percent above max | 1 |
| AASHTO T 59 (sieve test, percent max) | Each 0.2 percent above max | 1 |
| AASHTO T 59 (demulsibility percent) | Each 2 percent below min | 1 |
| Test on residue from evaporation test | | |
| AASHTO T 49 (penetration, 25 °C) | Each 2 dm above max or below min | 1 |
| ASTM D 36 (field softening point °C) | 2 °C below min | 1 |
| California Test 332 (torsional recovery ^a) | For each 1 increment below the min value of 18 | 1 |
| | For each 2 increments below the min value of 18 | 3 |
| | For each 3 or more increments below the min value of 18 | 10 |

^a The highest pay factor applies

The Engineer assesses a pay factor of 1 for sampling not performed in compliance with the specifications, including shipping and sampling containers.

For polymer asphaltic emulsion seal coat, if a test result for the screenings cleanness value is from 75 to 86, you may request that the asphaltic emulsion seal coat represented by the test remain in place. A payment deduction is made as specified in section 37-2.04D. If the screenings cleanness value is less than 75, remove the asphaltic emulsion seal coat.

37-2.04C(2) Materials

Polymer asphaltic emulsion must include elastomeric polymer.

Polymer asphaltic emulsion must comply with section 94, Table 3, under the test on residue from evaporation test for Grades PMRS2, PMRS2h, PMCRS2, and PMCRS2h and the following:

1. The penetration at 39.2 degrees F (200g for 60 seconds) determined under AASHTO T 49 must be at least 6.
2. Test elastic recovery under AASHTO T 301.
3. Polymer content in percent by weight does not apply.
4. The minimum ring and ball softening point temperature determined under AASHTO T 53 for Test on Residue from Evaporation Test must comply with the following:
 - 4.1. 126 degrees F for a geographical ambient temperature from 32 to 104 degrees F
 - 4.2. 129 degrees F for a geographical ambient temperature from 18 to 104 degrees F
 - 4.3. 135 degrees F for a geographical ambient temperature from 18 to greater than 104 degrees F

Screenings for polymer asphaltic emulsion seal coat must have the gradation as determined under California Test 202 in the following table:

Polymer Asphaltic Emulsion Seal Coat Screenings Gradation

| Sieve sizes | Percentage passing | | | |
|-------------|--------------------|--------------------|--------------------------|------------------|
| | Coarse 1/2" max | Medium 3/8" max | Medium fine 5/16" max | Fine 1/4" max |
| 3/4" | 100 | -- | -- | -- |
| 1/2" | 85–100 | 100 | -- | -- |
| 3/8" | 0–30 | 85–100 | 100 | 100 |
| No. 4 | 0–5 | 0–15 | 0–50 | 60–85 |
| No. 8 | -- | 0–5 | 0–15 | 0–25 |
| No. 16 | -- | -- | 0–5 | 0–5 |
| No. 30 | -- | -- | 0–3 | 0–3 |
| No. 200 | 0–2 | 0–2 | 0–2 | 0–2 |

The cleanness value determined under California Test 227 must be 86.

37-2.04C(3) Construction

Polymer asphaltic emulsion must be applied within the application rate ranges shown in the following table:

Polymer Asphaltic Emulsion Application Rates

| Screenings | Application rate range(gallons per square yard) |
|-------------|---|
| Fine | 0.15–0.30 |
| Medium fine | 0.25–0.35 |
| Medium | 0.25–0.40 |
| Coarse | 0.30–0.40 |

The Engineer determines the exact application rate.

At the time of application, the temperature of polymer asphaltic emulsion must be from 130 to 180 degrees F.

Apply polymer asphaltic emulsion when the ambient air temperature is from 60 to 105 degrees F and the pavement surface temperature is at least 55 degrees F.

Do not apply polymer asphaltic emulsion when weather forecasts predict the ambient air temperature will fall below 39 degrees F within 24 hours after application.

When tested under California Test 339, the application rate for polymer asphaltic emulsion must not vary from the average by more than:

1. 15 percent in the transverse direction
2. 10 percent in the longitudinal direction

For double asphaltic emulsion seal coat, polymer asphaltic emulsion must be applied within the application rates shown in the following table:

Polymer Asphaltic Emulsion Application Rates

| Screenings | Application rate range (gal/sq yd) |
|-----------------|------------------------------------|
| Double | |
| 1st application | 0.20–0.35 |
| 2nd application | 0.20–0.30 |

You may stockpile screenings for polymer emulsion seal coat if you prevent contamination. Screenings must have damp surfaces at spreading. If water visibly separates from the screenings, do not spread. You may redampen them in the delivery vehicle.

Spread screenings before the polymer emulsion sets or breaks.

Spread screenings within 10 percent of the rate determined by the Engineer. Screenings must have a spread rate within the ranges shown in the following table:

Screening Spread Rates

| Seal coat type | Range (lb/sq yd) |
|----------------|------------------|
| Fine | 12–20 |
| Medium fine | 16–25 |
| Medium | 20–30 |
| Coarse | 23–30 |

Do not spread screenings more than 2,500 feet ahead of the completed initial rolling.

For double seal coat, screenings must have a spread rate within the ranges shown in the following table:

Screening Spread Rates

| Seal coat type | Range (lb/sq yd) |
|-----------------|------------------|
| Double | |
| 1st application | 23–30 |
| 2nd application | 12–20 |

Remove excess screenings on the 1st application before the 2nd application of asphaltic emulsion.

37-2.04C(4) Payment

If polymer asphaltic emulsion seal coat with screenings does not comply with the specifications for cleanness value you may request that the seal coat remain in place with a pay deduction corresponding by the cleanness value shown in the following table:

Polymer Asphaltic Emulsion Seal Coat Cleanness Value Deductions

| Cleanness value | Deduction |
|-----------------|------------|
| 86 or over | None |
| 81–85 | \$2.20/ton |
| 77–80 | \$4.40/ton |
| 75–76 | \$6.60/ton |

If test results for polymer asphaltic emulsion aggregate grading and cleanness value test results do not comply with the specifications, all deductions are made. A test for polymer asphaltic emulsion represents the smaller of 55 tons or 1 day's production. A test for the screenings grading or cleanness value represents the smaller of 300 tons or 1 day's production.

The payment deduction for noncompliant polymer asphaltic emulsion is based on the total pay factor value determined from the table titled, "Polymer Asphaltic Emulsion Pay Factor Deduction." You must remove polymer asphaltic emulsion seal coat with a pay factor value greater than 20. You may request seal coat with noncompliant polymer asphaltic emulsion to remain in place with a pay deduction for the total pay factor value shown in the following table:

Polymer Asphaltic Emulsion Pay Factor Deductions

| Total pay factor value | Deduction |
|------------------------|-------------|
| 0 | none |
| 1–2 | \$5.00/ton |
| 3–5 | \$10.00/ton |
| 6–9 | \$15.00/ton |
| 10–14 | \$25.00/ton |
| 15–20 | \$50.00/ton |

37-2.05 ASPHALT BINDER SEAL COATS

37-2.05A General

Reserved

37-2.05B Asphalt Rubber Binder Seal Coats

37-2.05B(1) General

37-2.05B(1)(a) Summary

Section 37-2.05B includes specifications for applying asphalt rubber binder seal coat. Asphalt rubber seal coat includes applying heated asphalt rubber binder, followed by heated screenings precoated with asphalt binder, followed by a flush coat.

37-2.05B(1)(b) Definitions

crumb rubber modifier: Ground or granulated high natural crumb rubber or scrap tire crumb rubber.

descending viscosity reading: Subsequent viscosity reading at least 5 percent lower than the previous viscosity reading.

high natural crumb rubber: Material containing 40 to 48 percent natural rubber.

scrap tire crumb rubber: Any combination of:

1. Automobile tires
2. Truck tires
3. Tire buffing

37-2.05B(1)(c) Submittals

For each delivery of asphalt rubber binder ingredients and asphalt rubber binder to the job site, submit a certificate of compliance and a copy of the specified test results.

Submit MSDS for each asphalt rubber binder ingredient and the asphalt rubber binder.

At least 15 days before use, submit:

1. Four 1-quart cans of mixed asphalt rubber binder
2. Samples of each asphalt rubber binder ingredient
3. Asphalt rubber binder formulation and data as follows:
 - 3.1. For asphalt binder and asphalt modifier submit:
 - 3.1.1. Source and grade of asphalt binder
 - 3.1.2. Source and type of asphalt modifier
 - 3.1.3. Percentage of asphalt modifier by weight of asphalt binder
 - 3.1.4. Percentage of combined asphalt binder and asphalt modifier by weight of asphalt rubber binder
 - 3.1.5. Test results for the specified quality characteristics
 - 3.2. For crumb rubber modifier submit:
 - 3.2.1. Each source and type of scrap tire crumb rubber and high natural rubber
 - 3.2.2. Percentage of scrap tire crumb rubber and high natural rubber by total weight of asphalt rubber binder
 - 3.2.3. Test results for the specified quality characteristics
 - 3.3. For asphalt rubber binder submit:
 - 3.3.1. Test results for the specified quality characteristics
 - 3.3.2. Minimum reaction time and temperature

At least 5 business days before use, submit the permit issued by the local air quality agency for asphalt rubber binder:

1. Field blending equipment
2. Application equipment

If an air quality permit is not required by the local air quality agency for producing asphalt rubber binder or spray applying asphalt rubber binder, submit verification from the local air quality agency that an air quality permit is not required for this Contract.

Submit a certified volume or weight slip for each delivery of asphalt rubber binder ingredients and asphalt rubber binder.

Submit a certificate of compliance and accuracy verification of test results for viscometers.

When determined by the Engineer, submit notification 15 minutes before each viscosity test or submit a schedule of testing times.

Submit the log of asphalt rubber binder viscosity test results each day of asphalt rubber seal coat work.

37-2.05B(1)(d) Quality Control and Assurance

Equipment used in producing asphalt rubber binder must be permitted for use by the local air quality agency. Equipment used in spreading asphalt rubber binder must be permitted for use by the local air quality agency.

Each asphalt rubber binder ingredient must be sampled and tested for compliance with the specifications by the manufacturer.

Test and submit results at least once per project or the following, whichever frequency is greater:

1. For crumb rubber modifier except for grading, at least once per 250 tons. Samples of scrap tire crumb rubber and high natural crumb rubber must be sampled and tested separately. Test each delivery of crumb rubber modifier for grading.
2. For asphalt binder, test and submit at least once per 200 tons of asphalt binder production.
3. For asphalt modifier, test and submit at least once per 25 tons of asphalt modifier production.

Scrap tire crumb rubber and high natural crumb rubber must be delivered to the asphalt rubber production site in separate bags.

Take viscosity readings of asphalt rubber binder under ASTM D7741 during asphalt rubber binder production. Start taking viscosity readings of samples taken from the reaction vessel at least 45 minutes after adding crumb rubber modifier and continue taking viscosity readings every 30 minutes until 2 consecutive descending viscosity readings have been obtained and the final viscosity meets the specification requirement. After meeting the 2 descending viscosity readings requirement, continue to take viscosity readings hourly and within 15 minutes before use. Log the test results, including time of testing and temperature of the asphalt rubber binder.

37-2.05B(2) Material

37-2.05B(2)(a) General

Reserved

37-2.05B(2)(b) Asphalt Binder

Asphalt binder must comply with the specifications for asphalt binder. Do not modify asphalt binder with polymer.

37-2.05B(2)(c) Asphalt Modifier

Asphalt modifier must be a resinous, high flash point, and aromatic hydrocarbon. Asphalt modifier must have the values for the quality characteristics shown in the following table:

Asphalt Modifier for Asphalt Rubber Binder

| Quality characteristic | Test method | Value |
|--|-------------|--------------------|
| Viscosity, m ² /s (x 10 ⁻⁶) at 100 °C | ASTM D 445 | X ± 3 ^a |
| Flash point, C.L.O.C., °C | ASTM D 92 | 207 min |
| Molecular analysis | | |
| Asphaltenes, percent by mass | ASTM D 2007 | 0.1 max |
| Aromatics, percent by mass | ASTM D 2007 | 55 min |

^a "X" denotes the proposed asphalt modifier viscosity from 19 to 36. A change in "X" requires a new asphalt rubber binder submittal.

37-2.05B(2)(d) Crumb Rubber Modifier

Crumb rubber modifier must be ground or granulated at ambient temperature.

Scrap tire crumb rubber and high natural crumb rubber must be delivered to the asphalt rubber binder production site in separate bags.

Steel and fiber must be separated. If steel and fiber are cryogenically separated, it must occur before grinding and granulating. Cryogenically-produced crumb rubber modifier particles must be large enough to be ground or granulated.

Wire must not be more than 0.01 percent by weight of crumb rubber modifier. Crumb rubber modifier must be free of contaminants except fabric, which must not exceed 0.05 percent by weight of crumb rubber modifier. Method for determining the percent weight of wire and fabric is available under Laboratory Procedure 10 at the following METS Web site:

<http://www.dot.ca.gov/hq/esc/Translab/ofpm/fpmlab.htm>

The length of an individual crumb rubber modifier particle must not exceed 3/16 inch.

Crumb rubber modifier must be dry, free-flowing particles that do not stick together. A maximum of 3 percent calcium carbonate or talc by weight of crumb rubber modifier may be added. Crumb rubber modifier must not cause foaming when combined with the asphalt binder and asphalt modifier.

Specific gravity of crumb rubber modifier must be from 1.1 to 1.2 determined under California Test 208.

When tested under ASTM D 297, crumb rubber modifier must comply with the requirements shown in the following table:

Crumb Rubber Modifier

| Quality characteristic | Scrap tire crumb rubber (percent) | | High natural rubber (percent) | |
|------------------------|-----------------------------------|------|-------------------------------|------|
| | Min | Max | Min | Max |
| Acetone extract | 6.0 | 16.0 | 4.0 | 16.0 |
| Rubber hydrocarbon | 42.0 | 65.0 | 50.0 | -- |
| Natural rubber content | 22.0 | 39.0 | 40.0 | 48.0 |
| Carbon black content | 28.0 | 38.0 | -- | -- |
| Ash content | -- | 8.0 | -- | -- |

Scrap tire crumb rubber must have the gradation shown in the following table:

Scrap Tire Crumb Rubber Gradation
Percentage passing

| Sieve size | Gradation limit | Operating range | Contract compliance |
|------------|-----------------|-----------------|---------------------|
| No. 8 | 100 | 100 | 100 |
| No. 10 | 98–100 | 95–100 | 90–100 |
| No. 16 | 45–75 | 35–85 | 32–88 |
| No. 30 | 2–20 | 2–25 | 1–30 |
| No. 50 | 0–6 | 0–10 | 0–15 |
| No. 100 | 0–2 | 0–5 | 0–10 |
| No. 200 | 0 | 0–2 | 0–5 |

High natural crumb rubber must have the gradation shown in the following table:

High Natural Crumb Rubber Gradation
Percentage passing

| Sieve size | Gradation limit | Operating range | Contract compliance |
|------------|-----------------|-----------------|---------------------|
| No. 10 | 100 | 100 | 100 |
| No. 16 | 95–100 | 92–100 | 85–100 |
| No. 30 | 35–85 | 25–95 | 20–98 |
| No. 50 | 10–30 | 6–35 | 2–40 |
| No. 100 | 0–4 | 0–7 | 0–10 |
| No. 200 | 0–1 | 0–3 | 0–5 |

Test the crumb rubber modifier gradation under ASTM C 136 except

- Split or quarter 100 ± 5 g from the crumb rubber modifier sample and dry to a constant mass at a temperature from 57 to 63 degrees C and record the dry sample mass. Place the crumb rubber modifier sample and 5 g of talc in a 1/2-liter jar. Seal the jar, then shake the jar by hand for at least 1 minute to mix the crumb rubber modifier and the talc. Continue shaking or open the jar and stir until the particle agglomerates and clumps are broken and the talc is uniformly mixed.
- Place 1 rubber ball on each sieve. Each ball must weigh 8.5 ± 0.5 g, measure 24.5 ± 0.5 mm in diameter, and have a Shore Durometer "A" hardness of 50 ± 5 determined under ASTM D 2240. After sieving the combined material for 10 ± 1 minutes, disassemble the sieves. Brush material adhering to the bottom of a sieve into the next finer sieve. Weigh and record the mass of the material retained on the 2.36-millimeter sieve and leave this material (do not discard) on the scale or balance. Fabric balls must remain on the scale or balance and be placed together on the side to prevent them from being covered or disturbed when the material from finer sieves is placed onto the scale or balance. The material retained on the 2.00-millimeter sieve must be added to the scale or balance. Weigh and record that mass as the accumulative mass retained on the 2.00-millimeter sieve. Continue weighing and recording the accumulated masses retained on the remaining sieves until the accumulated mass retained in the pan has been determined. Before discarding the crumb rubber modifier sample, separately weigh and record the total mass of fabric balls in the sample.
- Determine the mass of material passing the 75-micrometer sieve by subtracting the accumulated mass retained on the 75-micrometer sieve from the accumulated mass retained in the pan. If the material passing the 75-micrometer sieve 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-micrometer 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-micrometer sieve 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 accounts 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.

37-2.05B(2)(e) Asphalt Rubber Binder

Asphalt rubber binder must be a combination of:

1. Asphalt binder
2. Asphalt modifier
3. Crumb rubber modifier

Asphalt rubber binder blending equipment must be authorized under the Department's material plant quality program.

The blending equipment must allow the determination of weight percentages of each asphalt rubber binder ingredient.

Asphalt rubber binder must be 79 ± 1 percent by weight asphalt binder and 21 ± 1 percent by weight of crumb rubber modifier. The minimum percentage of crumb rubber modifier must be 20.0 percent and lower values may not be rounded up.

Crumb rubber modifier must be 76 ± 2 percent by weight scrap tire crumb rubber and 24 ± 2 percent by weight high natural rubber.

Asphalt modifier and asphalt binder must be blended at the production site. Asphalt modifier must be from 2.5 to 6.0 percent by weight of the asphalt binder in the asphalt rubber binder. The asphalt rubber binder supplier determines the exact percentage.

If blended, the asphalt binder must be from 375 to 440 degrees F when asphalt modifier is added and the mixture must circulate for at least 20 minutes. Asphalt binder, asphalt modifier, and crumb rubber modifier may be proportioned and combined simultaneously.

The blend of asphalt binder and asphalt modifier must be combined with crumb rubber modifier at the asphalt rubber binder production site. The asphalt binder and asphalt modifier blend must be from 375 to 440 degrees F when crumb rubber modifier is added. Combined ingredients must be allowed to react at least 45 minutes at temperatures from 375 to 425 degrees F except the temperature must be at least 10 degrees F below the flash point of the asphalt rubber binder.

After reacting, the asphalt rubber binder must have the values for the quality characteristics shown in the following table:

| Asphalt Rubber Binder | | | |
|--|-------------|-------------|------|
| Quality characteristic | Test method | Requirement | |
| | | Min | Max |
| Cone penetration @ 25 °C, 1/10 mm | ASTM D 217 | 25 | 60 |
| Resilience @ 25 °C, percent rebound | ASTM D 5329 | 18 | 50 |
| Field softening point, °C | ASTM D 36 | 55 | 88 |
| Viscosity @190 °C, Pa • s ($\times 10^{-3}$) | ASTM D 7741 | 1500 | 2500 |

Maintain asphalt rubber binder at a temperature from 375 to 415 degrees F.

Stop heating unused asphalt rubber binder 4 hours after the 45-minute reaction period. Reheating asphalt rubber binder that cools below 375 degrees F is a reheat cycle. Do not exceed 2 reheat cycles. If reheating, asphalt rubber binder must be from 375 to 415 degrees F before use.

During reheating, you may add scrap tire crumb rubber. Scrap tire crumb rubber must not exceed 10 percent by weight of the asphalt rubber binder. Allow added scrap tire crumb rubber to react for at least 45 minutes. Reheated asphalt rubber binder must comply with the specifications for asphalt rubber binder.

37-2.05B(2)(f) Screenings

Before precoating with asphalt binder and when tested under California Test 202, screenings for asphalt rubber seal coat must have the gradation shown in the following table:

Asphalt Rubber Seal Coat Screenings Gradation

| Sieve sizes | Percentage passing by weight | | |
|-------------|------------------------------|--------------------|------------------|
| | Coarse 1/2" max | Medium 1/2" max | Fine 3/8" max |
| 3/4" | 100 | 100 | 100 |
| 1/2" | 75–90 | 85–90 | 95–100 |
| 3/8" | 0–20 | 0–30 | 70–85 |
| No. 4 | 0–2 | 0–5 | 0–15 |
| No. 8 | -- | -- | 0–5 |
| No. 200 | 0–1 | 0–1 | 0–1 |

Screenings must have the values for the properties shown in the following table:

Seal Coat Screenings

| Properties | Test method | Value |
|----------------------|------------------------|-------|
| Cleanness value, min | California Test 227 | 80 |
| Durability, min | California Test 229 | 52 |

37-2.05B(3) Construction

37-2.05B(3)(a) General

Reserved

37-2.05B(3)(b) Equipment

Self-propelled distributor truck for applying asphalt rubber binder must have the following features:

1. Heating unit
2. Internal mixing unit
3. Pumps that spray asphalt rubber binder within 0.05 gal/sq yd of the specified rate
4. Fully circulating spray bar that applies asphalt rubber binder uniformly
5. Tachometer
6. Pressure gages
7. Volume measuring devices
8. Thermometer
9. Observation platform on the rear of the truck for an observer on the platform to see the nozzles and unplug them if needed

37-2.05B(3)(c) Precoating Screenings

For asphalt rubber seal coat, do not recombine fine materials collected in dust control systems except cyclone collectors or knock-out boxes with any other aggregate used in the production of screenings.

For asphalt rubber seal coat, screenings must be preheated from 260 to 325 degrees F. Coat with any of the asphalts specified in the table titled "Performance Graded Asphalt Binder" in section 92. Coat at a central mixing plant. The asphalt must be from 0.5 to 1.0 percent by weight of dry screenings. The Engineer determines the exact rate.

Plant must be authorized under the Department's material plant quality program.

Do not stockpile preheated or precoated screenings.

37-2.05B(3)(d) Asphalt Rubber Binder Application

Apply asphalt rubber binder immediately after the reaction period. At the time of application, the temperature of asphalt rubber binder must be from 385 to 415 degrees F.

Apply asphalt rubber binder at a rate from 0.55 to 0.65 gal/sq yd. The Engineer determines the exact rate.

Apply asphalt rubber binder when the atmospheric temperature is from 60 to 105 degrees F and the pavement surface temperature is at least 55 degrees F.

Do not apply asphalt rubber binder unless there are sufficient screenings available to cover the asphalt rubber binder within 2 minutes. Intersections, turn lanes, gore points, and irregular areas must be covered within 15 minutes.

Do not apply asphalt rubber binder when weather or road conditions are unsuitable, including high wind or when the pavement is damp. In windy conditions you may adjust the distributor bar height and distribution speed, and use shielding equipment, if the Engineer authorizes your request.

37-2.05B(3)(e) Screenings Application

During transit, cover precoated screenings for asphalt rubber seal coat with tarpaulins if the ambient air temperature is below 65 degrees F or the haul time exceeds 30 minutes.

At the time of application, screenings for asphalt rubber seal coat must be from 225 to 325 degrees F.

Spread screenings at a rate from 28 to 40 lb/sq yd. The exact rate is determined by the Engineer. Spread to within 10 percent of the determined rate.

37-2.05B(3)(f) Rolling and Sweeping

Perform initial rolling within 90 seconds of spreading screenings. Do not spread screenings more than 200 feet ahead of the initial rolling.

For final rolling, you may request use of a steel-wheeled roller weighing from 8 to 10 tons, static mode only.

Perform a final sweeping before Contract acceptance. The final sweeping must not dislodge screenings.

Dispose of swept screenings at least 150 feet from any waterway.

37-2.05B(4) Payment

Screenings for asphalt rubber seal coat are measured by coated weight after they are preheated and precoated with asphalt binder. The weight of screenings must be the coated weight.

If recorded batch weights are printed automatically, the bid item for screenings for asphalt-rubber seal coat are measured using the printed batch weights, provided:

1. Total aggregate weight for screenings per batch is printed
2. Total asphalt binder weight per batch is printed
3. Each truckload's zero tolerance weight is printed before weighing the first batch and after weighing the last batch
4. Time, date, mix number, load number and truck identification are correlated with a load slip
5. A copy of the recorded batch weights is certified by a licensed weighmaster and submitted to the Engineer

Screenings for asphalt rubber seal coat is paid for as precoated screenings.

Asphalt-rubber binder is measured under the specifications for asphalts.

If test results for gradation tests do not comply with the specifications, deductions are taken.

Each gradation test for scrap tire crumb rubber represents 10,000 lbs or the amount used in that day's production, whichever is less.

Each gradation test for high natural rubber represents 3,400 lbs or the amount used in that day's production, whichever is less.

For each gradation test, the following pay deductions will be taken from the asphalt rubber bid item:

RAP at a substitution rate not exceeding 25 percent of the aggregate blend. Do not use RAP in OGFC and RHMA-G.

Assign the substitution rate of RAP aggregate for virgin aggregate with the JMF submittal. The JMF must include the percent of RAP used.

Provide enough space for meeting RAP handling requirements at your facility. Provide a clean, graded, well-drained area for stockpiles. Prevent material contamination and segregation.

If RAP is from multiple sources, blend the RAP thoroughly and completely. RAP stockpiles must be homogeneous.

Isolate the processed RAP stockpiles from other materials. Store processed RAP in conical or longitudinal stockpiles. Processed RAP must not be agglomerated or be allowed to congeal in large stockpiles.

AASHTO T 324 (Modified) is AASHTO T 324, "Hamburg Wheel-Track Testing of Compacted Hot Mix Asphalt (HMA)," with the following parameters:

07-19-13

1. Target air voids must equal 7 ± 1 percent
2. Specimen height must be $60 \text{ mm} \pm 1 \text{ mm}$
3. Number of test specimens must be 4
4. Test specimen must be a 150mm gyratory compacted specimen
5. Test temperature must be set at:
 - 5.1. 122 ± 2 degrees F for PG 58
 - 5.2. 131 ± 2 degrees F for PG 64
 - 5.3. 140 ± 2 degrees F for PG 70 and above
6. Measurements for impression must be taken at every 100 passes
7. Inflection point defined as the number of wheel passes at the intersection of the creep slope and the stripping slope
8. Testing shut off must be set at 25,000 passes

02-22-13

39-1.02F(2) Substitution Rate of 15 Percent or Less

For a RAP substitution rate of 15 percent or less, you may stockpile RAP during the entire project.

39-1.02F(3) Substitution Rate Greater than 15 Percent

07-19-13

For a RAP substitution rate greater than 15 percent, fractionate RAP into 2 sizes, a coarse fraction RAP retained on 3/8-inch screen and a fine fraction RAP passing 3/8-inch screen.

Sample and test processed RAP at a minimum frequency of 1 sample per 1000 tons with a minimum of 6 samples for each processed RAP stockpile. If a processed RAP stockpile is augmented, sample and test processed RAP quality characteristics at a minimum frequency of 1 sample per 500 tons of augmented RAP.

When tested under California Test 202 with a total mechanical shaking time of 10 minutes ± 15 seconds, the processed RAP must meet the grading requirements shown in the following table:

**Processed RAP Gradation
(Percentage Passing)**

| Sieve sizes | TV limits | Allowable tolerance |
|-------------|-----------|---------------------|
| 1/2" | 100 | -- |
| 3/8" | 97 | TV + 3 |

02-22-13

The processed RAP asphalt binder content must be within ± 2.0 percent of the average processed RAP stockpile asphalt binder content when tested under ASTM D 2172, Method B. If a new processed RAP stockpile is required, the average binder content of the new processed RAP stockpile must be within ± 2.0 percent of the average binder content of the original processed RAP stockpile.

The maximum specific gravity for processed RAP must be within ± 0.06 when tested under California Test 309 of the average maximum specific gravity reported on page 4 of your *Contractor Hot Mix Asphalt Design Data* form.

Replace items 7 and 8 in the 5th paragraph of section 39-1.03A with:

02-22-13

7. Substitution rate by more than 5 percent if your assigned RAP substitution rate is 15 percent or less
8. Substitution rate by more than 3 percent if your assigned RAP substitution rate is greater than 15 percent
9. Average binder content by more than 2 percent from the average binder content of the original processed RAP stockpile used in the mix design
10. Maximum specific gravity of processed RAP by more than ± 0.060 from the average maximum specific gravity of processed RAP reported on page 4 of your *Contractor Hot Mix Asphalt Design Data* form
11. Any material in the JMF

Replace the 1st paragraph of section 39-1.03B with:

02-22-13

Perform a mix design that produces HMA with the values for the quality characteristics shown in the following table:

HMA Mix Design Requirements

| Quality characteristic | Test method | HMA type | | |
|--|---------------------|-----------|-----------|------------------|
| | | A | B | RHMA-G |
| Air void content (%) | California Test 367 | 4.0 | 4.0 | Section 39-1.03B |
| Voids in mineral aggregate (% min.) No. 4 grading 3/8" grading 1/2" grading 3/4" grading | California Test 367 | 17.0 | 17.0 | -- |
| | | 15.0 | 15.0 | -- |
| | | 14.0 | 14.0 | 18.0–23.0 |
| | | 13.0 | 13.0 | 18.0–23.0 |
| Voids filled with asphalt (%) No. 4 grading 3/8" grading 1/2" grading 3/4" grading | California Test 367 | 65.0–75.0 | 65.0–75.0 | Note a |
| | | 65.0–75.0 | 65.0–75.0 | |
| | | 65.0–75.0 | 65.0–75.0 | |
| | | 65.0–75.0 | 65.0–75.0 | |
| Dust proportion No. 4 and 3/8" gradings 1/2" and 3/4" gradings | California Test 367 | 0.6–1.2 | 0.6–1.2 | Note a |
| | | 0.6–1.2 | 0.6–1.2 | |
| Stabilometer value (min.) No. 4 and 3/8" gradings 1/2" and 3/4" gradings | California Test 366 | 30 | 30 | -- |
| | | 37 | 35 | 23 |

^a Report this value in the JMF submittal.

For RAP substitution rate greater than 15 percent, the mix design must comply with the additional quality characteristics shown in the following table:

**Additional HMA Mix Design Requirements
for RAP Substitution Rate Greater Than 15 Percent**

| Quality characteristic | Test method | HMA type | | |
|--|--|----------|--------|--------|
| | | A | B | RHMA-G |
| Hamburg wheel track (minimum number of passes at 0.5 inch average rut depth) | AASHTO T 324 (Modified) ^a | | | |
| PG-58 | | 10,000 | 10,000 | -- |
| PG-64 | | 15,000 | 15,000 | |
| PG-70 | | 20,000 | 20,000 | |
| PG-76 or higher | | 25,000 | 25,000 | |
| Hamburg wheel track (inflection point minimum number of passes) | AASHTO T 324 (Modified) ^a | | | |
| PG-58 | | 10,000 | 10,000 | -- |
| PG-64 | | 10,000 | 10,000 | |
| PG-70 | | 12,500 | 12,500 | |
| PG-76 or higher | | 15000 | 15000 | |
| Moisture susceptibility (minimum dry strength, psi) | California Test 371 ^a | 120 | 120 | -- |
| Moisture susceptibility (tensile strength ration, %) | California Test 371 ^a | 70 | 70 | -- |

^aTest plant produced HMA.

For HMA with RAP, the maximum binder replacement must be 25.0 percent of OBC for surface course and 40.0 percent of OBC for lower courses.

For HMA with a binder replacement less than or equal to 25 percent of OBC, you may request that the PG asphalt binder grade with upper and lower temperature classifications be reduced by 6 degrees C from the specified grade.

For HMA with a binder replacement greater than 25 percent but less than or equal to 40 percent of OBC, you must use a PG asphalt binder grade with upper and lower temperature classifications reduced by 6 degrees C from the specified grade.

Replace item 4 in the list in the 1st paragraph of section 39-1.03C with:

4. JMF renewal on a *Caltrans Job Mix Formula Renewal* form, if applicable

01-20-12

Add to the end of section 39-1.03C:

For RAP substitution rate greater than 15 percent, submit with the JMF submittal:

02-22-13

- California Test 371 tensile strength ratio and minimum dry strength test results
- AASHTO T 324 (Modified) test results

For RAP substitution rate greater than 15 percent, submit California Test 371 and AASHTO T 324 (Modified) test results to the Engineer and to:

Moisture_Tests@dot.ca.gov

Replace the 2nd paragraph of section 39-1.03E with:

04-20-12

Use the OBC specified on your *Contractor Hot Mix Asphalt Design Data* form. No adjustments to asphalt binder content are allowed. Based on your testing and production experience, you may submit an adjusted aggregate gradation TV on a *Contractor Job Mix Formula Proposal* form before verification testing. Aggregate gradation TV must be within the TV limits specified in the aggregate gradation tables.

Add between the 3rd and 4th paragraphs of section 39-1.03E:

04-20-12

Asphalt binder set point for HMA must be the OBC specified on your *Contractor Hot Mix Asphalt Design Data* form. When RAP is used, asphalt binder set point for HMA must be:

$$\text{Asphalt Binder Set Point} = \frac{\frac{BC_{OBC}}{\left(1 - \frac{BC_{OBC}}{100}\right)} - R_{RAP} \left[\frac{BC_{RAP}}{\left(1 - \frac{BC_{RAP}}{100}\right)} \right]}{100 + \frac{BC_{OBC}}{\left(1 - \frac{BC_{OBC}}{100}\right)}}$$

Where:

BC_{OBC} = optimum asphalt binder content, percent based on total weight of mix

R_{RAP} = RAP ratio by weight of aggregate

BC_{RAP} = asphalt binder content of RAP, percent based on total weight of RAP mix

Replace item 4 in the list in the 8th paragraph of section 39-1.03E with:

04-20-12

4. HMA quality specified in the table titled "HMA Mix Design Requirements" except:
 - 4.1. Air void content, design value ± 2.0 percent
 - 4.2. Voids filled with asphalt, report only
 - 4.3. Dust proportion, report only

Replace the 12th paragraph of section 39-1.03E with:

04-20-12

If tests on plant-produced samples do not verify the JMF, the Engineer notifies you and you must submit a new JMF or submit an adjusted JMF based on your testing. JMF adjustments may include a change in aggregate gradation TV within the TV limits specified in the aggregate gradation tables.

Replace the 14th paragraph of section 39-1.03E with:

01-20-12

A verified JMF is valid for 12 months.

Replace the last sentence in the 15th paragraph of section 39-1.03E with:

01-20-12

This deduction does not apply to verifications initiated by the Engineer or JMF renewal.

Replace the 16th paragraph of section 39-1.03E with:

02-22-13

Except for RAP substitution rate greater than 15 percent, for any HMA produced under the QC/QA process the Department does not use California Test 371 test results for verification.

Add between the 1st and 2nd paragraphs of section 39-1.03F:

04-20-12

Target asphalt binder content on your Contractor *Job Mix Formula Proposal* form and the OBC specified on your *Contractor Hot Mix Asphalt Design Data* form must be the same.

Delete the 4th paragraph of section 39-1.03F.

01-20-12

Replace items 3 and 5 in the list in the 6th paragraph of section 39-1.03F with:

01-20-12

3. Engineer verifies each proposed JMF renewal within 20 days of receiving verification samples.
5. For each HMA type and aggregate gradation specified, the Engineer verifies at the Department's expense 1 proposed JMF renewal within a 12-month period.

Add between the 6th and 7th paragraphs of section 39-1.03F:

01-20-12

The most recent aggregate quality test results within the past 12 months may be used for verification of JMF renewal or the Engineer may perform aggregate quality tests for verification of JMF renewal.

Replace section 39-1.03G with:

04-20-12

39-1.03G Job Mix Formula Modification

For an accepted JMF, you may change asphalt binder source one time during production.

Submit your modified JMF request a minimum of 3 business days before production. Each modified JMF submittal must consist of:

1. Proposed modified JMF on *Contractor Job Mix Formula Proposal* form
2. Mix design records on *Contractor Hot Mix Asphalt Design Data* form for the accepted JMF to be modified
3. JMF verification on *Hot Mix Asphalt Verification* form for the accepted JMF to be modified
4. Quality characteristics test results for the modified JMF as specified in section 39-1.03B. Perform tests at the mix design OBC as shown on the *Contractor Asphalt Mix Design Data* form
5. If required, California Test 371 test results for the modified JMF.

With an accepted modified JMF submittal, the Engineer verifies each modified JMF within 5 business days of receiving all verification samples. If California Test 371 is required, the Engineer tests for California Test 371 within 10 days of receiving verification samples.

The Engineer verifies the modified JMF after the modified JMF HMA is placed on the project and verification samples are taken within the first 750 tons following sampling requirements in section 39-1.03E, "Job Mix Formula Verification." The Engineer tests verification samples for compliance with:

1. Stability as shown in the table titled "HMA Mix Design Requirements"
2. Air void content at design value ± 2.0 percent
3. Voids in mineral aggregate as shown in the table titled "HMA Mix Design Requirements"
4. Voids filled with asphalt, report only

5. Dust proportion, report only

If the modified JMF is verified, the Engineer revises your *Hot Mix Asphalt Verification* form to include the new asphalt binder source. Your revised form will have the same expiration date as the original form.

If a modified JMF is not verified, stop production and any HMA placed using the modified JMF is rejected.

The Engineer deducts \$2,000 from payments for each modified JMF verification. The Engineer deducts an additional \$2,000 for each modified JMF verification that requires California Test 371.

Add to section 39-1.03:

01-20-12

39-1.03H Job Mix Formula Acceptance

You may start HMA production if:

1. The Engineer's review of the JMF shows compliance with the specifications.
2. The Department has verified the JMF within 12 months before HMA production.
3. The Engineer accepts the verified JMF.

Replace "3 days" in the 1st paragraph of section 39-1.04A with:

01-20-12

3 business days

Replace the 2nd sentence in the 2nd paragraph of section 39-1.04A with:

01-20-12

During production, take samples under California Test 125. You may sample HMA from:

Replace "batch" in the 2nd sentence in the 2nd paragraph of section 39-1.04C with:

07-19-13

lot. Each asphalt binder lot consist of 1 or multiple batches of combined asphalt binder, asphalt modifier, and CRM proportioned under section 39-1.02D.

Replace the 2nd paragraph of section 39-1.04E with:

02-22-13

For RAP substitution rate of 15 percent or less, sample RAP once daily.

For RAP substitution rate of greater than 15percent, sample processed RAP twice daily.

Perform QC testing for processed RAP aggregate gradation under California Test 367, appendix B, and submit the results with the combined aggregate gradation.

Replace "5 days" in the 1st paragraph of section 39-1.06 with:

01-20-12

5 business days

Replace the 3rd paragraph of section 39-1.08A with:

04-20-12

During production, you may adjust hot or cold feed proportion controls for virgin aggregate and RAP.

Add to section 39-1.08A:

04-20-12

During production, asphalt binder set point for HMA Type A, HMA Type B, HMA Type C, and RHMA-G must be the OBC shown in *Contractor Hot Mix Asphalt Design Data* form. For OGFC, asphalt binder set point must be the OBC shown on *Caltrans Hot Mix Asphalt Verification* form. If RAP is used, asphalt binder set point for HMA must be calculated as specified in section 39-1.03E.

07-19-13

For RAP substitution rate of 15 percent or less, you may adjust the RAP by -5 percent.

For RAP substitution greater than 15, you may adjust the RAP by -3 percent.

04-20-12

You must request adjustments to the plant asphalt binder set point based on new RAP stockpiles average asphalt binder content. Do not adjust the HMA plant asphalt binder set point until authorized.

Replace the 3rd paragraph of section 39-1.08B with:

09-16-11

Asphalt rubber binder must be from 375 to 425 degrees F when mixed with aggregate.

Add to the beginning of section 39-1.08C:

07-19-13

Asphalt rubber binder blending plants must have current qualification under the Department's Material Plant Quality Program.

Replace section 39-1.11 with:

01-18-13

39-1.11 CONSTRUCTION

39-1.11A General

Do not place HMA on wet pavement or a frozen surface.

You may deposit HMA in a windrow and load it in the paver if:

1. Paver is equipped with a hopper that automatically feeds the screed
2. Loading equipment can pick up the windrowed material and deposit it in the paver hopper without damaging base material
3. Activities for deposit, pickup, loading, and paving are continuous
4. HMA temperature in the windrow does not fall below 260 degrees F

You may place HMA in 1 or more layers on areas less than 5 feet wide and outside the traveled way, including shoulders. You may use mechanical equipment other than a paver for these areas. The equipment must produce uniform smoothness and texture.

HMA handled, spread, or windrowed must not stain the finished surface of any improvement, including pavement.

Do not use petroleum products such as kerosene or diesel fuel to release HMA from trucks, spreaders, or compactors.

HMA must be free of:

1. Segregation
2. Coarse or fine aggregate pockets
3. Hardened lumps

39-1.11B Longitudinal Joints

39-1.11B(1) General

Longitudinal joints in the top layer must match specified lane edges. Alternate the longitudinal joint offsets in the lower layers at least 0.5 foot from each side of the specified lane edges. You may request other longitudinal joint placement patterns.

A vertical longitudinal joint of more than 0.15 ft is not allowed at any time between adjacent lanes open to traffic.

For HMA thickness of 0.15 ft or less, the distance between the ends of the adjacent surfaced lanes at the end of each day's work must not be greater than can be completed in the following day of normal paving.

For HMA thickness greater than 0.15 ft, you must place HMA on adjacent traveled way lanes so that at the end of each work shift the distance between the ends of HMA layers on adjacent lanes is from 5 to 10 feet. Place additional HMA along the transverse edge at each lane's end and along the exposed longitudinal edges between adjacent lanes. Hand rake and compact the additional HMA to form temporary conforms. You may place Kraft paper or another authorized bond breaker under the conform tapers to facilitate the taper removal when paving operations resume.

39-1.11B(2) Tapered Notched Wedge

For divided highways with an HMA lift thickness greater than 0.15 foot, you may construct a 1-foot wide tapered notched wedge joint as a longitudinal joint between adjacent lanes open to traffic. A vertical notch of 0.75 inch maximum must be placed at the top and bottom of the tapered wedge.

The tapered notched wedge must retain its shape while exposed to traffic. Pave the adjacent lane within 1 day.

Construct the tapered portion of the tapered notched wedge with an authorized strike-off device. The strike-off device must provide a uniform slope and must not restrict the main screed of the paver.

You may use a device attached to the screed to construct longitudinal joints that will form a tapered notched wedge in a single pass. The tapered notched wedge must be compacted to a minimum of 91 percent compaction.

Perform QC testing on the completed tapered notch wedge joint as follows:

1. Perform field compaction tests at the rate of 1 test for each 750-foot section along the joint. Select random locations for testing within each 750-foot section.
2. Perform field compaction tests at the centerline of the joint, 6 inches from the upper vertical notch, after the adjacent lane is placed and before opening the pavement to traffic.
3. Determine maximum density test results.
4. Determine percent compaction of the longitudinal joint as the ratio of the average of the field compaction values and the maximum density test results.

For HMA under QC/QA construction process, the additional quality control compaction results associated with the tapered notch wedge will not be included in the computation of any quality factor and process control.

For acceptance of the completed tapered notch wedge joint, take two 4- or 6-inch diameter cores 6 inches from the upper vertical notch of the completed longitudinal joint for every 3,000 feet at locations designated by the Engineer. Take cores after the adjacent lane is placed and before opening the pavement to traffic. Cores must be taken in the presence of the Engineer and must be marked to identify the test sites. Submit the cores. One core will be used for determination of the field density and 1 core will be used for dispute resolution. The Engineer determines:

1. Field compaction by measuring the bulk specific gravity of the cores under California Test 308, Method A
2. Percent compaction as the ratio of the average of the bulk specific gravity of the core for each day's production to the maximum density test value

For HMA under QC/QA construction process, the additional quality assurance testing by the Engineer to determine field compaction associated with the tapered notch wedge will not be included in the Engineer's verification testing and in the computation of any quality factor and process control.

Determine percent compaction values each day the joint is completed and submit values within 24 hours of testing. If the percent compaction of 1 day's production is less than 91 percent, that day's notched wedge joint is rejected. Discontinue placement of the tapered notched wedge and notify the Engineer of changes you will make to your construction process in order to meet the specifications.

For HMA under QC/QA construction process, quantities of HMA placed in the completed longitudinal joint will have a quality factor QF_{QC5} of 1.0.

39-1.11C Widening Existing Pavement

If widening existing pavement, construct new pavement structure to match the elevation of the existing pavement's edge before placing HMA over the existing pavement.

39-1.11D Shoulders, Medians, and Other Road Connections

Until the adjoining through lane's top layer has been paved, do not pave the top layer of:

1. Shoulders
2. Tapers
3. Transitions
4. Road connections
5. Driveways
6. Curve widenings
7. Chain control lanes
8. Turnouts
9. Turn pockets

If the number of lanes changes, pave each through lane's top layer before paving a tapering lane's top layer. Simultaneous to paving a through lane's top layer, you may pave an adjoining area's top layer, including shoulders. Do not operate spreading equipment on any area's top layer until completing final compaction.

39-1.11E Leveling

If leveling with HMA is specified, fill and level irregularities and ruts with HMA before spreading HMA over the base, existing surfaces, or bridge decks. You may use mechanical equipment other than a paver for these areas. The equipment must produce uniform smoothness and texture. HMA used to change an existing surface's cross slope or profile is not paid for as HMA (leveling).

If placing HMA against the edge of existing pavement, sawcut or grind the pavement straight and vertical along the joint and remove extraneous material.

39-1.11F Compaction

Rolling must leave the completed surface compacted and smooth without tearing, cracking, or shoving. Complete finish rolling activities before the pavement surface temperature is:

1. Below 150 degrees F for HMA with unmodified binder
2. Below 140 degrees F for HMA with modified binder
3. Below 200 degrees F for RHMA-G

If a vibratory roller is used as a finish roller, turn the vibrator off.

Do not use a pneumatic-tired roller to compact RHMA-G.

For Standard and QC/QA construction processes, if 3/4-inch aggregate grading is specified, you may use a 1/2-inch aggregate grading if the specified total paved thickness is at least 0.15 foot and less than 0.20 foot thick.

Spread and compact HMA under sections 39-3.03 and 39-3.04 if any of the following applies:

1. Specified paved thickness is less than 0.15 foot.

- 2. Specified paved thickness is less than 0.20 foot and 3/4-inch aggregate grading is specified and used.
- 3. You spread and compact at:
 - 3.1. Asphalt concrete surfacing replacement areas
 - 3.2. Leveling courses
 - 3.3. Areas for which the Engineer determines conventional compaction and compaction measurement methods are impeded

Do not open new HMA pavement to public traffic until its mid-depth temperature is below 160 degrees F.

If you request and if authorized, you may cool HMA Type A and Type B with water when rolling activities are complete. Apply water under section 17-3.

Spread sand at a rate from 1 to 2 lb/sq yd on new RHMA-G, RHMA-O, and RHMA-O-HB pavement when finish rolling is complete. Sand must be free of clay or organic matter. Sand must comply with section 90-1.02C(4)(c). Keep traffic off the pavement until spreading sand is complete.

Replace the 5th and 6th paragraphs of section 39-1.12C with:

07-20-12

On tangents and horizontal curves with a centerline radius of curvature 2,000 feet or more, the PI_0 must be at most 2.5 inches per 0.1-mile section.

On horizontal curves with a centerline radius of curvature between 1,000 feet and 2,000 feet including pavement within the superelevation transitions, the PI_0 must be at most 5 inches per 0.1-mile section.

Add to section 39-1.12:

01-20-12

39-1.12E Reserved

Add to section 39-1.14:

01-20-12

Prepare the area to receive HMA for miscellaneous areas and dikes, including any excavation and backfill as needed.

Replace "6.8" in item 3 in the list in the 4th paragraph of section 39-1.14 with:

04-20-12

6.4

Replace "6.0" in item 3 in the list in the 4th paragraph of section 39-1.14 with:

04-20-12

5.7

Replace "6.8" in the 1st paragraph of section 39-1.15B with:

04-20-12

6.4

Replace "6.0" in the 1st paragraph of section 39-1.15B with:

04-20-12

5.7

Replace the 1st paragraph of section 39-2.02B with:

02-22-13

Perform sampling and testing at the specified frequency for the quality characteristics shown in the following table:

Minimum Quality Control—Standard Construction Process

| Quality characteristic | Test method | Minimum sampling and testing frequency | HMA type | | | |
|--|----------------------------|---|------------------------------|------------------------------|------------------------------|------------------------------|
| | | | A | B | RHMA-G | OGFC |
| Aggregate gradation ^a | California Test 202 | 1 per 750 tons and any remaining part at the end of the project | JMF ± Tolerance ^b |
| Sand equivalent (min) ^c | California Test 217 | | 47 | 42 | 47 | -- |
| Asphalt binder content (%) | California Test 379 or 382 | | JMF±0.40 | JMF±0.40 | JMF ± 0.40 | JMF ± 0.40 |
| HMA moisture content (% max) | California Test 226 or 370 | 1 per 2,500 tons but not less than 1 per paving day | 1.0 | 1.0 | 1.0 | 1.0 |
| Field compaction (% max. theoretical density) ^{d,e} | QC plan | 2 per business day (min.) | 91–97 | 91–97 | 91–97 | -- |
| Stabilometer value (min) ^c No. 4 and 3/8" gradings 1/2" and 3/4" gradings | California Test 366 | 1 per 4,000 tons or 2 per 5 business days, whichever is greater | 30 | 30 | -- | -- |
| | | | 37 | 35 | 23 | -- |
| Air void content (%) ^{c,f} | California Test 367 | | 4 ± 2 | 4 ± 2 | TV ± 2 | -- |
| Aggregate moisture content at continuous mixing plants and RAP moisture content at continuous mixing plants and batch mixing plants ^g | California Test 226 or 370 | 2 per day during production | -- | -- | -- | -- |
| Percent of crushed particles coarse aggregate (% min) One fractured face Two fractured faces Fine aggregate (% min) (Passing no. 4 sieve and retained on no. 8 sieve.) One fractured face | California Test 205 | As designated in the QC plan. At least once per project | 90 | 25 | -- | 90 |
| | | | 75 | -- | 90 | 75 |
| Los Angeles Rattler (% max) Loss at 100 rev. | California Test 211 | | 70 | 20 | 70 | 90 |
| | | | 12 | -- | 12 | 12 |

| | | | | | | |
|---|-------------------------|---|--|--|------------------------------------|-------------|
| Loss at 500 rev. | | | 45 | 50 | 40 | 40 |
| Flat and elongated particles (% max by weight @ 5:1) | California Test 235 | | Report only | Report only | Report only | Report only |
| Fine aggregate angularity (% min) ^h | California Test 234 | | 45 | 45 | 45 | -- |
| Voids filled with asphalt (%) ⁱ No. 4 grading 3/8" grading 1/2" grading 3/4" grading | California Test 367 | | 65.0–75.0 65.0–75.0 65.0–75.0 65.0–75.0 | 65.0–75.0 65.0–75.0 65.0–75.0 65.0–75.0 | Report only | -- |
| Voids in mineral aggregate (% min) ⁱ No. 4 grading 3/8" grading 1/2" grading 3/4" grading | California Test 367 | | 17.0 15.0 14.0 13.0 | 17.0 15.0 14.0 13.0 | -- -- 18.0–23.0 18.0–23.0 | -- |
| Dust proportion ^l No. 4 and 3/8" gradings 1/2" and 3/4" gradings | California Test 367 | | 0.6-1.2 0.6–1.2 | 0.6-1.2 0.6–1.2 | Report only | -- |
| Hamburg wheel track (minimum number of passes at 0.5 inch average rut depth) ^j PG-58 PG-64 PG-70 PG-76 or higher | AASHTO T 324 (Modified) | 1 per 10,000 tons or 1 per project whichever is more | 10,000 15,000 20,000 25,000 | 10,000 15,000 20,000 25,000 | -- | -- |
| Hamburg wheel track (inflection point minimum number of passes) ^j PG-58 PG-64 PG-70 PG-76 or higher | AASHTO T 324 (Modified) | 1 per 10,000 tons or 1 per project whichever is more | 10,000 10,000 12,500 15000 | 10,000 10,000 12,500 15000 | -- | -- |
| Moisture susceptibility (minimum dry strength, psi) ^j | California Test 371 | For RAP ≥15% 1 per 10,000 tons or 1 per project whichever is greater | 120 | 120 | -- | -- |
| Moisture susceptibility (tensile strength ratio, %) ^j | California Test 371 | For RAP ≥15% 1 per 10,000 tons or 1 | 70 | 70 | -- | -- |

| | | | | | | |
|--|---------------------|--|---|---|---|---|
| | | per project whichever is greater | | | | |
| Smoothness | Section 39-1.12 | -- | 12-foot straight- edge, must grind, and PI ₀ |
| Asphalt rubber binder viscosity @ 375 °F, centipoises | Section 39-1.02D | Section 39-1.04C | -- | -- | 1,500– 4,000 | 1,500– 4,000 |
| Asphalt modifier | Section 39-1.02D | Section 39-1.04C | -- | -- | Section 39-1.02D | Section 39-1.02D |
| CRM | Section 39-1.02D | Section 39-1.04C | -- | -- | Section 39-1.02D | Section 39-1.02D |

^a Determine combined aggregate gradation containing RAP under California Test 367.

^b The tolerances must comply with the allowable tolerances in section 39-1.02E.

^c Report the average of 3 tests from a single split sample.

^d Determine field compaction for any of the following conditions:

1. 1/2-inch, 3/8-inch, or no. 4 aggregate grading is used and the specified total paved thickness is at least 0.15 foot.
2. 3/4-inch aggregate grading is used and the specified total paved thickness is at least 0.20 foot.

^e To determine field compaction use:

1. In-place density measurements using the method specified in your QC plan.
2. California Test 309 to determine the maximum theoretical density at the frequency specified in California Test 375, Part 5C.

^f Determine the bulk specific gravity of each lab-compacted briquette under California Test 308, Method A, and theoretical maximum specific gravity under California Test 309.

^g For adjusting the plant controller at the HMA plant.

^h The Engineer waives this specification if HMA contains 10 percent or less of nonmanufactured sand by weight of total aggregate. Manufactured sand is fine aggregate produced by crushing rock or gravel.

ⁱ Report only.

^j Applies to RAP substitution rate greater than 15 percent.

Replace the 1st paragraph of section 39-2.03A with:

02-22-13

The Department samples for acceptance testing and tests for the quality characteristics shown in the following table:

HMA Acceptance—Standard Construction Process

| Quality characteristic | Test method | HMA type | | | | | | |
|---|----------------------------|--|--|------------------------------------|------------------------------|----------------|------|------|
| | | A | B | RHMA-G | OGFC | | | |
| Aggregate gradation ^a | California Test 202 | JMF ± tolerance ^c | JMF ± tolerance ^c | JMF ± tolerance ^c | JMF ± tolerance ^c | | | |
| Sieve | | | | | | 3/4" | 1/2" | 3/8" |
| 1/2" | | | | | | X ^b | | |
| 3/8" | | | | | | | X | |
| No. 4 | | | | | | | | X |
| No. 8 | | | | | | X | X | X |
| No. 200 | X | X | X | | | | | |
| Sand equivalent (min) ^d | California Test 217 | 47 | 42 | 47 | -- | | | |
| Asphalt binder content (%) | California Test 379 or 382 | JMF±0.40 | JMF±0.40 | JMF ± 0.40 | JMF ± 0.40 | | | |
| HMA moisture content (% max) | California Test 226 or 370 | 1.0 | 1.0 | 1.0 | 1.0 | | | |
| Field compaction (% max. theoretical density) ^{e, f} | California Test 375 | 91–97 | 91–97 | 91–97 | -- | | | |
| Stabilometer value (min) ^d No. 4 and 3/8" gradings 1/2" and 3/4" gradings | California Test 366 | 30 37 | 30 35 | -- 23 | -- -- | | | |
| Air void content (%) ^{d, g} | California Test 367 | 4 ± 2 | 4 ± 2 | TV ± 2 | -- | | | |
| Percent of crushed particles Coarse aggregate (% min) One fractured face Two fractured faces Fine aggregate (% min) (Passing no. 4 sieve and retained on no. 8 sieve.) One fractured face | California Test 205 | 90 75 70 | 25 -- 20 | -- 90 70 | 90 75 90 | | | |
| Los Angeles Rattler (% max) Loss at 100 rev. Loss at 500 rev. | California Test 211 | 12 45 | -- 50 | 12 40 | 12 40 | | | |
| Fine aggregate angularity (% min) ^h | California Test 234 | 45 | 45 | 45 | -- | | | |
| Flat and elongated particles (% max by weight @ 5:1) | California Test 235 | Report only | Report only | Report only | Report only | | | |
| Voids filled with asphalt (%) ⁱ No. 4 grading 3/8" grading 1/2" grading 3/4" grading | California Test 367 | 65.0–75.0 65.0–75.0 65.0–75.0 65.0–75.0 | 65.0–75.0 65.0–75.0 65.0–75.0 65.0–75.0 | Report only | -- | | | |
| Voids in mineral aggregate (% min) ⁱ No. 4 grading 3/8" grading 1/2" grading 3/4" grading | California Test 367 | 17.0 15.0 14.0 13.0 | 17.0 15.0 14.0 13.0 | -- -- 18.0–23.0 18.0–23.0 | -- | | | |
| Dust proportion ⁱ | California | | | Report only | -- | | | |

| | | | | | |
|---|-------------------------------|--|---|---|---|
| No. 4 and 3/8" gradings 1/2" and 3/4" gradings | Test 367 | 0.6-1.2 0.6-1.2 | 0.6-1.2 0.6-1.2 | | |
| Hamburg wheel track (minimum number of passes at 0.5 inch average rut depth) ^j PG-58 PG-64 PG-70 PG-76 or higher | AASHTO T 324 (Modified) | 10,000 15,000 20,000 25,000 | 10,000 15,000 20,000 25,000 | -- | -- |
| Hamburg wheel track (inflection point minimum number of passes) ^j PG-58 PG-64 PG-70 PG-76 or higher | AASHTO T 324 (Modified) | 10,000 10,000 12,500 15000 | 10,000 10,000 12,500 15000 | -- | -- |
| Moisture susceptibility (minimum dry strength, psi) ^j | California Test 371 | 120 | 120 | -- | -- |
| Moisture susceptibility (tensile strength ration, %) ^j | California Test 371 | 70 | 70 | -- | -- |
| Smoothness | Section 39-1.12 | 12-foot straight- edge, must grind, and PI ₀ | 12-foot straight- edge, must grind, and PI ₀ | 12-foot straight- edge, must grind, and PI ₀ | 12-foot straight- edge and must grind |
| Asphalt binder | Various | Section 92 | Section 92 | Section 92 | Section 92 |
| Asphalt rubber binder | Various | -- | -- | Section 92- 1.01D(2) and section 39-1.02D | Section 92-1.01D(2) and section 39-1.02D |
| Asphalt modifier | Various | -- | -- | Section 39-1.02D | Section 39-1.02D |
| CRM | Various | -- | -- | Section 39-1.02D | Section 39-1.02D |

^a The Engineer determines combined aggregate gradations containing RAP under California Test 367.

^b "X" denotes the sieves the Engineer tests for the specified aggregate gradation.

^c The tolerances must comply with the allowable tolerances in section 39-1.02E.

^d The Engineer reports the average of 3 tests from a single split sample.

^e The Engineer determines field compaction for any of the following conditions:

1. 1/2-inch, 3/8-inch, or no. 4 aggregate grading is used and the specified total paved thickness is at least 0.15 foot.
2. 3/4-inch aggregate grading is used and the specified total paved thickness is at least 0.20 foot.

^f To determine field compaction, the Engineer uses:

1. California Test 308, Method A, to determine in-place density of each density core.
2. California Test 309 to determine the maximum theoretical density at the frequency specified in California Test 375, Part 5C.

^g The Engineer determines the bulk specific gravity of each lab-compacted briquette under California Test 308, Method A, and theoretical maximum specific gravity under California Test 309.

^h The Engineer waives this specification if HMA contains 10 percent or less of nonmanufactured sand by weight of total aggregate. Manufactured sand is fine aggregate produced by crushing rock or gravel.

ⁱ Report only.

^j Applies to RAP substitution rate greater than 15 percent.

Replace the 5th paragraph of section 39-2.03A with:

01-20-12

The Engineer determines the percent of maximum theoretical density from density cores taken from the final layer measured the full depth of the total paved HMA thickness if any of the following applies:

1. 1/2-inch, 3/8-inch, or no. 4 aggregate grading is used and the specified total paved thickness is at least 0.15 foot and any layer is less than 0.15 foot.
2. 3/4-inch aggregate grading is used and the specified total paved thickness is at least 0.2 foot and any layer is less than 0.20 foot.

Replace the 1st paragraph of section 39-3.02A with:

02-22-13

The Department samples for acceptance testing and tests for the quality characteristics shown in the following table:

HMA Acceptance—Method Construction Process

| Quality characteristic | Test method | HMA type | | | |
|---|----------------------------|--|--|------------------------------------|------------------------------|
| | | A | B | RHMA-G | OGFC |
| Aggregate gradation ^a | California Test 202 | JMF ± tolerance ^b | JMF ± tolerance ^b | JMF ± tolerance ^b | JMF ± tolerance ^b |
| Sand equivalent (min) ^c | California Test 217 | 47 | 42 | 47 | -- |
| Asphalt binder content (%) | California Test 379 or 382 | JMF±0.40 | JMF±0.40 | JMF ± 0.40 | JMF ± 0.40 |
| HMA moisture content (% max) | California Test 226 or 370 | 1.0 | 1.0 | 1.0 | 1.0 |
| Stabilometer value (min) ^c No. 4 and 3/8" gradings 1/2" and 3/4" gradings | California Test 366 | 30 37 | 30 35 | -- 23 | -- -- |
| Percent of crushed particles Coarse aggregate (% min) One fractured face Two fractured faces Fine aggregate (% min) (Passing no. 4 sieve and retained on no. 8 sieve.) One fractured face | California Test 205 | 90 75 70 | 25 -- 20 | -- 90 70 | 90 75 90 |
| Los Angeles Rattler (% max) Loss at 100 rev. Loss at 500 rev. | California Test 211 | 12 45 | -- 50 | 12 40 | 12 40 |
| Air void content (%) ^{c, d} | California Test 367 | 4 ± 2 | 4 ± 2 | TV ± 2 | -- |
| Fine aggregate angularity (% min) ^e | California Test 234 | 45 | 45 | 45 | -- |
| Flat and elongated particles (% max by weight @ 5:1) | California Test 235 | Report only | Report only | Report only | Report only |
| Voids filled with asphalt (%) ^f No. 4 grading 3/8" grading 1/2" grading 3/4" grading | California Test 367 | 65.0–75.0 65.0–75.0 65.0–75.0 65.0–75.0 | 65.0–75.0 65.0–75.0 65.0–75.0 65.0–75.0 | Report only | -- |
| Voids in mineral aggregate (% min) ^f No. 4 grading 3/8" grading 1/2" grading 3/4" grading | California Test 367 | 17.0 15.0 14.0 13.0 | 17.0 15.0 14.0 13.0 | -- -- 18.0–23.0 18.0–23.0 | -- |
| Dust proportion ^f No. 4 and 3/8" gradings 1/2" and 3/4" gradings | California Test 367 | 0.6–1.2 0.6–1.2 | 0.6–1.2 0.6–1.2 | Report only | -- |
| Hamburg wheel track (minimum number of passes at 0.5 inch average rut depth) ^g PG-58 PG-64 | AASHTO T 324 (Modified) | 10,000 15,000 | 10,000 15,000 | -- | -- |

| | | | | | |
|--|-------------------------------|--|--|---|---|
| PG-70 PG-76 or higher | | 20,000 25,000 | 20,000 25,000 | | |
| Hamburg wheel track (inflection point minimum number of passes) ^g | AASHTO T 324 (Modified) | | | -- | -- |
| PG-58 | | 10,000 | 10,000 | | |
| PG-64 | | 10,000 | 10,000 | | |
| PG-70 | | 12,500 | 12,500 | | |
| PG-76 or higher | | 15000 | 15000 | | |
| Moisture susceptibility (minimum dry strength, psi) ^g | California Test 371 | 120 | 120 | -- | -- |
| Moisture susceptibility (tensile strength ration, %) ^g | California Test 371 | 70 | 70 | -- | -- |
| Smoothness | Section 39-1.12 | 12-foot straight- edge and must-grind | 12-foot straight- edge and must-grind | 12-foot straight- edge and must-grind | 12-foot straight- edge and must-grind |
| Asphalt binder | Various | Section 92 | Section 92 | Section 92 | Section 92 |
| Asphalt rubber binder | Various | -- | -- | Section 92- 1.01D(2) and section 39-1.02D | Section 92- 1.01D(2) and section 39-1.02D |
| Asphalt modifier | Various | -- | -- | Section 39-1.02D | Section 39-1.02D |
| CRM | Various | -- | -- | Section 39-1.02D | Section 39-1.02D |

^a The Engineer determines combined aggregate gradations containing RAP under California Test 367.

^b The tolerances must comply with the allowable tolerances in section 39-1.02E.

^c The Engineer reports the average of 3 tests from a single split sample.

^d The Engineer determines the bulk specific gravity of each lab-compacted briquette under California Test 308, Method A, and theoretical maximum specific gravity under California Test 309.

^e The Engineer waives this specification if HMA contains 10 percent or less of nonmanufactured sand by weight of total aggregate. Manufactured sand is fine aggregate produced by crushing rock or gravel.

^f Report only.

^g Applies to RAP substitution rate greater than 15 percent.

Replace "280 degrees F" in item 2 in the list in the 6th paragraph of section 39-3.04 with:

285 degrees F

01-20-12

Replace "5,000" in the 5th paragraph of section 39-4.02C with:

10,000

02-22-13

Replace the 7th paragraph of section 39-4.02C with:

Except for RAP substitution rate of greater than 15 percent, the Department does not use results from California Test 371 to determine specification compliance.

02-22-13

Replace the 8th paragraph of section 39-4.02C with:

02-22-13

Comply with the values for the HMA quality characteristics and minimum random sampling and testing for quality control shown in the following table:

Minimum Quality Control—QC/QA Construction Process

| Quality characteristic | Test method | Minimum sampling and testing frequency | HMA Type | | | Location of sampling | Maximum report-ing time allow-ance |
|--|----------------------------|---|------------------------------|------------------------------|------------------------------|---|------------------------------------|
| | | | A | B | RHMA-G | | |
| Aggregate gradation ^a | California Test 202 | 1 per 750 tons | JMF ± tolerance ^b | JMF ± tolerance ^b | JMF ± tolerance ^b | California Test 125 | 24 hours |
| Asphalt binder content (%) | California Test 379 or 382 | | JMF±0.40 | JMF±0.40 | JMF ±0.40 | Loose mix behind paver See California Test 125 | |
| Field compaction (% max. theoretical density) ^{c,d} | QC plan | | 92–96 | 92–96 | 91–96 | QC plan | |
| Aggregate moisture content at continuous mixing plants and RAP moisture content at continuous mixing plants and batch mixing plants ^e | California Test 226 or 370 | 2 per day during production | -- | -- | -- | Stock-piles or cold feed belts | -- |
| Sand equivalent (min) ^f | California Test 217 | 1 per 750 tons | 47 | 42 | 47 | California Test 125 | 24 hours |
| HMA moisture content (% max) | California Test 226 or 370 | 1 per 2,500 tons but not less than 1 per paving day | 1.0 | 1.0 | 1.0 | Loose Mix Behind Paver See California Test 125 | 24 hours |
| Stabilometer value (min) ^f | California Test 366 | 1 per 4,000 tons or 2 per 5 business days, whichever is greater | 30 | 30 | -- | | 48 hours |
| No. 4 and 3/8" gradings 1/2" and 3/4" gradings | | | 37 | 35 | 23 | | |
| Air void content (%) ^{f,g} | California Test 367 | | 4 ± 2 | 4 ± 2 | TV ± 2 | | |

| | | | | | | | |
|---|---------------------|---|-------------|-------------|-------------|---------------------|----------|
| Percent of crushed particles coarse aggregate (% min.): One fractured face Two fractured faces | California Test 205 | As designated in QC plan. At least once per project. | 90 | 25 | -- | California Test 125 | 48 hours |
| | | | 75 | -- | 90 | | |
| Fine aggregate (% min) (Passing no. 4 sieve and retained on no. 8 sieve): One fractured face | | | 70 | 20 | 70 | | |
| | | | | | | | |
| Los Angeles Rattler (% max): Loss at 100 rev. Loss at 500 rev. | California Test 211 | | 12 | -- | 12 | California Test 125 | |
| | | | 45 | 50 | 40 | | |
| Fine aggregate angularity (% min) ⁿ | California Test 234 | | 45 | 45 | 45 | California Test 125 | |
| Flat and elongated particle (% max by weight @ 5:1) | California Test 235 | | Report only | Report only | Report only | California Test 125 | |
| Voids filled with asphalt (%) ⁱ No. 4 grading 3/8" grading 1/2" grading 3/4" grading | California Test 367 | | | | Report only | | |
| | | | 65.0–75.0 | 65.0–75.0 | | | |
| | | 65.0–75.0 | 65.0–75.0 | | | | |
| | | 65.0–75.0 | 65.0–75.0 | | | | |
| | | 65.0–75.0 | 65.0–75.0 | | | | |
| Voids in mineral aggregate (% min.) ⁱ No. 4 grading 3/8" grading 1/2" grading 3/4" grading | California Test 367 | | | | | | |
| | | 17.0 | 17.0 | -- | | | |
| | | 15.0 | 15.0 | -- | | | |
| | | 14.0 | 14.0 | 18.0–23.0 | | | |
| | | 13.0 | 13.0 | 18.0–23.0 | | | |

| | | | | | | | |
|---|-------------------------|---|--|--|--|------------------|----------|
| Dust proportion ⁱ No. 4 and 3/8" gradings 1/2" and 3/4" gradings | California Test 367 | | 0.6–1.2 0.6–1.2 | 0.6–1.2 0.6–1.2 | Report only | | |
| Hamburg wheel track (minimum number of passes at 0.5 inch average rut depth) ⁱ PG-58 PG-64 PG-70 PG-76 or higher | AASHTO T 324 (Modified) | 1 per 10,000 tons or 1 per project whichever is greater | 10,000 15,000 20,000 25,000 | 10,000 15,000 20,000 25,000 | -- | -- | |
| Hamburg wheel track (inflection point minimum number of passes) ⁱ PG-58 PG-64 PG-70 PG-76 or higher | AASHTO T 324 (Modified) | 1 per 10,000 tons or 1 per project whichever is greater | 10,000 10,000 12,500 15000 | 10,000 10,000 12,500 15000 | -- | -- | |
| Moisture susceptibility (minimum dry strength, psi) ^j | California Test 371 | 1 per 10,000 tons or 1 per project whichever is greater | 120 | 120 | -- | -- | |
| Moisture susceptibility (tensile strength ratio, %) ^j | California Test 371 | 1 per 10,000 tons or 1 per project whichever is greater | 70 | 70 | 70 | -- | |
| Smoothness | Section 39-1.12 | -- | 12-foot straight-edge, must-grind, and PI ₀ | 12-foot straight-edge, must-grind, and PI ₀ | 12-foot straight-edge, must-grind, and PI ₀ | -- | |
| Asphalt rubber binder viscosity @ 375 °F, centipoises | Section 39-1.02D | -- | -- | -- | 1,500–4,000 | Section 39-1.02D | 24 hours |
| CRM | Section 39-1.02D | -- | -- | -- | Section 39-1.02D | Section 39-1.02D | 48 hours |

- ^a Determine combined aggregate gradation containing RAP under California Test 367.
- ^b The tolerances must comply with the allowable tolerances in section 39-1.02E.
- ^c Determines field compaction for any of the following conditions:
 1. 1/2-inch, 3/8-inch, or no. 4 aggregate grading is used and the specified total paved thickness is at least 0.15 foot.
 2. 3/4-inch aggregate grading is used and the specified total paved thickness is at least 0.20 foot.
- ^d To determine field compaction use:
 1. In-place density measurements using the method specified in your QC plan.
 2. California Test 309 to determine the maximum theoretical density at the frequency specified in California Test 375, Part 5C.
- ^e For adjusting the plant controller at the HMA plant.
- ^f Report the average of 3 tests from a single split sample.
- ^g Determine the bulk specific gravity of each lab-compacted briquette under California Test 308, Method A, and theoretical maximum specific gravity under California Test 309.
- ^h The Engineer waives this specification if HMA contains 10 percent or less of nonmanufactured sand by weight of total aggregate. Manufactured sand is fine aggregate produced by crushing rock or gravel.
- ⁱ Report only.
- ^j Applies to RAP substitution rate greater than 15 percent.

Replace the 1st sentence in the 1st paragraph of section 39-4.03B(2) with:

01-20-12

For aggregate gradation and asphalt binder content, the minimum ratio of verification testing frequency to quality control testing frequency is 1:5.

Replace the 2nd "and" in the 7th paragraph of section 39-4.03B(2) with:

01-20-12

or

Replace the 1st paragraph of section 39-4.04A with:

02-22-13

The Engineer samples for acceptance testing and tests for the following quality characteristics:

HMA Acceptance—QC/QA Construction Process

| Index (i) | Quality characteristic | | | | Weight -ing factor (w) | Test method | HMA type | | |
|-----------|--|----------------------------------|------|------|------------------------|----------------------------|------------------------------|------------------------------|------------------------------------|
| | | | | | | | A | B | RHMA-G |
| | | Aggregate gradation ^a | | | | California Test 202 | JMF ± Tolerance ^c | | |
| | Sieve | 3/4" | 1/2" | 3/8" | | | | | |
| 1 | 1/2" | X ^b | -- | -- | 0.05 | | | | |
| 1 | 3/8" | -- | X | -- | 0.05 | | | | |
| 1 | No. 4 | -- | -- | X | 0.05 | | | | |
| 2 | No. 8 | X | X | X | 0.10 | | | | |
| 3 | No. 200 | X | X | X | 0.15 | | | | |
| 4 | Asphalt binder content (%) | | | | 0.30 | California Test 379 or 382 | JMF±0.40 | JMF±0.40 | JMF ± 0.40 |
| 5 | Field compaction (% max. theoretical density) ^{d, e} | | | | 0.40 | California Test 375 | 92–96 | 92–96 | 91–96 |
| | Sand equivalent (min) ^f | | | | | California Test 217 | 47 | 42 | 47 |
| | Stabilometer value (min) ^f No. 4 and 3/8" gradings 1/2" and 3/4" gradings | | | | | California Test 366 | 30 37 | 30 35 | -- 23 |
| | Air void content (%) ^{f, g} | | | | | California Test 367 | 4 ± 2 | 4 ± 2 | TV ± 2 |
| | Percent of crushed particles coarse aggregate (% min) One fractured face Two fractured faces Fine aggregate (% min) (Passing no. 4 sieve and retained on No. 8 sieve.) One fractured face | | | | | California Test 205 | 90 75 | 25 -- | -- 90 |
| | HMA moisture content (% max) | | | | | California Test 226 or 370 | 1.0 | 1.0 | 1.0 |
| | Los Angeles Rattler (% max) Loss at 100 rev. Loss at 500 rev. | | | | | California Test 211 | 12 45 | -- 50 | 12 40 |
| | Fine aggregate angularity (% min) ^h | | | | | California Test 234 | 45 | 45 | 45 |
| | Flat and elongated particle (% max by weight @ 5:1) | | | | | California Test 235 | Report only | Report only | Report only |
| | Voids in mineral aggregate (% min) ⁱ No. 4 grading 3/8" grading 1/2" grading 3/4" grading | | | | | California Test 367 | 17.0 15.0 14.0 13.0 | 17.0 15.0 14.0 13.0 | -- -- 18.0–23.0 18.0–23.0 |

| | | | | | | |
|--|--|--|-------------------------------|--|---|---|
| | Voids filled with asphalt (%) ⁱ No. 4 grading 3/8" grading 1/2" grading 3/4" grading | | California Test 367 | 65.0–75.0 65.0–75.0 65.0–75.0 65.0–75.0 | 65.0–75.0 65.0–75.0 65.0–75.0 65.0–75.0 | Report only |
| | Dust proportion ¹ No. 4 and 3/8" gradings 1/2" and 3/4" gradings | | California Test 367 | 0.6–1.2 0.6–1.2 | 0.6–1.2 0.6–1.2 | Report only |
| | Hamburg Wheel Tracker (minimum number of passes at 0.5 inch average rut depth) ^j PG-58 PG-64 PG-70 PG-76 or higher | | AASHTO T 324 (Modified) | 10,000 15,000 20,000 25,000 | 10,000 15,000 20,000 25,000 | -- |
| | Hamburg Wheel Tracker (inflection point minimum number of passes) ^j PG-58 PG-64 PG-70 PG-76 or higher | | AASHTO T 324 (Modified) | 10,000 15,000 20,000 25,000 | 10,000 15,000 20,000 25,000 | -- |
| | Moisture susceptibility (minimum dry strength, psi) ^j | | California Test 371 | 120 | 120 | -- |
| | Moisture susceptibility (tensile strength ratio %) ^j | | California Test 371 | 70 | 70 | 70 |
| | Smoothness | | Section 39-1.12 | 12-foot straight- edge, must grind, and PI ₀ | 12-foot straight- edge, must grind, and PI ₀ | 12-foot straight- edge, must grind, and PI ₀ |
| | Asphalt binder | | Various | Section 92 | Section 92 | Section 92 |
| | Asphalt rubber binder | | Various | -- | -- | Section 92-1.01D(2) and section 39-1.02D |
| | Asphalt modifier | | Various | -- | -- | Section 39-1.02D |
| | CRM | | Various | -- | -- | Section 39-1.02D |

suspension limit: Value at which production must be suspended while corrections are made.

40-1.01C Submittals

40-1.01C(1) General

At least 15 days before delivery to the job site, submit manufacturer's recommendations and instructions for storage and installation of:

1. Threaded tie bar splice couplers
2. Joint filler

As an informational submittal, submit calibration documentation and operational guidelines for frequency measuring devices (tachometer) for concrete consolidation vibrators.

Submit updated quality control charts each paving day.

40-1.01C(2) Certificates of Compliance

Submit a certificate of compliance for:

1. Tie bars
2. Threaded tie bar splice couplers
3. Dowel bars
4. Tie bar baskets
5. Dowel bar baskets
6. Joint filler
7. Epoxy powder coating

40-1.01C(3) Quality Control Plan

Submit a concrete pavement QC plan. Allow 30 days for review.

40-1.01C(4) Mix Design

At least 15 days before testing for mix proportions, submit a copy of the AASHTO accreditation for your laboratory determining the mix proportions. At least 15 days before starting field qualification, submit the proposed concrete mix proportions, the corresponding mix identifications, and laboratory test reports including the modulus of rupture for each trial mixture at 10, 21, 28, and 42 days.

40-1.01C(5) Concrete Field Qualification

Submit field qualification data and test reports including:

1. Mixing date
2. Mixing equipment and procedures used
3. Batch volume in cubic yards. The minimum batch size is 5 cu yd.
4. Type and source of ingredients used
5. Penetration of the concrete
6. Air content of the plastic concrete
7. Age and strength at time of concrete beam testing

Field qualification test reports must be certified with a signature by an official in responsible charge of the laboratory performing the tests.

40-1.01C(6) Cores

Submit for authorization the name of the laboratory you propose to use for testing the cores for air content.

Submit each core in an individual plastic bag marked with a location description.

40-1.01C(7) Profile Data and Straightedge Measurements

At least 5 business days before start of initial profiling or changing profiler or operator, submit:

1. Inertial profiler (IP) certification issued by the Department. The certification must not be more than 12 months old.

2. Operator certification for the IP issued by the Department. The operator must be certified for each different model of IP device operated. The certification must not be more than 12 months old.
3. List of manufacturer's recommended test procedures for IP calibration and verification.

Within 2 business days after cross correlation testing, submit ProVAL profiler certification analysis report for cross correlation test results performed on test section. ProVAL is FHWA's software. Submit the certification analysis report to the Engineer and to the electronic mailbox address:

smoothness@dot.ca.gov

Within 2 business days after each day of inertial profiling, submit profile data to the Engineer and to the electronic mailbox address:

smoothness@dot.ca.gov

Within 2 business days of performing straightedge testing, submit a report of areas requiring smoothness correction.

40-1.01C(8)–40-1.01C(12) Reserved

40-1.01D Quality Control and Assurance

40-1.01D(1) General

If the pavement quantity is at least 2000 cu yd, provide a QC manager.

Core pavement as described for, thickness, bar placement, and air content.

For the Department's modulus of rupture testing, assist the Engineer in fabricating test beams by providing materials and labor.

Allow at least 25 days for the Department to schedule testing for coefficient of friction. Notify the Engineer when the pavement is scheduled to be opened to traffic. Notify the Engineer when the pavement is ready for testing which is the latter of:

1. Seven days after paving
2. When the pavement has attained a modulus of rupture of at least 550 psi

The Department tests for coefficient of friction within 7 days of receiving notification that the pavement is ready for testing.

40-1.01D(2) Prepaving Conference

Schedule a prepaving conference at a mutually agreed upon time and place to meet with the Engineer. Make the arrangements for the conference facility. Discuss QC plan and methods of performing each item of the work.

Prepaving conference attendees must sign an attendance sheet provided by the Engineer. The prepaving conference must be attended by your:

1. Project superintendent
2. QC manager
3. Paving construction foreman
4. Workers and your subcontractor's workers, including:
 - 4.1. Foremen including subcontractor's Foremen
 - 4.2. Concrete plant manager
 - 4.3. Concrete plant operator

Do not start paving activities including test strips until the listed personnel have attended a prepaving conference.

40-1.01D(3) Just-In-Time-Training

Reserved

40-1.01D(4) Quality Control Plan

Establish, implement, and maintain a QC plan for pavement. The QC plan must describe the organization and procedures used to:

1. Control the production process
2. Determine if a change to the production process is needed
3. Implement a change

The QC plan must include action and suspension limits and details of corrective action to be taken if any process is out of those limits. Suspension limits must not exceed specified acceptance criteria.

The QC plan must address the elements affecting concrete pavement quality including:

1. Mix proportions
2. Aggregate gradation
3. Materials quality
4. Stockpile management
5. Line and grade control
6. Proportioning
7. Mixing and transportation
8. Placing and consolidation
9. Contraction and construction joints
10. Bar reinforcement placement and alignment
11. Dowel bar placement, alignment, and anchorage
12. Tie bar placement
13. Modulus of rupture
14. Finishing and curing
15. Protecting pavement
16. Surface smoothness

40-1.01D(5) Mix Design

Use a laboratory that complies with ASTM C 1077 to determine the mix proportions for concrete pavement. The laboratory must have a current AASHTO accreditation for:

1. AASHTO T 97 or ASTM C 78
2. ASTM C 192/C 192M

Make trial mixtures no more than 24 months before field qualification.

Using your trial mixtures, determine the minimum cementitious materials content. Use your value for minimum cementitious material content for *MC* in equation 1 and equation 2 of section 90-1.02B(3).

To determine the minimum cementitious materials content or maximum water to cementitious materials ratio, use modulus of rupture values of at least 570 psi for 28 days age and at least 650 psi for 42 days age.

If changing an aggregate supply source or the mix proportions, produce a trial batch and field-qualify the new concrete. The Engineer does not adjust contract time for performing sampling, testing, and qualifying new mix proportions or changing an aggregate supply source.

40-1.01D(6) Quality Control Testing

40-1.01D(6)(a) General

Testing laboratories and testing equipment must comply with the Department's Independent Assurance Program.

40-1.01D(6)(b) Concrete Mix

Before placing pavement, your mix design must be field qualified. Use an ACI certified "Concrete Laboratory Technician, Grade I" to perform field qualification tests and calculations. Test for modulus of rupture under California Test 523 at 10, 21, and 28 days of age.

When placing pavement, your quality control must include testing properties at the frequencies shown in the following table:

QC Testing Frequency

| Property | Test method | Minimum frequency |
|---|--|-------------------|
| Cleanness value | California Test 227 | 2 per day |
| Sand equivalent | California Test 217 | 2 per day |
| Aggregate gradation | California Test 202 | 2 per day |
| Air content (air entrainment specified) | California Test 504 | 1 per hour |
| Air content (air entrainment not specified) | California Test 504 | 1 per 4 hours |
| Density | California Test 518 | 1 per 4 hours |
| Penetration | California Test 533 | 1 per 4 hours |
| Aggregate moisture meter calibration ^a | California Test 223 or California Test 226 | 1 per day |

^a Check calibration of the plant moisture meter by comparing moisture meter readings with California Test 223 or California Test 226 test results.

Maintain control charts to identify potential problems and assignable causes. Post a copy of each control chart at a location determined by the Engineer.

Individual measurement control charts must use the target values in the mix proportions as indicators of central tendency.

Develop linear control charts for:

1. Cleanness value
2. Sand equivalent
3. Fine and coarse aggregate gradation
4. Air content
5. Penetration

Control charts must include:

1. Contract number
2. Mix proportions
3. Test number
4. Each test parameter
5. Action and suspension limits
6. Specification limits
7. Quality control test results

For fine and coarse aggregate gradation control charts, record the running average of the previous 4 consecutive gradation tests for each sieve and superimpose the specification limits.

For air content control charts, the action limit is ± 1.0 percent of the specified value. If no value is specified, the action limit is ± 1.0 percent of the value used for your approved mix design.

As a minimum, a process is out of control if any of the following occurs:

1. For fine and coarse aggregate gradation, 2 consecutive running averages of 4 tests are outside the specification limits
2. For individual penetration or air content measurements:
 - 2.1. One point falls outside the suspension limit line
 - 2.2. Two points in a row fall outside the action limit line

Stop production and take corrective action for out of control processes or the Engineer rejects subsequent material.

Before each day's concrete pavement placement and at intervals not to exceed 4 hours of production, use a tachometer to test and record vibration frequency for concrete consolidation vibrators.

40-1.01D(6)(c) Pavement Smoothness

40-1.01D(6)(c)(i) General

Notify the Engineer 2 business days before performing smoothness testing including IP calibration and verification testing. The notification must include start time and locations by station.

Before testing the pavement smoothness, remove foreign objects from the surface, and mark the beginning and ending station on the pavement shoulder.

Test pavement smoothness using an IP except use a 12-foot straightedge at the following locations:

1. Traffic lanes less than 1,000 feet in length including ramps, turn lanes, and acceleration and deceleration lanes
2. Areas within 15 feet of manholes
3. Shoulders
4. Weigh-in-motion areas
5. Miscellaneous areas such as medians, gore areas, turnouts, and maintenance pullouts

40-1.01D(6)(c)(ii) Straightedge Testing

Identify locations of areas requiring correction by:

1. Location Number
2. District-County-Route
3. Beginning station or post mile to the nearest 0.01 mile
4. For correction areas within a lane:
 - 4.1. Lane direction as NB, SB, EB, or WB
 - 4.2. Lane number from left to right in direction of travel
 - 4.3. Wheel path as "L" for left, "R" for right, or "B" for both
5. For correction areas not within a lane:
 - 5.1. Identify pavement area (e.g., shoulder, weight station, turnout)
 - 5.2. Direction and distance from centerline as "L" for left or "R" for right
6. Estimated size of correction area

40-1.01D(6)(c)(iii) Inertial Profile Testing

IP equipment must display a current certification decal with expiration date.

Conduct cross correlation IP verification test in the Engineer's presence before performing initial profiling. Verify cross correlation IP verification test at least annually. Conduct 5 repeat runs of the IP on an authorized test section. The test section must be on an existing concrete pavement surface 0.1 mile long. Calculate a cross correlation to determine the repeatability of your device under Section 8.3.1.2 of AASHTO R 56 using ProVAL profiler certification analysis with a 3 feet maximum offset. The cross correlation must be a minimum of 0.92.

Conduct the following IP calibration and verification tests in the Engineer's presence each day before performing inertial profiling:

1. Block test. Verify the height sensor accuracy under AASHTO R 57, section 5.3.2.3.
2. Bounce test. Verify the combined height sensor and accelerometer accuracy under AASHTO R 57, section 5.3.2.3.2.
3. DMI test. Calibrate the accuracy of the testing procedure under AASHTO R 56, section 8.4.
4. Manufacturer's recommended tests.

Collect IP data using the specified ProVAL analysis with 250 mm and IRI filters. Comply with the requirements for data collection under AASHTO R 56.

For IP testing, wheel paths are 3 feet from and parallel to the edge of a lane. Left and right are relative to the direction of travel. The IRI is the pavement smoothness along a wheel path of a given lane. The MRI is the average of the IRI values for the left and right wheel path from the same lane.

Operate the IP according to the manufacturer's recommendations and AASHTO R 57 at 1-inch recording intervals and a minimum 4 inch line laser sensor.

Collect IP data under AASHTO R 56. IP data must include:

1. Raw profile data for each lane.
2. ProVAL ride quality analysis report for the international roughness index (IRI) of left and right wheel paths of each lane. Submit in pdf file format.
3. ProVAL ride quality analysis report for the mean roughness index (MRI) of each lane. Submit in pdf file format.
4. ProVAL smoothness assurance analysis report for IRIs of left wheel path. Submit in pdf file format.
5. ProVAL smoothness assurance analysis report for IRIs of right wheel path. Submit in pdf file format.
6. GPS data file for each lane in GPS exchange. Submit in GPS eXchange file format.
7. Manufacturer's recommended IP calibration and verification tests results.
8. AASHTO IP calibration and verification test results including bounce, block, and distance measurement instrument (DMI).

Submit the IP raw profile data in unfiltered electronic pavement profile file (PPF) format. Name the PPF file using the following naming convention:

YYYYMMDD_TTCCRRR_D_L_W_S_X_PT.PPF

where:

YYYY = year

MM = Month, leading zero

DD = Day of month, leading zero

TT = District, leading zero

CCC = County, 2 or 3 letter abbreviation as shown in section 1-1.08

RRR = Route number, no leading zeros

D = Traffic direction as NB, SB, WB, or EB

L = Lane number from left to right in direction of travel

W = Wheel path as "L" for left, "R" for right, or "B" for both

S = Beginning station to the nearest foot (e.g., 10+20) or beginning post mile to the nearest hundredth (e.g., 25.06) no leading zero

X = Profile operation as "EXIST" for existing pavement, "PAVE" for after paving, or "CORR" for after final surface pavement correction

PT = Pavement type (e.g., "concrete", etc.)

Determine IRIs using the ProVAL ride quality analysis with a 250 mm and IRI filters. While collecting the profile data to determine IRI, record the following locations in the raw profile data:

1. Begin and end of all bridge approach slabs
2. Begin and end of all bridges
3. Begin and end of all culverts visible on the roadway surface

For each 0.1 mile section, your IRI values must be within 10 percent of the Department's IRI values. The Engineer may order you to recalibrate your IP equipment and reprofile. If your results are inaccurate due to operator error, the Engineer may disqualify your IP operator.

Determine the MRI for 0.1-mile fixed sections. A partial section less than 0.1 mile that is the result of an interruption to continuous pavement surface must comply with the MRI specifications for a full section. Adjust the MRI for a partial section to reflect a full section based on the proportion of a section paved.

Determine the areas of localized roughness. Use the ProVAL smoothness assurance with a continuous IRI for each wheel path, 25-foot interval, and 250 mm and IRI filters.

40-1.01D(6)(c)(iv) Reserved

40-1.01D(6)(d)–40-1.01D(6)(h) Reserved

40-1.01D(7) Pavement Acceptance

40-1.01D(7)(a) Acceptance Testing

40-1.01D(7)(a)(i) General

The Department's acceptance testing includes testing the pavement properties at the minimum frequencies shown in the following table:

| Property | Acceptance Testing Test Method | | Frequency ^a |
|-----------------------------|-----------------------------------|--------------------------|------------------------|
| | CRCP | JPCP | |
| Modulus of rupture (28 day) | California Test 523 | | 1,000 cu yd |
| Air content ^b | California Test 504 | | 1 day's paving |
| Dowel bar placement | -- | Measurement ^a | 700 sq yd |
| Tie bar placement | -- | Measurement ^a | 4,000 sq yd |
| Thickness | California Test 531 | | 1,200 sq yd |
| Coefficient of friction | California Test 342 | | 1 day's paving |

^aA single test represents no more than the frequency specified.

^bTested only when air entrainment is specified.

Pavement smoothness may be accepted based on your testing in the absence of the Department's testing.

40-1.01D(7)(a)(ii) Air Content

If air-entraining admixtures are specified, the Engineer uses a t-test to compare your QC test results with the Department's test results. The t-value for test data is determined using the following equation:

$$t = \frac{|\bar{X}_c - \bar{X}_v|}{S_p \sqrt{\frac{1}{n_c} + \frac{1}{n_v}}} \quad \text{and} \quad S_p^2 = \frac{S_c^2(n_c - 1) + S_v^2(n_v - 1)}{n_c + n_v - 2}$$

where:

- n_c = Number of your quality control tests (minimum of 6 required)
- n_v = Number of Department's tests (minimum of 2 required)
-  = Mean of your quality control tests
-  = Mean of the Department's tests
- S_p = Pooled standard deviation
(When $n_v = 1$, $S_p = S_c$)
- S_c = Standard deviation of your quality control tests
- S_v = Standard deviation of the Department's tests (when $n_v > 1$)

The Engineer compares your QC test results with the Department's test results at a level of significance of $\alpha = 0.01$. The Engineer compares the t-value to t_{crit} , using degrees of freedom showing in the following table:

| degrees of freedom (nc+nv-2) | tcrit (for $\alpha = 0.01$) |
|---------------------------------|---------------------------------|
| 1 | 63.657 |
| 2 | 9.925 |
| 3 | 5.841 |
| 4 | 4.604 |
| 5 | 4.032 |
| 6 | 3.707 |
| 7 | 3.499 |
| 8 | 3.355 |
| 9 | 3.250 |
| 10 | 3.169 |

If the t-value calculated is less than or equal to tcrit, your quality control test results are verified. If the t-value calculated is greater than tcrit, quality control test results are not verified.

If your quality control test results are not verified, core at least 3 specimens from concrete pavement under section 40-1.03P. The Engineer selects the core locations. The authorized laboratory must test these specimens for air content under ASTM C 457. The Engineer compares these test results with your quality control test results using the t-test method. If your quality control test results are verified based on this comparison, the Engineer uses the quality control test results for acceptance of concrete pavement for air content. If your quality control test results are not verified based on this comparison, the Engineer uses the air content of core specimens determined by the authorized laboratory under ASTM C 457 for acceptance.

40-1.01D(7)(a)(iii) Dowel and Tie Bar Placement

For JPCP, drill cores under section 40-1.03P for the Department's acceptance testing.

The Engineer identifies which joint and dowel or tie bar are to be tested. Core each day's paving within 2 business days. Each dowel or tie bar test consists of 2 cores, 1 on each bar end to expose both ends and allow measurement.

If the tests indicate dowel or tie bars are not placed within the specified tolerances or if there is unconsolidated concrete around the dowel or tie bars, core additional specimens identified by Engineer to determine the limits of unacceptable work.

40-1.01D(7)(a)(iv) Thickness

Drill cores under section 40-1.03P for the Department's acceptance testing in the primary area, which is the area placed in 1 day for each thickness. Core at locations determined by the Engineer and in the Engineer's presence.

Do not core until any grinding has been completed.

The core specimen diameter must be 4 inches. To identify the limits of concrete pavement deficient in thickness by more than 0.05 foot, you may divide primary areas into secondary areas. The Engineer measures cores under California Test 531 to the nearest 0.01 foot. Core at least 1 foot from existing, contiguous, and parallel concrete pavement not constructed as part of this Contract.

You may request the Engineer make additional thickness measurements and use them to determine the average thickness variation. The Engineer determines the locations with random sampling methods.

If each thickness measurement in a primary area is less than 0.05 foot deficient, the Engineer calculates the average thickness deficiency in that primary area. The Engineer uses 0.02 foot for a thickness difference more than 0.02 foot over the specified thickness.

For each thickness measurement in a primary area deficient by more than 0.05 foot, the Engineer determines a secondary area where the thickness deficiency is more than 0.05 foot. The Engineer determines this secondary area by measuring the thickness of each concrete pavement slab adjacent to

the measurement found to be more than 0.05 foot deficient. The Engineer continues to measure the thickness until an area that is bound by slabs with thickness deficient by 0.05 foot or less is determined.

Slabs without bar reinforcement are defined by the areas bound by longitudinal and transverse joints and concrete pavement edges. Slabs with bar reinforcement are defined by the areas bound by longitudinal joints and concrete pavement edges and 15-foot lengths. Secondary area thickness measurements in a slab determine that entire slab's thickness.

The Engineer measures the remaining primary area thickness after removing the secondary areas from consideration for determining the average thickness deficiency.

40-1.01D(7)(a)(v)–40-1.01D(7)(a)(ix) Reserved

40-1.01D(7)(b) Acceptance Criteria

40-1.01D(7)(b)(i) General

Reserved

40-1.01D(7)(b)(ii) Modulus of Rupture

For field qualification, the modulus of rupture at no later than 28 days must be at least:

1. 550 psi for each single beam
2. 570 psi for the average of 5 beams

For production, the modulus of rupture for the average of the individual test results of 2 beams aged for 28 days must be at least 570 psi.

40-1.01D(7)(b)(iii) Air Content

The air content must be within ± 1.5 percent of the specified value. If no value is specified, the air content must be within ± 1.5 percent of, the value used for your approved mix design.

40-1.01D(7)(b)(iv) Bar Reinforcement

In addition to requirements of Section 52, bar reinforcement must be more than 1/2 inch below the saw cut depth at concrete pavement joints.

40-1.01D(7)(b)(v) Dowel Bar and Tie Bar Placement

Tie bar placement must comply with the tolerances shown in the following table:

| Tie Bar Tolerance | |
|-------------------------------|--|
| Dimension | Tolerance |
| Horizontal and vertical skew | 5 1/4 inch, max |
| Longitudinal translation | ± 2 inch |
| Horizontal offset (embedment) | ± 2 inch |
| Vertical depth | <ol style="list-style-type: none"> 1. At least 1/2 inch below the bottom of the saw cut 2. When measured at any point along the bar, not less than 2 inches clear of the pavement's surface and bottom |

NOTE: Tolerances are measured relative to the completed joint.

Dowel bar placement must comply with the tolerances shown in the following table:

Dowel Bar Tolerances

| Dimension | Tolerance |
|--------------------------|---|
| Horizontal offset | ±1 inch |
| Longitudinal translation | ±2 inch |
| Horizontal skew | 5/8 inch, max |
| Vertical skew | 5/8 inch, max |
| Vertical depth | <p>The minimum distance measured from concrete pavement surface to any point along the top of dowel bar must be: DB + 1/2 inch</p> <p>where: DB = one third of pavement thickness in inches, or the saw cut depth, whichever is greater</p> <p>The maximum distance below the depth shown must be 5/8 inch.</p> |

NOTE: Tolerances are measured relative to the completed joint.

The Engineer determines the limits for removal and replacement.

40-1.01D(7)(b)(vi) Pavement Thickness

Concrete pavement thickness must not be deficient by more than 0.05 foot.

The minimum thickness is not reduced for specifications that may affect concrete pavement thickness such as allowable tolerances for subgrade construction.

The Engineer determines the areas of noncompliant pavement, the thickness deficiencies, and the limits where removal is required.

Pavement with an average thickness deficiency less than 0.01 foot is acceptable. If the thickness deficiency is 0.01 foot or more and less than 0.05 foot, you may request authorization to leave the pavement in place and accept a pay adjustment. If the deficiency is more than 0.05 foot the pavement must be removed and replaced.

40-1.01D(7)(b)(vii) Pavement Smoothness

Where testing with an IP is required, the pavement surface must have:

1. No areas of localized roughness with an IRI greater than 120 in/mi
2. MRI of 60 in/mi or less within a 0.1 mile section

Where testing with a straightedge is required, the pavement surface must not vary from the lower edge of the straightedge by more than:

1. 0.01 foot when the straightedge is laid parallel with the centerline
2. 0.02 foot when the straightedge is laid perpendicular to the centerline and extends from edge to edge of a traffic lane
3. 0.02 foot when the straightedge is laid within 24 feet of a pavement conform

40-1.01D(7)(b)(viii) Coefficient of Friction

Initial and final texturing must produce a coefficient of friction of at least 0.30. Do not open the pavement to traffic unless the coefficient of friction is at least 0.30.

40-1.01D(7)(b)(ix)–40-1.01D(7)(b)(xii) Reserved

40-1.02 MATERIALS

40-1.02A General

Water for coring must comply with section 90.

Tack coat must comply with section 39.

40-1.02B Concrete

40-1.02B(1) General

PCC for pavement must comply with section 90-1 except as otherwise specified.

40-1.02B(2) Cementitious Material

Concrete must contain from 505 pounds to 675 pounds cementitious material per cubic yard. The specifications for reducing cementitious material content in section 90-1.02E(2) do not apply .

40-1.02B(3) Aggregate

Aggregate must comply with section 90-1.02C except the specifications for reduction in operating range and contract compliance for cleanness value and sand equivalent specified in section 90-1.02C(2) and section 90-1.02C(3) do not apply.

For coarse aggregate in high desert and high mountain climate regions, the loss must not exceed 25 percent when tested under California Test 211 with 500 revolutions.

For combined aggregate gradings, the difference between the percent passing the 3/8-inch sieve and the percent passing the no. 8 sieve must not be less than 16 percent of the total aggregate.

40-1.02B(4) Air Entrainment

The second paragraph of section 90-1.02I(2)(a) does not apply.

For a project shown in the low and south mountain climate regions, add air-entraining admixture to the concrete at the rate required to produce an air content of 4 percent in the freshly mixed concrete.

For a project shown in the high desert and high mountain climate regions, add air-entraining admixture to the concrete at the rate required to produce an air content of 6 percent in the freshly mixed concrete.

40-1.02B(5)–40-1.02B(8) Reserved

40-1.02C Reinforcement, Bars, and Baskets

40-1.02C(1) Bar Reinforcement

Bar reinforcement must be deformed bars.

If the project is not shown to be in high desert or any mountain climate region, bar reinforcement must comply with section 52.

If the project is shown to be in high desert or any mountain climate regions, bar reinforcement must be one of the following:

1. Epoxy-coated bar reinforcement under section 52-2.03B except bars must comply with either ASTM A 706/A 706M; ASTM A 996/A 996M; or ASTM A 615/A 615M, Grade 40 or 60. Bars must be handled under ASTM D 3963/D 3963M and section 52-2.02C.
2. Low carbon, chromium steel bar complying with ASTM A 1035/A 1035M

40-1.02C(2) Dowel Bars

Dowel bars must be plain bars. Fabricate, sample, and handle epoxy-coated dowel bars under ASTM D 3963/D 3963M and section 52-2.03C except each sample must be 18 inches long.

If the project is not shown to be in high desert or any mountain climate region, dowel bars must be one of the following:

1. Epoxy-coated bars. Bars must comply with ASTM A 615/A 615M, Grade 40 or 60. Epoxy coating must comply with either section 52-2.02B or 52-2.03B.

2. Stainless-steel bars. Bars must be descaled solid stainless-steel bars under ASTM A 955/A 955M, UNS Designation S31603 or S31803.
3. Low carbon, chromium-steel bars under ASTM A 1035/A 1035M.

If the project is shown to be in high desert or any mountain climate region, dowel bars must be one of the following:

1. Epoxy-coated bars. Bars must comply with ASTM A 615/A 615M, Grade 40 or 60. Epoxy coating must comply with section 52-2.03B.
2. Stainless-steel bars. Bars must be descaled solid stainless-steel bars under ASTM A 955/A 955M, UNS Designation S31603 or S31803.

40-1.02C(3) Tie Bars

Tie bars must be deformed bars.

If the project is not shown to be in high desert or any mountain climate region, tie bars must be one of the following:

1. Epoxy-coated bar reinforcement. Bars must comply with either section 52-2.02B or 52-2.03B except bars must comply with either ASTM A 706/A 706M; ASTM A 996/A 996M; or ASTM A 615/A 615M, Grade 40 or 60.
2. Stainless-steel bars. Bars must be descaled solid stainless-steel bars under ASTM A 955/A 955M, UNS Designation S31603 or S31803.
3. Low carbon, chromium-steel bars under ASTM A 1035/A 1035M.

If the project is shown to be in high desert or any mountain climate region, tie bars must be one of the following:

1. Epoxy-coated bar reinforcement. Bars must comply with section 52-2.03B except bars must comply with either ASTM A 706/A 706M; ASTM A 996/A 996M; or ASTM A 615/A 615M, Grade 40 or 60.
2. Stainless-steel bars. Bars must be descaled solid stainless-steel bars under ASTM A 955/A 955M, UNS Designation S31603 or S31803.

Fabricate, sample, and handle epoxy-coated tie bars under ASTM D 3963/D 3963M, section 52-2.02, or section 52-2.03.

Do not bend tie bars.

40-1.02C(4) Dowel and Tie Bar Baskets

For dowel and tie bar baskets, wire must comply with ASTM A 82/A 82M and be welded under ASTM A 185/A 185M, Section 7.4. The minimum wire-size no. is W10. Use either U-frame or A-frame shaped assemblies.

If the project is not shown to be in high desert or any mountain climate region, baskets may be epoxy-coated, and the epoxy coating must comply with either section 52-2.02B or 52-2.03B.

If the project is shown to be in high desert or any mountain climate region, wire for dowel bar and tie bar baskets must be one of the following:

1. Epoxy-coated wire complying with section 52-2.03B
2. Stainless-steel wire. Wire must be descaled solid stainless-steel. Wire must comply with (1) the chemical requirements in ASTM A 276/A 276M, UNS Designation S31603 or S31803 and (2) the tension requirements in ASTM A 1022/ A 1022M.

Handle epoxy-coated tie bar and dowel bar baskets under ASTM D 3963/D 3963M and either section 52-2.02 or 52-2.03.

Fasteners must be driven fasteners under ASTM F 1667. Fasteners on lean concrete base or HMA must have a minimum shank diameter of 3/16 inch and a minimum shank length of 2-1/2 inches. For asphalt treated permeable base or cement treated permeable base, the shank diameter must be at least 3/16 inch and the shank length must be at least 5 inches.

Fasteners, clips, and washers must have a minimum 0.2-mil thick zinc coating applied by either electroplating or galvanizing.

40-1.02D Dowel Bar Lubricant

Dowel bar lubricant must be petroleum paraffin based or a curing compound. Paraffin-based lubricant must be Dayton Superior DSC BB-Coat or Valvoline Tectyl 506 or an approved equal and must be factory-applied. Curing compound must be curing compound no. 3.

40-1.02E Joint Filler

Joint filler for isolation joint must be preformed expansion joint filler for concrete (bituminous type) under ASTM D 994.

40-1.02F Curing Compound

Curing compound must be curing compound no. 1 or 2.

40-1.02G Nonshrink Hydraulic Cement Grout

Nonshrink hydraulic cement grout must comply with ASTM C 1107/C 1107M. Clean, uniform, rounded aggregate filler may be used to extend the grout. Aggregate filler must not exceed 60 percent of the grout mass or the maximum recommended by the manufacturer, whichever is less. Aggregate filler moisture content must not exceed 0.5 percent when tested under California Test 223 or California Test 226. Aggregate filler tested under California Test 202 must comply with the grading shown in the following table:

| Sieve size | Percentage passing |
|------------|--------------------|
| 1/2-inch | 100 |
| 3/8-inch | 85–100 |
| No. 4 | 10–30 |
| No. 8 | 0–10 |
| No. 16 | 0–5 |

40-1.02H Temporary Roadway Pavement Structure

Temporary roadway pavement structure must comply with section 41-1.02E.

40-1.02I–40-1.02N Reserved

40-1.03 CONSTRUCTION

40-1.03A General

Aggregate and bulk cementitious material must be proportioned by weight by means of automatic proportioning devices of approved types.

For widenings and lane reconstruction, construct only the portion of pavement where the work will be completed during the same lane closure. If you fail to complete the construction during the same lane closure, construct a temporary pavement structure under section 41-1.

40-1.03B Water Supply

Before placing concrete pavement, develop enough water supply.

40-1.03C Test Strips

Construct a test strip for each type of pavement with a quantity of more than 2,000 cu yd. Obtain authorization of the test strip before constructing pavement. Test strips must be:

1. 700 to 1,000 feet long
2. Same width as the planned paving, and
3. Constructed using the same equipment proposed for paving

The Engineer selects from 6 to 12 core locations for dowel bars and up to 6 locations for tie bars per test strip. If you use mechanical dowel bar inserters, the test strip must demonstrate they do not leave voids, segregations, or surface irregularities such as depressions, dips, or high areas.

Test strips must comply with the acceptance criteria for:

1. Smoothness, except IP is not required
2. Dowel bars and tie bars placement
3. Pavement thickness
4. Final finishing, except the coefficient of friction is not considered

Allow 3 business days for evaluation. If the test strip is noncompliant, stop paving and submit a plan for changed materials, methods, or equipment. Allow 3 business days for authorization of the plan. Construct another test strip per the authorized plan.

Remove and dispose of noncompliant test strips.

If the test strip is compliant except for smoothness and final finishing, you may grind the surface. After grinding retest the test strip smoothness under section 40-1.01D(6)(c).

If the test strip is compliant for smoothness and thickness, construction of an additional test strip is not required and the test strip may remain in place.

Construct additional test strips if you:

1. Propose different paving equipment including:
 - 1.1. Paver
 - 1.2. Dowel bar inserter
 - 1.3. Tie bar inserter
 - 1.4. Tining
 - 1.5. Curing equipment
2. Change concrete mix proportions

You may request authorization to eliminate the test strip if you use paving equipment and personnel from a Department project (1) for the same type of pavement and (2) completed within the past 12 months. Submit supporting documents and previous project information with your request.

40-1.03D Joints

40-1.03D(1) General

Do not bend tie bars or reinforcement in existing concrete pavement joints.

For contraction joints and isolation joints, saw cut a groove with a power-driven saw. After cutting, immediately wash slurry from the joint with water at less than 100 psi pressure.

Keep joints free from foreign material including soil, gravel, concrete, and asphalt. To keep foreign material out of the joint, you may use filler material. Filler material must not react adversely with the concrete or cause concrete pavement damage. After sawing and washing, install filler material that keeps moisture in the adjacent concrete during the 72 hours after paving. If you install filler material, the specifications for spraying the sawed joint with additional curing compound in section 40-1.03K does not apply. If using absorptive filler material, moisten the filler immediately before or after installation.

40-1.03D(2) Construction Joints

Construction joints must be vertical.

Before placing fresh concrete against hardened concrete, existing concrete pavement, or structures, apply curing compound no. 1 or 2 to the vertical surface of the hardened concrete, existing concrete pavement, or structures and allow it to dry.

At joints between concrete pavement and HMA, apply tack coat between the concrete pavement and HMA.

Use a metal or wooden bulkhead to form transverse construction joints. If dowel bars are described, the bulkhead must allow dowel bar installation.

40-1.03D(3) Contraction Joints

Saw contraction joints before cracking occurs and after the concrete is hard enough to saw without spalling, raveling, or tearing.

Saw cut using a power saw with a diamond blade. After cutting, immediately wash slurry from the joint with water at less than 100 psi pressure.

Except for longitudinal joints parallel to a curving centerline, transverse and longitudinal contraction joints must not deviate by more than 0.1 foot from either side of a 12-foot straight line

Cut transverse contraction joints within 0.5 foot of the spacing described. Adjust spacing if needed such that slabs are at least 10 feet long.

For widenings, do not match transverse contraction joints with existing joint spacing or skew unless otherwise described.

Cut transverse contraction joints straight across the full concrete pavement width, between isolation joints and edges of pavement. In areas of converging and diverging pavements, space transverse contraction joints such that the joint is continuous across the maximum pavement width. Longitudinal contraction joints must be parallel with the concrete pavement centerline, except when lanes converge or diverge.

40-1.03D(4) Isolation Joints

Before placing concrete at isolation joints, prepare the existing concrete face and secure joint filler. Prepare by saw cutting and making a clean flat vertical surface. Make the saw cut the same depth as the depth of the new pavement.

40-1.03E Bar Reinforcement

Place bar reinforcement under section 52.

40-1.03F Dowel Bar Placement

If using curing compound as lubricant, apply the curing compound to dowels in 2 separate applications. Lubricate each dowel bar entirely before placement. The last application must be applied not more than 8 hours before placing the dowel bars. Apply each curing compound application at a rate of 1 gallon per 150 square feet.

Install dowel bars using one of the following methods:

1. Drill and bond bars. Comply with section 41-10.
2. Mechanical insertion. Eliminate evidence of the insertion by reworking the concrete over the dowel bars.
3. Dowel bar baskets. Anchor baskets with fasteners. Use at least 1 fastener per foot for basket sections. Baskets must be anchored at least 200 feet in advance of the concrete placement activity unless your waiver request is authorized. If requesting a waiver, describe the construction limitations or restricted access preventing the advanced anchoring. After the baskets are anchored and before the concrete is placed, cut and remove temporary spacer wires and demonstrate the dowel bars do not move from their specified depth and alignment during concrete placement.

If dowel bars are noncompliant, stop paving activities, demonstrate your correction, and obtain verbal approval from the Engineer.

40-1.03G Tie Bar Placement

Install tie bars at longitudinal joints using one of the following methods:

1. Drill and bond bars. Comply with section 41-10.
2. Insert bars. Mechanically insert tie bars into plastic slip-formed concrete before finishing. Inserted tie bars must have full contact between the bar and the concrete. Eliminate evidence of the insertion by reworking the concrete over the tie bars.
3. Threaded couplers. Threaded tie bar splice couplers must be fabricated from deformed bar reinforcement and free of external welding or machining.
4. Tie bar baskets. Anchor baskets at least 200 feet in advance of pavement placement activity. If you request a waiver, describe the construction limitations or restricted access preventing the advanced

anchoring. After the baskets are anchored and before paving, demonstrate the tie bars do not move from their specified depth and alignment during paving. Use fasteners to anchor tie bar baskets.

If tie bars are noncompliant, stop paving activities, demonstrate your correction, and obtain verbal approval from the Engineer.

40-1.03H Placing Concrete

40-1.03H(1) General

Immediately prior to placing concrete, the surface to receive concrete must be:

1. In compliance with specified requirements, including compaction and elevation tolerances
2. Free of loose and extraneous material
3. Uniformly moist, but free of standing or flowing water

Place concrete pavement with stationary side forms or slip-form paving equipment.

Place consecutive concrete loads within 30 minutes of each other. Construct a transverse construction joint when concrete placement is interrupted by more than 30 minutes. The transverse construction joint must coincide with the next contraction joint location, or you must remove fresh concrete pavement to the preceding transverse joint location.

Place concrete pavement in full slab widths separated by construction joints or monolithically in multiples of full lane widths with a longitudinal contraction joint at each traffic lane line.

Do not retemper concrete.

If the concrete pavement surface width is constructed as specified, you may construct concrete pavement sides on a batter not flatter than 6:1 (vertical:horizontal).

40-1.03H(2) Paving Adjacent to Existing Concrete Pavement

Where pavement is placed adjacent to existing concrete pavement:

1. Grinding adjacent pavement must be completed before placing the pavement
2. Use paving equipment with padded crawler tracks or rubber-tired wheels with enough offset to prevent damage
3. Match pavement grade with the elevation of existing concrete pavement after grinding.

40-1.03H(3) Concrete Pavement Transition Panel

For concrete pavement placed in a transition panel, texture the surface with a drag strip of burlap, broom, or spring steel tine device that produces scoring in the finished surface. Scoring must be either parallel or transverse to the centerline. Texture at the time that produces the coarsest texture.

40-1.03H(4) Stationary Side Form Construction

Stationary side forms must be straight and without defects including warps, bends, and indentations. Side forms must be metal except at end closures and transverse construction joints where other materials may be used.

You may build up side forms by attaching a section to the top or bottom. If attached to the top of metal forms, the attached section must be metal.

The side form's base width must be at least 80 percent of the specified concrete pavement thickness.

Side forms including interlocking connections with adjoining forms must be rigid enough to prevent springing from subgrading and paving equipment and concrete pressure.

Construct subgrade to final grade before placing side forms. Side forms must bear fully on the foundation throughout their length and base width. Place side forms to the specified grade and alignment of the finished concrete pavement's edge. Support side forms during concrete placing, compacting, and finishing.

After subgrade work is complete and immediately before placing concrete, true side forms and set to line and grade for a distance that avoids delays due to form adjustment.

Clean and oil side forms before each use.

Side forms must remain in place for at least 1 day after placing concrete and until the concrete pavement edge no longer requires protection from the forms.

Spread, screed, shape, and consolidate concrete with 1 or more machines. The machines must uniformly distribute and consolidate the concrete. The machines must operate to place the concrete pavement to the specified cross section with minimal hand work.

Consolidate the concrete without segregation. If vibrators are used:

1. The vibration rate must be at least 3,500 cycles per minute for surface vibrators and 5,000 cycles per minute for internal vibrators
2. Amplitude of vibration must cause perceptible concrete surface movement at least 1 foot from the vibrating element
3. Use a calibrated tachometer for measuring frequency of vibration
4. Vibrators must not rest on side forms or new concrete pavement
5. Power to vibrators must automatically cease when forward or backward motion of the paving machine is stopped
6. Uniformly consolidate the concrete across the paving width including adjacent to forms by using high-frequency internal vibrators within 15 minutes of depositing concrete on the subgrade
7. Do not shift the mass of concrete with vibrators.

40-1.03H(5) Slip-Form Construction

If slip-form construction is used, spread, screed, shape, and consolidate concrete to the specified cross section with slip-form machines and minimal hand work. Slip-form paving machines must be equipped with traveling side forms and must not segregate the concrete.

Do not deviate from the specified concrete pavement alignment by more than 0.1 foot.

Slip-form paving machines must use high frequency internal vibrators to consolidate concrete. You may mount vibrators with their axes parallel or normal to the concrete pavement alignment. If mounted with axes parallel to the concrete pavement alignment, space vibrators no more than 2.5 feet measured center to center. If mounted with axes normal to the concrete pavement alignment, space the vibrators with a maximum 0.5-foot lateral clearance between individual vibrators.

Each vibrator must have a vibration rate from 5,000 to 8,000 cycles per minute. The amplitude of vibration must cause perceptible concrete surface movement at least 1 foot from the vibrating element. Use a calibrated tachometer to measure frequency of vibration.

40-1.03I Edge Treatment

Construct edge treatments as shown. Regrade when required for the preparation of safety edge areas.

Sections 40-1.03J(2) and 40-1.03J(3) do not apply to safety edges.

For safety edges placed after the concrete pavement is complete, concrete may comply with the requirements for minor concrete.

For safety edges placed after the concrete pavement is complete, install connecting bar reinforcement under section 52.

Saw cutting or grinding may be used to construct safety edges.

For safety edges, the angle of the slope must not deviate by more than ± 5 degrees from the angle shown. Measure the angle from the plane of the adjacent finished pavement surface.

40-1.03J Finishing

40-1.03J(1) General

Reserved

40-1.03J(2) Preliminary Finishing

40-1.03J(2)(a) General

Preliminary finishing must produce a smooth and true-to-grade finish. After preliminary finishing, mark each day's paving with a stamp. The stamp must be authorized before paving starts. The stamp must be approximately 1 by 2 feet in size. The stamp must form a uniform mark from 1/8 to 1/4 inch deep. Locate the mark 20 ± 5 feet from the transverse construction joint formed at each day's start of paving and 1 ± 0.25 foot from the pavement's outside edge. The stamp mark must show the month, day, and year of placement and the station of the transverse construction joint. Orient the stamp mark so it can be read from the pavement's outside edge.

Do not apply water to the pavement surface before float finishing.

40-1.03J(2)(b) Stationary Side Form Finishing

If stationary side form construction is used, give the pavement a preliminary finish by the machine float method or the hand method.

If using the machine float method:

1. Use self-propelled machine floats.
2. Determine the number of machine floats required to perform the work at a rate equal to the pavement delivery rate. If the time from paving to machine float finishing exceeds 30 minutes, stop pavement delivery. When machine floats are in proper position, you may resume pavement delivery and paving.
3. Run machine floats on side forms or adjacent pavement lanes. If running on adjacent pavement, protect the adjacent pavement surface under section 40-1.03L. Floats must be hardwood, steel, or steel-shod wood. Floats must be equipped with devices that adjust the underside to a true flat surface.

If using the hand method, finish pavement smooth and true to grade with manually operated floats or powered finishing machines.

40-1.03J(2)(c) Slip-Form Finishing

If slip-form construction is used, the slip-form paver must give the pavement a preliminary finish. You may supplement the slip-form paver with machine floats.

Before the pavement hardens, correct pavement edge slump in excess of 0.02 foot exclusive of edge rounding.

40-1.03J(3) Final Finishing

After completing preliminary finishing, round the edges of the initial paving widths to a 0.04-foot radius. Round transverse and longitudinal construction joints to a 0.02-foot radius.

Before curing, texture the pavement. Perform initial texturing with a burlap drag or broom device that produces striations parallel to the centerline. Perform final texturing with a steel-tined device that produces grooves parallel with the centerline.

Construct longitudinal grooves with a self-propelled machine designed specifically for grooving and texturing pavement. The machine must have tracks to maintain constant speed, provide traction, and maintain accurate tracking along the pavement surface. The machine must have a single row of rectangular spring steel tines. The tines must be from 3/32 to 1/8 inch wide, on 3/4-inch centers, and must have enough length, thickness, and resilience to form grooves approximately 3/16 inch deep. The machine must have horizontal and vertical controls. The machine must apply constant down pressure on the pavement surface during texturing. The machines must not cause raveling.

Construct grooves over the entire pavement width in a single pass except do not construct grooves 3 inches from the pavement edges and longitudinal joints. Final texture must be uniform and smooth. Use a guide to properly align the grooves. Grooves must be parallel and aligned to the pavement edge across the pavement width. Grooves must be from 1/8 to 3/16 inch deep after the pavement has hardened.

For irregular areas and areas inaccessible to the grooving machine, you may hand-construct grooves using the hand method. Hand-constructed grooves must comply with the specifications for machine-constructed grooves.

For ramp termini, use heavy brooming normal to the ramp centerline to produce a coefficient of friction of at least 0.35 determined on the hardened surface under California Test 342.

40-1.03K Curing

Cure the concrete pavement's exposed area under section 90-1.03B using the waterproof membrane method or curing compound method. If using the curing compound method use curing compound no. 1 or 2. When side forms are removed within 72 hours of the start of curing, also cure the concrete pavement edges.

Apply curing compound with mechanical sprayers. Reapply curing compound to saw cuts and disturbed areas.

40-1.03L Protecting Concrete Pavement

Protect concrete pavement under section 90-1.03C.

Maintain the concrete pavement surface temperature at not less than 40 degrees F for the initial 72 hours.

Protect the concrete pavement surface from activities that cause damage and reduce texture and coefficient of friction. Do not allow soil, gravel, petroleum products, concrete, or asphalt mixes on the concrete pavement surface.

Construct crossings for traffic convenience. If authorized, you may use RSC for crossings. Do not open crossings until the Department determines that the pavement's modulus of rupture is at least 550 psi under California Test 523 or California Test 524.

Do not open concrete pavement to traffic or use equipment on the concrete pavement for 10 days after paving nor before the concrete has attained a modulus of rupture of 550 psi based on Department's testing except:

1. If the equipment is for sawing contraction joints
2. If authorized, one side of paving equipment's tracks may be on the concrete pavement after a modulus of rupture of 350 psi has been attained, provided:
 - 2.1. Unit pressure exerted on the concrete pavement by the paver does not exceed 20 psi
 - 2.2. You change the paving equipment tracks to prevent damage or the paving equipment tracks travel on protective material such as planks
 - 2.3. No part of the track is closer than 1 foot from the concrete pavement's edge

If concrete pavement damage including visible cracking occurs, stop operating paving equipment on the concrete pavement and repair the damage.

40-1.03M Early Use of Concrete Pavement

If requesting early use of concrete pavement:

1. Furnish molds and machines for modulus of rupture testing
2. Sample concrete
3. Fabricate beam specimens
4. Test for modulus of rupture under California Test 523

If you request early use, concrete pavement must have a modulus of rupture of at least 350 psi. Protect concrete pavement under section 40-1.03L.

40-1.03N Reserved

40-1.03O Shoulder Rumble Strip

40-1.03O(1) General

Construct shoulder rumble strips by rolling or grinding indentations in new concrete pavement.

Do not construct shoulder rumble strips on structures or approach slabs.

Construct rumble strips within 2 inches of the specified alignment. Rumble strip equipment must be equipped with a sighting device enabling the operator to maintain the rumble strip alignment.

Indentations must not vary from the specified dimensions by more than 1/16 inch in depth nor more than 10 percent in length and width.

Grind or remove and replace noncompliant rumble strip indentations at locations determined by the Engineer. Ground surface areas must be neat and uniform in appearance.

Remove grinding residue under section 42-1.03B.

40-1.03O(2) Rolled-In Indentations

Construct rolled-in indentations before final concrete set. Indentation construction must not displace adjacent concrete.

40-1.03O(3) Ground-In Indentations

Concrete pavement must be hardened before grinding rumble strips indentations. Do not construct indentations until the following occurs:

1. 10 days elapse after concrete placement
2. Concrete has developed a modulus of rupture of 550 psi determined under California Test 523,

40-1.03P Drilling Cores

Drill concrete pavement cores under ASTM C 42/C 42M. Use diamond impregnated drill bits.

Clean, dry, and fill core holes with hydraulic cement grout (nonshrink) or pavement concrete. Coat the core hole walls with epoxy adhesive for bonding new concrete to old concrete under section 95. Finish the backfill to match the adjacent surface elevation and texture.

40-1.03Q Pavement Repair and Replacement

40-1.03Q(1) General

If surface raveling or full-depth cracks occur within one year of Contract acceptance, repair or replace the pavement under section 6-3.06.

Repair and replace pavement in the following sequence:

1. Replace pavement
2. Repair spall, ravel, and working cracks
3. Correct smoothness and coefficient of friction
4. Treat partial depth cracks
5. Replace damaged joint seals under section 41-5

In addition to removing pavement for other noncompliance, remove and replace JPCP slabs that:

1. Have one or more full depth crack
2. Have raveled surfaces such that either:
 - 2.1. Combined raveled areas are more than 5 percent of the total slab area
 - 2.2. Single area is more than 4 sq ft

Remove and replace JPCP 3 feet on both sides of a joint with a rejected dowel bar.

40-1.03Q(2) Spall and Ravel Repair

Repair spalled or raveled areas that are:

1. Deeper than 0.05 foot
2. Wider than 0.10 foot
3. Longer than 0.3 foot

Repairs must comply with section 41-4 and be completed before opening pavement to traffic.

40-1.03Q(3) Crack Repair

Treat partial depth cracks for JPCP under section 41-3.

If the joints are sealed, repair working cracks by routing and sealing. Use a powered rotary router mounted on wheels, with a vertical shaft and a routing spindle that casters as it moves along the crack. Form a reservoir 3/4 inch deep by 3/8 inch wide in the crack. Equipment must not cause raveling nor spalling

Treat the contraction joint adjacent to the working crack by either:

1. Epoxy resin under ASTM C 881/C 881M, Type IV, Grade 2
2. Pressure injecting epoxy resin under ASTM C 881/C881M, Type IV, Grade 1

40-1.03Q(4) Smoothness and Friction Correction

Correct pavement that is noncompliant for:

1. Smoothness by grinding under section 42-3
2. Coefficient of friction by grooving or grinding under section 42

Do not start corrective work until:

1. Pavement has cured 10 days
2. Pavement has at least a 550 psi modulus of rupture
3. Your corrective method is authorized

Correct the entire lane width. Begin and end grinding at lines perpendicular to the roadway centerline. The corrected area must have a uniform texture and appearance.

If corrections are made within areas where testing with an IP is required, retest the entire lane length with an IP under sections 40-1.01D(6)(c) and 40-1.01D(7)(b)(vii).

If corrections are made within areas where testing with a 12-foot straightedge is required, retest the corrected area with a straightedge under sections 40-1.01D(6)(c) and 40-1.01D(7)(b)(vii).

Allow 25 days for the Department's coefficient of friction retesting.

40-1.03R–40-1.03U Reserved

40-1.04 PAYMENT

The payment quantity for pavement is based on the dimensions shown.

The deduction for pavement thickness deficiency in each primary area is shown in the following table:

| Deduction for Thickness Deficiency | |
|--|---------------------|
| Average thickness deficiency (foot) ^a | Deduction(\$/sq yd) |
| 0.01 | 0.90 |
| 0.02 | 2.30 |
| 0.03 | 4.10 |
| 0.04 | 6.40 |
| 0.05 | 9.11 |

^aValues greater than 0.01 are rounded to the nearest 0.01 foot.

Shoulder rumble strips are measured by the station along each shoulder on which the rumble strips are constructed without deductions for gaps between indentations.

If the initial cores show that dowel bars or tie bars are within alignment tolerances and the Engineer orders more dowel or tie bar coring, the additional cores are paid for as change order work.

The Department does not pay for additional coring to check dowel or tie bar alignment which you request.

If the Engineer accepts a test strip and it remains as part of the paving surface, the test strip is paid for as the type of pavement involved.

If the curvature of a slab affects tie bar spacing and additional tie bars are required, no additional payment is made for the additional tie bars.

Payment for grinding existing pavement is not included in the payment for the type of pavement involved.

40-2 CONTINUOUSLY REINFORCED CONCRETE PAVEMENT

40-2.01 GENERAL

40-2.01A Summary

Section 40-2 includes specifications for constructing CRCP.

Terminal joints include saw cutting, dowel bars, drill and bond dowel bars, support slab, support slab reinforcement, tack coat, and temporary hot mix asphalt.

Expansion joints include polystyrene, support slab, support slab reinforcement, dowel bars, drill and bond dowel bars, and bond breaker.

Wide flange beam terminals include polyethylene foam, support slab, and support slab reinforcement.

Pavement anchors include cross drains, anchor reinforcement, filter fabric, and permeable material.

40-2.01B Definitions

Reserved

40-2.01C Submittals

Reserved

40-2.01D Quality Control and Assurance

40-2.01D(1) General

Reserved

40-2.01D(2) Testing for Coefficient of Thermal Expansion

For field qualification, test coefficient of thermal expansion under AASHTO T 336. The coefficient of thermal expansion must not exceed 6.0 microstrain/degree Fahrenheit.

40-2.02 MATERIALS

40-2.02A General

Class 1 permeable material, filter fabric, and slotted plastic pipe cross drain as shown for pavement anchors must comply with section 68-3.

40-2.02B Concrete

Concrete for terminal joints, support slabs, and pavement anchors must comply with section 40-1.02.

40-2.02C Transverse Bar Assembly

Instead of transverse bar and other support devices, you may use transverse bar assemblies to support longitudinal bar. Bar reinforcement and wire must comply with section 40-1.02C.

40-2.02D Wide Flange Beam

Wide flange beams and studs must be either rolled structural steel shapes under ASTM A 36/A 36M or structural steel under ASTM A 572/A 572M.

40-2.02E Joints

Joint seals for wide flange beam terminals must comply with section 51-2.02.

Joint seals for transverse expansion joints must comply with section 51-2.02.

Expanded polystyrene for transverse expansion joints must comply with section 51-2.01B(1).

40-2.03 CONSTRUCTION

40-2.03A General

Reserved

40-2.03B Test Strips

Comply with section 40-1.03C except during the evaluation, the Engineer visually checks reinforcement, dowel and tie bar placement.

40-2.03C Construction Joints

Transverse construction joints must be perpendicular to the lane line. Construct joints to allow for lap splices of the longitudinal bar. Comply with the lap splice lengths shown for CRCP.

Clean construction joint surfaces before placing fresh concrete against the joint surfaces. Remove surface laitance, curing compound, and other foreign materials.

40-2.03D Bar Reinforcement

Place bar reinforcement under section 52-1.03D, except you may request to use plastic chairs. Plastic chairs will only be considered for support directly under the transverse bars. Your request to use plastic chairs must include a sample of the plastic chair, the manufacturer's written recommendations for the applicable use and load capacity, chair spacing, and your calculation for the load on a chair for the area of bar reinforcement sitting on it. Vertical and lateral stability of the bar reinforcement and plastic chairs must be demonstrated during construction of the test strip. Obtain authorization before using the proposed plastic chairs for work after the test strip is accepted.

For transverse bar in a curve with a radius under 2,500 feet, place the reinforcement in a single continuous straight line across the lanes and aligned with the radius point as shown.

40-2.03E Wide Flange Beams

Weld stud ends with an electric arc welder completely fusing the studs to the wide flange beam. Replace studs dislodged in shipping or that can be dislodged with a hammer.

40-2.03F Repair and Replacement

40-2.03F(1) General

Requirements for repair of cracks under section 40-1.03Q do not apply to CRCP. High molecular weight methacrylate is not to be applied to cracks in CRCP.

New CRCP will be monitored for 1 year from contract acceptance or relief from maintenance, whichever is less. CRCP that develops raveling areas of 6 inches by 6 inches or greater will require partial depth repair under section 6-3.06. CRCP that develops one or more full-depth transverse cracks with faulting greater than 0.25 inch or one or more full-depth longitudinal cracks with faulting greater 0.50 inch will require full depth repair.

40-2.03F(2) Partial Depth Repair

Partial depth repair must comply with section 41-4 except:

1. Determine a rectangular boundary which extends 6 inches beyond the damaged area. The limits of saw depth must be between 2 inches from the surface to 1/2 inch above the longitudinal bars.
2. If each length of the repair boundaries is equal to or greater than 3 ft, additional reinforcement is needed for the repair area. Submit a plan for authorization before starting the repair.

40-2.03F(3) Full Depth Repair

40-2.03F(3)(a) General

Removal of CRCP must be full depth except for portion of reinforcement to remain. Provide continuity of reinforcement. Comply with section 52-6. Submit a plan for authorization, before starting the repair. Do not damage the base, concrete and reinforcement to remain. Place concrete in the removal area.

40-2.03F(3)(b) Transverse Cracks

Make initial full-depth transverse saw cuts normal to the lane line a distance of 3 feet on each side of the transverse crack.

40-2.03F(3)(c) Longitudinal Cracks

Remove the cracked area normal to the lane line for the full width of the lane a distance of 1 foot beyond the ends of the crack. You may propose alternate limits with your repair plan for authorization.

40-2.03G Reserved

40-2.04 PAYMENT

Not Used

40-3 RESERVED

40-4 JOINTED PLAIN CONCRETE PAVEMENT

40-4.01 GENERAL

40-4.01A Summary

Section 40-4 includes specifications for constructing JPCP.

40-4.01B Definitions

Reserved

40-4.01C Submittals

40-4.01C(1) General

Reserved

40-4.01C(2) Early Age Crack Mitigation System

At least 24 hours before each paving shift, submit the following information as an informational submittal:

1. Early age stress and strength predictions
2. Scheduled sawing and curing activities
3. Contingency plan if cracking occurs

40-4.01C(3)–40-4.01C(8) Reserved

40-4.01D Quality Control and Assurance

40-4.01D(1) General

Reserved

40-4.01D(2) Quality Control Plan

The QC plan must include a procedure for identifying transverse contraction joint locations relative to the dowel bars longitudinal center and a procedure for consolidating concrete around the dowel bars.

40-4.01D(3) Early Age Crack Mitigation System

For JPCP, develop and implement a system for predicting stresses and strength during the initial 72 hours after paving. The system must include:

1. Subscription to a weather service to obtain forecasts for wind speed, ambient temperatures, humidity, and cloud cover
2. Portable weather station with an anemometer, temperature and humidity sensors, located at the paving site
3. Early age concrete pavement stress and strength prediction plan
4. Analyzing, monitoring, updating, and reporting the system's predictions

40-4.01D(4)–40-4.01D(9) Reserved

40-4.02 MATERIALS

Not Used

40-4.03 CONSTRUCTION

40-4.03A General

Transverse contraction joints on a curve must be on a single straight line through the curve's radius point. If transverse joints do not align in a curve, drill a full depth 2" diameter hole under ASTM C 42/C 42M where the joint meets the adjacent slab. Fill the hole with joint filler. If joints are not sealed, avoid joint filler material penetration into the joint.

40-4.03B Repair and Replacement

If replacing concrete, saw cut and remove to full depth.

41-1.02B Fast-Setting Concrete

Fast-setting concrete must be one of the following:

1. Magnesium phosphate concrete that is either:
 - 1.1. Single component water activated
 - 1.2. Dual component with a prepackaged liquid activator
2. Modified high-alumina based concrete
3. Portland cement based concrete

Fast-setting concrete must be stored in a cool and dry environment.

If used, the addition of retarders must comply with the manufacturer's instructions.

You may use any accelerating chemical admixtures complying with ASTM C494/C494M, Type C and section 90-1.02E.

Fast-setting concrete properties must have the values shown in the following table:

| Fast-Setting Concrete | | |
|---|---------------------|-------|
| Property | Test method | Value |
| Compressive strength ^a (psi, min) | | |
| at 3 hours | California Test 551 | 3,000 |
| at 24 hours | California Test 551 | 5,000 |
| Flexural strength ^a (psi, min, at 24 hours) | California Test 551 | 500 |
| Bond strength ^a (psi, min, at 24 hours) | | |
| Saturated surface dry concrete | California Test 551 | 300 |
| Dry concrete | California Test 551 | 400 |
| Water absorption (% max) | California Test 551 | 10 |
| Abrasion resistance ^a (g, max, at 24 hours) | California Test 550 | 25 |
| Drying shrinkage (% max, at 4 days) | ASTM C596 | 0.13 |
| Water soluble chlorides ^d (% max, by weight) | California Test 422 | 0.05 |
| Water soluble sulfates ^d (% max, by weight) | California Test 417 | 0.25 |
| Thermal stability (% min) | California Test 553 | 90 |

^aPerform test with aggregate filler if used.

^bTest must be performed on a cube specimen, fabricated under California Test 551, cured at least 14 days, and then pulverized to 100% passing the no. 50 sieve.

Aggregate filler may be used to extend prepackaged concrete. Aggregate filler must:

1. Be clean and uniformly rounded.
2. Have a moisture content of 0.5-percent by weight or less when tested under California Test 226.
3. Comply with sections 90-1.02C(2) and 90-1.02C(3).
4. Not exceed 50 percent of the concrete volume or the maximum recommended by the fast-setting concrete manufacturer, whichever is less.

When tested under California Test 202, aggregate filler must comply with the grading in the following table:

| Aggregate Filler Grading | |
|--------------------------|--------------------|
| Sieve size | Percentage passing |
| 3/8 inch | 100 |
| No. 4 | 50–100 |
| No. 16 | 0–5 |

41-1.02C Polyester Concrete

Polyester concrete consists of polyester resin binder and dry aggregate. The polyester resin binder must be an unsaturated isophthalic polyester-styrene copolymer.

Polyester resin binder properties must have the values shown in the following table:

Polyester Resin Binder

| Property | Test method | Value |
|---|---|-----------------|
| Viscosity ^a (Pa·s) RVT, No. 1 spindle, 20 RPM at 77 °F | ASTM D2196 | 0.075– 0.200 |
| Specific gravity ^a (77 °F) | ASTM D1475 | 1.05–1.10 |
| Elongation (%), min) Type I specimen, 0.25 ± 0.03 inch thick Speed of testing = 0.45 inch/minute Condition 18/25/50+5/70: T—23/50 | ASTM D638 | 35 |
| Tensile strength (psi, min) Type I specimen, 0.25 ± 0.03 inch thick Speed of testing = 0.45 inch/minute Condition 18/25/50+5/70: T—23/50 | ASTM D638 | 2,500 |
| Styrene content ^a (%), by weight) | ASTM D2369 | 40–50 |
| Silane coupler (%), min, by weight of polyester resin binder) | -- | 1.0 |
| PCC saturated surface-dry bond strength at 24 hours and 70 ± 2 °F (psi, min) | California Test 551 | 500 |
| Static volatile emissions ^a (g/sq m, max) | South Coast Air Quality Management District, Method 309-91 ^b | 60 |

^aPerform the test before adding initiator.

^bFor the test method, go to:

<http://www.aqmd.gov/tao/methods/lab/309-91.pdf>

Silane coupler must be an organosilane ester, gamma-methacryloxypropyltrimethoxysilane. Promoter must be compatible with suitable methyl ethyl ketone peroxide (MEKP) and cumene hydroperoxide (CHP) initiators.

Aggregate for polyester concrete must comply with section 90-1.02C(1), 90-1.02C(2), and 90-1.02C(3).

When tested under California Test 202, the combined aggregate grading must comply with one of the gradations in the following table:

Combined Aggregate Grading

| Sieve size | Percentage passing | | |
|------------|--------------------|-------|-------|
| | A | B | C |
| 1/2" | 100 | 100 | 100 |
| 3/8" | 83–100 | 100 | 100 |
| No. 4 | 65–82 | 62–85 | 45–80 |
| No. 8 | 45–64 | 45–67 | 35–67 |
| No. 16 | 27–48 | 29–50 | 25–50 |
| No. 30 | 12–30 | 16–36 | 15–36 |
| No. 50 | 6–17 | 5–20 | 5–20 |
| No. 100 | 0–7 | 0–7 | 0–9 |
| No. 200 | 0–3 | 0–3 | 0–6 |

Aggregate retained on the no. 8 sieve must have a maximum of 45 percent crushed particles under California Test 205. Fine aggregate must be natural sand.

The weighted average absorption must not exceed 1 percent when tested under California Tests 206 and 207.

You may submit an alternative grading or request to use manufactured sand as fine aggregate but 100 percent of the combined grading must pass the 3/8 inch sieve. Allow 21 days for authorization.

Polyester concrete must have a minimum compressive strength of 1250 psi at 3 hours and 30 minutes under California Test 551 or ASTM C109.

41-1.02D Bonding Agent

Bonding agent must comply with the concrete manufacturer's recommendations.

41-1.02E Temporary Pavement Structure

Temporary pavement structure consists of RSC or aggregate base with HMA. RSC not conforming to the specifications may serve as temporary pavement structure if:

1. The modulus of rupture is at least 200 psi before opening to traffic
2. RSC thickness is greater than or equal to the existing concrete pavement surface layer
3. RSC is replaced during the next paving shift

Aggregate base for temporary pavement structure must comply with the 3/4-inch maximum grading specified in section 26-1.02B.

HMA must comply with section 39-1.15 except do not use HMA Type B.

41-1.02F Reserved

41-1.03 CONSTRUCTION

41-1.03A General

Repair only the portion of pavement where the work will be completed during the same lane closure. If removal is required, remove only the portion of pavement where the repair will be completed during the same traffic closure. Completion of concrete repair includes curing until the concrete attains the specified minimum properties required before opening the repaired pavement to traffic.

If you fail to complete the concrete pavement repair during the same lane closure, construct temporary pavement before opening the lane to traffic.

Before starting repair work, except saw cutting: the equipment, materials, and personnel for constructing temporary pavement structure must be at the job site or an approved location. If HMA can be delivered to the job site within 1 hour, you may request 1-hour delivery as an alternative to having the HMA at the job site.

Maintain the temporary pavement structure and replace it as a first order of work as soon as you resume concrete pavement repair work.

After removing temporary pavement structure, you may stockpile that aggregate base at the job site and reuse it for temporary pavement structure.

41-1.03B Mixing and Applying Bonding Agent

Mix and apply the bonding agent at the job site under the manufacturer's instructions and in small quantities.

Apply bonding agent after cleaning the surface and before placing concrete.

Apply a thin, even coat of bonding agent with a stiff bristle brush until the entire repair surface is scrubbed and coated with bonding agent.

41-1.03C Mixing Concrete

41-1.03C(1) General

Mix concrete in compliance with the manufacturer's instructions. For repairing spalls, mix in a small mobile drum or paddle mixer. Comply with the manufacturer's recommended limits for the quantity of aggregate filler, water, and liquid activator.

Mix the entire contents of prepackaged dual-component magnesium phosphate concrete as supplied by the manufacturer. Use the full amount of each component and do not add water to dual-component magnesium phosphate concrete.

Magnesium phosphate concrete must not be mixed in containers or worked with tools containing zinc, cadmium, aluminum, or copper.

Modified high-alumina based concrete must not be mixed in containers or worked with tools containing aluminum.

41-1.03C(2) Polyester Concrete

When mixing with resin, the moisture content of the combined aggregate must not exceed 1/2 of the average aggregate absorption when tested under California Test 226.

Proportion the polyester resin and aggregate to produce a mixture with suitable workability for the intended work. Only a minimal amount of resin may rise to the surface after finishing.

41-1.03D Placing Concrete

The pavement surface temperature must be at least 40 degrees F before placing concrete. You may propose methods to heat the surfaces.

Place magnesium phosphate concrete on a dry surface.

Place portland cement and modified high-alumina concrete on surfaces treated with a bonding agent recommended by the concrete manufacturer. If no bonding agent is recommended by the manufacturer, place concrete on damp surfaces that are not saturated.

Do not retemper concrete. Use dry finishing tools cleaned with water before working the concrete.

41-1.03E Curing Concrete

Cure concrete under the manufacturer's instructions. When curing compound is used, comply with section 90-1.03B for curing compound no. 1 or 2.

41-1.03F Reserved

41-1.04 PAYMENT

Not Used

41-2 SUBSEALING AND JACKING

41-2.01 GENERAL

41-2.01A Summary

Section 41-2 includes specifications for filling voids under existing concrete pavement.

41-2.01B Definitions

Reserved

41-2.01C Submittals

Submit shipping invoices with packaged or bulk fly ash and cement.

Before grouting activities begin, submit a proposal for the materials to be used. Include authorized laboratory test data for the grout indicating:

1. Time of initial setting under ASTM C266.
2. Compressive strength results at 1, 3, and 7 days for 10, 12, and 14-second grout efflux times.

If requesting a substitution of grout materials, submit a proposal that includes test data.

41-2.01D Quality Control and Assurance

Reserved

41-2.02 MATERIALS

41-2.02A General

Reserved

41-2.02B Grout

Grout must consist of Type II portland cement, fly ash, and water. Use from 2.4 to 2.7 parts fly ash to 1 part portland cement by weight. Use enough water to produce the following grout efflux times determined under California Test 541, Part D:

1. From 10 to 16 seconds for subsealing
2. From 10 to 26 seconds for jacking

Cement for grout must comply with the specifications for Type II portland cement in section 90-1.02B(2).

Fly ash must comply with AASHTO M 295, Class C or Class F. Fly ash sources must be on the Authorized Material List.

You may use chemical admixtures and calcium chloride. Chemical admixtures must comply with section 90-1.02E(2). Calcium chloride must comply with ASTM D98.

Test grout compressive strength under California Test 551, Part 1 at 7-days with 12 seconds efflux time. Follow the procedures for moist cure. The 7-day compressive strength must be at least 750 psi.

41-2.02C Mortar

Mortar must be a prepackaged fast-setting mortar that complies with ASTM C928.

41-2.02D Reserved

41-2.03 CONSTRUCTION

41-2.03A General

Drill holes in the pavement, inject grout, plug the holes, and finish the holes with mortar.

Drill holes through the pavement and underlying base to a depth from 15 to 18 inches below the pavement surface. The hole diameter must match the fitting for the grout injecting equipment.

41-2.03B Injecting Grout

41-2.03B(1) General

Inject grout within 2 days of drilling holes.

Immediately before injecting grout, clean the drilled holes with water at a minimum pressure of 40 psi. The cleaning device must have at least 4 jets that direct water horizontally at the slab-base interface.

Do not inject grout if the atmospheric or subgrade temperature is below 40 degrees F. Do not inject grout in inclement weather. If water is present in the holes, obtain the Engineer's authorization before injecting grout.

Do not inject grout until at least 2 consecutive slabs requiring subsealing are drilled ahead of the grouting activities.

The grout plant must have a positive displacement cement injection pump and a high-speed colloidal mixer capable of operating from 800 to 2,000 rpm. The injection pump must sustain 150 psi if pumping grout with a 12-second efflux time. A pressure gauge must be located immediately adjacent to the supply valve of the grout hose supply valve and positioned for easy monitoring.

Before mixing, weigh dry cement and fly ash if delivered in bulk. If the materials are packaged, each container must weigh the same.

Introduce water to the mixer through a meter or scale.

Inject grout under pressure until the voids under the pavement slab are filled. The injection nozzle must not leak. Do not inject grout if the nozzle is below the bottom of the slab. Inject grout 1 hole at a time.

Stop injecting grout in a hole if either:

1. Grout does not flow under a sustained pump gauge pressure of 150 psi after 7 seconds and there is no indication the slab is moving.
2. Injected grout rises to the surface at any joint or crack, or flows into an adjacent hole.

Dispose of unused grout within 1 hour of mixing.

41-2.03B(2) Subsealing

If a slab raises more than 1/16 inch due to grout injection, stop injecting grout in that hole.

41-2.03B(3) Jacking

The positive displacement pump used for grout injection must be able to provide a sustained gauge pressure of 200 psi. Gauge pressures may be from 200 to 600 psi for brief periods to start slab movement.

You may add additional water to initiate pressure injection of grout. Do not reduce the grout efflux time below 10 seconds.

Raise the slabs uniformly. Use string lines to monitor the pavement movement.

Do not move adjacent slabs not specified for pavement jacking. If you move adjacent slabs, correct the grade within the tolerances for final pavement elevation.

41-2.03B(4) Finishing

Immediately after removing the injection nozzle, plug the hole with a round, tapered wooden plug. Do not remove plugs until adjacent holes are injected with grout and no grout surfaces through previously injected holes.

After grouting, remove grout from drilled holes at least 4 inches below the pavement surface. Clean holes and fill with mortar. Finish filled holes flush with the pavement surface.

41-2.03B(5) Tolerances

The final pavement elevation must be within 0.01 foot of the required grade. If the final pavement elevation is between 0.01 and 0.10 foot higher than the required grade, grind the noncompliant pavement surface under section 42 to within 0.01 foot of the required grade.

If the final pavement elevation is higher than 0.10 foot from the required grade, remove and replace the noncompliant pavement under section 41-9.

41-2.04 PAYMENT

The payment quantity for subsealing is calculated by adding the dry weight of cement and fly ash used for the placed grout. The payment quantity for jacking is calculated by adding the dry weight of cement and fly ash used for the placed grout.

The Department does not pay for wasted grout.

The Department does not adjust the unit price for an increase or decrease in the subsealing quantity.

The Department does not adjust the unit price for an increase or decrease in the jacking quantity.

41-3 CRACK TREATMENT

41-3.01 GENERAL

41-3.01A Summary

Section 41-3 includes specifications for applying high-molecular-weight methacrylate (HMWM) to concrete pavement surface cracks that do not extend the full slab depth.

41-3.01B Definitions

Reserved

41-3.01C Submittals

41-3.01C(1) General

Submit HMWM samples 20 days before use.

If sealant is to be removed, submit the proposed removal method at least 7 days before sealant removal. Do not remove sealant until the proposed sealant removal method is authorized.

41-3.01C(2) Public Safety and Placement Plans

Before starting crack treatment, submit a public safety plan for HMWM and a placement plan for construction activity as shop drawings.

The public safety and placement plans must identify the materials, equipment, and methods to be used.

In the public safety plan, include the MSDS for each component of HMWM and details for:

1. Shipping
2. Storage
3. Handling
4. Disposal of residual HMWM and containers

If the project is in an urban area adjacent to a school or residence, the public safety plan must also include an airborne emissions monitoring plan prepared by a CIH certified in comprehensive practice by the American Board of Industrial Hygiene. Submit a copy of the CIH's certification. The CIH must monitor the emissions at a minimum of 4 points including the mixing point, the application point, and the point of nearest public contact. At work completion, submit a report by the industrial hygienist with results of the airborne emissions monitoring plan.

The placement plan must include:

1. Crack treatment schedule including coefficient of friction testing
2. Methods and materials including:
 - 2.1. Description of equipment for applying HMWM
 - 2.2. Description of equipment for applying sand
 - 2.3. Gel time range and final cure time for resin

Revise rejected plans and resubmit. With each plan rejection, the Engineer gives revision directions including detailed comments in writing. The Engineer notifies you of a plan's acceptance or rejection within 2 weeks of receiving that plan.

41-3.01C(3) Reserved

41-3.01D Quality Control and Assurance

41-3.01D(1) General

Use test tiles to evaluate the HMWM cure time. Coat at least one 4 by 4 inch smooth glazed tile for each batch of HMWM. Place the coated tile adjacent to the area being treated. Do not apply sand to the test tiles.

Use the same type of crack treatment equipment for testing and production.

41-3.01D(2) Test Area

Before starting crack treatment, treat a test area of at least 500 square feet within the project limits at a location accepted by the Engineer. Use test areas outside the traveled way if available.

Treat the test area under weather and pavement conditions similar to those expected during crack treatment production.

The Engineer evaluates the test area based on the acceptance criteria. Do not begin crack treatment until the Engineer accepts the test area.

41-3.01D(3) Reserved

41-3.01D(4) Acceptance Criteria

The Engineer accepts a treated area if:

1. Corresponding test tiles are dry to the touch
2. Treated surface is tack-free and not oily
3. Sand cover adheres enough to resist hand brushing
4. Excess sand is removed
5. Coefficient of friction is at least 0.30 when tested under California Test 342

41-3.02 MATERIALS

HMWM consists of compatible resin, promoter, and initiator. HMWM resin may be prepromoted by mixing promoter and resin together before filling containers. Identify prepromoted resin on the container label.

Adjust the gel time to compensate for temperature changes throughout the application.

HMWM resin properties must have the following values:

| Property | Test method | Value |
|---|---|-------|
| Viscosity ^a (cP, max, Brookfield RVT with UL adapter, 50 RPM at 77 °F) | ASTM D2196 | 25 |
| Specific gravity ^a (min, at 77 °F) | ASTM D1475 | 0.90 |
| Flash point ^a (°F, min) | ASTM D3278 | 180 |
| Vapor pressure ^a (mm Hg, max, at 77 °F) | ASTM D323 | 1.0 |
| Tack-free time (minutes, max, at 77 °F) | Specimen prepared under California Test 551 | 400 |
| Volatile content ^a (% , max) | ASTM D2369 | 30 |
| PCC saturated surface-dry bond strength (psi, min, at 24 hours and 77 ± 2 °F) | California Test 551 | 500 |

^aPerform the test before adding initiator.

Sand must be commercial quality dry blast sand. At least 95 percent of the sand must pass the no. 8 sieve and at least 95 percent must be retained on the no. 20 sieve when tested under California Test 202.

41-3.02D Reserved

41-3.03 CONSTRUCTION

41-3.03A General

Before applying HMWM, clean the pavement surface by abrasive blasting and blow loose material from visible cracks with high-pressure air. Remove concrete curing seals from the pavement to be treated. The pavement must be dry when blast cleaning is performed. If the pavement surface becomes contaminated before applying the HMWM, clean the pavement surface by abrasive blasting.

If performing abrasive blasting within 10 feet of a lane occupied by traffic, operate abrasive blasting equipment with a concurrently operating vacuum attachment.

During pavement treatment, protect pavement joints, working cracks, and surfaces not being treated.

The equipment applying HMWM must combine the components by either static in-line mixers or by external intersecting spray fans. The pump pressure at the spray bars must not cause atomization. Do not use compressed air to produce the spray. Use a shroud to enclose the spray bar apparatus.

You may apply HMWM manually to prevent overspray onto adjacent traffic. If applying resin manually, limit the batch quantity of HMWM to 5 gallons.

Apply HMWM at a rate of 90 square feet per gallon. The prepared area must be dry and the surface temperature must be from 50 to 100 degrees F while applying HMWM. Do not apply HMWM if the ambient relative humidity is more than 90 percent.

Protect existing facilities from HMWM. Repair or replace existing facilities contaminated with HMWM at your expense.

Flood the treatment area with HMWM to penetrate the pavement and cracks. Apply HMWM within 5 minutes after complete mixing. Mixed HMWM viscosity must not increase. Redistribute excess material with squeegees or brooms within 10 minutes of application. Remove excess material from tined grooves.

Wait at least 20 minutes after applying HMWM before applying sand. Apply sand at a rate of approximately 2 pounds per square yard or until refusal. Remove excess sand by vacuuming or sweeping.

Do not allow traffic on the treated surface until:

1. Treated surface is tack-free and non-oily
2. Sand cover adheres enough to resist hand brushing
3. Excess sand is removed
4. Coefficient of friction is at least 0.30 determined under California Test 342

41-3.04 PAYMENT

Not Used

41-4 SPALL REPAIR

41-4.01 GENERAL

Section 41-4 includes specifications for repairing spalls in concrete pavement.

41-4.02 MATERIALS

Repair spalls using polyester concrete with a bonding agent. The bonding agent must comply with the requirements for HMWM in section 41-3.02 except tack-free time requirements do not apply and the HMWM must not contain wax.

Form board must be corrugated cardboard with a 6-mil polyethylene covering.

41-4.03 CONSTRUCTION

41-4.03A General

Prepare spall areas by removing concrete and cleaning. Use a form board to provide compression relief at joints and cracks.

After completing spall repairs do not allow traffic on the repairs for at least 2 hours after the time of final setting under ASTM C403/403M.

41-4.03B Remove Pavement

The Engineer determines the rectangular limits of unsound concrete pavement. Before removing pavement, mark the saw cut lines and spall repair area on the pavement surface.

Do not remove pavement until the Engineer verbally authorizes the saw cut area.

Use a power-driven saw with a diamond blade.

Remove pavement as shown and:

1. From the center of the repair area towards the saw cut
2. To the full saw cut depth
3. At least 2 inches beyond the saw cut edge to produce a rough angled surface

Produce a rough surface by chipping or other removal methods that do not damage the pavement remaining in-place. Completely remove any saw overcuts. Pneumatic hammers used for concrete removal must weigh 15 lbs or less.

If you damage concrete pavement outside the removal area, enlarge the area to remove the damaged pavement.

If dowel bars are exposed during removal, remove concrete from the exposed surface and cover with duct tape.

41-4.03C Cleaning

After pavement has been removed, clean the exposed faces of the concrete by:

1. Sand or water blasting. Water blasting equipment must be capable of producing a blast pressure of 3,000 to 6,000 psi.

2. Blowing the exposed concrete area with compressed air free of moisture and oil to remove debris after blasting. Air compressors must deliver air at a minimum of 120 cfm and develop 90 psi of nozzle pressure.

41-4.03D Form Board Installation

After cleaning, place the form board to match the existing joint or crack alignment. Extend the form board at least 3 inches beyond each end of the repair and at least 1 inch deeper than the repair. Remove the form board before sealing joints or cracks.

41-4.03E–41-4.03I Reserved

41-4.04 PAYMENT

Payment is calculated based on the authorized saw cut area.

The Department does not adjust the unit price for an increase or decrease in the spall repair quantity.

41-5 JOINT SEALS

41-5.01 GENERAL

41-5.01A Summary

Section 41-5 includes specifications for sealing concrete pavement joints or replacing existing concrete pavement joint seals. Pavement joints include isolation joints.

41-5.01B Definitions

Reserved

41-5.01C Submittals

At least 15 days before delivery to the job site, submit a certificate of compliance, MSDS, manufacturer's recommendations, and instructions for storage and installation of:

1. Liquid joint sealant.
2. Backer rods. Include the manufacturer data sheet verifying compatibility with the liquid joint sealant.
3. Preformed compression joint seal. Include the manufacturer data sheet used to verify the seal for the joint dimensions shown.
4. Lubricant adhesive.

Asphalt rubber joint sealant containers must comply with ASTM D6690. Upon delivery of asphalt rubber joint sealant to the job site, submit a certified test report for each lot based on testing performed within 12 months.

Submit a work plan for removing pavement and joint materials. Allow 10 days for authorization. Include descriptions of the equipment and methods for removal of existing pavement and joint material.

41-5.01D Quality Control and Assurance

41-5.01D(1) General

Before sealing joints, arrange for a representative from the manufacturer to provide training on cleaning and preparing the joint and installing the liquid joint sealant or preformed compression joint seal. Do not seal joints until your personnel and the Department's personnel have been trained.

The Engineer accepts joint seals based on constructed dimensions and visual inspection of completed seals for voids.

41-5.01D(2) Reserved

41-5.02 MATERIALS

41-5.02A General

Use the type of seal material described.

Silicone or asphalt rubber joint sealant must not bond or react with the backer rod.

41-5.02B Silicone Joint Sealant

Silicone joint sealant must be on the Authorized Material List.

41-5.02C Asphalt Rubber Joint Sealant

Asphalt rubber joint sealant must:

1. Be paving asphalt mixed with not less than 10 percent ground rubber by weight. Ground rubber must be vulcanized or a combination of vulcanized and devulcanized materials that pass a no. 8 sieve.
2. Comply with ASTM D6690 for Type II.
3. Be capable of melting at a temperature below 400 degrees F and applied to cracks and joints.

41-5.02D Backer Rods

Backer rods must:

1. Comply with ASTM D5249:
 - 1.1. Type 1 for asphalt rubber joint sealant
 - 1.2. Type 1 or Type 3 for silicone joint sealant
2. Be expanded, closed-cell polyethylene foam
3. Have a diameter at least 25 percent greater than the saw cut joint width

41-5.02E Preformed Compression Joint Seals

Preformed compression joint seals must:

1. Comply with ASTM D2628
2. Have 5 or 6 cells, except seals 1/2 inch wide or less may have 4 cells

Lubricant adhesive used to install seals must comply with ASTM D2835.

41-5.02F–41-5.02K Reserved

41-5.03 CONSTRUCTION

41-5.03A General

If joint sealing is described for new concrete pavement, do not start joint sealing activities until the pavement has been in place for at least 7 days. Seal new concrete pavement joints at least 7 days after concrete pavement placement if shown.

Remove existing pavement and joint material by sawing, rectangular plowing, cutting, or manual labor. Saw cut the reservoir before cleaning the joint. Use a power-driven saw with a diamond blade.

If you damage a portion of the pavement to remain in place, repair the pavement under section 41-4.

41-5.03B Joint Cleaning

41-5.03B(1) General

Clean the joint after removal and any repair is complete before installing joint seal material. Cleaning must be completed no more than 4 hours before installing backer rods, liquid joint seal, or preformed compression seals using the following sequence:

1. Removing debris
2. Drying
3. Sandblasting
4. Air blasting
5. Vacuuming

Clean in 1 direction to minimize contamination of surrounding areas.

41-5.03B(2) Removing Debris

Remove debris including dust, dirt, and visible traces of old sealant from the joint after sawing, plowing, cutting, or manual removal. Do not use chemical solvents to wash the joint.

41-5.03B(3) Drying

After removing debris, allow the reservoir surfaces to dry or remove moisture and dampness at the joint with compressed air that may be moderately hot.

41-5.03B(4) Sandblasting

After the joint is dry, sandblast the reservoir to remove remaining residue using a 1/4-inch diameter nozzle and 90 psi minimum pressure. Do not sandblast straight into the reservoir. Angle the sandblasting nozzle within 1 to 2 inches from the concrete and make at least 1 pass to clean each reservoir face.

41-5.03B(5) Air Blasting

After sandblasting, air blast the reservoir to remove sand, dirt, and dust 1 hour before sealing the joint. Use compressed air free of oil and moisture delivered at a minimum rate of 120 cfm and 90 psi nozzle pressure.

41-5.03B(6) Vacuuming

After air blasting, use a vacuum sweeper to remove debris and contaminants from the pavement surfaces surrounding the joint.

41-5.03B(7) Reserved

41-5.03C Installing Liquid Joint Sealant

Where backer rods are shown, place the rods before installing liquid joint sealant. Place backer rods under the manufacturer's instructions unless otherwise specified. The pavement and reservoir surfaces must be dry and the ambient air temperature must be at least 40 degrees F and above the dew point. The reservoir surface must be free of residue or film. Do not puncture the backer rod.

Immediately after placing the backer rod, install liquid joint sealant under the manufacturer's instructions unless otherwise specified. Before installing, demonstrate that fresh liquid sealant is ejected from the nozzle free of cooled or cured material. For asphalt rubber joint sealant, the pavement surface temperature must be at least 50 degrees F before installing.

Pump liquid joint sealant through a nozzle sized for the width of the reservoir so that liquid joint sealant is placed directly onto the backer rod. The installer must draw the nozzle toward his body and extrude liquid joint sealant evenly. Liquid joint sealant must maintain continuous contact with the reservoir walls during extrusion.

After placing liquid joint sealant, recess it to the depth shown within 10 minutes of installation and before a skin begins to form.

After each joint is sealed, remove excess liquid joint sealant on the pavement surface. Do not allow traffic over the sealed joints until the liquid joint sealant is set, tack free, and firm enough to prevent embedment of roadway debris.

41-5.03D Installing Preformed Compression Joint Seals

Install preformed compression joint seals using lubricant adhesive as shown and under the manufacturer's instructions.

Install longitudinal seals before transverse seals. Longitudinal seals must be continuous except splicing is allowed at intersections with transverse seals. Transverse seals must be continuous for the entire transverse length of concrete pavement except splices are allowed for widening and staged construction. With a sharp instrument, cut across the longitudinal seal at the intersection with transverse construction joints. If the longitudinal seal does not relax enough to properly install the transverse seal, trim the longitudinal seal to form a tight seal between the 2 joints.

If splicing is authorized, comply with the manufacturer's instructions.

Use a machine specifically designed for preformed compression joint seal installation. The machine must install the seal:

1. To the specified depth
2. To make continuous contact with the joint walls
3. Without cutting, nicking, or twisting the seal
4. Without stretching the seal more than 4 percent

Cut preformed compression joint seal material to the exact length of the pavement joint to be sealed. The Engineer measures this length. After you install the preformed compression joint seal, the Engineer

measures the excess length of material at the joint end. The Engineer divides the excess length by the measured cut length to determine the stretch percentage.

Seals must be compressed from 30 to 50 percent of the joint width when complete in place.

41-5.03E Reserved

41-5.04 PAYMENT

Not Used

41-6 CRACK AND SEAT

41-6.01 GENERAL

41-6.01A Summary

Section 41-6 includes specifications for cracking, seating, and preparing the surface of existing concrete pavement.

41-6.01B Definitions

Reserved

41-6.01C Submittals

Submit each core in a plastic bag or tube for acceptance at the time of sampling. Mark each core with a location description.

41-6.01D Quality Control and Assurance

41-6.01D(1) General

If cracking is noncompliant:

1. Stop crack and seat work
2. Modify your equipment and procedures and crack the noncompliant pavement again
3. Construct another test section
4. Take additional core samples to verify compliance
5. Construct an inspection strip if the concrete pavement has HMA on the surface

41-6.01D(2) Test Section

The Engineer determines and marks a test section up to 1000 square feet within the crack and seat area shown. Construct the test section and obtain the Engineer's verbal authorization before starting crack and seat work.

Immediately before cracking the test section, apply water to the pavement surface so that cracking can be readily evaluated. Crack the test section and vary impact energy and striking patterns to verify your procedure.

41-6.01D(3) Coring

Drill cores at least 6 inches in diameter under ASTM C42 to verify cracking in the Engineer's presence. Take at least 2 cores per test section and 1 core per lane mile for each pavement cracking machine used. The Engineer determines the core locations.

41-6.01D(4) Reserved

41-6.02 MATERIALS

41-6.02A General

Use fast-setting or polyester concrete to fill core holes.

41-6.03 CONSTRUCTION

41-6.03A Cracking

Crack existing concrete pavement using the procedures and equipment from the authorized test section.

Do not allow flying debris during cracking operations.

Crack existing concrete pavement into segments that nominally measure 6 feet transversely by 4 feet longitudinally. If the existing pavement is already cracked into segments, crack it into equal-sized square

or rectangular pieces that nominally measure not more than 6 feet transversely and from 3 to 5 feet longitudinally. Do not impact the pavement within 1 foot of another break line, pavement joint, or edge of pavement.

Cracks must be vertical, continuous, and penetrate the full depth of pavement. Cracks must be within 6 inches of vertical along the full depth of pavement. Do not cause surface spalling over 0.10-foot deep or excessive shattering of the pavement or base.

Cracking equipment must impact the pavement with a variable force in a controlled location. Do not use unguided free-falling weights such as "headache balls."

If the concrete pavement has no more than 0.10 foot of asphalt concrete on the surface, you may crack the pavement without removing the asphalt concrete. After cracking, construct an inspection strip by removing at least 500 square feet of asphalt concrete at a location determined by the Engineer. Construct additional inspection strips to demonstrate compliance where ordered by the Engineer.

After cracking, allow public traffic on the cracked or initial pavement layer for no more than 15 days.

41-6.03B Seating

Seat cracked concrete by making at least 5 passes over the cracked concrete with either:

1. Oscillating pneumatic-tired roller under section 39-3.03 and at least 15 tons
2. Vibratory pad-foot roller exerting a dynamic centrifugal force of at least 10 tons

A pass is 1 movement of a roller in either direction at 5 mph or less.

After all segments have been seated, clean loose debris from joints and cracks using compressed air free of moisture and oil.

Reseat any segment of cracked pavement that has not been overlaid within 24 hours of seating.

41-6.03C Surface Preparation

Before opening cracked and seated pavement to traffic or overlaying:

1. Fill joints, cracks, and spalls wider than 3/4 inch and deeper than 1 inch by applying tack coat and placing HMA under section 39-1.15, except use the no. 4 gradation instead of 3/8-inch.
2. Remove all loose debris and sweep the pavement.

41-6.03D Reserved

41-6.04 PAYMENT

Crack and seat existing concrete pavement is measured from the area of pavement cracked and seated. No deduction is made for existing cracked segments. The Department does not pay for HMA used to fill joints, cracks, and spalls.

41-7 TRANSITION TAPER

41-7.01 GENERAL

Section 41-7 includes specifications for constructing transition tapers in existing pavement.

41-7.02 MATERIALS

Not Used

41-7.03 CONSTRUCTION

Construct transition tapers by either grinding or removing and replacing the existing concrete. Do not allow flying debris during the construction of tapers.

Grinding must comply with section 42.

Replacement concrete must comply with section 41-9 except place concrete to the taper level shown and finish the surface with a coarse broom.

If the transition taper will be overlaid with HMA that is not placed before opening to traffic and there is a grade difference of more than 0.04 foot, construct a temporary taper by placing HMA that complies with section 39-1.15. Remove the temporary HMA taper before constructing the transition taper.

41-7.04 PAYMENT

Pavement transition tapers are measured using the dimensions shown. The Department does not pay for temporary HMA tapers.

41-8 DOWEL BAR RETROFIT

Reserved

41-9 INDIVIDUAL SLAB REPLACEMENT WITH RAPID STRENGTH CONCRETE

41-9.01 GENERAL

41-9.01A Summary

Section 41-9 includes specifications for removing existing concrete pavement and constructing individual slab replacement with rapid strength concrete (ISR—RSC).

41-9.01B Definitions

concrete raveling: Disintegration of the concrete surface layer from aggregate loss.

early age: Any age less than 10 times the time of final setting for concrete determined under ASTM C403/C403M.

full-depth crack: Crack that runs from one edge of the concrete slab to the opposite or adjacent side of the slab.

opening age: Age when the minimum modulus of rupture specified for opening to traffic and equipment is attained.

time of final setting: Elapsed time required to develop a concrete penetration resistance that is at least 4,000 psi under ASTM C403/C403M.

41-9.01C Submittals

41-9.01C(1) General

At least 15 days before delivery to the job site, submit manufacturer's recommendations, MSDS and instructions for storage and installation of joint filler material.

At least 45 days before starting ISR—RSC work submit a sample of cement from each proposed lot and samples of proposed admixtures in the quantities ordered by the Engineer.

During ISR—RSC placement operations, submit uniformity reports for hydraulic cement at least once every 30 days to the Engineer and METS, attention Cement Laboratory. Uniformity reports must comply with ASTM C917 except testing age and water content may be modified to suit the particular material.

Except for modulus of rupture tests, submit QC test result forms within 48 hours of the paving shift. Submit modulus of rupture results within:

1. 15 minutes of opening age test completion
2. 24 hours of 3-day test completion

41-9.01C(2) Quality Control Plan

If the quantity of ISR—RSC is at least 300 cu yd, submit a QC plan at least 20 days before placing trial slabs. If the quantity of ISR—RSC is less than 300 cu yd, submit proposed forms for RSC inspection, sampling, and testing.

41-9.01C(3) Mix Design

At least 10 days before use in a trial slab, submit a mix design. The maximum ambient temperature range for a mix design is 18 degrees F. Submit more than 1 mix design based on ambient temperature variations anticipated during RSC placement. Each mix design must include:

1. Mix design identification number

2. Aggregate source
3. Opening age
4. Aggregate gradation
5. Types of cement and chemical admixtures
6. Mix proportions
7. Maximum time allowed between batching and placing
8. Range of effective ambient temperatures
9. Time of final setting
10. Modulus of rupture development data from laboratory-prepared samples, including tests at:
 - 10.1. 1 hour before opening age
 - 10.2. Opening age
 - 10.3. 1 hour after opening age
 - 10.4. 1 day
 - 10.5. 3 days
 - 10.6. 7 days
 - 10.7. 28 days
11. Shrinkage test data
12. Any special instructions or conditions such as water temperature requirements

41-9.01C(4) Reserved

41-9.01D Quality Control and Assurance

41-9.01D(1) General

Designate a QC manager and assistant QC managers to administer the QC plan. The QC managers must hold current American Concrete Institute (ACI) certification as a Concrete Field Testing Technician-Grade I and a Concrete Laboratory Testing Technician-Grade II, except the assistant QC managers may hold Concrete Laboratory Testing Technician-Grade I instead of Grade II.

The QC manager responsible for the production period involved must review and sign the sampling, inspection, and test reports before submitting them. The QC manager must be present for:

1. Each stage of mix design
2. Trial slab construction
3. Production and construction of RSC
4. Meetings with the Engineer relating to production, placement, or testing

The QC manager must not be a member of this project's production or paving crews, an inspector, or a tester. The QC manager must have no duties during the production and placement of RSC except those specified.

Testing laboratories and equipment must comply with the Department's Independent Assurance Program. At the time of the QC plan submittal, the Department evaluates the quality control samplers and testers.

41-9.01D(2) Just-in-time Training

Reserved

41-9.01D(3) Quality Control Plan

Establish, implement, and maintain a QC plan for pavement. The QC plan must describe the organization and procedures used to:

1. Control the production process
2. Determine if a change to the production process is needed
3. Implement a change

The QC plan must include:

1. Names, qualifications, and certifications of QC personnel, including:
 - 1.1. QC manager
 - 1.2. Assistant QC managers
 - 1.3. Samplers and testers
2. Outline of procedure for the production, transportation, placement, and finishing of RSC

3. Outline of procedure and forms for concrete QC, sampling, and testing to be performed during and after RSC construction, including testing frequencies for modulus of rupture
4. Contingency plan for identifying and correcting problems in production, transportation, placement, or finishing RSC including:
 - 4.1. Action limits
 - 4.2. Suspension limits that do not exceed specified material requirements
 - 4.3. Detailed corrective action if limits are exceeded
 - 4.4. Temporary pavement structure provisions, including:
 - 4.4.1. The quantity and location of standby material
 - 4.4.2. Determination of need
5. Location of your quality control testing laboratory and testing equipment during and after paving operations
6. List of the testing equipment to be used, including the date of last calibration
7. Production target values for material properties that impact concrete quality or strength including cleanness value and sand equivalent
8. Outline procedure for placing and testing trial slabs, including:
 - 8.1. Locations and times
 - 8.2. Production procedures
 - 8.3. Placing and finishing methods
 - 8.4. Sampling methods, sample curing, and sample transportation
 - 8.5. Testing and test result reporting
9. Name of source plant with approved Material Plant Quality Program (MPQP)
10. Procedures or methods for controlling pavement quality including:
 - 10.1. Materials quality
 - 10.2. Contraction and construction joints
 - 10.3. Protecting pavement before opening to traffic

41-9.01D(4) Prepaving Conference

Schedule a prepaving conference and provide a facility to meet with the Engineer.

Prepaving conference attendees must sign an attendance sheet provided by the Engineer. The prepaving conference must be attended by your:

1. Project superintendent
2. Project manager
3. QC manager
4. Workers and your subcontractor's workers, including:
 - 4.1. Foremen
 - 4.2. Concrete plant manager
 - 4.3. Concrete plant operator
 - 4.4. Concrete plant inspectors
 - 4.5. Personnel performing saw cutting and joint sealing
 - 4.6. Paving machine operators
 - 4.7. Inspectors
 - 4.8. Samplers
 - 4.9. Testers

The purpose of the prepaving conference is to familiarize personnel with the project's specifications. Discuss the QC plan and processes for constructing each item of work, including:

1. Production
2. Transportation
3. Trial slabs
4. Pavement structure removal
5. Placement
6. Contingency plan
7. Sampling
8. Testing
9. Acceptance

Do not start trial slabs or paving activities until the listed personnel have attended the prepaving conference.

41-9.01D(5) Trial Slabs

Before starting individual slab replacement work, complete 1 trial slab for each mix design.

Place trial slabs near the job site at a mutually-agreed location that is neither on the roadway nor within the project limits. Trial slabs must be 10 by 20 feet and at least 10 inches thick.

During trial slab construction, sample and split the aggregate for grading, cleanness value, and sand equivalent testing.

Fabricate and test beams under California Test 524 to determine the modulus of rupture values.

Cure beams fabricated for early age testing such that the monitored temperatures in the beams and the slab are always within 5 degrees F of each other.

Monitor and record the internal temperatures of trial slabs and early age beams at intervals of at least 5 minutes. Install thermocouples or thermistors connected to strip-chart recorders or digital data loggers to monitor the temperatures. Temperature recording devices must be accurate to within 2 degrees F. Measure internal temperatures at 1 inch from the top, 1 inch from the bottom, and no closer than 3 inches from any edge until early age testing is completed.

Cure beams fabricated for 3-day testing under California Test 524 except place them into sand at a time that is from 5 to 10 times the time of final setting measured under ASTM C403/403M or 24 hours, whichever is earlier.

Trial slabs must have an opening age modulus of rupture of not less than 400 psi and a 3-day modulus of rupture of not less than 600 psi.

After authorization, remove and dispose of trial slabs and testing materials.

41-9.01D(6) Quality Control Testing

41-9.01D(6)(a) General

Provide continuous process control and quality control sampling and testing throughout RSC production and placement. Notify the Engineer at least 2 business days notice before any sampling and testing. Establish a testing facility at the job site or at an authorized location.

Sample under California Test 125.

During ISR—RSC placement, sample and fabricate beams for modulus of rupture testing within the first 30 cubic yards, at least once every 130 cu yd, and within the final truckload. Submit split samples and fabricate test beams for the Department's testing unless the Engineer informs you otherwise.

Determine the modulus of rupture at opening age under California Test 524, except beam specimens may be fabricated using an internal vibrator under ASTM C 31. Cure beams under the same conditions as the pavement until 1 hour before testing. Test 3 beam specimens in the presence of the Engineer and average the results. A single test represents no more than that day's production or 130 cu yd, whichever is less.

Determine the modulus of rupture at other ages using beams cured and tested under California Test 524 except place them in sand from 5 to 10 times the time of final setting under ASTM C403/C403M or 24 hours, whichever is earlier.

41-9.01D(6)(b) Rapid Strength Concrete

Your quality control must include testing RSC for the properties at the frequencies shown in the following table:

RSC Minimum Quality Control

| Property | Test method | Minimum testing frequency ^a |
|---|--|--|
| Cleanness value | California Test 227 | 650 cu yd or 1 per shift |
| Sand equivalent | California Test 217 | 650 cu yd or 1 per shift |
| Aggregate gradation | California Test 202 | 650 cu yd or 1 per shift |
| Air content | California Test 504 | 130 cu yd or 2 per shift |
| Yield | California Test 518 | 2 per shift |
| Slump or penetration | ASTM C143 or California Test 533 | 1 per 2 hours of paving |
| Unit weight | California Test 518 | 650 cubic yards or 2 per shift |
| Aggregate Moisture Meter Calibration ^b | California Test 223 or California Test 226 | 1 per shift |
| Modulus of rupture | California Test 524 | Comply with section 41-9.01D(6)(a) |

^aTest at the most frequent interval.

^bCheck calibration of the plant moisture meter by comparing moisture meter readings with California Test 223 or California Test 226 test results

Maintain control charts to identify potential problems and causes. Post a copy of each control chart at a location determined by the Engineer.

Individual measurement control charts must use the target values in the mix proportions as indicators of central tendency.

Develop linear control charts for:

1. Cleanness value
2. Sand equivalent
3. Fine and coarse aggregate gradation
4. Air content
5. Penetration

Control charts must include:

1. Contract number
2. Mix proportions
3. Test number
4. Each test parameter
5. Action and suspension limits
6. Specification limits
7. Quality control test results

For fine and coarse aggregate gradation control charts, record the running average of the previous 4 consecutive gradation tests for each sieve and superimpose the specification limits.

For air content control charts, the action limit is ± 1.0 percent and the suspension limit is ± 1.5 percent of the specified values. If no value is specified, apply the air content value used in the approved mix design.

As a minimum, a process is out of control if any of the following occurs:

1. For fine and coarse aggregate gradation, 2 consecutive running averages of 4 tests are outside the specification limits
2. For individual penetration or air content measurements:
 - 2.1. One point falls outside the suspension limit line
 - 2.2. Two points in a row fall outside the action limit line

Stop production and take corrective action for out of control processes or the Engineer rejects subsequent RSC.

Before each day's concrete pavement placement and at intervals not to exceed 4 hours of production, use a tachometer to test and record vibration frequency for concrete consolidation vibrators.

41-9.01D(6)(c) Reserved

41-9.01D(7) Acceptance Criteria

41-9.01D(7)(a) General

The final texture of ISR—RSC must pass visual inspection and have a coefficient of friction of at least 0.30 determined under California Test 342.

Allow at least 25 days for the Department to schedule testing for coefficient of friction. Notify the Engineer when the pavement is scheduled to be opened to traffic.

41-9.01D(7)(b) Modulus of Rupture

ISR—RSC is accepted based on your testing for modulus of rupture at opening age and the Department's testing for modulus of rupture at 3 days.

ISR—RSC must have a modulus of rupture at opening age that is at least 400 psi and a modulus of rupture at 3 days that is at least 600 psi.

Calculate the test result as the average from testing 3 beams for each sample. The test result represents 1 paving shift or 130 cu yd, whichever is less.

41-9.01D(7)(c) Concrete Pavement Smoothness

The Department tests for concrete pavement smoothness using a 12-foot straightedge. Straightedge smoothness specifications do not apply to the pavement surface placed within 12 inches of existing concrete pavement except parallel to the centerline at the midpoint of a transverse construction joint.

The concrete pavement surface must not vary from the lower edge of a 12-foot straightedge by more than:

1. 0.01 feet when parallel to the centerline
2. 0.02 feet when perpendicular to the centerline extending from edge to edge of a traffic lane

41-9.01D(7)(d) Cracking and Raveling

The Engineer rejects an ISR—RSC slab under section 6-3.06 if within 1 year of contract acceptance there is either:

1. Partial or full-depth cracking
2. Concrete raveling consisting of either:
 - 2.1. Combined raveled areas more than 5 percent of each ISR—RSC slab area
 - 2.2. Any single raveled area of more than 4 sq ft

41-9.01D(8) Reserved

41-9.02 MATERIALS

41-9.02A General

Reserved

41-9.02B Rapid Strength Concrete

RSC for ISR—RSC must comply with section 90-3.

Use either the 1-1/2 inch maximum or the 1-inch maximum combined grading specified in section 90-1.02C(4)(d).

Air content must comply with the minimum requirements in section 40-1.02B(4).

41-9.02C Base Bond Breaker

Use base bond breaker no. 3, 4, or 5 under section 36-2.

41-9.02D Reserved

41-9.03 CONSTRUCTION

41-9.03A General

Complete ISR—RSC adjacent to new pavement or existing pavement shown for construction as a 1st order of work. Replace individual slabs damaged during construction before placing final pavement delineation.

41-9.03B Removing Existing Pavement

Remove pavement under section 15-2.02. The Engineer determines the exact ISR—RSC limits after overlying layers are removed.

After removing pavement to the depth shown, grade to a uniform plane. Water as needed and compact the material remaining in place to a firm and stable base. The finished surface of the remaining material must not extend above the grade established by the Engineer.

41-9.03C Drill and Bond Dowel Bars

Drill existing concrete and bond dowel bars under section 41-10 if described. Do not install dowel bars in contraction joints.

41-9.03D Base Bond Breaker

Place base bond breaker before placing ISR—RSC. Comply with section 36-2.

41-9.03E Placing Rapid Strength Concrete

Do not place RSC if the ambient air temperature is forecast by the National Weather Service to be less than 40 degrees F within 72 hours of final finishing.

Before placing RSC against existing concrete, place 1/4-inch thick commercial quality polyethylene flexible foam expansion joint filler across the original transverse and longitudinal joint faces and extend the full depth of pavement to the top of the base layer. Place the top of the joint filler flush with the top of the pavement. Secure joint filler to the joint face of the existing pavement to prevent the joint filler from moving during the placement of RSC.

Use metal or wood side forms. Wood side forms must not be less than 1-1/2 inches thick. Side forms and connections must be of sufficient rigidity that movement will not occur under forces from equipment or RSC. Clean and oil side forms before each use. Side forms must remain in place until the pavement edge no longer requires the protection of forms.

After you place RSC, consolidate it using high-frequency internal vibrators adjacent to forms and across the full paving width. Place RSC as nearly as possible to its final position. Do not use vibrators for extensive shifting of concrete pavement.

Spread and shape RSC with powered finishing machines supplemented by hand finishing. After you mix and place RSC, do not add water to the surface to facilitate finishing. You may request authorization to use surface finishing additives. Submit the manufacturer's instructions with your request.

Place consecutive concrete loads without interruption. Do not allow cold joints where a visible lineation forms after concrete is placed, sets, and hardens before additional concrete placed.

Where the existing transverse joint spacing in an adjacent lane exceeds 15 feet, construct an additional transverse contraction joint midway between the existing joints. Complete sawing of contraction joints within 2 hours of completion of final finishing.

Cut contraction joints a minimum of 1/3 the slab depth.

41-9.03F Final Finishing

After preliminary finishing, round the edges of the initial paving width to a 0.04-foot radius. Round transverse and longitudinal construction joints to a 0.02-foot radius. Mark each ISR—RSC area with a stamp. The stamp mark must show the month, day, and year of placement and contract number. Level the location of the stamp with a steel trowel below the pavement texture. Orient the stamp mark so it can be read from the outside edge of ISR—RSC.

Before curing, texture the pavement. Perform initial texturing with a burlap drag or broom device that produces striations parallel to the centerline. Perform final texturing with a steel-tined device that produces grooves parallel with the centerline.

Tines must be from 3/32 to 1/8 inch wide on 3/4-inch centers and have enough length, thickness, and resilience to form grooves from 1/8 to 3/16 inch deep after the concrete has hardened. Grooves must extend over the entire pavement width except do not construct grooves 3 inches from longitudinal pavement edges or joints.

Final texture must be uniform and smooth. Grooves must be parallel and aligned to the pavement edge across the pavement width. The groove alignment must not vary more than 0.1 foot for every 12 foot length.

Protect RSC under section 90-1.03C.

41-9.03G Temporary Pavement Structure

Temporary pavement structure must be RSC or 3-1/2 inch thick HMA over aggregate base.

41-9.03H Noncompliant Individual Slab Replacement

Replace an ISR—RSC slab with any of the following:

1. One or more full-depth cracks.
2. Concrete raveling.
3. Noncompliant smoothness except you may request authorization for grinding under section 42 and retesting. Grinding that causes a depression will not be considered. Smoothness must be corrected within 48 hours of placing ISR—RSC.
4. Noncompliant modulus of rupture.

If the modulus of rupture at opening age is at least 400 psi and the modulus of rupture at 3 days is at least 500 psi but less than 600 psi, you may request authorization to leave the ISR—RSC in place and accept the specified deduction.

If pavement is noncompliant for coefficient of friction, groove or grind the pavement under section 42. Comply with section 40-1.03Q(4) and groove or grind before the installation of any required joint seal or edge drains adjacent to the areas to the noncompliant area.

If an ISR—RSC slab has partial depth cracking, treat it with high-molecular-weight methacrylate under section 41-3.

41-9.03I Replace Pavement Delineation

Replace traffic stripes, pavement markings, and markers that are removed, obliterated, or damaged by ISR—RSC under sections 84 and 85.

41-9.03J Reserved

41-9.04 PAYMENT

Replace base is not included in the payment for individual slab replacement (RSC).

Drill and bond dowel bars are not included in payment for individual slab replacement (RSC).

For individual slab replacement (RSC) with a modulus of rupture at opening age that is at least 400 psi and a modulus of rupture at 3 days that is greater than or equal to 500 psi but less than 550 psi, the Department deducts 10 percent of the payment for individual slab replacement (RSC).

For individual slab replacement (RSC) with a modulus of rupture at opening age that is at least 400 psi and a modulus of rupture at 3 days that is greater than or equal to 550 psi but less than 600 psi, the Department deducts 5 percent of the payment for individual slab replacement (RSC).

41-10 DRILL AND BOND BARS

41-10.01 GENERAL

41-10.01A Summary

Section 41-10 includes specifications for drilling, installing, and bonding tie bars and dowel bars in concrete pavement.

41-10.01B Definitions

Reserved

41-10.01C Submittals

Submit a certificate of compliance for:

1. Tie bars
2. Dowel bars
3. Dowel bar lubricant
4. Chemical adhesive
5. Epoxy powder coating

At least 15 days before delivery to the job site, submit the manufacturer's recommendations and instructions for storage, handling, and use of chemical adhesive.

41-10.01D Quality Control and Assurance

41-10.01D(1) General

Drill and bond bar is accepted based on inspection before concrete placement.

41-10.01D(2) Reserved

41-10.02 MATERIALS

41-10.02A General

Dowel bar lubricant must comply with section 40-1.02D.

Chemical adhesive for drilling and bonding bars must be on the Authorized Material List. The Authorized Material List indicates the appropriate chemical adhesive system for concrete temperature and installation conditions.

Each chemical adhesive system container must clearly and permanently show the following:

1. Manufacturer's name
2. Model number of the system
3. Manufacture date
4. Batch number
5. Expiration date
6. Current International Conference of Building Officials Evaluation Report number
7. Directions for use
8. Storage requirement
9. Warnings or precautions required by state and federal laws and regulations

41-10.02B Reserved

41-10.03 CONSTRUCTION

41-10.03A General

Drill holes for bars. Clean drilled holes in compliance with the chemical adhesive manufacturer's instructions. Holes must be dry at the time of placing the chemical adhesive and bars. Use a grout retention ring when drilling and bonding dowel bars. Immediately after inserting the bar into the chemical adhesive, support the bar to prevent movement until chemical adhesive has cured the minimum time recommended by the manufacturer.

Apply dowel bar lubricant to the entire exposed portion of the dowel bar.

If the Engineer rejects a bar installation: stop paving, drilling, and bonding activities. Adjust your procedures and obtain the Engineer's verbal authorization before resuming paving, drilling, and bonding.

Cut the rejected bar flush with the pavement joint surface and coat the exposed end of the bar with chemical adhesive. Offset the new hole 3 inches horizontally from the rejected hole's center.

41-10.03B Tie Bar Tolerance

Place tie bars within the tolerances shown in the following table:

| Tie Bar Tolerances | |
|---|-----------|
| Dimension | Tolerance |
| Horizontal skew (vertical skew: bar length) | 1:6 |
| Vertical skew (vertical skew: bar length) | 1:6 |
| Longitudinal translation (inch) | ±1 |
| Horizontal offset (embedment, inch) | ±1 |
| Height relative to the adjacent bar | ±1 |
| Vertical Depth (clearance from the pavement surface or bottom, inches, min) | 3 |

41-10.03C Dowel Bar Tolerance

Place dowel bars within the tolerances specified in section 40-1.01D(7)(b)(v).

41-10.03D Reserved

41-10.04 PAYMENT

Not Used

41-11-41-15 RESERVED

42 GROOVE AND GRIND CONCRETE

07-19-13

Replace the paragraph of section 42-1.01A with:

Section 42-1 includes general specifications for grooving and grinding concrete.

07-19-13

Replace the headings and paragraphs in section 42-3 with:

42-3.01 GENERAL

42-3.01A Summary

Section 42-3 includes specifications for grinding the surfaces of pavement, bridge decks, and approach slabs.

42-3.01B Definitions

Reserved

42-3.01C Submittals

Reserved

42-3.01D Quality Control and Assurance

Reserved

42-3.02 MATERIALS

Not Used

07-19-13

42-3.03 CONSTRUCTION

42-3.03A General

Grind surfaces in the longitudinal direction of the traveled way and grind the full lane width. Begin and end grinding at lines perpendicular to the roadway centerline.

Grinding must result in a parallel corduroy texture with grooves from 0.08 to 0.12 inch wide and from 55 to 60 grooves per foot of width. Grooves must be from 0.06 to 0.08 inch from the top of the ridge to the bottom of the groove.

Grind with abrasive grinding equipment using diamond cutting blades mounted on a self-propelled machine designed for grinding and texturing concrete pavements.

42-3.03B Pavement

Grind existing concrete pavement that is adjacent to an individual slab replacement. Grind the replaced individual slab and all the existing slabs immediately surrounding it. Grind after the individual slab is replaced.

Grind existing concrete pavement that is adjacent to new lanes of concrete pavement. Grind before paving.

After grinding, the existing pavement must comply with requirements for smoothness and coefficient of friction in section 40 except:

1. At the midpoint of a joint or crack, test smoothness with a straightedge. Both sides must have uniform texture.
2. Straightedge and inertial profiler requirements do not apply to areas abnormally depressed from subsidence or other localized causes. End smoothness testing 15 feet before and resume 15 feet after these areas.
3. Cross-slope must be uniform and have positive drainage across the traveled way and shoulder.

As an alternative to grinding existing concrete pavement, you may replace the existing pavement. The new concrete pavement must be the same thickness as the removed pavement. Replace existing pavement between longitudinal joints or pavement edges and transverse joints. Do not remove portions of slabs.

Replacement of existing concrete pavement must comply with requirements for individual slab replacement in section 41-9.

42-3.03C Bridge Decks, Approach Slabs, and Approach Pavement

Grind bridge decks, approach slabs, and approach pavement only if described.

The following ground areas must comply with the specifications for smoothness and concrete cover over reinforcing steel in section 51-1.01D(4):

1. Bridge decks
2. Approach slabs
3. Adjacent 50 feet of approach pavement

After grinding, the coefficient of friction must comply with section 51-1.01D(4).

42-3.04 PAYMENT

Grinding existing approach slabs and adjacent 50 feet of approach pavement is paid for as grind existing bridge deck.

The Department does not pay for grinding replacement concrete pavement or for additional grinding to comply with smoothness requirements.

section 90, except they must not contain chloride ions in excess of 0.25 percent by weight. Do not exceed 5 gallons of water per 94 lb of cement.

Mix the grout as follows:

1. Add water to the mixer followed by cement and any admixtures or fine aggregate.
2. Mix the grout with mechanical mixing equipment that produces a uniform and thoroughly mixed grout.
3. Agitate the grout continuously until the grout is pumped.
4. Do not add water after the initial mixing.

Add to section 46-1.03B:

04-20-12

Dispose of drill cuttings under section 19-2.03B.

Add to the end of section 46-1.03C:

07-19-13

Grouting equipment must be:

1. Capable of grouting at a pressure of at least 100 psi
2. Equipped with a pressure gage having a full-scale reading of not more than 300 psi

07-19-13

Delete the 3rd paragraph of section 46-2.01A.

Add to the beginning of section 46-2.01C:

07-19-13

Submittals for strand tendons, bar tendons, bar couplers, and anchorage assemblies must comply with section 50-1.01C.

Add to section 46-2.01D:

07-19-13

46-2.01D(3) Steel

Strand tendons, bar tendons, bar couplers, and anchorage assemblies must comply with section 50-1.01D.

46-2.01D(4) Grout

The Department tests the efflux time of the grout under California Test 541.

Add to the beginning of section 46-2.02B:

07-19-13

Strand tendons, bar tendons, and bar couplers must comply with section 50-1.02B.

Replace the 1st paragraph of section 46-2.02E with:

07-19-13

The efflux time of the grout immediately after mixing must be at least 11 seconds.

Replace the 1st paragraph of section 47-2.02E with:

02-17-12

Steel wire must comply with ASTM A 82/A 82M. Welded wire reinforcement must comply with ASTM A 185/A 185M.

Replace section 47-3 with:

07-19-13

47-3 REINFORCED CONCRETE CRIB WALLS

47-3.01 General

Section 47-3 includes specifications for constructing reinforced concrete crib walls.

Reinforced concrete crib walls must comply with section 51.

Reinforcement must comply with section 52.

Concrete crib walls consist of a series of rectangular cells composed of interlocking, precast, reinforced concrete headers, stretchers, and blocks.

47-3.02 Materials

47-3.02A General

Pads shown to be placed between bearing surfaces must either be (1) neoprene complying with the specifications for strip waterstops in section 51-2.05 or (2) commercial quality no. 30 asphalt felt. The protective board is not required for neoprene pads.

47-3.02B Crib Members

47-3.02B(1) General

All members may be manufactured to dimensions 1/8 inch greater in thickness than shown. The thickness of the lowest step must not be less than the dimension shown.

Stretchers may be manufactured 1/2 inch less in length than shown.

When an opening is shown in the face of the wall, special length stretchers and additional headers may be necessary.

For non-tangent wall alignments, special length stretchers may be required.

For non-tangent wall alignments and at locations where filler blocks are required, special length front face closure members may be required.

47-3.02B(2) Reinforcement

Reinforcing wire must comply with ASTM A 496/A 496M.

For hoops or stirrups use either (1) reinforcing wire or (2) deformed steel welded wire reinforcement. The size must be equivalent to the reinforcing steel shown. Deformed steel welded wire reinforcement must comply with ASTM A 497/A 497M.

47-3.02B(3) Concrete

Concrete test cylinders must comply with section 90-1.01D(5), except when the penetration of fresh concrete is less than 1 inch, the concrete in the test mold must be consolidated by vibrating the mold equivalent to the consolidating effort being used to consolidate the concrete in the members.

Cure crib members under section 51-4.02C.

When removed from forms, the members must present a true surface of even texture, free from honeycombs and voids larger than 1 inch in diameter and 5/16 inch in depth. Clean and fill other pockets with mortar under sections 51-1.02F and 51-1.03E(2).

External vibration resulting in adequate consolidation may be used.

If the Engineer determines that rock pockets are of the extent or character as to affect the strength of the member or to endanger the life of the steel reinforcement, replace the member.

Finish concrete-to-concrete bearing surfaces to a smooth plane. Section 51-1.03F does not apply to concrete crib members.

47-3.03 Construction

Place reinforced concrete crib walls to the lines and grades established by the Engineer. The foundation must be accepted by the Engineer before any crib members are placed.

The gap between bearing surfaces must not exceed 1/8 inch.

Where a gap of 1/16 inch to 1/8 inch exists or where shown, place a 1/16-inch pad of asphalt felt or sheet neoprene between the bearing surfaces.

47-3.04 Payment

The area of reinforced concrete crib wall is measured on the batter at the outer face for the height from the bottom of the bottom stretcher to the top of the top stretcher and for a length measured from end to end of each section of wall.

Add between the 3rd and 4th paragraphs of section 47-5.01:

Reinforcement must comply with section 52.

10-19-12

Add to section 47-6.01A:

The alternative earth retaining system must comply with the specifications for the type of wall being constructed.

10-19-12

Replace "sets" at each occurrence in the 1st paragraph of section 47-6.01C with:

copies

04-19-13

AA

48 TEMPORARY STRUCTURES

07-19-13

Replace "previously welded splice" and its definition in section 48-2.01B with:

previously welded splice: Splice made in a falsework member in compliance with AWS D1.1 or other recognized welding standard before contract award.

04-19-13

Add to section 48-2.01B:

independent support system: Support system that is in addition to the falsework removal system employing methods of holding falsework from above by winches, hydraulic jacks with prestressing steel, HS rods, or cranes.

07-19-13

Delete "field" in the 1st sentence of the 5th paragraph of section 48-2.01C(1).

04-19-13

Replace item 1 in the list in the 6th paragraph of section 48-2.01C(1) with:

04-19-13

1. Itemize the testing, inspection methods, and acceptance criteria used

Replace "sets" at each occurrence in the 4th paragraph of section 48-2.01C(2) with:

07-19-13

copies

Replace the 7th paragraph of section 48-2.01C(2) with:

09-16-11

If you submit multiple submittals at the same time or additional submittals before review of a previous submittal is complete:

1. You must designate a review sequence for submittals
2. Review time for any submittal is the review time specified plus 15 days for each submittal of higher priority still under review

Add to section 48-2.01C(2):

07-19-13

Shop drawings and calculations for falsework removal systems employing methods of holding falsework from above by winches, hydraulic jacks with prestressing steel, HS rods, or cranes must include:

1. Design code used for the analysis of the structural members of the independent support system
2. Provisions for complying with current Cal/OSHA requirements
3. Load tests and ratings within 1 year of intended use of hydraulic jacks and winches
4. Location of the winches, hydraulic jacks with prestressing steel, HS rods, or cranes
5. Analysis showing that the bridge deck and overhang are capable of supporting all loads at all time
6. Analysis showing that winches will not overturn or slide during all stages of loading
7. Location of deck and soffit openings if needed
8. Details of repair for the deck and soffit openings after falsework removal

Replace the 1st paragraph of section 48-2.01D(2) with:

04-19-13

Welding must comply with AWS D1.1 or other recognized welding standard, except for fillet welds where the load demands are 1,000 lb or less per inch for each 1/8 inch of fillet weld.

Replace the 1st through 3rd sentences in the 2nd paragraph of section 48-2.01D(2) with:

04-19-13

Perform NDT on welded splices using UT or RT. Each weld and any repair made to a previously welded splice must be tested.

Replace the 3rd paragraph of section 48-2.01D(2) with:

04-19-13

For previously welded splices, perform and document all necessary testing and inspection required to certify the ability of the falsework members to sustain the design stresses.

Replace the paragraph of section 49-2.01A(1) with:

07-19-13

Section 49-2.01 includes general specifications for fabricating and installing driven piles.
Epoxy-coated bar reinforcing steel used for pile anchors must comply with section 52-2.02.

Replace the 2nd paragraph of section 49-2.01D with:

01-20-12

Furnish piling is measured along the longest side of the pile from the specified tip elevation shown to the plane of pile cutoff.

Replace the paragraph of section 49-2.02A(1) with:

07-19-13

Section 49-2.02 includes specifications for fabricating and installing steel pipe piles.

Replace the definitions in section 49-2.02A(2) with:

07-19-13

shop welding: Welding performed at a plant on the Department's Authorized Facility Audit List.
field welding: Welding not performed at a plant on the Department's Authorized Facility Audit List.

Replace item 2 in the list in the paragraph of section 49-2.02A(3)(b) with:

07-19-13

2. Certified mill test reports for each heat number of steel used in pipe piles being furnished.

Replace the paragraph of section 49-2.02A(4)(a) with:

07-19-13

Section 11-3.02 does not apply to shop welds in steel pipe piles fabricated at a facility on the Department's Authorized Facility Audit List.

For groove welds using submerged arc welding from both sides without backgouging, qualify the WPS under Table 4.5 of AWS D1.1.

Replace "0.45" in the 2nd paragraph of section 49-2.02B(1)(a) with:

07-19-13

0.47

Replace the 1st paragraph of section 49-2.02B(1)(b) with:

07-19-13

Welds must comply with AWS D1.1. Circumferential welds must be CJP welds.

Delete the 5th paragraph of section 49-2.02B(1)(b).

07-19-13

Add to section 49-2.02B(1):

07-19-13

49-2.02B(1)(d) Reserved

Replace "4.8.4" in item 2.3 in the list in the 2nd paragraph of section 49-2.02B(2) with:

07-19-13

4.9.4

Delete the 3rd paragraph of section 49-2.02C(2).

07-19-13

Replace the paragraph of section 49-2.03A(1) with:

07-19-13

Section 49-2.03 includes specifications for fabricating and installing structural shape steel piles.

Replace the paragraph of section 49-2.03A(3) with:

07-19-13

Submit a certified material test report and a certificate of compliance that includes a statement that all materials and workmanship incorporated in the work and all required tests and inspections of this work have been performed as described.

Replace the 1st paragraph of section 49-2.03B with:

07-19-13

Structural shape steel piles must comply with ASTM A 36/A 36M, ASTM A 572/A 572M, ASTM A 709/A 709M, or ASTM A 992/A 992M.

Replace "sets" in the 1st paragraph of section 49-2.04A(3) with:

04-19-13

copies

Delete the 1st paragraph of section 49-2.04A(4).

07-19-13

Replace the 3rd and 4th paragraphs of section 49-2.04B(2) with:

10-19-12

Piles in a corrosive environment must be steam or water cured under section 90-4.03.

If piles in a corrosive environment are steam cured, either:

1. Keep the piles continuously wet for at least 3 days. The 3 days includes the holding and steam curing periods.
2. Apply curing compound under section 90-1.03B(3) after steam curing.

Replace the 1st paragraph of section 49-3.01A with:

07-19-13

Section 49-3.01 includes general specifications for constructing CIP concrete piles.

Add to section 49-3.01A:

01-20-12

Concrete must comply with section 51.

Replace the 1st paragraph of section 49-3.01C with:

01-20-12

Except for CIDH concrete piles constructed under slurry, construct CIP concrete piles such that the excavation methods and the concrete placement procedures provide for placing the concrete against undisturbed material in a dry or dewatered hole.

Replace "Reserved" in section 49-3.02A(2) with:

01-20-12

dry hole:

1. Except for CIDH concrete piles specified as end bearing, a drilled hole that:
 - 1.1. Accumulates no more than 12 inches of water in the bottom of the drilled hole during a period of 1 hour without any pumping from the hole during the hour.
 - 1.2. Has no more than 3 inches of water in the bottom of the drilled hole immediately before placing concrete.
2. For CIDH concrete piles specified as end bearing, a drilled hole free of water without the use of pumps.

Replace "Reserved" in section 49-3.02A(3)(a) with:

01-20-12

If plastic spacers are proposed for use, submit the manufacturer's data and a sample of the plastic spacer. Allow 10 days for review.

Replace item 5 in the list in the 1st paragraph of section 49-3.02A(3)(b) with:

10-19-12

5. Methods and equipment for determining:
 - 5.1. Depth of concrete
 - 5.2. Theoretical volume of concrete to be placed, including the effects on volume if casings are withdrawn
 - 5.3. Actual volume of concrete placed

Add to the list in the 1st paragraph of section 49-3.02A(3)(b):

01-18-13

8. Drilling sequence and concrete placement plan.

Replace item 2 in the list in the 1st paragraph of section 49-3.02A(3)(g) with:

01-20-12

2. Be sealed and signed by an engineer who is registered as a civil engineer in the State. This requirement is waived for either of the following conditions:
 - 2.1. The proposed mitigation will be performed under the current Department-published version of *ADSC Standard Mitigation Plan 'A' - Basic Repair* without exception or modification.
 - 2.2. The Engineer determines that the rejected pile does not require mitigation due to structural, geotechnical, or corrosion concerns, and you elect to repair the pile using the current

Department-published version of *ADSC Standard Mitigation Plan 'B' - Grouting Repair* without exception or modification.

Replace "49-2.03A(4)(d)" in the 1st paragraph of section 49-3.02A(4)(d)(i) with:

07-19-13

49-3.02A(4)(d)

Add to the beginning of section 49-3.02A(4)(d)(ii):

07-19-13

If the drilled hole is dry or dewatered without the use of temporary casing to control ground water, installation of inspection pipes is not required.

Replace item 1 in the list in the 1st paragraph of section 49-3.02A(4)(d)(ii) with:

01-20-12

1. Inspection pipes must be schedule 40 PVC pipe complying with ASTM D 1785 with a nominal pipe size of 2 inches. Watertight PVC couplers complying with ASTM D 2466 are allowed to facilitate pipe lengths in excess of those commercially available. Log the location of the inspection pipe couplers with respect to the plane of pile cutoff.

Add to section 49-3.02A(4)(d)(iv):

01-20-12

If the Engineer determines it is not feasible to use one of ADSC's standard mitigation plans to mitigate the pile, schedule a meeting and meet with the Engineer before submitting a nonstandard mitigation plan.

The meeting attendees must include your representatives and the Engineer's representatives involved in the pile mitigation. The purpose of the meeting is to discuss the type of pile mitigation acceptable to the Department.

Provide the meeting facility. The Engineer conducts the meeting.

Replace the 1st paragraph of section 49-3.02B(5) with:

07-19-13

Grout must consist of cementitious material and water, and may contain an admixture if authorized. Do not exceed 5 gallons of water per 94 lb of cement.

Cementitious material must comply with section 90-1.02B, except SCMs are not required.

Water must comply with section 90-1.02D. If municipally supplied potable water is used, the testing specified in section 90-1.02D is waived.

Admixtures must comply with section 90, except admixtures must not contain chloride ions in excess of 0.25 percent by weight.

Use aggregate to extend the grout as follows:

1. Aggregate must consist of at least 70 percent fine aggregate and approximately 30 percent pea gravel, by weight.
2. Fine aggregate must comply with section 90-1.02C(3).
3. Size of pea gravel must be such that 100 percent passes the 1/2-inch sieve, at least 85 percent passes the 3/8-inch sieve, and not more than 5 percent passes the no. 8 sieve.
4. Minimum cementitious material content of the grout must not be less than 845 lb/cu yd of grout.

Mix the grout as follows:

1. Add water to the mixer followed by cementitious material, aggregates, and any admixtures.
2. Mix the grout with mechanical mixing equipment that produces a uniform and thoroughly mixed grout.
3. Agitate the grout continuously until the grout is pumped.
4. Do not add water after initial mixing.

Replace section 49-3.02B(8) with:

01-20-12

49-3.02B(8) Spacers

Spacers must comply with section 52-1.03D, except you may use plastic spacers.

Plastic spacers must:

1. Comply with sections 3.4 and 3.5 of the Concrete Reinforcing Steel Institute's *Manual of Standard Practice*
2. Have at least 25 percent of their gross plane area perforated to compensate for the difference in the coefficient of thermal expansion between the plastic and concrete
3. Be of commercial quality

Add between the 1st and 2nd paragraphs of section 49-3.02C(2):

07-19-13

For CIDH concrete piles with a pile cap, the horizontal tolerance at the center of each pile at pile cut-off is the larger of 1/24 of the pile diameter or 3 inches. The horizontal tolerance for the center-to-center spacing of 2 adjacent piles is the larger of 1/24 of the pile diameter or 3 inches.

Add to section 49-3.02C(4):

01-20-12

Unless otherwise shown, the bar reinforcing steel cage must have at least 3 inches of clear cover measured from the outside of the cage to the sides of the hole or casing.

Place spacers at least 5 inches clear from any inspection tubes.

Place plastic spacers around the circumference of the cage and at intervals along the length of the cage, as recommended by the manufacturer.

07-19-13

For a single CIDH concrete pile supporting a column:

1. If the pile and the column share the same reinforcing cage diameter, this cage must be accurately placed as shown
2. If the pile reinforcing cage is larger than the column cage and the concrete is placed under dry conditions, maintain a clear horizontal distance of at least 3.5 inches between the two cages
3. If the pile reinforcing cage is larger than the column cage and the concrete is placed under slurry, maintain a clear horizontal distance of at least 5 inches between the two cages

Replace section 49-3.02C(6) with:

07-19-13

49-3.02C(6) Construction Joint

Section 49-3.02C(6) applies to CIDH concrete piles where a construction joint is shown.

If a permanent steel casing is not shown, you must furnish and install a permanent casing. The permanent casing must:

1. Be watertight and of sufficient strength to prevent damage and to withstand the loads from installation procedures, drilling and tooling equipment, lateral concrete pressures, and earth pressures.
2. Extend at least 5 feet below the construction joint. If placing casing into rock, the casing must extend at least 2 feet below the construction joint.
3. Not extend above the top of the drilled hole or final grade whichever is lower.
4. Not increase the diameter of the CIDH concrete pile more than 2 feet.
5. Be installed by impact or vibratory hammers, oscillators, rotators, or by placing in a drilled hole. Casings placed in a drilled hole must comply with section 49-3.02C(5).

Section 49-2.01A(4)(b) does not apply to permanent casings specified in this section.

Add to section 49-4.01:

07-19-13

Steel soldier piles must comply with section 49-2.03.

Replace the headings and paragraphs in section 49-4.02 with:

07-19-13

Concrete anchors must comply with the specifications for studs in clause 7 of AWS D1.1.

AA

50 PRESTRESSING CONCRETE

07-19-13

Replace "sets" at each occurrence in the 2nd and 3rd paragraphs of section 50-1.01C(3) with:

04-19-13

copies

Add to section 50-1.01C(3):

07-19-13

Include a grouting plan with your shop drawing submittal. The grouting plan must include:

1. Detailed grouting procedures
2. Type, quantity, and brand of materials to be used
3. Type of equipment to be used including provisions for backup equipment
4. Types and locations of grout inlets, outlets, and vents
5. Methods to clean ducts before grouting
6. Methods to control the rate of flow within ducts
7. Theoretical grout volume calculations for each duct
8. Duct repair procedures due to an air pressure test failure
9. Mixing and pumping procedures
10. Direction of grouting
11. Sequence of use of inlets and outlets
12. Procedure for handling blockages
13. Proposed forms for recording grouting information
14. Procedure for secondary grouting
15. Names of people who will perform grouting activities including their relevant experience and certifications

Add to section 50-1.01C:

07-19-13

50-1.01C(5) Grout

Submit a daily grouting report for each day grouting is performed. Submit the report within 3 days after grouting. The report must be signed by the technician supervising the grouting activity. The report must include:

1. Identification of each tendon
2. Date grouting occurred
3. Time the grouting started and ended
4. Date of placing the prestressing steel in the ducts
5. Date of stressing
6. Type of grout used
7. Injection end and applied grouting pressure
8. Actual and theoretical quantity of grout used to fill duct
9. Ratio of actual to theoretical grout quantity
10. Records of air, grout, and structure surface temperatures during grouting.
11. Summary of tests performed and results, except submit compressive strength and chloride ion test results within 48 hours of test completion
12. Names of personnel performing the grouting activity
13. Summary of problems encountered and corrective actions taken
14. Summary of void investigations and repairs made

Replace the introductory clause in the 1st paragraph of section 50-1.01C(4) with:

07-19-13

Submit test samples for the materials shown in the following table to be used in the work:

Add between "the" and "test samples" in the 1st paragraph of section 50-1.01D(2):

07-19-13

prestressing steel

Replace the 3rd paragraph of section 50-1.01D(2) with:

10-19-12

The Department may verify the prestressing force using the Department's load cells.

Replace the 3rd paragraph in section 50-1.01D(3) with:

07-19-13

Each pressure gage must be fully functional and have an accurately reading, clearly visible dial or display. The dial must be at least 6 inches in diameter and graduated in 100 psi increments or less.

Add between the 5th and 6th paragraphs of section 50-1.01D(3):

07-19-13

Each jack and its gages must be calibrated as a unit.

Replace the 6th paragraph in section 50-1.01D(3) with:

07-19-13

Each jack used to tension prestressing steel permanently anchored at 25 percent or more of its specified minimum ultimate tensile strength must be calibrated by METS within 1 year of use and after each repair. You must:

1. Schedule the calibration of the jacking equipment with METS
2. Mechanically calibrate the gages with a dead weight tester or other authorized means before calibration of the jacking equipment by METS
3. Verify that the jack and supporting systems are complete, with proper components, and are in good operating condition
4. Provide labor, equipment, and material to (1) install and support the jacking and calibration equipment and (2) remove the equipment after the calibration is complete
5. Plot the calibration results

Each jack used to tension prestressing steel permanently anchored at less than 25 percent of its specified minimum ultimate tensile strength must be calibrated by an authorized laboratory within 6 months of use and after each repair.

Add to section 50-1.01D:

07-19-13

50-1.01D(4) Pressure Testing Ducts

For post-tensioned concrete bridges, pressure test each duct with compressed air after stressing. To pressure test the ducts:

1. Seal all inlets, outlets, and grout caps.
2. Open all inlets and outlets on adjacent ducts.
3. Attach an air compressor to an inlet at 1 end of the duct. The attachment must include a valve that separates the duct from the air source.
4. Attach a pressure gage to the inlet at the end of the duct.
5. Pressurize the duct to 50 psi.
6. Lock-off the air source.
7. Record the pressure loss after 1 minute.
8. If there is a pressure loss exceeding 25 psi, repair the leaks with authorized methods and retest.

Compressed air used to clear and test the ducts must be clean, dry, and free of oil or contaminants.

50-1.01D(5) Duct Demonstration of Post-Tensioned Members

Before placing forms for deck slabs of box girder bridges, demonstrate that any prestressing steel placed in the ducts is free and unbonded. If no prestressing steel is in the ducts, demonstrate that the ducts are unobstructed.

If prestressing steel is installed after the concrete is placed, demonstrate that the ducts are free of water and debris immediately before installing the steel.

Before post-tensioning any member, demonstrate that the prestressing steel is free and unbonded in the duct.

The Engineer must witness all demonstrations.

50-1.01D(6) Void Investigation

In the presence of the Engineer, investigate the ducts for voids between 24 hours and 72 hours after grouting completion. As a minimum, inspect the inlet and outlet ports at the anchorages and at high points in the tendons for voids after removal. Completely fill any voids found with secondary grout.

50-1.01D(7) Personnel Qualifications

Perform post-tensioning field activities, including grouting, under the direct supervision of a technician certified as a level 2 Bonded PT Field Specialist through the Post-Tensioning Institute. Grouting activities may be performed under the direct supervision of a technician certified as a Grouting Technician through the American Segmental Bridge Institute.

Replace the 6th paragraph of section 50-1.02B with:

07-19-13

Package the prestressing steel in containers or shipping forms that protect the steel against physical damage and corrosion during shipping and storage.

Replace the 13th paragraph of section 50-1.02B with:

07-19-13

Prestressing steel is rejected if surface rust either:

1. Cannot be removed by hand-cleaning with a fine steel wool pad
2. Leaves pits visible to the unaided eye after cleaning

Replace the 4th paragraph of section 50-1.02C with:

07-19-13

Admixtures must comply with section 90, except admixtures must not contain chloride ions in excess of 0.25 percent by weight.

Delete the 5th paragraphs of section 50-1.02C.

07-19-13

Add to section 50-1.02C:

07-19-13

Secondary grout must:

1. Comply with ASTM C 1107
2. Not have a deleterious effect on the steel, concrete, or bond strength of the steel to concrete

Replace item 9 including items 9.1 and 9.2 in the list in the 1st paragraph of section 50-1.02D with:

07-19-13

9. Have an inside cross-sectional area of at least 2.5 times the net area of the prestressing steel for multistrand tendons

Replace "3/8" in item 10 in the list in the 1st paragraph of section 50-1.02D with:

07-19-13

1/2

Delete the 2nd sentences in the 1st paragraph of section 50-1.02E.

07-19-13

Replace section 50-1.02F with:

07-19-13

50-1.02F Permanent Grout Caps

Permanent grout caps for anchorage systems of post-tensioned tendons must:

1. Be glass-fiber-reinforced plastic with antioxidant additives. The environmental stress-cracking failure time must be at least 192 hours under ASTM D 1693, Condition C.

2. Completely cover and seal the wedge plate or anchorage head and all exposed metal parts of the anchorage against the bearing plate using neoprene O-ring seals.
3. Have a grout vent at the top of the cap.
4. Be bolted to the anchorage with stainless steel complying with ASTM F 593, alloy 316. All fasteners, including nuts and washers, must be alloy 316.
5. Be pressure rated at or above 150 psi.

Add to section 50-1.02:

09-16-11

50-1.02G Sheathing

Sheathing for debonding prestressing strand must:

1. Be split or un-split flexible polymer plastic tubing
2. Have a minimum wall thickness of 0.025 inch
3. Have an inside diameter exceeding the maximum outside diameter of the strand by 0.025 to 0.14 inch

Split sheathing must overlap at least 3/8 inch.

Waterproofing tape used to seal the ends of the sheathing must be flexible adhesive tape.

The sheathing and waterproof tape must not react with the concrete, coating, or steel.

Replace the 2nd paragraph of section 50-1.03A(3) with:

07-19-13

After installation, cover the duct ends and vents to prevent water or debris from entering.

Add to section 50-1.03A(3):

07-19-13

Support ducts vertically and horizontally during concrete placement at a spacing of at most 4 feet.

Delete "at least" in the 1st paragraph of section 50-1.03B(1).

07-19-13

Add to section 50-1.03B(1):

01-20-12

After seating, the maximum tensile stress in the prestressing steel must not exceed 75 percent of the minimum ultimate tensile strength shown.

Delete the 1st through 4th paragraphs of section 50-1.03B(2)(a).

07-19-13

Replace "temporary tensile strength" in the 7th paragraph of section 50-1.03B(2)(a) with:

07-19-13

temporary tensile stress

Add to section 50-1.03B(2)(a):

07-19-13

If prestressing strand is installed using the push-through method, use guide caps at the front end of each strand to protect the duct from damage.

Add to the list in the 2nd paragraph of section 50-1.03B(2)(c):

07-19-13

3. Be equipped with permanent grout caps

Replace section 50-1.03B(2)(d) with:

07-19-13

50-1.03B(2)(d) Bonding and Grouting

50-1.03B(2)(d)(i) General

Bond the post-tensioned prestressing steel to the concrete by completely filling the entire void space between the duct and the prestressing steel with grout.

Ducts, vents, and grout caps must be clean and free from water and deleterious materials that would impair bonding of the grout or interfere with grouting procedures. Compressed air used for cleaning must be clean, dry, and free of oil or contaminants.

Prevent the leakage of grout through the anchorage assembly by positive mechanical means.

Before starting daily grouting activities, drain the pump system to remove any water from the piping system.

Break down and thoroughly clean the pump and piping system after each grouting session.

After completing duct grouting activities:

1. Abrasive blast clean and expose the aggregate of concrete surfaces where concrete is to be placed to cover and encase the anchorage assemblies
2. Remove the ends of vents 1 inch below the roadway surface

50-1.03B(2)(d)(ii) Mixing and Proportioning

Proportion solids by weight to an accuracy of 2 percent.

Proportion liquids by weight or volume to an accuracy of 1 percent.

Mix the grout as follows:

1. Add water to the mixer followed by the other ingredients.
2. Mix the grout with mechanical mixing equipment that produces a uniform and thoroughly mixed grout without an excessive temperature increase or loss of properties of the mixture.
3. Do not exceed 5 gal of water per 94 lb of cement or the quantity of water in the manufacturer's instructions, whichever is less.
4. Agitate the grout continuously until the grout is pumped. Do not add water after the initial mixing.

50-1.03B(2)(d)(iii) Placing

Pump grout into the duct within 30 minutes of the 1st addition of the mix components.

Inject grout from the lowest point of the duct in an uphill direction in 1 continuous operation maintaining a one-way flow of the grout. You may inject from the lowest anchorage if complete filling is ensured.

Before injecting grout, open all vents.

Continuously discharge grout from the vent to be closed. Do not close any vent until free water, visible slugs of grout, and entrapped air have been ejected and the consistency of the grout flowing from the vent is equivalent to the injected grout.

Pump the grout at a rate of 16 to 50 feet of duct per minute.

Conduct grouting at a pressure range of 10 to 50 psi measured at the grout inlet. Do not exceed maximum pumping pressure of 150 psi at the grout inlet.

As grout is injected, close the vents in sequence in the direction of flow starting with the closest vent.

Before closing the final vent at the grout cap, discharge at least 2 gal of grout into a clean receptacle.

Bleed all high point vents.

Lock a pressure of 5 psi into the duct by closing the grout inlet valve.

50-1.03B(2)(d)(iv) Weather Conditions

If hot weather conditions will contribute to quick stiffening of the grout, cool the grout by authorized methods as necessary to prevent blockages during pumping activities.

If freezing weather conditions are anticipated during and following the placement of grout, provide adequate means to protect the grout in the ducts from damage by freezing.

50-1.03B(2)(d)(v) Curing

During grouting and for a period of 24 hours after grouting, eliminate vibration from contractor controlled sources within 100 feet of the span in which grouting is taking place, including from moving vehicles, jackhammers, large compressors or generators, pile driving activities, soil compaction, and falsework removal. Do not vary loads on the span.

For PC concrete members, do not move or disturb the members after grouting for 24 hours. If ambient temperature drops below 50 degrees F, do not move or disturb the members for 48 hours.

Do not remove or open valves until grout has cured for at least 24 hours.

50-1.03B(2)(d)(vi) Grouting Equipment

Grouting equipment must be:

1. Capable of grouting at a pressure of at least 100 psi
2. Equipped with a pressure gage having a full-scale reading of not more than 300 psi
3. Able to continuously grout the longest tendon on the project in less than 20 minutes

Grout must pass through a screen with clear openings of 1/16 inch or less before entering the pump.

Fit grout injection pipes, ejection pipes, and vents with positive mechanical shutoff valves capable of withstanding the pumping pressures. Do not remove or open valves until the grout has set. If authorized, you may substitute mechanical valves with suitable alternatives after demonstrating their effectiveness.

Provide a standby grout mixer and pump.

50-1.03B(2)(d)(vii) Grout Storage

Store grout in a dry environment.

50-1.03B(2)(d)(viii) Blockages

If the grouting pressure reaches 150 psi, close the inlet and pump the grout at the next vent that has just been or is ready to be closed as long as a one-way flow is maintained. Do not pump grout into a succeeding outlet from which grout has not yet flowed.

When complete grouting of the tendon cannot be achieved by the steps specified, stop the grouting operation.

50-1.03B(2)(d)(ix) Secondary Grouting

Perform secondary grouting by vacuum grouting under the direct supervision of a person who has been trained and has experience in the use of vacuum grouting equipment and procedures.

The vacuum grouting process must be able to determine the size of the void and measure the volume of grout filling the void.

7. Pipe culvert headwalls, endwalls, and wingwalls for a pipe with a diameter of 5 feet or greater

Falsework must comply with section 48-2.

Joints must comply with section 51-2.

Elastomeric bearing pads must comply with section 51-3.

Reinforcement for the following concrete structures must comply with section 52:

1. Sound wall footings
2. Sound wall pile caps
3. Barrier slabs
4. Junction structures
5. Minor structures
6. PC concrete members

You may use RSC for a concrete structure only where the specifications allow the use of RSC.

Replace "sets" in the 1st paragraph of section 51-1.01C(2) with:

copies

07-19-13

Replace the heading of section 51-1.01D(4) with:

Testing Concrete Surfaces

04-19-13

Add to section 51-1.01D(4)(a):

The Engineer tests POC deck surfaces for smoothness and crack intensity.

04-19-13

Add to the list in the 1st paragraph of section 51-1.01D(4)(b):

3. Completed deck surfaces, including ramps and landings of POCs

04-19-13

Replace the 4th paragraph in section 51-1.01D(4)(b) with:

Except for POCs, surface smoothness is tested using a bridge profilograph under California Test 547. Two profiles are obtained in each lane approximately 3 feet from the lane lines and 1 profile is obtained in each shoulder approximately 3 feet from the curb or rail face. Profiles are taken parallel to the direction of traffic.

04-19-13

Add between the 5th and 6th paragraphs of section 51-1.01D(4)(b):

POC deck surfaces must comply with the following smoothness requirements:

04-19-13

1. Surfaces between grade changes must not vary more than 0.02 foot from the lower edge of a 12-foot-long straightedge placed parallel to the centerline of the POC
2. Surface must not vary more than 0.01 foot from the lower edge of a 6-foot-long straightedge placed perpendicular to the centerline of the POC

Add to section 51-1.01D(4)(d):

04-19-13

The Engineer measures crack intensity of POC deck surfaces after curing, before prestressing, and before falsework release. Clean the surface for the Engineer to measure surface crack intensity.

In any 100 sq ft portion of a new POC deck surface, if there are more than 10 feet of cracks having a width at any point of over 0.02 inch, treat the deck with methacrylate resin under section 15-5.05. Treat the entire deck width between the curbs to 5 feet beyond where the furthest continuous crack emanating from the 100 sq ft section is 0.02 inch wide. Treat the deck surface before grinding.

Replace the 2nd paragraph of section 51-1.02B with:

07-19-13

Except for minor structures, the minimum required 28-day compressive strength for concrete in structures or portions of structures is the compressive strength described or 3,600 psi, whichever is greater.

Add to section 51-1.03C(2)(c)(i):

04-20-12

Permanent steel deck forms are only allowed where shown or if specified as an option in the special provisions.

Replace the 3rd paragraph of section 51-1.03C(2)(c)(ii) with:

04-20-12

Compute the physical design properties under AISI's *North American Specification for the Design of Cold-Formed Steel Structural Members*.

Replace the 8th paragraph of section 51-1.03D(1) with:

10-19-12

Except for concrete placed as pipe culvert headwalls and endwalls, slope paving and aprons, and concrete placed under water, consolidate concrete using high-frequency internal vibrators within 15 minutes of placing concrete in the forms. Do not attach vibrators to or hold them against forms or reinforcing steel. Do not displace reinforcement, ducts, or prestressing steel during vibrating.

Add to section 51-1.03E(5):

08-05-11

Drill the holes without damaging the adjacent concrete. If reinforcement is encountered during drilling before the specified depth is attained, notify the Engineer. Unless coring through the reinforcement is authorized, drill a new hole adjacent to the rejected hole to the depth shown.

Add to section 51-1.03F(5)(a):

04-19-13

For approach slabs, sleeper slabs, and other roadway surfaces of concrete structures, texture the roadway surface as specified for bridge deck surfaces in section 51-1.03F(5)(b).

Replace "Reserved" in section 51-1.03F(5)(b) with:

04-20-12

51-1.03F(5)(b)(i) General

Except for bridge widenings, texture the bridge deck surfaces longitudinally by grinding and grooving or by longitudinal tining.

10-19-12

For bridge widenings, texture the deck surface longitudinally by longitudinal tining.

04-20-12

In freeze-thaw areas, do not texture PCC surfaces of bridge decks.

51-1.03F(5)(b)(ii) Grinding and Grooving

When texturing the deck surface by grinding and grooving, place a 1/4 inch of sacrificial concrete cover on the bridge deck above the finished grade shown. Place items to be embedded in the concrete based on the final profile grade elevations shown. Construct joint seals after completing the grinding and grooving.

Before grinding and grooving, deck surfaces must comply with the smoothness and deck crack treatment requirements.

Grind and groove the deck surface as follows:

1. Grind the surface to within 18 inches of the toe of the barrier under section 42-3. Grinding must not reduce the concrete cover on reinforcing steel to less than 1-3/4 inches.
2. Groove the ground surfaces longitudinally under section 42-2. The grooves must be parallel to the centerline.

51-1.03F(5)(b)(iii) Longitudinal Tining

When texturing the deck surface by longitudinal tining, perform initial texturing with a burlap drag or broom device that produces striations parallel to the centerline. Perform final texturing with spring steel tines that produce grooves parallel with the centerline.

The tines must:

1. Be rectangular in cross section
2. Be from 3/32 to 1/8 inch wide on 3/4-inch centers
3. Have enough length, thickness, and resilience to form grooves approximately 3/16 inch deep

Construct grooves to within 6 inches of the layout line of the concrete barrier toe. Grooves must be from 1/8 to 3/16 inch deep and 3/16 inch wide after concrete has hardened.

For irregular areas and areas inaccessible to the grooving machine, you may hand construct grooves. Hand-constructed grooves must comply with the specifications for machine-constructed grooves.

Tining must not cause tearing of the deck surface or visible separation of coarse aggregate at the surface.

Add to section 51-1.03F:

04-19-13

51-1.03F(6) Finishing Pedestrian Overcrossing Surfaces

Construct deck surfaces, including ramps and landings of POCs to the grade and cross section shown. Surfaces must comply with the specified smoothness, surface texture, and surface crack requirements.

The Engineer sets deck elevation control points for your use in establishing the grade and cross section of the deck surface. The grade established by the deck elevation control points includes all camber allowances. Except for landings, elevation control points include the beginning and end of the ramp and will not be closer together than approximately 8 feet longitudinally and 4 feet transversely to the POC centerline. Landing elevation control points are at the beginning and the end of the landing.

Broom finish the deck surfaces of POCs. Apply the broom finish perpendicular to the path of travel. You may apply water mist to the surface immediately before brooming.

Clean any discolored concrete by abrasive blast cleaning or other authorized methods.

Replace the paragraphs of section 51-1.04 with:

10-19-12

If concrete involved in bridge work is not designated by type and is not otherwise paid for under a separate bid item, the concrete is paid for as structural concrete, bridge.

The payment quantity for structural concrete includes the volume in the concrete occupied by bar reinforcing steel, structural steel, prestressing steel materials, and piling.

The payment quantity for seal course concrete is the actual volume of seal course concrete placed except the payment quantity must not exceed the volume of concrete contained between vertical planes 1 foot outside the neat lines of the seal course shown. The Department does not adjust the unit price for an increase or decrease in the seal course concrete quantity.

Structural concrete for pier columns is measured as follows:

1. Horizontal limits are vertical planes at the neat lines of the pier column shown.
2. Bottom limit is the bottom of the foundation excavation in the completed work.
3. Upper limit is the top of the pier column concrete shown.

The payment quantity for drill and bond dowel is determined from the number and depths of the holes shown.

Replace section 51-2.01B(2) with:

04-19-13

51-2.01B(2) Reserved

04-19-13

Delete the 4th paragraph of section 51-2.01C.

Replace "SSPC-QP 3" in the 1st paragraph of section 51-2.02A(2) with:

10-19-12

AISC-420-10/SSPC-QP 3

Replace the 2nd and 3rd paragraphs of section 51-2.02B(3)(b) with:

04-20-12

Concrete saws for cutting grooves in the concrete must have diamond blades with a minimum thickness of 3/16 inch. Cut both sides of the groove simultaneously for a minimum 1st pass depth of 2 inches. The completed groove must have:

1. Top width within 1/8 inch of the width shown or ordered
2. Bottom width not varying from the top width by more than 1/16 inch for each 2 inches of depth
3. Uniform width and depth

Cutting grooves in existing decks includes cutting any conflicting reinforcing steel.

Replace "sets" in the 1st and 2nd paragraphs of section 51-2.02D(1)(c)(ii) with:

copies

04-19-13

Replace "set" in the 7th paragraph of section 51-2.02D(1)(c)(ii) with:

copy

04-19-13

Add to the 1st paragraph of section 51-2.02D(3):

POC deck surfaces must comply with section 51-1.03F(6) before placing and anchoring joint seal assemblies.

04-19-13

Replace "sets" in the 2nd paragraph of section 51-2.02E(1)(c) with:

copies

04-19-13

Replace "set" in the 6th paragraph of section 51-2.02E(1)(c) with:

copy

04-19-13

Replace the 2nd paragraph of section 51-2.02E(1)(e) with:

Except for components in contact with the tires, the design loading must be the AASHTO LRFD Bridge Design Specifications Design Truck with 100 percent dynamic load allowance. Each component in contact with the tires must support a minimum of 80 percent of the AASHTO LRFD Bridge Design Specifications Design Truck with 100 percent dynamic load allowance. The tire contact area must be 10 inches measured normal to the longitudinal assembly axis by 20 inches wide. The assembly must provide a smooth-riding joint without slapping of components or tire rumble.

08-05-11

Replace "sets" in the 1st and 2nd paragraphs of section 51-2.02F(1)(c) with:

copies

04-19-13

Add between the 1st and 2nd paragraphs of section 51-4.01A:

Prestressing concrete members must comply with section 50.

10-19-12

Delete the 2nd paragraph of section 51-4.01A.

04-20-12

Replace the 3rd paragraph of section 51-4.01C(2) with:

For segmental or spliced-girder construction, shop drawings must include the following additional information:

04-20-12

1. Details showing construction joints or closure joints
2. Arrangement of bar reinforcing steel, prestressing tendons, and pressure-grouting pipe
3. Materials and methods for making closures
4. Construction joint keys and surface treatment
5. Other requested information

For segmental girder construction, shop drawings must include concrete form and casting details.

Replace "sets" in the 1st paragraph of section 51-4.01C(3) with:

copies

04-19-13

Delete the 1st and 2nd paragraphs of section 51-4.02A.

10-19-12

Replace the 3rd paragraph of section 51-4.02B(2) with:

04-20-12

For segmental or spliced-girder construction, materials for construction joints or closure joints at exterior girders must match the color and texture of the adjoining concrete.

Add to section 51-4.02B(2):

04-20-12

At spliced-girder closure joints:

1. If shear keys are not shown, the vertical surfaces of the girder segment ends must be given a coarse texture as specified for the top surface of PC members.
2. Post-tensioning ducts must extend out of the vertical surface of the girder segment closure end sufficiently to facilitate splicing of the duct.

For spliced girders, pretension strand extending from the closure end of the girder segment to be embedded in the closure joint must be free of mortar, oil, dirt, excessive mill scale and scabby rust, and other coatings that would destroy or reduce the bond.

Add to section 51-4.03B:

04-20-12

The specifications for prestressing force distribution and sequencing of stressing in the post-tensioning activity in 50-1.03B(2)(a) do not apply if post-tensioning of spliced girders before starting deck construction is described. The composite deck-girder structure must be post-tensioned in a subsequent stage.

Temporary spliced-girder supports must comply with the specifications for falsework in section 48-2.

Before post-tensioning of spliced girders, remove the forms at CIP concrete closures and intermediate diaphragms to allow inspection for concrete consolidation.

Add to section 51-5.01A:

07-19-13

Structure excavation and backfill must comply with section 19-3.

Treated permeable base must comply with section 29.

12. Material specification and grade listed on the bill of materials.
13. Identification of tension members and fracture critical members.
14. Proposed deviations from plans, specifications, or previously submitted shop drawings.
15. Contract plan sheet references for details.

Replace items 2 and 3 in the list in the 1st paragraph of section 55-1.01C(3) with:

2. Tension flanges and webs of horizontally curved girders
3. Hanger plates

07-19-13

Replace the 2nd paragraph of section 55-1.01C(3) with:

Furnish plates, shapes, or bars with extra length to provide for removal of check samples.

07-19-13

Delete the 1st and 2nd sentences in the 3rd paragraph of section 55-1.01C(3).

07-19-13

Replace the 4th paragraph of section 55-1.01C(3) with:

Remove material for test samples in the Engineer's presence. Test samples for plates over 24 inches wide must be 10 by 12 inches with the long dimension transverse to the direction of rolling. Test samples for other products must be 12 inches long taken in the direction of rolling with a width equal to the product width.

07-19-13

Replace the 1st sentence of the 6th paragraph in section 55-1.01C(3) with:

Results of check testing are delivered to you within 20 days of receipt of samples at METS.

07-19-13

Delete the 2nd paragraph of section 55-1.01D(1).

07-19-13

Replace the 2nd sentence of the 4th paragraph in section 55-1.01D(1) with:

The calibration must be performed by an authorized repair and calibration center approved by the tool manufacturer.

07-19-13

Add to section 55-1.01D(1):

For bolts installed as snug tight, rotational capacity testing and installation tension testing are not required.

07-19-13

In addition to NDT requirements in AWS D1.5, ultrasonically test 25 percent of all main member tension butt welds in material over 1/2 inch thick.

Perform NDT on 100 percent of each pin as follows:

1. MT under ASTM A 788, S 18, with no linear indication allowed exceeding 3 mm
2. UT under ASTM A 788, S 20, level S and level DA in two perpendicular directions

The Engineer determines the location of all NDT testing for welding.

07-19-13

Delete the 2nd paragraph of section 55-1.01D(3)(a).

Replace section 55-1.01D(4)(b) with:

07-19-13

Perform rotational capacity testing on each rotational capacity lot under section 55-1.01D(3)(b) at the job site before installation.

Replace the 1st sentence of the 2nd paragraph in section 55-1.01D(4)(c) with:

07-19-13

Test 3 representative HS fastener assemblies under section 8 of *Specification for Structural Joints Using High-Strength Bolts* of the RCSC.

Replace the 1st paragraph in section 55-1.01D(4)(d) with:

07-19-13

Perform fastener tension testing to verify minimum tension in HS bolted connections no later than 48 hours after all fasteners in a connection have been tensioned.

Replace the 3rd paragraph in section 55-1.01D(4)(d) with:

07-19-13

Test 10 percent of each type of fastener assembly in each HS bolted connection for minimum tension using the procedure described in section 10 of *Specification for Structural Joints Using High-Strength Bolts* of the RCSC. Check at least 2 assemblies per connection. For short bolts, determine the inspection torque using steps 1 through 7 of "Arbitration of Disputes, Torque Method-Short Bolts" in *Structural Bolting Handbook* of the Steel Structures Technology Center.

Replace the 1st table in the 1st paragraph of section 55-1.02A(1) with:

07-19-13

Structural Steel

| Material | Specification |
|--|--|
| Carbon steel | ASTM A 709/A 709M, Grade 36 or {ASTM A36/A36M} ^a |
| HS low alloy columbium vanadium steel | ASTM A 709/A 709M, Grade 50 or {ASTM A 992/A 992M or ASTM A 572/A 572M, Grade 50} ^a |
| HS low alloy structural steel | ASTM A 709/A 709M, Grade 50W or Grade HPS 50W, or {ASTM A 588/A 588M} ^a |
| HS low alloy structural steel plate | ASTM A 709/A 709M, Grade HPS 70W |
| High-yield strength quenched and tempered alloy steel plate suitable for welding | ASTM A 709/A 709M, Grade 100, Grade 100W, or Grade HPS 100W, or {ASTM A 514/A 514M} ^a |

^aGrades you may substitute for the equivalent ASTM A 709 steel subject to the modifications and additions specified and to the requirements of ASTM A 709.

Replace the 2nd table in the 1st paragraph of section 55-1.02A(1) with:

07-19-13

| Fasteners | |
|--|---|
| Material | Specification |
| Steel fastener components for general applications: | |
| Bolts and studs | ASTM A 307 |
| Anchor bolts | ASTM F 1554 ^a |
| HS bolts and studs | ASTM A 449, Type 1 ^a |
| HS threaded rods | ASTM A 449, Type 1 ^a |
| HS nonheaded anchor bolts | ASTM F 1554, Grade 105, Class 2A ^a |
| Nuts | ASTM A 563, including appendix X1 ^b |
| Washers | ASTM F 844 |
| Hardened Washers | ASTM F 436, Type 1, including S1 supplementary requirements |
| Components of HS steel fastener assemblies for use in structural steel joints: | |
| Bolts | ASTM A 325, Type 1 |
| Tension control bolts | ASTM F 1852, Type 1 |
| Nuts | ASTM A 563, including appendix X1 ^b |
| Hardened washers | ASTM F 436, Type 1, Circular, including S1 supplementary requirements |
| Direct tension indicators | ASTM F 959, Type 325, zinc-coated |

^aUse hardened washers.

^bZinc-coated nuts tightened beyond snug or wrench tight must be furnished with a dry lubricant complying with supplementary requirement S2 in ASTM A 563.

Replace the 3rd table in the 1st paragraph of section 55-1.02A(1) with:

07-19-13

| Other Materials | |
|--|---|
| Material | Specification |
| Carbon steel for forgings, pins, and rollers | ASTM A 668/A 668M, Class D |
| Alloy steel for forgings | ASTM A 668/A 668M, Class G |
| Pin nuts | ASTM A 709/A 709M or ASTM A 563, including appendix X1 ^a |
| Carbon-steel castings | ASTM A 27/A 27M, Grade 65-35, Class 1 |
| Malleable iron castings | ASTM A 47/A 47M, Grade 32510 |
| Gray iron castings | ASTM A 48, Class 30B |
| Carbon steel structural tubing | ASTM A 500/A 500M, Grade B, ASTM A 501, ASTM A 847/A 847M, or ASTM A 1085 |
| Steel pipe ^b | ASTM A 53, Type E or S, Grade B; ASTM A 106, Grade B; or ASTM A 139, Grade B |
| Stud connectors | ASTM A 108 |

^aZinc-coated nuts tightened beyond snug or wrench tight must be furnished with a dry lubricant complying with supplementary requirement S2 in ASTM A 563.

^bHydrostatic testing will not apply.

Replace the table in the 1st paragraph in section 55-1.02A(2) with:

07-19-13

| Material complying with ASTM A 709/A 709M | CVN impact value (ft-lb at temperature) |
|--|--|
| Grade 36 | 15 at 40 °F |
| Grade 50 ^a (Thickness up to 2 inches) | 15 at 40 °F |
| Grade 50W ^a (Thickness up to 2 inches) | 15 at 40 °F |
| Grade 50 ^a (Thickness over 2 inches up to 4 inches) | 20 at 40 °F |
| Grade 50W ^a (Thickness over 2 inches up to 4 inches) | 20 at 40 °F |
| Grade HPS 50W ^a (Thickness up to 4 inches) | 20 at 10 °F |
| Grade HPS 70W (Thickness up to 4 inches) | 25 at -10 °F |
| Grade 100 (Thickness of 2-1/2 inches or less) | 25 at 0 °F |
| Grade 100W (Thickness over 2-1/2 inches up to 4 inches) | 35 at 0 °F |
| Grade HPS 100W (Thickness of 2-1/2 inches or less) | 25 at -30 °F |
| Grade HPS 100W (Thickness over 2-1/2 inches up to 4 inches) | 35 at -30 °F |

^aIf the material yield strength is more than 65,000 psi, reduce the temperature for the CVN impact value 15 degrees F for each increment of 10,000 psi above 65,000 psi.

Replace the 1st sentence of the 1st paragraph in section 55-1.02A(5) with:

07-19-13

Steel, gray iron, and malleable iron castings must have continuous fillets cast in place in reentrant angles.

Delete the 3rd and 4th sentences in the 2nd paragraph in section 55-1.02A(5).

07-19-13

Replace the 1st paragraph of section 55-1.02B(1) with:

07-19-13

Section 55-1.02B(1) applies to work performed at the source and at the job site.

Replace the 4th paragraph in section 55-1.02B(1) with:

07-19-13

Ends of girder stiffeners shown as tight-fit must bear on the girder flange with at least point bearing. Local clearances between the end of the stiffener and the girder flange must be at most 1/16 inch.

Replace the 1st sentence of the 5th paragraph in section 55-1.02B(1) with:

07-19-13

Fabricate floor beams, stringers, and girders having end connection angles to exact length back to back of connection angles.

Add to the 7th paragraph in section 55-1.02B(1):

07-19-13

Use low-stress stamps for fracture critical members and tension members.

Replace the 2nd sentence of the 9th paragraph in section 55-1.02B(1) with:

07-19-13

Slightly round edges and sharp corners, including edges marred, cut, or roughened during handling or erection.

Replace the 3rd paragraph in section 55-1.02B(2) with:

07-19-13

Instead of machining, you may heat straighten steel not in contact with other metal bearing surfaces if the above tolerances are met.

Replace item 2 in the list in the 1st paragraph of section 55-1.02B(3) with:

07-19-13

2. Radius of bend measured to the concave face must comply with *Manual of Steel Construction* of the AISC

Replace the 1st sentence of the 2nd paragraph in section 55-1.02B(3) with:

07-19-13

Plates to be bent to a smaller radius than specified in *Manual of Steel Construction* of the AISC must be bent hot.

Replace the introductory clause of the 2nd paragraph of section 55-1.02B(4) with:

07-19-13

Threads for pin ends and pin nuts 1-1/2 inches or more in diameter must comply with the following:

Replace the 3rd paragraph in section 55-1.02B(5) with:

07-19-13

Holes for pins must be:

1. True to the diameter specified.
2. At right angles to the member axis.
3. Parallel with each other except for pins where nonparallel holes are required.
4. Smooth and straight with the final surface produced by a finishing cut.

Replace the 1st paragraph in section 55-1.02B(6)(c) with:

07-19-13

Bolted connections using HS fastener assemblies must comply with *Specification for Structural Joints Using High-Strength Bolts* of the RCSC.

Replace the 7th paragraph in section 55-1.02B(6)(c) with:

07-19-13

For all bolts, thread stickout after tensioning must be at least flush with the outer nut face. At least 3 full threads must be located within the grip of the connection.

07-19-13

Delete the 3rd paragraph in section 55-1.02B(7)(a).

Add to section 55-1.02B(7)(a):

07-19-13

For welds indicated to be subject to tensile forces that are to receive RT, grind smooth and flush on both sides of welds before testing.

For groove weld surface profiles that interfere with NDT procedures, grind welds smooth and blend with the adjacent material.

For fillet weld surface profiles that interfere with NDT procedures, grind welds and blend the toes smoothly with the adjacent base metal.

Add to section 55-1.02B(7):

07-19-13

55-1.02B(7)(c) Steel Pedestrian Bridges

Reserved

Replace the 1st paragraph in section 55-1.02B(9) with:

07-19-13

Prepare and paint contact surfaces of HS bolted connections before assembly. Thoroughly clean all other surfaces of metal in contact to bare metal before assembly. Remove all rust, mill scale, and foreign material.

Replace the 1st sentence of the 4th paragraph in section 55-1.02B(9) with:

07-19-13

Preassemble truss work in lengths of at least 3 abutting panels and adjust members for line and camber.

Replace the 1st sentence of the 5th paragraph in section 55-1.02B(9) with:

07-19-13

Preassemble bolted splice joints for plate girders in lengths of at least 3 abutting sections and adjust abutting sections for line and camber.

Replace the 6th paragraph in section 55-1.02B(9) with:

07-19-13

Preassemble prepared splice joints for welded girders with abutting members and adjust for line and camber.

Replace the paragraphs in section 55-1.03C(1) with:

07-19-13

Reserved

Replace the 3rd sentence of the 1st paragraph in section 55-1.03C(2) with:

07-19-13

Attain full bearing on the concrete under bearing assemblies.

59 PAINTING

11-15-13

Replace "SSPC-SP 10" at each occurrence in section 59 with:

SSPC-SP 10/NACE no. 2

10-19-12

Replace "SSPC-SP 6" at each occurrence in section 59 with:

SSPC-SP 6/NACE no. 3

10-19-12

Replace "SSPC-CS 23.00" at each occurrence in section 59 with:

SSPC-CS 23.00/AWS C 2.23M/NACE no. 12

10-19-12

Replace "*Specification for Structural Joints Using ASTM A325 or A 490 Bolts*" in the 1st paragraph of section 59-2.01C(1) with:

Specification for Structural Joints Using High-Strength Bolts

07-19-13

Replace "SSPC-QP 3 or AISC SPE, Certification P-1 Enclosed" in item 3 in the list in the 1st paragraph of section 59-2.01D(1) with:

AISC-420-10/SSPC-QP 3 (Enclosed Shop)

10-19-12

Replace "*Specification for Structural Joints Using ASTM A325 or A 490 Bolts*" in the 1st paragraph of section 59-2.02 with:

Specification for Structural Joints Using High-Strength Bolts

07-19-13

Replace the paragraphs in section 59-2.03A with:

Clean and paint all exposed structural steel and other metal surfaces.

10-19-12

You must provide enclosures for cleaning and painting structural steel. Cleaning and painting of new structural steel must be performed in an Enclosed Shop as defined in AISC-420-10/SSPC-QP 3. Maintain atmospheric conditions inside enclosures within specified limits.

Except for blast cleaning within closed buildings, perform blast cleaning and painting during daylight hours.

Add to section 59-2.03B:

07-19-13

59-2.03B(3) Containment Systems

59-2.03B(3)(a) General

Construct containment systems when disturbing existing paint systems during bridge rehabilitation.

The containment system must be one of the following:

1. Ventilated containment system
2. Vacuum-shrouded surface preparation equipment and drapes and ground covers
3. Equivalent containment system if authorized

The containment system must contain all water, resulting debris, and visible dust produced when the existing paint system is disturbed.

Properly maintain the containment system while work is in progress and do not change the containment system unless authorized.

Containment systems over railroad property must provide the minimum clearances as specified in section 5-1.20C for the passage of railroad traffic.

59-2.03B(3)(b) Ventilated Containment Systems

59-2.03B(3)(b)(i) General

If flexible framing is used, support and fasten it to (1) prevent the escape of abrasive and blast materials due to whipping from traffic or wind and (2) maintain clearances.

If the wind speed reaches 50 mph or greater, relieve the wind pressure on the containment system using an authorized method.

59-2.03B(3)(b)(ii) Design Criteria

Scaffolding or supports for the ventilated containment system must not extend below the vertical clearance level nor to the ground line at locations within the roadbed.

For truss-type bridges, all connections of the ventilated containment system to the existing structure must be made through the deck, girder, stringer, or floor beam system. No connections are allowed that will cause bending stresses in a truss member.

The ventilated containment system must comply with section 7-1.02K(6)(e).

The minimum total design load for the ventilated containment system must consist of the sum of the dead and live vertical loads.

Dead and live loads are as follows:

1. Dead load must consist of the actual load of the ventilated containment system
2. Live loads for bridges with only spot blast cleaning work must consist of:
 - 2.1. Uniform load of at least 25 psf applied over the supported area
 - 2.2. Moving concentrated load of 1000 lb to produce maximum stress in the main supporting elements of the ventilated containment system
3. Live loads for bridges with 100 percent blast cleaning to bare metal must consist of:
 - 3.1. Uniform load of at least 45 psf, which includes 20 psf of sand load, applied over the supported area
 - 3.2. Moving concentrated load of 1000 lb to produce maximum stress in the main supporting elements of the ventilated containment system

Assumed horizontal loads do not need to be included in the design of the ventilated containment system.

Maximum allowable stresses must comply with section 48-2.01D(3)(c).

59-2.03B(3)(b)(iii) Ventilation

The ventilation system in the ventilated containment system must be of the forced input airflow type with fans or blowers.

Negative air pressure must be employed within the ventilated containment system and will be verified by visual methods by observing the concave nature of the ventilated containment system while taking into account wind effects or by using smoke or other visible means to observe airflow. The input airflow must be properly balanced with the exhaust capacity throughout the range of operations.

The exhaust airflow of the ventilation system in the ventilated containment system must be forced into wet or dry dust collectors or bag houses.

Replace item 1 in the list in the 2nd paragraph of section 59-2.03C(1) with:

10-19-12

1. Apply a stripe coat of undercoat paint on all edges, corners, seams, crevices, interior angles, junctions of joining members, weld lines, and similar surface irregularities. The stripe coat must completely hide the surface being covered. If spot blast cleaning portions of the bridge, apply the stripe coat of undercoat paint before each undercoat and follow with the undercoat as soon as practical. If removing all existing paint from the bridge, apply the undercoat first as soon as practical and follow with the stripe coat of undercoat paint for each undercoat.

Replace the heading of section 59-2.03C(2) with:

04-19-13

Zinc Coating System

Add to section 59-2.03C(2)(a):

04-19-13

Coatings for new structural steel and connections between new and existing structural steel must comply with the requirements shown in the following table:

Zinc Coating System

| Description | Coating | Dry film thickness (mils) |
|--|--|--------------------------------|
| All new surfaces: | | |
| Undercoat | Inorganic zinc primer, AASHTO M 300 Type I or II | 4–8 |
| Finish coat ^a | Exterior grade latex ^b , 2 coats | 2 minimum each coat, 4–8 total |
| Total thickness, all coats | | 8–14 |
| Connections to existing structural steel:^c | | |
| Undercoat | Inorganic zinc primer, AASHTO M 300 Type I or II | 4–8 |
| Finish coat ^a | Exterior grade latex ^b , 2 coats | 2 minimum each coat, 4–8 total |
| Total thickness, all coats | | 8–14 |

^aIf no finish coats are described, a final coat of inorganic zinc primer is required.

^bExterior grade latex must comply with section 91-2.02 unless otherwise specified.

^cIncludes the following locations:

1. New and existing contact surfaces
2. Existing member surfaces under new HS bolt heads, nuts, or washers
3. Bare surfaces of existing steel after trimming, cutting, drilling, or reaming
4. Areas within a 4-inch radius from the point of application of heat for welding or flame cutting

Replace "*Specification for Structural Joints Using ASTM A325 or A 490 Bolts*" in the 7th paragraph of section 59-2.03C(2)(b)(i) with:

07-19-13

Specification for Structural Joints Using High-Strength Bolts

Add to section 59-2.03C:

04-19-13

59-2.03C(3) Moisture-Cured Polyurethane Coating System

Reserved

59-2.03C(4) State Specification Paint Waterborne Coating System

59-2.03C(4)(a) General

The State Specification PWB coating system for existing structural steel must comply with the requirements shown in the following table:

| State Specification PWB Coating System | | | |
|---|----------------------------|---------------------------------|---------------------------|
| Surface | Description | State Specification PWB Coating | Dry film thickness (mils) |
| Surfaces cleaned to bare metal ^a : | 1st undercoat | 145 | 2-3 |
| | 2nd undercoat | 146 | 2-3 |
| | 1st finish coat | 171 | 1.5-3 |
| | 2nd finish coat | 172 | 1.5-3 |
| | Total thickness, all coats | -- | 7-12 |
| Existing painted surfaces to be topcoated: | Undercoat | 146 | 2-3 |
| | 1st finish coat | 171 | 1.5-3 |
| | 2nd finish coat | 172 | 1.5-3 |
| | Total thickness, new coats | -- | 5-9 |

^aIncludes locations of spot blast cleaning

59-2.03C(4)(b) Finish Coats

11-15-13

Reserved

Add to section 59-5.01:

04-19-13

Where specified, prepare and paint sign structures under sections 59-2 and 59-3.

Instead of submitting proof of the certification complying with SSPC-QP 1, you may submit documentation with the painting quality work plan showing compliance with the requirements in section 3 of SSPC-QP 1.

Instead of submitting proof of the certification complying with SSPC-QP 2, you may submit documentation with the painting quality work plan showing compliance with the requirements in sections 4.2 through 4.4 of SSPC-QP 2, Category A.

Instead of submitting proof of the certification complying with AISC-420-10/SSPC-QP 3 (Enclosed Shop), you may submit documentation with the painting quality work plan showing compliance with the requirements in sections 5 through 18 of AISC-420-10/SSPC-QP3.

Replace the paragraphs of section 59-5.03 with:

04-19-13

59-5.03A General

You may prepare and paint sign structures before or after erection. After erection, repair damaged paint to the satisfaction of the Engineer.

The total dry film thickness of finish coats on contact surfaces of galvanized HS bolted connections (1) must be from 1 to 4 mils and (2) may be applied in 1 application.

59-5.03B Undercoating of Ungalvanized Surfaces

Blast-cleaned surfaces must receive a single undercoat consisting of an inorganic zinc coating as specified in AASHTO M 300, Type I or Type II, except:

1. The first 2 sentences of section 5.6 do not apply
2. Section 5.6.1 does not apply

If you propose to use a coating that is not on the Authorized Material List, submit the required documentation specified in section 5.6 of AASHTO M 300. Allow 30 days for the Engineer's review.

59-5.03C Testing of Inorganic Zinc Coating

Perform adhesion and hardness testing no sooner than 72 hours after application of the single undercoat of inorganic zinc coating.

59-5.03D Finish Coating

The exposed area of inorganic zinc coating must receive a minimum of 2 finish coats of exterior grade latex paint.

The 1st finish coat color must match no. 24558 of FED-STD-595. The 2nd finish coat color must match no. 24491 of FED-STD-595. The total dry film thickness of the applications of the 2nd finish coat must be not less than 2 mils.

Replace section 59-7 with:

07-19-13

59-7 STAINING CONCRETE AND SHOTCRETE

59-7.01 GENERAL

59-7.01A General

59-7.01A(1) Summary

Section 59-7.01 includes specifications for preparing and staining concrete and shotcrete surfaces using an acid stain.

59-7.01A(2) Definitions

Reserved

59-7.01A(3) Submittals

Submit stain manufacturer's product data and application instructions at least 7 days before starting staining activities.

59-7.01A(4) Quality Control and Assurance

Reserved

59-7.01B Materials

59-7.01B(1) General

Reserved

59-7.01B(2) Stain

Stain must:

1. Be a water-based solution of inorganic metallic salts
2. Contain dilute acid that penetrates and etches the concrete or shotcrete surface
3. Be a commercial quality product designed specifically for exterior applications
4. Produce abrasion-resistant color deposits

59-7.01B(3) Sealer

Reserved

59-7.01B(4) Joint Sealing Compound

Reserved

59-7.01C Construction

59-7.01C(1) General

Seal joints between concrete and shotcrete surfaces to be stained and adjacent metal with joint sealing compound before applying the stain.

Test surfaces for acceptance of the stain before applying the stain. Clean surfaces that resist accepting the stain and retest until passing.

Apply the stain under the manufacturer's instructions.

Before staining, the concrete or shotcrete surfaces must be:

1. At least 28 days old
2. Prepared under SSPC-SP 13/NACE no. 6
3. Thoroughly dry

Apply the stain uniformly to avoid excessive rundown. Work the stain into the concrete using a nylon bristle brush in a circular motion.

After the last coat of stain has dried, rinse stained surfaces with water and wet scrub with a stiff bristle nylon brush until the rinse water runs clear. Collect all rinse water.

Protect adjacent surfaces during staining.

Thoroughly cure each application of the stain and correct skips, holidays, thin areas, or other deficiencies before the next application.

Drips, puddles, or other irregularities must be worked into the concrete or shotcrete surface.

59-7.01C(2) Test Panel

For staining concrete or shotcrete, stain a test panel complying with section 51-1.01D(3).

For staining sculpted shotcrete, stain a test panel complying with section 53-3.01D(3).

The test panel must be:

1. Stained using the same personnel, materials, equipment and methods to be used in the work
2. Accessible for viewing
3. Displayed in an upright position near the work
4. Authorized for staining before starting the staining work

If ordered, construct additional test panels until a satisfactory color is attained.

The Engineer uses the authorized stained test panel to determine the acceptability of the stained surface.

Dispose of the test panels after the staining work is complete and authorized. Notify the Engineer before disposing of the test panels.

59-7.01D Payment

Not Used

59-7.02 SCULPTED SHOTCRETE AND TEXTURED CONCRETE

59-7.02A General

59-7.02A(1) Summary

Section 59-7.02 includes specifications for preparing and staining sculpted shotcrete and textured concrete surfaces using an acid stain.

59-7.02A(2) Definitions

Reserved

59-7.02A(3) Submittals

59-7.02A(3)(a) General

Reserved

59-7.02A(3)(b) Experience Qualifications

Submit the following documentation of the staining subcontractor's experience at least 10 days before the preconstruction meeting:

1. Summary of the staining subcontractor's experience that demonstrates compliance with section 59-7.02A(4)(b).
2. List of at least 3 projects completed in the last 5 years that demonstrate the staining subcontractor's ability to stain textured concrete or sculpted shotcrete surfaces similar to the textured concrete or sculpted shotcrete for this project. For each project include:
 - 2.1. Project description
 - 2.2. Name and phone number of the owner
 - 2.3. Staining completion date
 - 2.4. Color photos of the completed stained surface

59-7.02A(3)(c) Installation Plan

Submit an installation plan at least 10 days before the preconstruction meeting. The installation plan must include details for preparing and staining the textured concrete or sculpted shotcrete to achieve the required color, including:

1. Number of applications that will be used to apply the stain
2. For each application of the stain, a description of:
 - 2.1. Manufacturer, color, finish, and percentage strength mixture of the stain that will be applied
 - 2.2. Methods and tools that will be used to apply the stain
3. Methods for protecting adjacent surfaces during staining
4. Rinse water collection plan for containing all liquid, effluent, and residue resulting from preparing and staining textured concrete or sculpted shotcrete

59-7.02A(4) Quality Control and Assurance

59-7.02A(4)(a) General

Reserved

59-7.02A(4)(b) Contractor Qualifications

The staining subcontractor must:

1. Have experience in staining textured concrete or sculpted shotcrete surfaces to simulate the appearance of natural rock formations or stone masonry
2. Have successfully completed at least 3 projects in the past 5 years involving staining of concrete or sculpted shotcrete surfaces similar to the textured concrete or sculpted shotcrete for this project

59-7.02A(4)(c) Preconstruction Meeting

Before starting staining activities, conduct a meeting to discuss the installation plan. Meeting attendees must include the Engineer and all staining subcontractors.

59-7.02B Materials

Not Used

59-7.02C Construction

Not Used

59-7.02D Payment

Prepare and stain concrete and prepare and stain shotcrete are measured by the area of the vertical or sloped wall face stained.

Replace "solider" in the 5th paragraph of section 59-9.03 with:

04-19-13

soldier

Replace section 59-11 with:

07-19-13

59-11 STAINING GALVANIZED SURFACES

Reserved

Replace section 59-12 with:

07-19-13

59-12 ROCK STAINING

59-12.01 GENERAL

59-12.01A Summary

Section 59-12 includes specifications for applying stain to the exterior surface of landscape boulders, native rock that has been damaged or scarred, rock energy dissipaters, rock slope protection and gabion surfaces.

59-12.01B Submittals

Submit the following:

1. Work plan showing methods to control overspray and spillage, and to protect adjacent surfaces
2. Product data including the manufacturer's product sheet and the instructions for the application of the stain

59-12.01C Quality Control and Assurance

59-12.01C(1) General

Reserved

59-12.01C(2) Test Plot

Apply the stain to a test plot rock area of at least 3 by 3 feet at a location designated by the Engineer. Notify the Engineer at least 7 days before staining the test plot. Prepare and stain the test plot with the same materials, tools, equipment, and methods to be used in staining the final surfaces. Separate test plots are required for staining rock slope protection and native rock.

If ordered, prepare additional test plots. Additional test plots are change order work.

Obtain authorization of the test plot before starting the staining work. Use the authorized test plot as the standard for comparison in determining acceptability of staining. If the test plot is not incorporated into the work and the Engineer determines it is no longer needed, dispose of it.

59-12.02 MATERIALS

59-12.02A General

Reserved

59-12.02B Stain

Reserved

59-12.03 CONSTRUCTION

59-12.03A General

Reserved

59-12.03B Preparation

Before applying the stain:

AA

65 CONCRETE PIPE

07-19-13

Replace the 2nd paragraph of section 65-1.01 with:

10-19-12

Concrete pipe includes all necessary elbows, wyes, tees, other branches, concrete collars or tees, and reinforcement.

Replace section 65-2.02D with:

07-19-13

65-2.02D Reserved

AA

70 MISCELLANEOUS DRAINAGE FACILITIES

07-19-13

Replace section 70-5.02A(2) with:

01-20-12

70-5.02A(2) Plastic Flared End Sections

Plastic flared end sections must comply with ASTM D 3350.

Replace "40-1.03N" in item 2.4 of the 1st paragraph of section 70-5.06C with:

07-19-13

40-1.03K

Replace the 2nd, 3rd, and 4th paragraphs of section 70-7.02B with:

01-18-13

Before shipping, the exterior surfaces of the casing must be cleaned, primed, and coated to comply with ANSI/AWWA C213 or ANSI/AWWA C214.

Wrapping tape for repairing damaged coating and wrapping field joints and fittings must be a pressure-sensitive PVC or polyethylene tape with a minimum thickness of 50 mils, 2 inches wide.

Add to section 70-7.03:

01-18-13

Repair damaged coating on the casing and wrap field joints and fittings with wrapping tape as follows:

1. Before wrapping, thoroughly clean and prime the pipe casing, joints, and fittings under the tape manufacturer's instructions.
2. Wrap the tape tightly with 1/2 uniform lap, free from wrinkles and voids to provide not less than a 100-mil thickness.
3. Wrapping at joints must extend at least 6 inches over adjacent pipe casing coverings. Apply tension such that the tape will conform closely to contours of the joint.

detector: Detector as defined in the *California MUTCD*.

electrolier: Assembly of a lighting standard and luminaire.

flasher: Device for opening and closing signal circuits at a repetitive rate.

flashing beacon control assembly: Assembly of switches, circuit breakers, terminal blocks, flasher, wiring, and other necessary electrical components housed in a single enclosure for operating a beacon.

inductive loop detector: Detector capable of being actuated by an inductance change caused by a vehicle passing or standing over the loop.

lighting standard: Pole and mast arm supporting the luminaire.

luminaire: Assembly that houses the light source and controls the light emitted from the light source.

magnetic detector: Detector capable of being actuated by an induced voltage caused by a vehicle passing through the earth's magnetic field.

powder coating: Coating applied electrostatically using exterior-grade UV-stable polymer powder.

pretimed controller assembly: Assembly operating traffic signals under a predetermined cycle length.

pull box: A box with a cover that is installed in an accessible place in a run of conduit to facilitate the pulling in of wires or cables.

signal face: Signal face as defined in the *California MUTCD*.

signal head: Signal head as defined in the *California MUTCD*.

signal indication: Signal indication as defined in the *California MUTCD*.

signal section: Signal section as defined in the *California MUTCD*.

signal standard: Pole and mast arm supporting 1 or more signal faces with or without a luminaire mast arm.

traffic-actuated controller assembly: Assembly for operating traffic signals under the varying demands of traffic as registered by detector actuation.

traffic phase: Signal phase as defined in the *California MUTCD*.

vehicle: Vehicle as defined in the *California Vehicle Code*.

Replace the paragraphs in section 86-1.02 with:

07-19-13

Comply with 8 CA Code of Regs § 2299 et seq.

Electrical equipment must comply with one or more of the following standards:

1. ANSI
2. ASTM
3. EIA
4. NEMA
5. NETA
6. UL
7. Public Utilities Commission, General Order No. 95, "Rules for Overhead Electrical Sign Construction"
8. Public Utilities Commission, General Order No. 128, "Rules for Construction of Underground Electric Supply and Communication Systems"

Materials and workmanship must comply with:

1. FCC rules

2. ITE standards
3. NEC
4. California Electrical Code

Electrical equipment and materials must be NRTL certified wherever applicable.

Replace the paragraphs in section 86-1.03 with:

07-19-13

Submit a schedule of values within 15 days after Contract approval.

Determine the quantities required to complete the work. Submit the quantities as part of the schedule of values.

Provide a schedule of values for each lump sum bid item.

Do not include costs for the traffic control system in the schedule of values.

The schedule of values must include the type, size, and installation method for:

1. Foundations
2. Standards and poles
3. Conduit
4. Pull boxes
5. Conductors and cables
6. Service equipment enclosures
7. Telephone demarcation cabinets
8. Vehicle signal heads and hardware
9. Pedestrian signal heads and hardware
10. Push buttons
11. Loop detectors
12. Luminaires and lighting fixtures
13. Materials shown in the quantity tables on plan sheets labeled *E*

Replace the paragraphs in section 86-1.04 with:

07-19-13

Within 15 days of Contract approval, submit a list of equipment and materials that you propose to install. Submit the list before shipping equipment or materials to the job site. The list must include the following information:

1. Manufacturer's name
2. Make and model number
3. Month and year of manufacture
4. Lot and serial numbers
5. Dimensions
6. List of components
7. Manufacturer's installation instructions
8. Contract number
9. Your contact information

Supplement the list with 2 copies of the following data:

1. Schematic wiring diagrams
2. Scale drawings of cabinets showing location and spacing of shelves, terminal blocks, and equipment, including dimensions
3. Operation manual

Electrical equipment constructed as shown does not require detailed drawings and diagrams.

Submit 3 sets of computer-generated schematic wiring diagrams for the cabinet.

Place the schematic wiring diagram in a heavy-duty plastic envelope and attach it to the inside of the cabinet door.

Prepare diagrams, plans, and drawings using graphic symbols in IEEE 315, "Graphic Symbols for Electrical and Electronic Diagrams."

Replace the 5th paragraph of section 86-2.04B(2) with:

07-19-13

HS bolts, nuts, and flat washers used to connect slip base plates must comply with the requirements for HS fastener assemblies for use in structural steel joints in section 55-1.02A(1) except rotational capacity testing and tension testing are not required.

07-19-13

Delete the row for standard Type 36-20A in the table in the 6th paragraph of section 86-2.04B(2).

Replace the 10th paragraph of section 86-2.04B(2) with:

07-19-13

Bolted connections attaching signal or luminaire arm to the pole must be considered slip critical. Galvanized faying surfaces of plates on luminaire arm, signal arm, and pole must be roughened by hand using a wire brush before assembly and must comply with requirements for Class C surface conditions for slip-critical connections in *Specification for Structural Joints Using High-Strength Bolts* of the RCSC. Coatings for faying surfaces must comply with the RCSC specification for Class B coatings.

Replace the 1st sentence of item 8 in the list in the 1st paragraph of section 86-2.04B(3) with:

07-19-13

During manufacturing, longitudinal seams on vertical tubular members of cantilevered support structures must be within 90 degrees circumferentially of the center of the longest mast arm connection.

07-19-13

Delete item 15.3 in the list in the 1st paragraph of section 86-2.04B(3).

Add between "Exposed" and "conduit" in the 2nd paragraph of section 86-2.05B:

07-19-13

Type 1

Replace the 1st sentence of the 10th paragraph of section 86-2.05C with:

07-19-13

After installing conduit, install the pull tape.

Replace the 1st sentence of the 15th paragraph of section 86-2.05C with:

11-15-13

Conduit runs shown to be located behind curbs may be installed in the street within 3 feet of and parallel to the face of the curb by the trenching in pavement method.

Replace the 1st and 2nd sentences of the 2nd paragraph of section 86-2.05D with:

07-19-13

Install an expansion-deflection fitting for expansion joints with a 1-1/2-inch movement rating. The fitting must be watertight and include a molded neoprene sleeve, a bonding jumper, and 2 silicon bronze or zinc-plated iron hubs.

Replace section 86-2.06 with:

07-19-13

86-2.06 PULL BOXES

86-2.06A General

86-2.06A(1) Cover Marking

The cover marking must be clearly defined, uniform in depth, and parallel to either the long or short sides of the cover.

Marking letters must be 1 to 3 inches high.

Before galvanizing steel or cast iron cover, apply marking by one of the following methods:

1. Use cast iron strip at least 1/4 inch thick with letters raised a minimum of 1/16 inch. Fasten strip to cover with 1/4-inch flathead stainless steel machine bolts and nuts. Peen bolts after tightening.
2. Use sheet steel strip at least 0.027 inch thick with letters raised a minimum of 1/16 inch. Fasten strip to cover by spot welding, tack welding, or brazing, with 1/4-inch stainless steel rivets or 1/4-inch roundhead stainless steel machine bolts and nuts. Peen bolts after tightening.
3. Bead weld the letters on cover such that the letters are raised a minimum of 3/32 inch.

86-2.06A(2) Installation and Use

Space pull boxes no more than 200 feet apart. You may install additional pull boxes to facilitate the work.

You may use a larger standard size pull box than that shown on the plans or specified.

A pull box in ground or sidewalk area must be installed as follows:

1. Embed bottom of the pull box in crushed rock.
2. Place a layer of roofing paper on the crushed rock.
3. Place grout over the layer of roofing paper. Grout must be 0.50 to 1 inch thick and sloped toward the drain hole.
4. Make a 1-inch drain hole in the center of the pull box through the grout and roofing paper.
5. Place grout between the pull box and the pull box extension, and around conduits.

The top of the pull box must be flush with the surrounding grade or the top of an adjacent curb, except in unpaved areas where the pull box is not immediately adjacent to and protected by a concrete foundation, pole, or other protective construction. Place the pull box 1-1/4 inches above the surrounding grade. Where practical, place a pull box shown in the vicinity of curbs or adjacent to a standard on the side of the foundation facing away from traffic. If a pull box is installed in a sidewalk area, adjust the depth of the pull box so that the top of the pull box is flush with the sidewalk.

Reconstruct the sump of an existing pull box if disturbed by your activities. Remove old grout and replace with new if the sump was grouted.

86-2.06B Non-Traffic Pull Boxes

Reserved

86-2.06C Traffic Pull Boxes

The traffic pull box and cover must comply with ASTM C857, "Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures," for HS20 loading. You must be able to place the load anywhere on the box and cover for 1 minute without causing cracks or permanent deformations.

Frame must be anchored to the box with 1/4 by 2-1/4 inch concrete anchors. Four concrete anchors must be included for No. 3-1/2(T) pull box; one placed in each corner. Six concrete anchors must be included for No. 5(T) and No. 6(T) pull boxes; one placed in each corner and one near the middle of each of the longer sides.

Nuts must be zinc-plated carbon steel, vibration resistant, and have a wedge ramp at the root of the thread.

After installation of traffic pull box, install the steel cover and keep it bolted down when your activities are not in progress at the pull box. When the steel cover is placed for the final time, the cover and Z bar frame must be cleaned of debris and tightened securely.

Steel cover must be countersunk approximately 1/4 inch to accommodate the bolt head. When tightened, the bolt head must not exceed more than 1/8 inch above the top of the cover.

Concrete placed around and under traffic pull boxes must be minor concrete.

Replace the 11th row in the table in the 1st paragraph of section 86-2.08B with:

07-19-13

| | | | | | |
|----------------------------|------------------------------------|-----|------|-----|----|
| Grounded circuit conductor | Pedestrian push buttons | Wht | Blk | NBR | 14 |
| | Signals and multiple lighting | Wht | None | NBR | 10 |
| | Flashing beacons and sign lighting | Wht | None | NBR | 12 |
| | Lighting control | Wht | None | C-3 | 14 |
| | Service | Wht | None | NBR | 14 |

Replace the 1st sentence of the 1st paragraph of section 86-2.08C with:

07-19-13

Circuit conductors, connectors, and terminals must be UL or NRTL listed and rated for 600 V(ac) operation.

Add to the beginning of section 86-2.09A:

07-19-13

Provide enough traffic signal light conductors for functional operation of the signal. Provide 3 spare conductors in all conduits containing traffic signal light conductors.

Replace the paragraphs in section 86-2.09C with:

07-19-13

Connectors must be crimp type. Use a manufacturer-recommended tool for connectors and terminals to join conductors. Comply with SAE-AS7928.

Terminate stranded conductors smaller than no. 14 in crimp style terminal lugs.

Terminate field conductors no. 12 and smaller with spade type terminals. Terminate field conductors no. 10 and larger with spade type or ring type terminals.

Replace the value for resistivity in the table in the 6th paragraph of section 86-2.09E with:

07-19-13

25 x 10¹³ Ω per inch, minimum

Add between "the" and "head" in the 3rd sentence of the 2nd paragraph of 86-2.09F:

connector

07-19-13

Replace "project" in the 3rd paragraph of section 86-2.11A with:

work

10-19-12

Replace "Contract" in item 2 in the list in the 11th paragraph of section 86-2.11A with:

work

10-19-12

Delete the 12th paragraph of section 86-2.11A.

07-19-13

Replace section 86-2.11C with:

07-19-13

86-2.11C Electrical Service for Booster Pumps

Provide electrical service from the service point to the booster pump.

Furnish conductors, conduit, and pull boxes from the service point to the booster pump.

Do not use Type 3 conduit unless shown otherwise.

Replace section 86-2.14A with:

07-19-13

86-2.14A General

Deliver material and equipment for acceptance testing to either METS or a testing location as ordered.

Allow 30 days for testing. The Department notifies you when testing is complete. You must pick up the material or equipment from the test site and deliver it to the job site.

If material or equipment is rejected, allow 30 days for retesting. The retesting period starts when replacement material or equipment is delivered to the test site.

If material or equipment submitted for testing does not comply with the specifications, remove it within 5 business days after you are notified that the equipment is rejected. If equipment is not removed within that period, the Department may ship it to you and deduct the shipping cost.

Testing and quality control procedures for traffic signal controller assemblies must comply with NEMA TS standards for traffic control systems.

Replace the 2nd paragraph of section 86-3.02A(1) with:

The Department furnishes the BBS components under section 6-2.03.

07-19-13

Replace the 9th paragraph of section 86-3.02B with:

07-19-13

The couplings between the external cabinet and Model 332L cabinet must include a conduit for power connections between the 2 cabinets. Couplings must include:

1. 2-inch nylon-insulated steel chase nipple
2. 2-inch sealing steel locknut
3. 2-inch nylon-insulated steel bushing

Delete item 1.3 in the list in the 7th paragraph of section 86-3.04A.

07-19-13

Replace the 2nd paragraph of section 86-4.01A with:

07-19-13

The housing must not fail structurally as described in the following table:

Housing Structural Failure

| Housing type | Test method | Description of structural failure |
|--------------|---------------------|--|
| Metal | California Test 666 | Fracture within the housing assembly or deflection of more than half the lens diameter of the signal section during the wind load test |
| Plastic | California Test 605 | Fracture within the housing assembly or deflection of more than 10 degrees in either the vertical or horizontal plane after the wind load has been removed from the front of the signal face or deflection of more than 6 degrees in either the vertical or horizontal plane after the wind load has been removed from the back of the signal face |

Replace the 1st sentence of section 86-4.01A(1) with:

07-19-13

Each metal housing must have a metal visor.

Replace the 1st sentence of section 86-4.01A(2) with:

07-19-13

Each plastic housing must be molded in 1 piece or fabricated from 2 or more pieces and joined into a single piece.

Delete item 1 in the list in section 86-4.01D(1)(b).

07-19-13

Replace the paragraphs in section 86-4.01D(1)(c)(i) with:

07-19-13

LED signal modules must be on the Authorized Material List for LED traffic signals.

The Department tests modules under section 86-2.14A, ANSI/ASQ Z1.4, and:

1. California Test 604 for LED and circular LED signal modules
2. California Test 3001 for arrow, U-turn, and bicycle LED signal modules

The LED signal modules submitted for testing must be typical production units. LEDs must be spread evenly across the module.

The Department may test the modules on all parameters specified in section 86-4.01D.

Replace the 1st and 2nd sentences of the 3rd paragraph of 86-4.01D(2)(b) with:

The electrical connection for each flashing LED signal module must be 4 secured, color-coded, jacketed copper wires. The wire must comply with the NEC. 07-19-13

Replace the heading of section 86-4.02 with:

PROGRAMMED VISIBILITY VEHICLE SIGNAL SECTION

07-19-13

Replace "face" in the 1st paragraph of section 86-4.02 with:

section

07-19-13

Add before the 1st sentence in section 86-4.03A:

The pedestrian signal face must be Type A.

07-19-13

Replace the 1st sentence of the 2nd paragraph of section 86-4.03B with:

The Department tests the pedestrian signal's front screen in a horizontal position with its edges supported.

07-19-13

Delete items 1 and 4 in the list in section 86-4.03I(1)(b).

07-19-13

Replace the paragraphs of section 86-4.03I(1)(c)(i) with:

The LED PSF module must be on the Authorized Material List for LED traffic signals.

The Department tests LED PSF modules under section 86-2.14A, ANSI/ASQ Z1.4, and California Test 606.

The LED PSF modules submitted for testing must be representative of typical production units.

The Department may test the modules on all parameters specified in section 86-4.03I.

07-19-13

Replace item 1 in the list in the 1st paragraph of section 86-4.03I(2) with:

1. Not include reflectors.

07-19-13

Replace item 6 in the list in the 1st paragraph of section 86-4.03I(2) with:

07-19-13

6. Be able to replace signal lamp optical units and pedestrian signal faces with LEDs.

Replace the table titled "Chromaticity Standards (CIE Chart)" in the 16th paragraph of section 86-4.03I(2) with:

07-19-13

Chromaticity Standards (CIE Chart)

| | |
|----------------|--|
| Upraised hand | X: not greater than 0.659 or less than 0.600 Y: not greater than 0.390 or less than 0.331 Y= 0.990-X |
| Walking person | X: not greater than 0.440 or less than 0.280 Y: not greater than 0.0483 + 0.7917(X) or less than 0.0983 + 0.7917(X) |

Add between "beacon" and "must" in the 1st sentence of section 86-4.05:

07-19-13

signal face

Delete "face" in item 1 in the list in the 1st paragraph of section 86-4.05.

07-19-13

Replace the row for viscosity in the table in the 2nd paragraph of section 86-5.01A(3)(c) with:

07-19-13

| | | |
|---|--------|--------------|
| Viscosity, Brookfield Thermosel, no. 27 Spindle, 20 rpm, 190 °C | D 4402 | 2.5–3.5 Pa·s |
|---|--------|--------------|

Replace the paragraph in section 86-5.01A(3)(d) with:

07-19-13

Use epoxy sealant for repair work in and around sawcuts housing inductive loops.

Replace "all loop conductors" in the 3rd paragraph of section 86-5.01A(4) with:

07-19-13

the detector lead-in cable

Replace "Encase the loop wires" in the 1st sentence of the 3rd paragraph of section 86-5.01A(5) with:

07-19-13

The loop wires must be encased

Replace the row for hydraulic bursting strength in the table in the 2nd paragraph of section 88-1.02B with:

10-19-12

| | | |
|---------------------------------------|-------------|-----|
| Puncture strength, lb min | ASTM D 6241 | 310 |
| Trapezoid tearing strength, lb min | ASTM D 4533 | 56 |

Replace the 3rd paragraph in section 88-1.02C with:

10-19-12

Geocomposite wall drain must be from 0.25 to 2 inches thick.

Replace the value for permittivity of woven fabric in the table in the 1st paragraph of section 88-1.02E with:

01-20-12

0.05

Replace the value for apparent size opening of nonwoven fabric in the table in the 1st paragraph of section 88-1.02E with:

01-20-12

0.012

Replace the table in the 1st paragraph of section 88-1.02G with:

01-20-12

Sediment Filter Bag

| Property | Test | Values | |
|--|-------------|---------|----------|
| | | Woven | Nonwoven |
| Grab breaking load, lb, 1-inch grip min, in each direction | ASTM D 4632 | 200 | 250 |
| Apparent elongation, percent min, in each direction | ASTM D 4632 | 10 | 50 |
| Water flow rate, gal per minute/sq ft min and max average roll value | ASTM D 4491 | 100-200 | 75-200 |
| Permittivity, sec ⁻¹ min | ASTM D 4491 | 1.0 | 1.0 |
| Apparent opening size, inches max average roll value | ASTM D 4751 | 0.023 | 0.012 |
| Ultraviolet resistance, % min retained grab breaking load, 500 hr. | ASTM D 4355 | 70 | 70 |

Replace the table in the 1st paragraph of section 88-1.02H with:

01-20-12

Temporary Cover

| Property | Test | Values | |
|--|-------------|--------|----------|
| | | Woven | Nonwoven |
| Grab breaking load, lb, 1-inch grip min, in each direction | ASTM D 4632 | 200 | 200 |
| Apparent elongation, percent min, in each direction | ASTM D 4632 | 15 | 50 |
| Water flow rate, gal per minute/sq ft min and max average roll value | ASTM D 4491 | 4-10 | 80-120 |
| Permittivity, sec ⁻¹ min | ASTM D 4491 | 0.05 | 1.0 |
| Apparent opening size, inches max average roll value | ASTM D 4751 | 0.023 | 0.012 |
| Ultraviolet resistance, % min retained grab breaking load, 500 hr. | ASTM D 4355 | 70 | 70 |

Replace section 88-1.02P with:

01-18-13

88-1.02P Biaxial Geogrid

Geosynthetics used for biaxial geogrid must be a punched and drawn polypropylene material formed into an integrally formed biaxial grid. When tested under the referenced test methods, properties of biaxial geogrid must have the values shown in the following table:

Biaxial Geogrid

| Property | Test | Value |
|--|-------------|-------------------|
| Aperture size, inch ^a min and max | Calipered | 0.8-1.3 x 1.0-1.6 |
| Rib thickness, inch min | Calipered | 0.04 |
| Junction thickness, inch min | Calipered | 0.150 |
| Tensile strength, 2% strain, lb/ft ^a min | ASTM D 6637 | 410 x 620 |
| Tensile strength at ultimate, lb/ft ^a min | ASTM D 6637 | 1,310 x 1,970 |
| Ultraviolet resistance, percent min retained tensile strength, 500 hours | ASTM D 4355 | 100 |
| Junction strength, lb/ft ^a min | ASTM D 7737 | 1,220 x 1,830 |
| Overall flexural rigidity, mg-cm min | ASTM D 7748 | 750,000 |
| Torsional rigidity at 20 cm-kg, mm-kg/deg ^b min | GRI:GG9 | 0.65 |

^aMachine direction x cross direction

^bGeosynthetic Research Institute, Test Method GG9, *Torsional Behavior of Bidirectional Geogrids When Subjected to In-Plane Rotation*

Replace the paragraphs in section 90-4.01C with:

07-19-13

90-4.01C(1) General

For reports and logs, type or clearly print the name next to the signature of the person signing the report or log.

Submit expansion test data under section 90-4.02, if required.

90-4.01C(2) Certificates of Compliance

Submit a certificate of compliance for the cementitious material used in PC concrete members. The certificate must be signed by the PC concrete product manufacturer.

Submit a certificate of compliance for each PC concrete member. The certificate of compliance for tier 1 and tier 2 members must be signed by the QC manager. The certificate of compliance for tier 3 members must be signed by the QC Inspector.

90-4.01C(3) Precast Concrete Quality Control Plan

Before performing any precasting activities for tier 1 and tier 2 PC concrete members, submit 3 copies of the project-specific QC plan for the PC plant. The QC plan must supplement the information from the authorized facility audit. Submit a separate QC plan for each plant. Allow 25 days for review.

Each project-specific QC plan must include:

1. Name of the precasting plant, concrete plants, and any testing laboratory to be used.
2. Manual prepared by the precasting plant that includes:
 - 2.1. Equipment description
 - 2.2. Testing procedures
 - 2.3. Safety plan
 - 2.4. Personnel names, qualifications, and copies of certifications
3. QC manager and QC inspector names, qualifications, and copies of certifications.
4. Organizational chart showing QC personnel and their assigned QC responsibilities.
5. Methods and frequencies for performing QC procedures including inspections, material testing, and any survey performed for all components of PC concrete members. Components include prestressing, concrete, grout, reinforcement, steel, miscellaneous metal, and formwork.
6. System for reporting noncompliant PC concrete members to the Engineer.
7. System for identification and tracking repairs and repair methods.
8. Procedure for the reinspection of repaired PC concrete members.
9. Forms for certificates of compliance, daily production logs, and daily reports.

Submit a revised QC plan for any changes to:

1. Concrete plants
2. Material sources
3. Material testing procedures
4. Testing laboratory
5. Procedures and equipment
6. Updated systems for tracking and identifying PC concrete members
7. QC personnel

After authorization, submit 7 copies of each authorized QC plan and make 1 copy available at each location where work is performed.

Allow 7 days for review of a revised QC plan.

90-4.01C(4) Daily Production Log

The QC inspector must provide reports to the QC manager for each day that precasting activities are performed.

The QC manager must maintain a daily production log of PC activities for each day's precasting. PC activities include setting forms, placing reinforcement, setting prestressing steel, casting, curing, post

tensioning, and form release. This daily log must be available at the precasting plant. The daily log must include:

1. Plant location
2. Specific description of casting or related activities
3. Any problems or deficiencies discovered
4. Any testing or repair work performed
5. Names of QC inspectors and the specific QC inspections they performed that day
6. Reports for that day's precasting activities from each QC inspector including before, during, and after precast inspections

Immediately notify the Engineer when any precasting problems or deficiencies are discovered, and submit the proposed repair or process changes necessary to correct them.

90-4.01C(5) Precast Concrete Report

Before shipping PC concrete members, submit a PC concrete report. The report must include:

1. Reports of all material tests and any survey checks
2. Documentation that:
 - 2.1. You have evaluated all tests
 - 2.2. You corrected all rejected deficiencies
 - 2.3. Repairs have been reexamined with the required tests and found acceptable
3. Daily production logs
4. Certificates of compliance
5. Documentation of inspections

Each person who performs a material test or survey check must sign the corresponding report and submit the report directly to the QC manager.

Replace the paragraphs in section 90-4.01D with:

07-19-13

90-4.01D(1) General

Quality control and assurance for PC concrete includes:

1. Your QC program
2. Department's acceptance of PC concrete members

PC concrete members are categorized into the following 4 tiers:

1. Tier 1 consists of:
 - 1.1. Components of bridge structures, including girders, deck panels, bent caps, abutments, slabs, closure wall panels, and piling
 - 1.2. Prestressed pavement
2. Tier 2 consists of:
 - 2.1. Components of earth retaining systems
 - 2.2. Wingwalls
 - 2.3. Types A, B, and C pipe culvert headwalls, endwalls, and wingwalls
 - 2.4. Pavement
 - 2.5. Box culverts
 - 2.6. Sound wall panels and supports
3. Tier 3 consists of:
 - 3.1. Pipes
 - 3.2. Pipe drainage facilities
 - 3.3. Straight and "L" pipe culvert headwalls except those listed under tier 2
 - 3.4. Drainage Inlets
 - 3.5. Flared end sections
4. Tier 4 consists of any member not described as tier 1, tier 2, or tier 3

90-4.01D(2) Quality Control

90-4.01D(2)(a) General

For tier 1 and tier 2 PC concrete members:

1. Fabricate PC concrete members at a plant on the Authorized Facility Audit List
2. Assign a PC concrete QC manager to the plant
3. Assign a QC inspector who is either registered as a civil engineer in the State or:
 - 3.1. For tier 1, has a Plant Quality Personnel Level II certification from the Precast/Prestressed Concrete Institute
 - 3.2. For tier 2, has a Plant Quality Personnel Level I certification from the Precast/Prestressed Concrete Institute
4. Prepare a PC concrete QC plan
5. Perform PC concrete materials testing
6. Maintain a daily production log
7. Prepare a PC concrete report
8. Prepare a certificate of compliance

For tier 3 PC concrete members:

1. Assign a QC inspector who has one of the following qualifications:
 - 1.1. Registration as a civil engineer in the State.
 - 1.2. Plant Quality Personnel, Level I certification from the Precast/Prestressed Concrete Institute.
 - 1.3. Competency to perform inspection of PC operations. An inspector is competent if the individual has completed training or has experience in PC operations and inspection.
2. Prepare a certificate of compliance

For tier 4 PC concrete members, prepare a certificate of compliance.

For each ASTM test method specified in this section, the material's test result must comply with the requirement specified for the comparable test in section 90 unless otherwise specified.

If curing compound is used, provide certificate of compliance as specified in section 90-1.01C(5).

If PC concrete is manufactured at an established PC concrete plant, a trial batch and prequalification of the materials, mix proportions, mixing equipment, and procedures under section 90-1.01D(5)(b) are not required.

90-4.01D(2)(b) Quality Control Meeting

After submitting the PC concrete QC plan, hold a meeting to discuss the requirements for PC concrete QC. The meeting attendees must include the Engineer, the PC concrete QC manager, and a representative from each plant performing PC concrete activities for the Contract.

90-4.01D(2)(c) Sampling, Testing, and Inspecting

The QC laboratory testing personnel or the QC inspector must witness sampling. The QC laboratory testing personnel must perform testing.

QC laboratory testing personnel must have the following certifications, as applicable:

1. ACI Strength Testing Technician
2. ACI Concrete Laboratory Testing Technician Level 1
3. ACI Aggregate Testing Technician Level 2

The QC Inspector must perform inspections before, during, and after casting is complete.

QC field testing and inspection personnel must have an ACI Concrete Field Testing Technician, Grade I certification.

For each mix design used for tier 1 and tier 2 PC concrete members, perform sampling and testing at the minimum frequencies shown in the following tables:

Aggregate QC Tests

| Property | Test method | Minimum testing frequency |
|---|---|--|
| Aggregate gradation | ASTM C136 | Once per 400 cu yd of concrete cast or once a week, whichever is more frequent |
| Sand equivalent | ASTM D2419 | |
| Percent fines under 75 microns ^a | ASTM C117 | |
| Moisture content of fine aggregate | ASTM C566, or electronically actuated moisture meter ^b | 1–2 times per each day of pour, depending on conditions |

^aPercent fines under 75 microns test replaces the cleanness test in section 90-1.02C with the requirements of 1.5 percent maximum for "Operating Range" and 2.0 percent maximum for "Contract Compliance." The 5th paragraph of section 90-1.02C(2) does not apply.

^bElectronically actuated moisture meter must be calibrated once per week per ASTM C566.

Concrete QC Tests

| Property | Test method | Minimum testing frequency |
|-----------------------------------|---|---|
| Compressive strength ^b | ASTM C172/C172M, ASTM C31/C31M, and ASTM C39/C39M | Once per 100 cu yd of concrete cast, or every day of casting, whichever is more frequent |
| Slump | ASTM C143/C143M | |
| Temperature | ASTM C1064/C1064M | |
| Density | ASTM C138 | Once per 600 cu yd of concrete cast or each week of batching, whichever is more frequent |
| Air content | ASTM C231/C231M or ASTM C173/C173M ^a | If concrete is air entrained, once for each set of cylinders, and when conditions warrant |

^aASTM C173/C173M must be used for lightweight concrete.

^bCylinders must be 6 by 12 inches.

If concrete is batched at more than 1 plant, perform the tests at each plant.

Cure test cylinders for determining time of prestressing loading in the same manner as the concrete in the member.

Cure test cylinders for determining compliance with 28-day strength requirements in the same manner as the member until completion of the steam curing process followed by a water bath or moist room at 60 to 80 degrees F until tested.

92 ASPHALTS

07-19-13

Replace "Reserved" in section 92-1.01B with:

07-19-13

modified asphalt binder: Asphalt binder modified with polymers, crumb rubber, or both.

Replace the row for dynamic shear for original binder in the table in the 1st paragraph of section 92-1.02B with:

01-20-12

| | | | | | | |
|---|-------|------|------|------|------|------|
| Dynamic shear, Test temperature at 10 rad/s, °C | T 315 | 58 | 64 | 64 | 64 | 70 |
| min $G^*/\sin(\delta)$, kPa | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| max $G^*/\sin(\delta)$, kPa | | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 |

Replace 2nd paragraph of section 92-1.02B with:

07-19-13

PG modified asphalt binder must comply with the requirements shown in the following table:

PG Modified Asphalt Binder

| Property | AASHTO Test Method | Grade | | |
|---|--------------------|---------------------|---------------------|---------------------|
| | | PG 58-34 M | PG 64-28 M | PG 76-22 M |
| Original Binder | | | | |
| Flash point, min °C | T 48 | 230 | 230 | 230 |
| Solubility, min % | T 44 ^a | 97.5 | 97.5 | 97.5 ^b |
| Viscosity at 135 °C ^c , max, Pa·s | T 316 | 3.0 | 3.0 | 3.0 |
| Dynamic shear, Test temperature at 10 rad/s, °C min G*/sin(delta), kPa | T 315 | 58 1.00 | 64 1.00 | 76 1.00 |
| RTFO test ^d , Mass loss, max, % | T 240 | 1.00 | 1.00 | 1.00 |
| RTFO Test Aged Binder | | | | |
| Dynamic shear, Test temperature at 10 rad/s, °C min G*/sin(delta), kPa | T 315 | 58 2.20 | 64 2.20 | 76 2.20 |
| Dynamic shear, Test temperature at 10 rad/s, °C max (delta), degree | T 315 | 80 ^e | 80 ^e | 80 ^e |
| Elastic recovery ^f , Test temperature °C min recovery, % | T 301 | 25 75 | 25 75 | 25 65 |
| PAV ^g , temperature, °C | R 28 | 100 | 100 | 110 |
| RTFO Test and PAV Aged Binder | | | | |
| Dynamic shear, Test temperature at 10 rad/s, °C max G*sin(delta), kPa | T 315 | 16 5000 | 22 5000 | 31 5000 |
| Creep stiffness, Test temperature, °C max S-value, MPa min M-value | T 313 | -24 300 0.300 | -18 300 0.300 | -12 300 0.300 |

