



STATE OF CALIFORNIA  
DEPARTMENT OF TRANSPORTATION

**NOTICE TO BIDDERS  
AND  
SPECIAL PROVISIONS**

**FOR CONSTRUCTION ON STATE HIGHWAY IN SISKIYOU COUNTY NEAR  
DUNSMUIR AT DUNSMUIR GRADE COMMERCIAL VEHICLE ENFORCEMENT  
FACILITY**

**In District 02 On Route 5  
Under**

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*Bid book dated November 16, 2015*

*Standard Specifications dated 2010*

*Project plans approved August 24, 2015*

*Standard Plans dated 2010*

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Identified by

Contract No. 02-2E8004

02-Sis-5-R7.2

Project ID 0200000603

**Electronic Bidding Contract**

Bids open Wednesday, January 6, 2016  
Dated November 16, 2015

AADD  
OSD  
IH



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# SPECIAL NOTICES

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- See sections 2 and 3 for contractors' registration requirements.
- See section 2 for prebid site access opportunity.
- See section 2-1.03 for mandatory prebid meeting requirements.

CONTRACT NO. 02-2E8004  
PROJECT ID: 0200006031

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

**ARCHITECT**

*[Signature]* 11/12/14

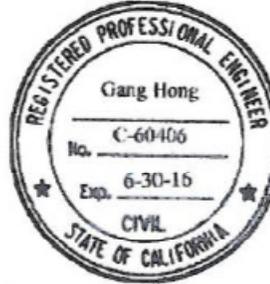
LICENSED ARCHITECT DATE



**STRUCTURES**

*[Signature]* 11/12/14

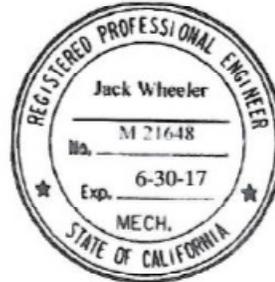
REGISTERED CIVIL ENGINEER DATE



**MECHANICAL**

*[Signature]* 11-12-14

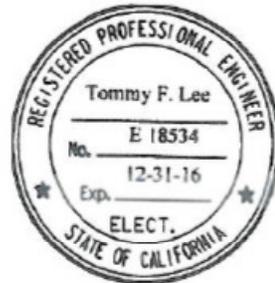
REGISTERED MECHANICAL ENGINEER DATE



**ELECTRICAL**

*[Signature]* 11/12/14

REGISTERED ELECTRICAL ENGINEER DATE



CONTRACT NO. 02-2E8004  
PROJECT ID: 0200006031

**WATER AND WASTEWATER**

 11/12/14

REGISTERED CIVIL ENGINEER

DATE



**HIGHWAY**

 1/27/2015

REGISTERED CIVIL ENGINEER

DATE





# TABLE OF CONTENTS

NOTICE TO BIDDERS.....	1
BID ITEM LIST .....	3
SPECIAL PROVISIONS.....	5
ORGANIZATION.....	5
DIVISION I GENERAL PROVISIONS .....	5
1 GENERAL.....	5
2 BIDDING.....	5
5 CONTROL OF WORK.....	6
7 LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC .....	7
8 PROSECUTION AND PROGRESS .....	7
DIVISION II GENERAL CONSTRUCTION.....	8
10 GENERAL.....	8
12 TEMPORARY TRAFFIC CONTROL .....	9
14 ENVIRONMENTAL STEWARDSHIP.....	11
15 EXISTING FACILITIES.....	17
DIVISION III GRADING.....	17
16 CLEARING AND GRUBBING.....	17
19 EARTHWORK.....	17
DIVISION V SURFACINGS AND PAVEMENTS.....	18
37 BITUMINOUS SEALS .....	18
39 HOT MIX ASPHALT .....	18
DIVISION VII DRAINAGE.....	20
70 MISCELLANEOUS DRAINAGE FACILITIES.....	20
DIVISION VIII MISCELLANEOUS CONSTRUCTION.....	22
72 SLOPE PROTECTION.....	22
DIVISION IX TRAFFIC CONTROL FACILITIES.....	22
86 ELECTRICAL SYSTEMS .....	22
DIVISION X MATERIALS.....	25
90 CONCRETE.....	25
DIVISION XI BUILDING CONSTRUCTION.....	26
99 BUILDING CONSTRUCTION.....	26
REVISED STANDARD SPECIFICATIONS APPLICABLE TO THE 2010 EDITION OF THE STANDARD SPECIFICATIONS.....	264

# 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)
A20A	Pavement Markers and Traffic Lines, Typical Details
A20B	Pavement Markers and Traffic Lines, Typical Details
A20D	Pavement Markers and Traffic Lines, Typical Details
RSP A24A	Pavement Markings - Arrows
RSP A24C	Pavement Markings - Symbols and Numerals
RSP A24E	Pavement Markings - Words, Limit and Yield Lines
A62A	Excavation and Backfill - Miscellaneous Details
A62D	Excavation and Backfill - Concrete Pipe Culverts
RSP A62DA	Excavation and Backfill - Concrete Pipe Culverts - Indirect Design Method
A62F	Excavation and Backfill - Metal and Plastic Culverts
RSP A85	Chain Link Fence
A85A	Chain Link Fence Details
RSP A85B	Chain Link Fence Details
D75A	Steel Pipe Inlets
RSP D77B	Grate Details No. 2
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
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)
RSP T9	Traffic Control System Tables for Lane and Ramp Closures
RSP T10	Traffic Control System for Lane Closure on Freeways and Expressways
RSP T14	Traffic Control System for Ramp Closure
T57	Temporary Water Pollution Control Details (Temporary Check Dam)
T59	Temporary Water Pollution Control Details (Temporary Concrete Washout Facility)
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 ES-1A	Electrical Systems (Legend and Abbreviations)

## 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-6H	07-19-13
A77A2	07-19-13	A77K1	07-19-13	ES-6I	07-19-13
A77B1	07-19-13	A77K2	07-19-13	ES-6J	07-19-13
A77C1	07-19-13	P3	07-19-13	ES-7I	07-19-13
A77C2	07-19-13	C8A	07-19-13	ES-8	01-20-12
A77C3	07-19-13	C8B	07-19-13	ES-10	07-20-12
A77C4	07-19-13	C8C	07-19-13	ES-12A	10-30-15
RSP A77C5	07-19-13	D98D	10-30-15	ES-12B	10-30-15
RSP A77C6	07-19-13	D98E	10-30-15		
RSP A77C7	07-19-13	B3-1	04-20-12		
RSP A77C8	07-19-13	B3-2	04-20-12		
RSP A77C9	07-19-13	B3-3	04-20-12		
RSP A77C10	07-19-13	B3-4	04-20-12		
A77E1	07-19-13	B3-7	04-20-12		
A77E2	07-19-13	B3-8	04-20-12		
A77E3	07-19-13	S7	07-19-13		
A77E4	07-19-13	S14	07-19-13		
A77E5	07-19-13	S41	07-19-13		
A77E6	07-19-13	S42	07-19-13		
A77F1	07-19-13	S43	07-19-13		
A77F2	07-19-13	S44	07-19-13		
A77F3	07-19-13	S45	07-19-13		
A77F4	07-19-13	S46	07-19-13		
A77F5	07-19-13	S47	07-19-13		
A77G1	07-19-13	S120	07-19-13		
A77G2	07-19-13	S121	07-19-13		
A77G3	07-19-13	S122	07-19-13		
A77G4	07-19-13	S123	07-19-13		
A77G5	07-19-13	S124	07-19-13		
A77G6	07-19-13	S125	07-19-13		
A77G7	07-19-13	S126	07-19-13		
A77G8	07-19-13	S127	07-19-13		
A77H1	07-19-13	S128	07-19-13		
A77H2	07-19-13	S129	07-19-13		
A77H3	07-19-13	S130	07-19-13		
A77I1	07-19-13	S131	07-19-13		
A77I2	07-19-13	S132	07-19-13		
A77J1	07-19-13	S133	07-19-13		
A77J2	07-19-13	S134	07-19-13		
A77J3	07-19-13	S135	07-19-13		

# NOTICE TO BIDDERS

Bids open Wednesday, January 6, 2016

Dated November 16, 2015

General work description: Reconstruction of the Dunsmuir Commercial Vehicle Enforcement Facility  
The Department will receive sealed bids for CONSTRUCTION ON STATE HIGHWAY IN SISKIYOU COUNTY NEAR DUNSMUIR AT DUNSMUIR GRADE COMMERCIAL VEHICLE ENFORCEMENT FACILITY.

District-County-Route-Post Mile: 02-Sis-5-R7.2

Contract No. 02-2E8004

The Contractor must have either a Class A license or Class B license or a combination of Class C licenses which constitutes a majority of the work.

The Department establishes no DVBE Contract goal but encourages bidders to obtain DVBE participation.

For the Federal training program, the number of trainees or apprentices is 8.

Bids must be on a unit price basis.

Complete the work within 250 working days.

The estimated cost of the project is \$6,300,000.

A mandatory prebid meeting is scheduled on December 1, 2015 at 10:00 am at Caltrans West Venture Building, Lassen Conference Room, 1031 Butte Street, Redding, CA 96001.

The Department will receive bids until 2:00 p.m. on the bid open date via Bid Express web site. Bids received after this time will not be accepted. For more information refer to the Electronic Bidding Guide at the Bidders' Exchange web site.

The Department will open and publicly read the bids at 1727 30th Street, Bidders' Exchange, MS 26, Sacramento, CA 95816 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](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.

Under Govt Code § 14835 et seq. and 2 CA Code of Regs § 1896 et seq., the Department gives preference to certified small businesses and non-small businesses who commit to 25 percent certified small business participation.

Under Pub Cont Code § 6107, the Department gives preference to a "California company," as defined, for bid comparison purposes over a nonresident contractor from any state that gives or requires a preference to be given to contractors from that state on its public entity construction contracts.

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 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](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>.

Caltrans and the Construction Industry are committed to making partnering the way we do business. For more information, go to <http://www.dot.ca.gov/hq/construc/partnering.html>.

Department of Transportation

D02BWT

### 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	120090	CONSTRUCTION AREA SIGNS	LS	LUMP SUM
4	120100	TRAFFIC CONTROL SYSTEM	LS	LUMP SUM
5	130100	JOB SITE MANAGEMENT	LS	LUMP SUM
6	130200	PREPARE WATER POLLUTION CONTROL PROGRAM	LS	LUMP SUM
7	130650	TEMPORARY GRAVEL BAG BERM	LF	50
8	130900	TEMPORARY CONCRETE WASHOUT	LS	LUMP SUM
9	140003	ASBESTOS COMPLIANCE PLAN	LS	LUMP SUM
10	150715	REMOVE THERMOPLASTIC PAVEMENT MARKING	SQFT	1,190
11	150745	REMOVE ROADSIDE SIGN (METAL POST)	EA	2
12	030251	RECONSTRUCT TEMPORARY RAILING (TYPE K)	LF	80
13	153121	REMOVE CONCRETE (CY)	CY	78
14	160102	CLEARING AND GRUBBING (LS)	LS	LUMP SUM
15	170101	DEVELOP WATER SUPPLY	LS	LUMP SUM
16	190101	ROADWAY EXCAVATION	CY	32
17	194001	DITCH EXCAVATION	CY	50
18	210420	STRAW	SQFT	31,000
19	260203	CLASS 2 AGGREGATE BASE (CY)	CY	44
20	375020	PARKING AREA SEAL	TON	18

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
21	390132	HOT MIX ASPHALT (TYPE A)	TON	150
22	397005	TACK COAT	TON	0.1
23	620140	24" ALTERNATIVE PIPE CULVERT	LF	62
24	665002	6" CORRUGATED STEEL PIPE (.064" THICK)	LF	10
25	700638	36" CORRUGATED STEEL PIPE INLET (.079" THICK)	LF	6
26	703233	GRATED LINE DRAIN	LF	32
27	721020	ROCK SLOPE PROTECTION (NO. 3, METHOD B) (TON)	TON	70
28	731502	MINOR CONCRETE (MISCELLANEOUS CONSTRUCTION)	CY	0.4
29 (F)	750001	MISCELLANEOUS IRON AND STEEL	LB	236
30	800360	CHAIN LINK FENCE (TYPE CL-6)	LF	47
31	802501	4' CHAIN LINK GATE (TYPE CL-6)	EA	1
32	840515	THERMOPLASTIC PAVEMENT MARKING	SQFT	620
33	840560	THERMOPLASTIC TRAFFIC STRIPE (SPRAYABLE)	LF	11,800
34	850122	PAVEMENT MARKER (RETROREFLECTIVE-RECESSED)	EA	88
35	860090	MAINTAINING EXISTING TRAFFIC MANAGEMENT SYSTEM ELEMENTS DURING CONSTRUCTION	LS	LUMP SUM
36	994650	BUILDING WORK	LS	LUMP SUM











A minimum of 1 paved traffic lane not less than 12 feet wide must be open for use by traffic.

Replace "Reserved" in section 12-4.04 with:

Lane Closure Restriction for Designated Holidays										
Thu	Fri	Sat	Sun	Mon	Tues	Wed	Thu	Fri	Sat	Sun
x	<b>H</b> xx	xx	xx							
x	xx	<b>H</b> xx	xx							
	x	xx	<b>H</b> xx	xx						
	x	xx	xx	<b>H</b> xx	xx					
				x	<b>H</b> xx					
					x	<b>H</b> xx				
						x	<b>H</b> xx	xx	xx	xx
Legend:										
x	The full width of the traveled way must be open for use by traffic after 3 p.m.									
xx	The full width of the traveled way must be open for use by traffic.									
<b>H</b>	Designated holiday									

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 lane closures on multilane 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**

Not Used

**12-5.03 CONSTRUCTION**

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.

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.

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.

**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.

AA

**14 ENVIRONMENTAL STEWARDSHIP**

**Replace the 3rd paragraph of section 14-6.03A with:**

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

**Add to section 14-9.02A**

Notify the following agencies as required by the National Emission Standards for Hazardous Air Pollutants (NESHAP) at 40 CFR Part 61, Subpart M, and California Health and Safety Code section 39658(b)(1). Notification must take place not less than 10 days before starting demolition or renovation activities as defined in the NESHAP regulations. Notification forms and other information are available from the California Air Resources Board web site at: <http://www.arb.ca.gov/enf/oasse.htm#asb>.

The contractor must mail the original notification form with any necessary attachments to:

U.S. EPA, REGION IX  
ASBESTOS NESHAP NOTIFICATION (AIR-5)  
75 HAWTHORNE STREET  
SAN FRANCISCO, CA 94105

Mail a copy or send a fax of the notification form and any necessary attachments to:

CALIFORNIA AIR RESOURCES BOARD  
ENFORCEMENT DIVISION  
ASBESTOS NESHAP NOTIFICATION  
POST OFFICE BOX 2815  
SACRAMENTO, CA 95812  
Fax: (916) 445-7986

Notify other local permit agencies and utility companies before starting any demolition activities. Submit a copy of the notification form and attachments as an informational submittal before starting demolition or renovation activities.

**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 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**

Asbestos was detected at this facility in various locations as detailed in two information handouts entitled "Asbestos and Lead Containing Paint Survey Report" dated December 2006 and February 2014.

**14-11.11A(4) Submittals**

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

Not used

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

Not used

**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 removal 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**

Prepare a work plan for the removal, storage, transportation and disposal of ACM.

The work plan must include:

1. Installing asbestos warning signs at perimeters of abatement work areas
2. Wetting asbestos materials with sprayers
3. Containing large volumes of asbestos materials in disposal bins for temporary storage until removed from the site
4. Providing manifests for disposal upon completion for the Engineer to sign
5. Providing transporters registered to transport hazardous waste in the state of California under the Health and Safety Code Ch 6.5, Div 20 and 22 CA Code of Regs, Div 4.5
6. Disposing of asbestos materials at a disposal facility permitted by the California Environmental Protection Agency
7. Compliance with federal, state, and local requirements for asbestos work, transport, and disposal

Allow 10 days for review. If required, submit a revised removal work plan.

#### **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**

Submit a copy of all waste shipment records within 30 days after shipment.

#### **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.

The person in charge of asbestos removal must be registered under Labor Code § 6501.5 and certified under Bus & Prof Code § 7058.6.

Laboratories used to perform asbestos analysis must be certified by the CDPH Environmental Laboratory Accreditation Program 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
2. 8 CA Code of Regs, General Industry Safety Order 5208 Asbestos
3. 8 CA Code of Reg, § 1529 and 341
4. 22 CA Code of Regs, Division 4.5
5. Cal/OSHA, Part 26 (amended), of 29 CFR
6. 40 CFR, Part 61, subpart M

#### **14-11.11B Materials**

Not used

#### **14-11.11C Construction**

##### **14-11.11C(1) General**

Notify Cal/OSHA of changes in work locations or conditions under 8 CA Code of Regs § 341.9.

Before starting work in areas containing or suspected to contain asbestos, provide safety training that meets the requirements of 8 CA Code of Regs § 1529 to personnel who have no prior training or are not current in their training status, including State personnel.

Provide training, personal protective equipment, and medical surveillance required by the Asbestos Compliance Plan to 3 State personnel.

**14-11.11C(2) Unanticipated Suspected ACM discovered During Demolition or Excavation**

If unanticipated suspected ACM is discovered during demolition, the portion of the work that involves the unanticipated suspected ACM must be performed by or under the direction of CAC. Test the suspected ACM in compliance with USEPA "Asbestos/NESHAP Regulated Asbestos Containing Materials Guidance."

Notify the APCD or the AQMD of changes to removal or demolition plans, including discovery of ACM during demolition, within 2 business days of the change.

**14-11.11C(3) Removal**

Comply with 8 CA Code of Regs § 1529 and § 341. Remove friable ACM using the wetting method. Remove and handle all non-friable ACM to prevent breakage. The removal of ACM encased in concrete or other similar structural material is not required before demolition, but the ACM must be adequately wetted whenever exposed during demolition. Prevent visible emissions from all ACM removal activities.

Mark all regulated work areas with the following or equivalent warning:

**DANGER  
ASBESTOS  
CANCER AND LUNG DISEASE HAZARD  
AUTHORIZED PERSONNEL ONLY**

**14-11.11C(4) Packaging**

Comply with 22 CA Code of Regs, Div 4.5, Chapter 12, Article 3 requirements for packaging and labeling removed ACM. Place removed ACM in approved containers (double ply, 0.06-inch minimum thickness, plastic bags) with caution labels affixed to bags. Caution labels must have conspicuous, legible lettering, that spells out the following or equivalent warning:

**DANGER  
CONTAINS ASBESTOS FIBERS  
AVOID CREATING DUST  
CANCER AND LUNG DISEASE HAZARD**

Place removed materials containing asbestos directly into a covered, lockable roll off or drop box that has the same caution label affixed on all sides.

**14-11.11C(5) Transportation**

All haulers of friable ACM must have current registration with DTSC for transporting hazardous waste and must have a U.S. Environmental Protection Agency Identification Number (U.S. EPA I.D. Number). All vehicles used to transport hazardous waste material must carry a valid registration during transport. Transport non-friable (non-hazardous waste) ACM to the disposal facility with a shipping document or waste shipment record.

**14-11.11C(6) Disposal**

Dispose of friable and non-friable waste containing asbestos at a disposal facility permitted to accept the waste and that meets all the requirements specified by federal, state and local regulations. Notify the proper authorities at the disposal site in advance of delivery of ACM.

**14-11.11D Payment**

Not Used

**Replace section 14-11.13 with:**

**14-11.13 REMOVAL OF LEAD PAINT ON NON-CONTINUOUSLY OCCUPIED STRUCTURES**

**14-11.13A General**

**14-11.13A(1) Summary**

Section 14-11.13 includes specifications for removing lead paint on structures not continuously occupied by workers.

Hazardous waste levels of lead were detected in intact paint samples from the structure(s) to be demolished at this facility in various locations as detailed in two information handouts entitled "Asbestos and Lead Containing Paint Survey Report" dated December 2006 and February 2014.

Lead paint concentration data and sample location maps are included in the *Information Handout*.

**14-11.13A(2) Definitions**

Not used

**14-11.13A(3) Submittals**

**14-11.13A(3)(a) Notification to Air Quality Management District**

Notify the Siskiyou County Air Quality Management District (AQMD) under NESHAP, 40CFR Part 61, and California Air Resources Control Board rules. Provide a copy of the notification form and attachments to the Engineer before submittal to the local air district. Notify the air districts a minimum of 10 days before demolition or renovation activities. Notify other local permit agencies and utility companies before demolition or renovation activities.

**14-11.13A(3)(b) Lead Compliance Plan**

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

**14-11.13A(3)(c) Removal Work Plan**

Prepare a work plan for the removal, storage, transportation and disposal of lead containing paint.

The work plan must include:

1. Installing warning signs at perimeters of abatement work areas
2. Containing large volumes of lead in disposal bins for temporary storage until removed from the site
3. Providing manifests for disposal upon completion for the Engineer to sign
4. Providing transporters registered to transport hazardous waste in the state of California under the Health and Safety Code Ch 6.5, Div 20 and 22 CA Code of Regs, Div 4.5
5. Disposing of lead containing paint materials at a disposal facility permitted by the California Environmental Protection Agency
6. Compliance with federal, state, and local requirements for lead work, transport, and disposal

**14-11.13A(4) Training**

Before performing any work in areas containing lead containing paint, provide safety training to personnel, including department personnel, who have no prior training or are not current in their training status.

The training must meet the requirements of 8 CA Code of Regs, Section 1532.1 and the Lead Compliance Plan.

Provide a written certification of completion of safety training to the Engineer for all trained personnel before performing any work in areas containing lead paint.

**14-11.13A(5) Quality Control and Assurance**

A contractor who is registered under Section 6501.5 of the Labor Code and certified under Section 7058.6 of the Business and Professions Code must perform the removal and management of material containing lead paint.

Remove lead paint under Cal/OSHA requirements in 8 CA Code of Regs, Sections 1532.1 and 341.





**DIVISION V SURFACINGS AND PAVEMENTS**  
**37 BITUMINOUS SEALS**

**Add between the 5th and 6th paragraphs of section 37-4.03D:**

Apply the parking area seal at a total rate of 0.35 to 0.45 gal/sq yd not including added water.

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**39 HOT MIX ASPHALT**

**Add to the table in the 1st paragraph of section 39-1.01D(8)(c)(ii) of the RSS for section 39:**

Coarse durability index <sup>c</sup>	AASHTO T 210	1 per 3,000 tons or 1 per paving day, whichever is greater
Fine durability index	AASHTO T 210	1 per 3,000 tons or 1 per paving day, whichever is greater
Sodium sulfate soundness <sup>d</sup>	AASHTO T 104	1 per project

<sup>c</sup>Requirement applies if aggregate source is in Lassen, Modoc, Siskiyou, or Shasta County.

<sup>d</sup>Requirement applies if aggregate source is in Modoc, Siskiyou, or Shasta County.

**Delete the 3rd and 4th paragraphs in section 39-1.02B(2) of the RSS for section 39.**

**Add to section 39-1.02D(3)(a) of the RSS for section 39:**

Treat aggregate with lime slurry marination.

**Replace the row for combined in the table in the 7th paragraph of section 39-1.02D(3)(a) of the RSS for section 39 with:**

Combined	1.0–1.5
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**Replace the 2nd sentence in the 1st paragraph of section 39-1.02J of the RSS for section 39 with:**  
 Choose from CRS2, CQS1, or PMCRS2 asphaltic emulsion, or asphalt binder.

**Replace the table in the 2nd paragraph of section 39-1.03C(6) of the RSS for section 39 with:**

**Tack Coat Application Rates for HMA**

HMA over:	Minimum Residual Rates (gal/sq yd)	
	CRS2 and CQS1 Asphaltic Emulsion	Asphalt Binder and PMCRS2 Asphaltic Emulsion
New HMA (between layers)	0.03	0.02
PCC and existing AC surfacing	0.04	0.03
Planed pavement	0.06	0.04

**Add to section 39-2.01A of the RSS for section 39:**

Do not place Type A HMA on the traveled way between November 1 and May 1 for any of the following conditions:

1. Quantity of HMA is greater than 1000 tons
2. Project elevation is greater than 1500 feet

**Add to the table in the 1st paragraph of section 39-2.01D(2)(b) of the RSS for section 39:**

Coarse durability index <sup>e</sup>	AASHTO T 210	1 per 3,000 tons or 1 per paving day, whichever is greater
Fine durability index	AASHTO T 210	1 per 3,000 tons or 1 per paving day, whichever is greater
Sodium sulfate soundness <sup>f</sup>	AASHTO T 104	1 per project

<sup>e</sup>Requirement applies if aggregate source is in Lassen, Modoc, Siskiyou, or Shasta County.

<sup>f</sup>Requirement applies if aggregate source is in Modoc, Siskiyou, or Shasta County.

**Replace the row for Los Angeles Rattler in the table in item 1 in the list in the paragraph of section 39-2.01D(5) of the RSS for section 39 with:**

Los Angeles Rattler (max, %)	AASHTOT 96	12
Loss at 100 Rev.		
Loss at 500 Rev.		

**Add to the table in item 1 in the list in the paragraph of section 39-2.01D(5) of the RSS for section 39:**

Coarse durability index (D <sub>c</sub> , min) <sup>e</sup>	AASHTO T 210	65
Fine durability index (D <sub>f</sub> , min)	AASHTO T 210	50
Sodium sulfate soundness (max loss, %) <sup>f</sup>	AASHTO T 104	25

<sup>e</sup>Requirement applies if aggregate source is in Lassen, Modoc, Siskiyou, or Shasta County.

<sup>f</sup>Requirement applies if aggregate source is in Modoc, Siskiyou, or Shasta County.

**Delete the row for moisture susceptibility, dry strength, in the table in item 3 in the list in the paragraph of section 39-2.01D(5) of the RSS for section 39.**

**Replace the row for moisture susceptibility, wet strength, in the table in item 3 in the list in the paragraph of section 39-2.01D(5) of the RSS for section 39 with:**

Moisture susceptibility (min, tensile strength ratio)	AASHTO T 283	80
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**Add to the table in item 3 in the list in the paragraph of section 39-2.01D(5) of the RSS for section 39:**

Surface abrasion loss (max, g/cm <sup>2</sup> ) <sup>h</sup>	California Test 360	0.4
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<sup>h</sup>If the project elevation is greater than 1500 feet

**Delete the row for moisture susceptibility, dry strength, in the table in the 1st paragraph of section 39-2.02B of the RSS for section 39.**



## 70-6.02 MATERIALS

### 70-6.02A General

Concrete backfill must comply with the specifications for minor concrete.

### 70-6.02B 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 vinylester 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

### 70-6.02C 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.



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.

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 86-2.05A:**

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 4inches above the conduit with minor concrete under section 90-2, except the concrete must contain not less than 421pounds 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.

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# DIVISION XI BUILDING CONSTRUCTION

## 99 BUILDING CONSTRUCTION

Replace "Reserved" in section 99 with:

### DIVISION 1 GENERAL REQUIREMENTS

#### SECTION 010000 GENERAL REQUIREMENTS

##### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Divisions 1 through 16 of Standard Specification Section 99 include specifications for performing building construction work.
- B. Building construction work includes the demolition of an existing office building and the construction of a new office building with an area of 7,500 square feet shown on the sheets labeled *GP, A, ST, M, EE, SS, and W*.
- C. "Standard Specification Section" refers to section numbers of the *Standard Specifications* as revised by any revised standard specification, special provision, or both.
- D. Standard Specification Sections 1 through 14 and 99 apply to building construction work. Standard Specification Sections 15 through 98 do not apply, except where a specific reference is made to one of these sections.
- E. Specifications in a *Standard Specification* section titled "General" apply to all subordinate sections within the section. A reference to a section includes specifications in sections titled "General" that apply to the section.
- F. Where a reference is made to a *Standard Specification* section, Standard Specification Sections 1 through 9 apply and these Division 1 specifications do not apply.
- G. The styles of Divisions 1 through 16 of Standard Specification Section 99 differ from the styles of the other *Standard Specifications* sections in that:
  - 1. The 5-digit number that follows "99-" and the title of each correlate with the 16-division CSI Master Format number and title except as specified below.
  - 2. Some Standard Specification Section 99 specifications are in a streamlined form. In these specifications, interpret a colon as "must be."
- H. Within Divisions 1 through 16 of Standard Specification Section 99, the Department is gradually changing the specifications to align with CSI's Master Format styles and 50-division CSI Master Format numbers. Because of this transition, the format, organization, and language may vary between sections. Until the transition is complete, a 50-division section number will be located in the division that correlates with the 16-division CSI Master Format.

##### 1.2 INTERPRETATION OF BUILDING-INDUSTRY-STANDARD TERMINOLOGY

Divisions 1 through 16 of Standard Specification Section 99 use building-industry-standard terminology. Some of this terminology differs from that used in sections other than Standard Specification Section 99. Interpret Standard Specification Section 99 terminology as shown in the following table:

Division 1 through 16 of Standard Specification Section 99 terminology	Interpretation
Allowance	Change order work
Approved	When used to convey Engineer's action on Contractor's submittals, applications, and requests, "approved" is limited to Engineer's duties and responsibilities as specified for the Engineer's authorization in Standard Specification Sections 1 through 9
Comparable product	Product that is equal to or better than a specified product as specified in Standard Specification Section 6-3.02.
Compliance with substitution procedure	Compliance with VECF specifications.
Construction Change Directive	Disregard references to this document. Comply with change procedures in Standard Specification Section 4.
Construction Manager	Engineer
Contract modification procedures	Change procedures
Contract sum	Price bid for building work
Directed	A command or instruction by Engineer as specified for orders in Standard Specification Sections 1 through 9. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
Furnish	Supply and deliver to job site, ready for unloading, unpacking, assembly, installation, and similar operations.
Indicated	Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
Install	Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at job site.
Material Certificate	Certificate of compliance
Product Certificate	Certificate of compliance
Project identification	Contract number
Punch list	Disregard references to a punch list. The Department does not engage in this practice.
Substantial Completion	Work completion
Work Change Directive	Disregard references to this document. Comply with change procedures in Standard Specification Section 4.
Work Change Proposal Request	<i>Change Order</i>
Project site	"Job site" as defined in Standard Specification Section 1

### 1.3 ABBREVIATIONS

A. Interpret the meaning of an abbreviation as shown in the following table:

Abbreviation	Meaning
AAMA	American Architectural Manufacturers' Association
ADAAG	ADA Accessibility Guidelines for Buildings and Facilities
AGA	American Gas Association
AITC	American Institute of Timber Construction
ALSC	American Lumber Standard Committee
AMCA	Air Movement and Control Association International
APA	Engineered Wood Association
AHRI	Air-Conditioning, Heating, and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
BIA	Brick Industry Association
CEC	California Electrical Code
CMC	California Mechanical Code
CPC	California Plumbing Code
CRRC	Cool Roof Rating Council
CSA	Canadian Standards Association
ESO	Electrical Safety Orders
FM	FM Global
FS	Federal Specification
GA	Gypsum Association
GANA	Glass Association of North America
IGMA	Insulating Glass Manufacturers Alliance
ISO	International Organization for Standardization
NAAMM	National Association of Architectural Metal Manufacturers
PEI	Porcelain Enamel Institute
RIS	Redwood Inspection Service
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
TCNA	Tile Council of North America
TPI	Truss Plate Institute
WCLB	Grade stamp issued by West Coast Lumber Inspection Bureau
WI	Woodwork Institute
WWPA	Western Wood Products Association

### 1.4 DEFINITIONS (Not Used)

### 1.5 COORDINATION WITH THE DEPARTMENT

- A. The Department will be working at or near the job site. Coordinate activities with the Department to avoid delays.
- B. Comply with security policies of the Department facility.
- C. Submit a request for authorization before interrupting any service for the purpose of making or breaking a connection. Include in the request the proposed time necessary to complete the work. Allow 5 days for the review of each request.
- D. You may obtain electrical power and water from existing Department electrical power and water outlets on the job site for Contract operations at no cost to you. The Engineer determines which outlets you may use. You must not modify outlets.
- E. Do not use Department telephones.

### 1.6 SUBMITTALS

- A. In addition to specified submittals, submit any other submittal the Engineer requests.
- B. Within 50 days of Contract approval, submit building construction work action submittals, including:
  - 1. Shop drawings
  - 2. Material lists

3. Product and descriptive data
  4. Samples
- C. Submit at least 5 sets or samples for each item. Except for samples, the Department returns 2 copies that show an authorized date or a request for correction and resubmittal.
  - D. Submit the schedule of values within 20 days of Contract approval. Submit at least 2 sets.
  - E. Each shop drawing sheet must be at least 11 by 17 inches and at most 24 by 36 inches.
  - F. Each material list must include the name of manufacturer, catalog number, size, capacity, finish, all pertinent ratings, and identification symbols described.
  - G. Submit building construction work submittals to OSD, Documents Unit. Notify the Engineer of the submittal. Include the date and contents of the submittal in the notification.
  - H. Allow 20 days for the review.
  - I. Dispose of samples not incorporated in the work.
  - J. Submit 3 copies of the following items as informational submittals:
    1. Part lists and service instructions packaged with or accompanying the equipment
    2. Operating and maintenance instructions
    3. Manufacturer's warranties
    4. Qualification data

### **1.7 QUALITY CONTROL AND ASSURANCE (Not Used)**

### **1.8 SCHEDULE OF VALUES**

- A. Standard Specification Section 9-1.16B does not apply.
- B. Divide the schedule of values into sections representing the cost of each separate building or structure. Do not include work that is not part of the building or structure, such as excavation, grading, curbs, gutters, sidewalks, paving, sewer and storm drainage, or utility distribution lines, in the building or structure cost. Include this work in a section titled "General Work."
- C. List indirect costs and bond premiums as separate line items of work.
- D. Identify the sections representing each building or structure as to the building or structure they represent and break them down to show the corresponding value of each craft, trade, or other significant portion of the work. Provide a subtotal for each section.
- E. Obtain authorization of a schedule of values before you perform work shown on the schedule. The Department does not process a progress payment for building work without an authorized schedule of values.
- F. The sum of the items listed in the schedule of values must equal the contract lump sum price for building work. Distribute overhead and profit proportionally across all line items of cost.

### **1.9 UTILITY CONNECTIONS**

- A. Make arrangements and obtain PLACs required for the extension of and connection to each utility service. For extensions not furnished by the utility, furnish the extensions and install any intermediate equipment required by the serving utilities.
- B. The costs incurred by you for the following items is change order work:
  1. Utility permits, licenses, connection charges, and excess length charges
  2. Extensions of utilities beyond the limits shown
  3. Furnishing and installing any intermediate equipment required by the serving utilities

### **1.10 SANITARY FACILITIES**

- A. During toilet room renovation or other periods when Department sanitary facilities are not operational, furnish the following for Department forces:
  1. Wash facilities
  2. Drinking water fixtures
  3. At least 2 temporary toilet units
- B. Furnish separate temporary toilet units for your personnel.

- C. During toilet room renovation or other periods when Department sanitary facilities are not operational for Commercial Vehicle Operators (CVO), furnish the following for CVO:
  - 1. Wash facilities
  - 2. At least 2 temporary toilet units
- D. Temporary toilet units must be (1) single-occupant units of the chemical type, (2) properly vented, and (3) fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material (4) Temporary toilet units for CVO must be ADA compliant.
- E. Perform periodic flushing, waste removal, and cleaning of temporary toilet units. Maintain units in a clean and sanitary condition, including a supply of toilet paper, toilet seat covers, and paper towels.

### 1.11 AS-BUILT DRAWINGS

- A. Prepare and maintain 1 set of as-built drawings using an unaltered set of original project plans, to show all as-constructed information, including:
  - 1. Any plan clarifications or *Change Order* changes
  - 2. Locations of any underground utilities
  - 3. Location, size, type, and manufacturer of major products or components used in the work
- B. Neatly prepare as-built drawings as follows:
  - 1. Place markings on the project record drawings using red ink or red pencil.
  - 2. Do not eradicate or write over original figures.
  - 3. Line out superseded material.
  - 4. Submit additional drawings if the required information cannot be clearly shown on the original set of project plans. The additional drawings must be at least 11 by 17 inches and at most 24 by 36 inches.
  - 5. Sign and date each sheet verifying that all as-built information shown on the drawings is correct.
- C. Review the as-built drawings monthly with the Engineer during the progress of the work to assure that all changes and other required information are being recorded.
- D. Before completion of the work, request a review of the as-built drawings to determine the completeness and adequacy of them. If the as-built drawings are unacceptable, you must inspect, measure, and survey the work as necessary to record the required additional information.

## PART 2 - PRODUCTS

(Not Used)

## PART 3 - EXECUTION

### 1.1 INSPECTION

- A. Any work that will be covered or not visible in the completed work must be inspected and accepted by the Engineer before progress of work conceals portions to be inspected. Notify the Engineer at least 3 business days before needing inspection.

## END OF SECTION 99-01000

## 99-01050 FIELD ENGINEERING

### 99-01050A General

#### 99-01050A(1) Summary

This work includes administrative and procedural requirements for field engineering services to be performed by the Contractor.

**99-01050A(2) Definitions**

Not Used

**99-01050A(3) Submittals**

Not Used

**99-01050A(4) Quality Control and Assurance**

Lines and Grades:

Such stakes or marks will be set by the Engineer as he determines to be necessary to establish the lines and grades required for the completion of the work shown and as described. In general, these will consist of the primary vertical and horizontal control points.

Stakes and marks set by the Engineer must be carefully preserved by the Contractor. In case such stakes and marks are destroyed or damaged they will be replaced at the Engineer's earliest convenience. The Contractor will be charged for the cost of necessary replacement or restoration of such stakes and marks which in the judgment of the Engineer were carelessly or willfully destroyed or damaged by the Contractor's operations. This charge will be deducted from any moneys due or to become due the Contractor.

All other stakes or marks required to establish the lines and grades required for the completion of the work must be the responsibility of the Contractor.

Existing Utilities and Equipment:

The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, the Contractor must investigate and verify the existence and location of underground utilities and other construction.

Prior to construction, the Contractor must verify the location and invert elevation at points of connection of sanitary and septic sewers, storm sewer, and water or fire service piping.

**99-01050B Materials**

Not Used

**99-01050C Construction**

Surveys for Layout and Performance:

The Contractor must perform all surveys for layout and performance, reduce field notes, and make all necessary calculations and drawings necessary to carry out the work.

The Contractor must locate and layout site improvements, and other work requiring field engineering services, including pavements, stakes for grading, fill and topsoil placement, utility slopes and invert elevations by instrumentation and similar appropriate means.

Batter boards must be located and laid out for structures, building foundations, column grids and locations, floor levels and, control lines and levels required for mechanical and electrical work.

Survey Accuracy and Tolerances:

The tolerances generally applicable in setting survey stakes for foundations, slabs, and underground work must not exceed the following:

Survey Stakes or Markers	Tolerance
Rough grading or excavation	0.10-foot
Trimming or preparation of subgrade for roadways	0.05-foot
Roadway surfacing, steel or concrete pipe	0.02-foot
Structures or building construction	0.01-foot

Such tolerance must not supersede stricter tolerances required by the plans or special provisions, and must not otherwise relieve the Contractor of responsibility for measurements in compliance therein.

**99-01050D Payment**

Not Used

**DIVISION 2 SITEWORK**

**99-02071 REMOVING PORTIONS OF EXISTING FACILITIES**

**99-02071A General**

**99-02071A(1) Summary**

Scope: This work consists of removing portions of the existing facilities, including removal of existing work to gain access to or for new work.

**99-02071A(2) Definitions**

Not Used

**99-02071A(3) Submittals**

Not Used

**99-02071(4) Quality Control and Assurance**

Not Used

**99-02071B Materials**

Not Used

**99-02071C Construction**

**99-02071C(1) Preparation**

The limits of removal must be located and identified. Items to be removed and the interface of items to be removed and items to remain intact must be identified and marked.

Prior to removing concrete or masonry, a saw cut approximately one inch deep must be made along the limits of removal on all faces that will be visible in the completed work.

At new door openings in concrete or masonry, full depth saw cuts must be made from both faces. Overcuts must not be made at corners. Remaining material at corners must be chipped out and the surfaces ground smooth.

**99-02071C(2) Removal**

Removal must be to the limits shown. Removal must be done carefully to minimize damage to the portions to remain. Remaining portions that are damaged by the Contractor's operation must be restored to original condition at the Contractor's expense.

Assemblies to be salvaged which require dismantling for removal must be matchmarked before dismantling.

Existing apparatuses, devices, or accessories which would be functionally impaired by new construction or remodeling must be moved, brought out to new surfaces, or provided with new access covers, as necessary to restore apparatuses, devices, or accessories to their original usefulness.

Piping and conduits to be abandoned must be capped or plugged.

Surfaces that are exposed to view at the limits of removal work must be patched, bumps must be removed and depressions filled, and the surface must be finished to match the existing surrounding surfaces. Depressions in concrete less than one inch deep must be deepened to one inch minimum depth before filling with cement mortar.

Anchor bolts and reinforcement must be removed at least one inch below the surrounding surfaces, and the resulting hole must be patched with cement mortar.

Existing reinforcement that is to be incorporated into the new work must be protected from damage and thoroughly cleaned before being embedded in new concrete.

**99-02071C(3) Disposal**

Materials that are to be removed must be handled under section 14-10.

**99-02071C(4) Salvage**

Materials or equipment shown to be salvaged for use by the Department must remain the property of the State and must be removed, cleaned, and stockpiled at a location at the job site designated by the Engineer.

**99-02071D Payment**

Not Used

**99-02072 RELOCATING MATERIALS AND EQUIPMENT**

**99-02072A General**

**99-02072A(1) Summary**

Scope: This work consists of relocating existing materials and equipment.

**99-02072A(2) Definitions**

Not Used

**99-02072A(3) Submittals**

Not Used

**99-02072(4) Quality Control and Assurance**

Not Used

**99-02072B Materials**

Not Used

**99-02072C Construction**

**99-02072C(1) Relocation**

Materials or equipment to be relocated must be removed carefully to avoid damage to the materials or equipment or to the materials or equipment which are to remain. Assemblies to be relocated which require dismantling for removal must be matchmarked before dismantling.

The Contractor must notify the Engineer prior to the relocation work in order that the materials or equipment may be inspected for existing damage.

Materials or equipment to be relocated must have all adhering concrete, mastics, earth, or other deleterious materials removed and must have all exterior surfaces cleaned.

Materials or equipment which are damaged by the Contractor's operations must be replaced or restored to match the condition of the materials or equipment prior to the beginning of the Contractor's operations. Replacement or restoration of damaged materials or equipment must be at the Contractor's expense.

Connections, anchorages, and fasteners for relocated materials and equipment must match existing and must be furnished and installed by the Contractor. Assemblies which have been dismantled must be reassembled to match the existing installation. Relocated materials and equipment must be installed as required for new work.

Modifications to wiring and plumbing to accommodate relocated items must be as shown. Ends of piping and conduits to be abandoned must be capped.

Surfaces that are exposed to view upon removal or relocation of materials or equipment must be patched. Bumps must be removed and depressions filled, and the surface finished to match the existing surfaces. Depressions in concrete less than one inch deep must be deepened to one-inch minimum depth before filling with cement mortar.

**99-02072C(2) Disposal**

If the Engineer determines that the materials or equipment from existing facilities to be reused in the work is unsuitable for use, the materials or equipment must be handled under section 14-10. The unsuitable material or equipment must be replaced as ordered by the Engineer and will be change order work.

**99-02072D Payment**

Not Used

**99-02074 REMOVING PORTIONS OF EXISTING ROOF COVERING**

**99-02074A General**

**99-02074A(1) Summary**

Scope: This work consists of removing portions of the existing roof covering.

**99-02074A(2) Definitions**

Not Used

**99-02074A(3) Submittals**

Not Used

**99-02074A(4) Quality Control and Assurance**

Not Used

**99-02074B Materials**

Not Used

**99-02074C Construction**

Consult with roofing manufacturer to determine:

- 1. Whether roofing material can be recycled
- 2. How to minimize material not eligible for recycling

Existing roof covering must be removed to the top of existing insulation. Removal of portions of existing roof covering must be done carefully to minimize damage to portions of the roof covering which are to remain.

Holes, tears, breaks, and abrasions to existing insulation must be repaired or insulation must be removed and replaced to match the original condition of the insulation.

Surface irregularities resulting from the removal of the existing roof covering must be filled or trimmed to provide a flat substrate surface for receiving the new roof covering.

At locations where integral felt and primer have been scraped from the top of the existing board insulation, the insulation must be repaired with polyurethane foam and the surface must be primed and covered with one layer of Type 15 roofing felt before the application of additional roofing materials. Foam for repairing existing polyurethane board insulation must be commercially available, single component, atmospherically moisture cured, semi-rigid polyurethane foam in a spray can container, suitable for repair of urethane foam insulation. Repair insulation under the insulation manufacturer's instructions.

Removal of portions of existing roof covering during any day must not extend beyond the area to be reroofed that day. Insulation exposed by removal of existing roof covering must be covered by new roofing or cutoffs the same day as removal.

Portions of insulation must be removed to full depth at the locations where new wood nailers are to be placed. Removal of portions of insulation must be to neat lines.

Damage to the roofing insulation or decking caused by the Contractor's operations must be repaired or replaced at the Contractor's expense.

Disposal: Removed materials must be recycled or disposed of under section 14-10.

**99-02074D Payment**

Not Used

**99-02076 REMOVE WASTE DISPOSAL SYSTEM**

**99-02076A General**

**99-02076A(1) Summary**

Scope: This work consists of removing the existing waste disposal system.

**99-02076A(2) Definitions**

Not Used

**99-02076A(3) Submittals**

Not Used

**99-02076A(4) Quality Control and Assurance**

Not Used

**99-02076B Materials**

Not Used

**99-02076C Construction**

Staging of Work: Work that will curtail the use of the waste disposal system must not be done until the facilities utilizing the system are closed and are no longer required.

Disposal: Sewage facilities to be removed must be pumped out and the sewage and sediment removed from such facilities must be disposed of.

Abandoning Piping: Each pipe entering or exiting the sewage disposal system to be removed must be closed by a tight fitting plug or wall of concrete not less than 0.5 foot thick. Such concrete must be commercial quality concrete and must contain not less than 505 pounds of cement per cubic yard of concrete.

Manhole Frames and Covers: Manhole frames and covers which are to be removed must become the property of the Contractor. Such disposal must comply with the laws, rules, and regulations of all agencies having jurisdiction at the disposal site.

**99-02076D Payment**

Not Used

**99-02110 CLEARING AND GRUBBING**

**99-02110A General**

**99-02110A(1) Summary**

Scope: This work consists of removing all objectionable material from the building site.

Clearing and grubbing must be performed in advance of any other grading or construction operations.

The area to be cleared and grubbed must be within the building work construction area.

**99-02110A(2) Definitions**

Not Used

**99-02110A(3) Submittals**

Not Used

**99-02110A(4) Quality Control and Assurance**

Not Used

**99-02110A(5) Site Conditions**

Traffic: Clearing and grubbing must be conducted to ensure minimum interference with roads, street, walks, or other occupied areas.

Protection of Existing Landscaping and Trees: Existing landscaping and trees which are to remain in place must be protected from injury or damage. Existing trees must be protected with a temporary fence around the drip line.

**99-02110B Materials**

Not Used

**99-02110C Construction**

**99-02110C(1) Site Clearing**

Remove trees, shrubs, grass, and other vegetation, concrete and masonry, improvements, or obstructions interfering with the new construction.

Trees to be removed must be grubbed to a depth of not less than 2 feet below finished grade.

**99-02110C(2) Removal of Waste Material**

Hauling: When hauling is done over highways or city streets, and when directed by the Engineer, the loads must be trimmed and all material removed from shelf areas of the vehicles.

Disposal: Trees, shrubs, grass, weeds and other vegetation, debris, and any obstructions above or below the ground surface that interfere with the building work, must be removed and disposed of.

**99-02110D Payment**

Not Used

**99-02220 EARTHWORK FOR BUILDING WORK**

**99-02220A General**

**99-02220A(1) Summary**

Scope: This work consists of performing earthwork for building work.

Earthwork for building work consists of structure excavation and structure backfill. Structure excavation must include excavation for footings, foundations, walls, slabs, tanks, drywells, manholes, oil/water separators, clarifiers, and trenches. Structure backfill must include backfilling under slabs; backfilling under and around footings; backfilling for walls, backfilling for pipes and conduits; backfilling holes resulting from removal of existing facilities. In addition to structure excavation and structure backfill, earthwork for building work must include any other earthwork, not mentioned, but necessary to complete the building work.

The Materials Information Handout includes information regarding foundation recommendations and reports that were prepared for use during the design of this project.

Related Work: Leach lines must be excavated and backfilled under section 99-02740.

**99-02220A(2) Definitions**

Not Used

**99-02220A(3) Submittals**

Samples: Submit samples of sand, pea gravel, or crushed stone, weighing not less than 25 pounds.

**99-02220A(4) Quality Control and Assurance**

Not Used

**99-02220A(5) Site Conditions**

Existing Underground Piping and Conduit: The location of existing underground piping and conduit is based on the best records available. Before beginning work, the Contractor must accurately locate the piping and conduit involved in the work. If the location of the existing piping or conduit deviates from the location shown by more than 5 feet, or, if no elevations are indicated and the piping or conduit is more than 3 feet below grade, the cost of the additional excavation, backfill, piping or conduit, and removal and replacement of concrete, if any, will be change order work.

Existing Surfaced or Planted Areas:

Existing surfaced or planted areas that are removed, broken, or damaged by the Contractor's operations must be restored to their original condition except as otherwise shown or described.

Restoration materials must be equal to or better than the original materials. Surfacing must be replaced to match the material thickness, grades, and finish of the adjacent surrounding surfaces.

**99-02220B Materials**

**Structure Backfill:** Structure and trench backfill must be free of organic and other deleterious material and must be suitable for the required compaction. Gravel without sand matrix must not be used except as free draining granular material beneath slabs and footings.

**Sand:** Sand must be clean, washed sand, free from clay or organic material graded such that 100 percent passes the 1/4-inch sieve, 90 percent to 100 percent passes the No. 4 sieve and not more than 5 percent passes the No. 200 sieve size.

**Pea Gravel (Naturally Rounded):**

Pea gravel (naturally rounded) must be clean, washed, dry density of not less than 95 pounds per cubic foot, free from clay or organic material and must comply with the following grading as determined by California Test 202:

Sieve or Screen Size	Percentage Passing
3/4"	100
1/2"	90-100
3/8"	40-70
No. 4	0-15
No. 8	0-3

Pea gravel must comply with the following requirements:

Test	California Test No.	Test Requirements
Durability Index	229	35 Min.

**Crushed Stone:**

Crushed stone must be clean, washed, dry density of not less than 95 pounds per cubic foot, crushed stone or crushed gravel with an angular particle size not less than 1/8 inch or more than 1/2 inch.

Sieve or Screen Size	Percentage Passing
1/2"	100
3/8"	85-100
No. 4	10-30
No. 8	0-3

Crushed stone must comply with the following requirements:

Test	California Test No.	Test Requirements
Durability Index	229	35 Min.

**99-02220C Construction**

**99-02220C(1) Preparation and Restoration**

Sawcutting: Prior to excavation or trenching, existing surfacing must be removed to saw cut lines, or to existing wood dividers or expansion joints, if any. The saw cut must be to a neat line and have a depth not less than one inch.

Restoration: Surfacing must be replaced to match the thickness, grades and finish of the adjacent surrounding surfaces.

**99-02220C(2) Structure Excavation**

Unless otherwise noted, all excavation for building work must be classified as structure excavation.

**Footing Excavation:**

The bottom of excavation must not be disturbed. The contractor must excavate by hand to the final grade. The bottom of concrete footings must be poured against undisturbed material. Unless otherwise noted, compaction of the bottom of footing excavation is not required unless the material is disturbed. The footing depths shown must be changed to suit field conditions when directed by the Engineer. Solid rock at or near required depths must not be disturbed. Unsuitable material must be excavated down to firm bearing as directed by the Engineer. Work and materials required because of excavation in excess of the depths shown, when such excavation has been ordered by the Engineer, will be change order work.

Excavate to the elevations and dimensions within a tolerance of  $\pm 1/2$  inch. Limits of the excavation must allow for adequate working space for installing materials and as required for safety of personnel. Such working space excavation must be replaced in kind and compacted at the Contractor's expense.

Overdepth excavation for footings must be backfilled with concrete or such other material recommended by the Contractor and authorized by the Engineer. Relative compaction must be not less than 95 percent.

At locations and to the limits shown, material below the bottom of the foundation or footing must be removed and replaced with select backfill under the placing and compacting requirements for backfill.

**Excavation for Pipes and Conduits:**

Pipes or conduits in the same trench must have a minimum clear distance between pipes or conduits of 6 inches. Pipes or conduits must have not less than 2 1/2 feet of cover from top of pipes or conduits to finished grade unless otherwise shown or described.

Trenching must be of sufficient depth to permit placing a minimum depth of 4 inches of compacted sand under all pipes and conduits.

Excavation adjacent to trees must be performed by hand methods where necessary to avoid injury to trees and roots. Roots 2 inches in diameter and larger must be protected with heavy burlap. Roots smaller than 2 inches in diameter adjacent to trees must be hand trimmed. Cuts through roots 1/2 inch in diameter and larger must be sealed with tree trimmers' asphaltic emulsion. If trenches remain open more than 24 hours, the side of the trench adjacent to the tree must be shaded with burlap and kept damp. Materials must not be stockpiled within the drip line of trees.

Dewatering: Excavations must be kept clear of standing water. Water must be removed by pumping if necessary. Water removed from excavation must be carried away from the building site and disposed of.

### **99-02220C(3) Structure Backfilling**

Unless otherwise noted, all backfill for building work must be classified as structure backfill. Backfill must be placed and compacted in horizontal layers, not more than 6 inches thick prior to compaction, and to the lines and grades shown or to original ground.

Structure Backfill: After structures are in place and forms are removed, wood and other debris must be removed from excavations before placing structure backfill.

Backfilling Pipes and Conduits:

Backfill placed under pipe and conduits must be compacted sand, 4 inches minimum depth. Backfill material placed to a level 6 inches above tops of pipes and conduits must be sand or fine earth and particles must not exceed 1/2 inch in greatest dimension. For wrapped, coated, or plastic pipe or conduits, sand must be used for backfill. Backfill material placed higher than 6 inches above tops of pipes or conduits must consist of material free of stones or lumps exceeding 4 inches in greatest dimension except:

1. The top 12 inches of backfill under roads, walks or paving must consist of aggregate base material.
2. The top 6 inches of backfill in planted areas must consist of topsoil.

Unless otherwise shown, pipe under roads, with less than 2½ feet of cover over the top of pipe, must be backfilled with concrete to a level 4 inches above the top of pipe. Concrete for backfill must be commercial quality concrete containing not less than 590 pounds of cement per cubic yard.

### **99-02220C(4) Compaction**

Relative compaction must be determined under California Test 216 or 231.

Unless otherwise noted below, all backfill must be compacted to a minimum relative compaction of 90 percent.

Unless authorized, compaction by jetting or ponding will not be permitted.

Compact Original Ground: Original ground surface under fill with surfacing of concrete and asphalt concrete must be compacted to a relative compaction of not less than 95 percent for a minimum depth of 6 inches.

Subgrade Preparation:

Preparation of subgrade material for placing aggregate base, surfacing, or slabs thereon must include fine grading, compaction, reworking as necessary. The upper 6 inches of the subgrade must have the same compaction as the fill to be placed over it.

The prism of backfill directly underneath the building foundation and sloping downward at 1:1 must be compacted to 95 percent.

Structure Backfill: Structure backfill must be compacted to not less than 95 percent relative compaction.

A relative compaction of not less than 95 percent must be obtained for a minimum depth of 6 inches below the bottom of the excavation before placing select backfill.

Trench Backfill: Trench backfill placed beneath slabs or paved areas must be compacted to a relative compaction of not less than 95 percent.

### **99-02220C(5) Disposal**

Surplus Material: Surplus material from the excavation must be removed and disposed of.

### **99-02220C(6) Field Quality Control**

Inspection: When the excavation is substantially completed to grade, the Contractor must notify the Engineer. No concrete must be placed until the foundation has been authorized by the Engineer.

Testing: The Department will conduct compaction tests during the backfilling and compacting operations.

**99-02220D Payment**

Not Used

**99-02236 FREE DRAINING GRANULAR MATERIAL**

**99-02236A General**

**99-02236A(1) Summary**

Scope: This work consists of furnishing and placing free draining granular material beneath slabs.

**99-02236A(2) Definitions**

Not Used

**99-02236A(3) Submittals**

Not Used

**99-02236A(4) Quality Control and Assurance**

Not Used

**99-02236B Materials**

Free Draining Granular Material: Free draining granular material must be clean, hard, durable, free-draining rock. The material gradation must be such that all passes the one-inch screen, and not more than 10 percent passes the No. 4 sieve as determined by California Test 202. Granular material must be free from organic material, clay balls, or other deleterious substances.

**99-02236C Construction**

Free draining granular material must be placed, spread, and consolidated by tamping or vibrating.

**99-02236D Payment**

Not Used

**99-02585 PAINTED PAVEMENT MARKINGS**

**99-02585A General**

**99-02585A(1) Summary**

Scope: This work consists of applying paint, temporary striping, and pavement marking tape for pavement markings.

Pavement markings include word and symbol markings, and parking stall markings.

**99-02585A(2) Definitions**

Not Used

**99-02585A(3) Submittals**

Not Used

**99-02585A(4) Quality Control and Assurance**

Not Used

**99-02585B Materials**

Paint:

Paint must be commercial quality for pavement marking, formulated for the use intended, and manufactured by a nationally recognized manufacturer of coating products.

Traffic paint must comply with the rules for control of volatile organic compound (VOC) emissions adopted by the air quality control district in the air basin in which the coatings are applied.

Temporary (Removable) Striping and Pavement Marking Tape (6 months or less): Products used for temporary (removable) striping and pavement marking tape (6 months or less) must be selected from the pre-qualified products list below:

1. Advanced Traffic Marking, Series 200
2. Brite-Line, Series 100
3. Garlock Rubber Technologies, Series 2000
4. P.B. Laminations, Aztec, Grade 102
5. Swarco Industries, "Director-2"
6. Trelleborg Industries, R140 Series
7. 3M Series 620 "CR", and Series A750
8. 3M Series A145, Removable Black Line Mask  
(Black Tape: for use only on Asphalt Concrete Surfaces)
9. Advanced Traffic Marking Black "Hide-A-Line"  
(Black Tape: for use only on Asphalt Concrete Surfaces)
10. Brite-Line "BTR" Black Removable Tape  
(Black Tape: for use only on Asphalt Concrete Surfaces)
11. Trelleborg Industries, RB-140  
(Black Tape: for use only on Asphalt Concrete Surfaces)

### **99-02585C Construction**

#### **Alignment and Layout:**

All necessary alignment and layout work must be performed by the Contractor, in a manner that will not damage the pavement.

Unless otherwise shown, the width of parking stall markings must be 4 inches.

#### **Equipment and Operation:**

Mechanical means must be used to paint pavement markings.

All equipment used in the application of paint must produce pavement markings of uniform quality.

All spray equipment must be the proper type and of adequate capacity for the work involved.

Air atomized spray equipment must be equipped with oil and water extractors and pressure regulators, and must have adequate air volume and compressor recovery capacity. Spray gun tip needle assemblies and orifices must be the proper size.

Stencils and hand spray equipment must be used to paint word and symbol markings. Stencils must be furnished by the Contractor. The stencil layout must comply with the dimensions shown.

**Surface Preparation:** Surfaces to receive paint, temporary striping, or pavement marking tape must be cleaned of all dirt and loose material.

#### **Application:**

Paint must be applied only on dry surfaces, and only during periods of favorable weather, under the manufacturer's instructions.

On new surfacing, paint must be applied in 2 coats. The first coat must be dry before application of the second coat is applied.

On existing surfacing, paint must be applied in one coat.

Completed pavement markings must have clean and well-defined edges, and must comply with the dimensions shown or as described.

Drips, oversprays, improper markings, and paint material tracked by traffic must be immediately removed from the pavement by methods authorized by the Engineer. All such removal must be at the Contractor's expense.

Temporary striping and pavement marking tape must be applied under the manufacturer's instructions.

Application Rates: Each application of paint must be applied at the rates recommended by the paint manufacturer for the type of surface involved.

Protection: Newly placed pavement markings must be protected from damage by traffic or other causes until the paint is thoroughly dry.

Disabled Accessible Parking Stall Symbol: Each parking space reserved for persons with physical disabilities must have a minimum 3' x 3' surface identification with the international symbol of accessibility. The symbol and border must be white and the background must be blue complying with Federal Standard 595B, Color No. 15090.

#### **99-02585D Payment**

Not Used

#### **99-02740 SEPTIC SEWAGE DISPOSAL SYSTEM**

##### **99-02740A General**

##### **99-02740A(1) Summary**

Scope: This work consists of installing and constructing a septic sewage disposal system.

Septic sewage disposal system must include such other materials and appurtenances, not mentioned, which are required for the complete installation and proper operation of the system.

Related Work: Sewer pipes in buildings, and to a point 5 feet beyond the building, must comply with section 99-15.

Order of Work: Work which will curtail the use of the existing sewage system must not be done until the facilities utilizing the system are closed and are no longer required.

##### **99-02740A(2) Definitions**

Not Used

##### **99-02740A(3) Submittals**

Product Data:

Material lists for materials to be used must be submitted and must include the name of the manufacturer and the source, model number, description, and standard of manufacture.

Manufacturer's descriptive data and catalog cuts for the following must be submitted:

1. Underground tracer tape
2. Sewer and drain pipe and fittings
3. Leach line pipe and fittings
4. Septic tank
5. Manhole frames and covers
6. Cleanouts
7. Coatings
8. Valve boxes
9. Pipe wrapping tape
10. Filter fabric
11. Distribution box
12. Observation well
13. Sampling box
14. Cement mortar
15. Epoxy mortar
16. Sealant

Samples: Test results and a representative sample of the following products weighing approximately 25 pounds must be submitted to the Engineer at the job site:

1. Sand
2. Leach line backfill
3. Leach line rock
4. Pea gravel

Shop Drawings: Shop drawings for precast septic tank used in the work must be submitted. Complete bedding, assembly, installation, and backfilling instructions must be submitted.

Certificates of Compliance: Submit a certificate of compliance for manhole frames and covers.

#### **99-02740A(4) Quality Control and Assurance**

Codes and Standards: All sanitary sewage work must comply with the applicable portions of the CPC, California Code of Regulations, Title 24, Part 5.

#### **99-02740B Materials**

##### **99-02740B(1) Identification**

Underground Tracer Tape: Underground tracer tape must be permanent, detectable, bright colored, continuous printed plastic tape intended for direct burial service; not less than 2 inches wide by 4 mils thick; lettering must read "CAUTION SEWER BURIED BELOW".

##### **99-02740B(2) Pipes and Pipe Fittings**

The Contractor must install pipes and fittings from the following materials, of the weight and class with the joining method as indicated.

Sewer and Drain Pipe and Fittings: Sewer and drain pipe and fittings must be polyvinyl chloride (PVC) gravity sewer plastic pipe and fittings complying with ASTM D 3034, Standard Dimension Ratio (SDR) 35, with integral bell and bell and spigot rubber gasketed joints or complying with ASTM D2665 with solvent welded fittings. Rubber gaskets must comply with ASTM F 477. Stainless steel clamps with rubber boots must not be used.

Sewer Pipe Adapters: Sewer pipe adapters for PVC to cast iron soil or clay pipe must be appropriately sized PVC flexible coupling manufactured for connecting dissimilar pipes. Adapters must be attached to piping with adjustable stainless steel band clamps with hex tightening screws. Rubber boots will not be allowed. Sewer pipe adapter must be Indiana Seal; Fernco; or equal.

Vent Pipe and Fittings:

Vent pipe underground must be plain end schedule 40 polyvinyl chloride (PVC) pipe with solvent welded fittings ASTM D 2241, Type I, Grade 1, Standard Dimension Ratio (SDR) 21, rated for 200 psi.

Vent pipe risers above ground and below ground must be Schedule 40 galvanized steel pipe complying with ASTM A 53, with 150 psi galvanized malleable iron banded screwed fittings and galvanized steel couplings. The weight of the zinc coating must be not less than 90 percent of that specified in ASTM A 53.

Water Pipe and Fittings:

Water pipe and Fittings must comply with section 99-15060.

Leach Line Pipe:

Leach line pipe must be perforated PVC plastic sewer pipe and fittings, standard dimension ratio, (SDR) 35, complying with ASTM D 3034; or perforated PVC drain, waste and vent pipe, (PVC-DWV), complying with ASTM D 2665.

Perforations must be 1/2 inch or 5/8 inch in diameter, located in 2 rows 120 degrees apart and spaced at intervals between 3 inches to 5 inches. Piping which is manufactured without the required drain holes must have the holes drilled using authorized drilling equipment and jigs. Burrs on the pipe surfaces resulting from the drilling operation must be removed.

### **99-02740B(3) Manholes, and Valve Boxes**

Manholes: Manholes and distribution box riser sections and cones must be precast, reinforced concrete complying with ASTM C 478 or precast reinforced concrete pipe complying with ASTM C 76.

Manhole Frame and Cover: Manhole frame and cover must be gray cast iron, complying with ASTM A 48, Class 30 or greater (traffic type). Cover must be T-handle bar lock (no bolt), closed pick hole and must be marked "SS," "SEWER," or "SANITARY SEWER." Three T-handles must be supplied. The side or bottom of the cover must be machined grooved for an integral O-ring gasket. The frame seat for the bottom O-ring gasket must be a minimum of 7/8 inch in width.

Valve Box: Valve box must be precast concrete box with cast iron cover. Cover must be factory marked "SEWER," "SS," or "SANITARY SEWER", and must be traffic rated. Valve box must be Cook Concrete Products, No. 10-T-12; Christy No. G-5C; Brooks, No. 3-RT; or equal with extensions as required.

### **99-02740B(4) Septic Tank**

Septic Tank: Septic tank must be a precast reinforced concrete tank of the size shown. All joints must be above the normal operating water level. The septic tank must be 1) listed and approved by the International Association of Plumbing and Mechanical Officials (IAPMO) and tank must be marked accordingly, or 2) the design must be stamped and certified by a California Registered Engineer as meeting the general industry standards necessary to comply with these standards.

Cones and risers must be precast, reinforced concrete, complying with ASTM C 478 or precast reinforced concrete pipe complying with ASTM C 76.

### **99-02740B(5) Cleanouts**

Cleanout to Grade: Cleanout piping must terminate with an appropriately sized flexible PVC access cap and stainless steel band coupler with hex tightening screw. Rubber coupling or cap will not be allowed. Access cap must be Indiana Seal; Fernco; or equal.

### **99-02740B(6) Valves**

Not Used

### **99-02740B(7) Observation Wells**

Observation Wells: Observation wells must be sewer pipe, SDR 35, complying with ASTM D 3034; or plastic drain, waste, and vent pipe, complying with ASTM D 2665, perforated as shown, and terminating with an appropriately sized flexible PVC access cap and stainless steel band coupler with hex tightening screw threaded cap and stainless steel band coupler with hex tightening screw threaded cap fitting.

### **99-02740B(8) Miscellaneous Materials**

Cement Mortar: Cement mortar must be one part cement to 2 to 3 parts clean plaster or concrete sand mixed with just enough water for suitable consistency.

Epoxy Adhesive: Epoxy adhesive must be commercial quality low viscosity paste polysulfide extended epoxy formulated primarily for use in bonding new portland cement concrete to existing portland cement concrete.

Joint Sealant: Plastic joint sealant must be commercial quality butyl mastic strip type, complying with ASTM C 900, Henry; Press-Seal; or equal.

Sealant: Sealant for precast septic tank must be closed cell expanded neoprene complying with ASTM D 1056, Grade RE 41.

Sand: Sand must be clean, washed sand, free from clay or organic material graded such that 90 percent to 100 percent passes the No. 4 sieve size and not more than 20 passes the No. 50 sieve size.

Leach Line Backfill: Leach line backfill must be native material free of rocks greater than 2 inches in greatest dimension, vegetable matter, trash, or other deleterious material.

Leach Line Rock: Leach line rock must be washed, clean, graded gravel, rock, or crushed rock varying in size between 3/4 in and 2½ inches in greatest dimension. Rock must have not more than 10 percent loss when tested under California Test 214. Tests may be waived if rock is from an authorized supply or is accompanied by a certificate of compliance.

Pea Gravel: Pea gravel must be clean aggregate, free from clay or organic material and graded such that 90 percent to 100 percent passes the No. 4 sieve size, and not more than 50 percent must pass the No. 30 sieve size.

**Filter Fabric:**

Filter fabric must be commercial quality, chemically stable, non-biodegradable, ultraviolet stabilized, 100 percent polyester, 100 percent polypropylene or 100 percent combined polyester and polypropylene, nonwoven, needle punched permeable geotextile.

Filter fabric must be shipped in packaging that must protect filter fabric from ultraviolet radiation and abrasion during storage and handling. Filter fabric must be Mirafi, 140N; AMOCO Fabrics, 4506; or equal.

Filter fabric must comply with the following requirements:

Property	Value	Test Designation
Average roll weight	4.0 ounces per square yard, min.	ASTM D 1117
Grab tensile strength, Pounds	MD 120 ±15 XMD 110 ±15	ASTM D 5034, 5035 1 inch grip
Grab elongation	MD 50 min.	ASTM D 5034, 5035
Trapezoidal tear strength, Pounds	MD 50 ±10 XMD 45 ±10	ASTM D 1117
Water passage rate	100 gallons per minute per square foot, min.	ASTM D 4491 (Constant head, 2 inches)
Thickness, mils	55 min.	ASTM D 1777
Permeability, cm per sec.	0.3 cm per sec.±0.1 cm per sec.	ASTM D 4491 (Constant head, 2 inches)
AOS (Avg. opening size)	0.21 mm, min.	ASTM D 4751

Epoxy Mortar: Epoxy mortar must be a commercial quality trowelable 3-component epoxy mortar consisting of 2 pourable epoxy components and a chemically resistant aggregate filler of silica quartz sand with maximum water absorption of 0.1 percent. Epoxy must have a pull-off strength of not less than 1,000 psi and a 90 percent cure in 24 hours. Epoxy mortar must be the type that requires no primer as bonding agent.

Pipe Wrapping Tape: Pipe wrapping tape must be pressure sensitive polyvinyl chloride or pressure sensitive polyethylene tape having nominal thickness of 20 mils. Wrapping tape must be Polyken, 922; Manville, Trantex VID-20; Scotchrap, 51; or equal.

**99-02740B(9) Coatings**

Bituminous Coating: Bituminous coating must be cold applied coal or epoxy based single component, self-priming, heavy-duty protective coating designed for buried concrete. Bituminous coating must be Devoc, Devtak 5A; Polykem, 938; Tnemec, 46-465; or equal.

**99-02740C Construction**

**99-02740C(1) Preparation**

Existing System: The existing septic tank must be pumped of solids and liquid, and the sewage and sediment disposed of.

**99-02740C(2) Installation of Identification**

Continuous underground tracer tape must be installed directly above the buried line and 6 inches to 8 inches below finished grade during backfilling operations. Appropriate tape must be used for drain, sewer pipes.

### **99-02740C(3) Installation of Pipes and Fittings**

Closing Abandoned Utilities: Open ends of abandoned underground utilities must be closed. Sufficiently strong closures, either 6 inches of concrete or pipe cap with concrete thrust block, must be placed to withstand hydro-static pressure which may result after the pipes are closed.

Sewers Near Water Lines:

Sewers near water lines must be installed below water lines in the same trench, in parallel trenches less than 10 feet apart, or at any crossing.

When water lines cross above a sewer line, a vertical separation of not less than 12 inches must be maintained between the top of the sewer pipe and the bottom of the water line.

Connections between Differing Pipe Types: Joints between different types of pipes must be made with sewer pipe adapters intended for that purpose.

Damaged Pipe: Damaged pipe must be replaced prior to use. Misaligned pipe must be corrected or replaced prior to use.

Cleaning Pipe:

Interior of pipes must be cleaned of dirt and other materials as the work progresses.

Lines between manholes must be flushed as necessary to remove collected material.

### **99-02740C(4) Installation of Septic Tanks, Manholes, and Valve Boxes**

Sewer Structures:

Septic tanks, distribution boxes, manholes, riser sections, concentric/eccentric cones, grade rings, valve, access, utility and boxes including extensions must be installed under the plans, these specifications, code and standards and/or the manufacturer's instructions where applicable when authorized by the Engineer.

Manufactured sewer structures must be installed under the manufacturer's instructions and to the lines and grades shown.

All joints and penetrations of septic tanks, septic tank manholes, and distribution boxes must be sealed watertight, inside and outside, with epoxy mortar or joint sealant.

Box penetrations must be precast or cored.

Interior of tank must be cleaned of all debris after installation of tank, barrels, and manhole frame and covers is complete and prior to testing. All debris from flushing and testing must be removed prior to use.

Collars must be broom surface finished. Collars must match existing/finished grade. Compaction prior to form work must be as described elsewhere.

Where manholes, pipe inlets, or cleanouts to grade are located in areas to be paved or surfaced, no individual structure must be constructed to final grade until the paving or surfacing has been completed immediately adjacent to said structure.

### **99-02740C(5) Installation of Cleanouts**

Cleanouts must be installed 90 degrees to finished grade and must terminate in a valve box. A concrete pad must be provided full width of the trench under a wye branch.

Cleanouts to grade must be a combination of fittings as shown. Piping and fittings for 4-inch pipe must be sewer pipe.

Collars must be broom surface finished. Collars must match existing/finished grade. Compaction prior to form work must be as described elsewhere.

Where cleanouts are to be installed to grade in areas to be paved or surfaced, no individual structure must be constructed to final grade until the paving or surfacing has been completed in the indicated area.

**99-02740C(6) Installation of Valves**

Not Used

**99-02740C(7) Installation of Leach Lines**

Leach Lines:

Leach line construction must be performed in dry weather. The excavation for leach lines must not commence until the soil moisture condition is dry to a depth of 2 inches as defined in the following definition from Table 3, "Criteria for Describing Moisture Condition," in ASTM D 2488: "Absence of moisture, dusty, dry to the touch."

The trenches must be prepared by carefully raking sidewalls and the bottom to remove any smeared or glazed soil surfaces. All loose material must be removed from the trench. Sharp objects which may damage the filter fabric must be removed during backfilling operations.

Leach line trenches must not remain exposed to the elements for more than one day after excavation. Open trenches must not, under any circumstances, be exposed to rainfall, or any other external source of moisture.

A single layer of filter fabric extending the full perimeter of the trench must be placed immediately adjacent to the bottom and sides of the trench prior to placing leach line rock. All splices in the filter fabric must have a 12-inch minimum overlap. Washed rock must be placed in the center of the trench to minimize disturbance of the trench sidewalls.

Leach line pipe must be installed on prepared rock layers to the invert elevations shown and to flat grades established by accurate survey methods. Pipes must be within 1/4 inch of the required grade and installed with perforated sides down.

Washed rock fill material must be placed evenly on both sides of the leach line pipe and above the pipe in such a manner as to prevent displacement or disturbance of the pipe system.

Leach line crossover inverts must be placed by accurate survey methods and must be within 1/8 inch of the required grade.

Sand and backfill placed above the leach line filter fabric must be placed without adding water. The backfill material must be placed in 6-inch maximum thickness lifts and, unless otherwise shown, mounded 3 inches above the trench. Backfill must not be compacted.

**99-02740C(8) Application of Coatings**

The interior and exterior surfaces of precast sewer structures, and the exterior surfaces of cast-in-place concrete sewer structures, except the exterior bottom of tanks, must be completely coated with 2 applications of bituminous coating, applied at a rate of 100 square feet per gallon.

The preparation of surfaces to receive coatings must be under the coating manufacturer's instructions.

Concrete surfaces to be coated must not be coated until 28 days after the last concrete for these structures has been poured.

The edge and bottom of manhole cover seat areas must be coated with a uniform application of heavy duty, waterproof automotive or industrial grease.

**99-02740C(9) Tap Connection**

Not Used

**99-02740C(10) Field Quality Control****99-02740C(11) Testing**

Testing Pipes:

All sewer and drain pipes must be tested for obstructions before covering the pipes by balling and flushing the pipes with an authorized commercial sewer cleaning ball. The ball must be moved slowly through the sewer with a tag line. Four-inch sewer pipe must be tested by pulling an appropriate sized inflatable plug through the pipe. Obstructions or irregularities must be removed or repaired.

Sewer and drain pipes must be tested for leakage for a minimum period of 4 hours by filling with water to an elevation of 4 feet above the average invert of sewer, or to the top of the manholes where less than 4 feet deep. The system must show no visible leaks, and the leakage rate must not exceed 3.5 gallons per 24 hours, per 1-inch diameter, per 100 feet of pipe. Sewers may be tested in sections with the test water progressively passed down the sewers if feasible. Water must be released at a rate which will not create water hammer or surge in the plugged section of sewer.

In lieu of hydrostatic test with water, the air test method, "Air Test," as outlined in the CPC, may be used.

Testing Septic Tank: The septic tank must be tested for leakage by filling the tank with water to the outlet flow line for a period of 24 hours. The tank must remain watertight. Repairs, if necessary, must be made at the Contractor's expense.

**99-02740D Payment**

Not Used

**99-02842 GUARD POSTS AND BOLLARDS**

**99-02842A General**

**99-02842A(1) Summary**

Scope: This work consists of constructing guard posts and bollards.

**99-02842A(2) Definitions**

Not Used

**99-02842A(3) Submittals**

Not Used

**99-02842A(4) Quality Control and Assurance**

Not Used

**99-02842B Materials**

Steel Posts: Steel posts for guard posts and bollards must be standard weight, galvanized steel pipe complying with the details shown.

Concrete: Concrete for guard posts and bollards must be commercial quality concrete, proportioned to provide a workable mix suitable for the intended use, with not less than 505 pounds of cement per cubic yard.

**99-02842C Construction**

Installation:

The length and diameter of the guard posts and bollards must comply with the details shown.

Guard posts and bollards must be placed in holes excavated to the depth and cross section shown and must be installed plumb.

Excavations for guard posts and bollards must be backfilled with concrete as shown. Guard posts and bollards must be filled with concrete.

Painting: Guard posts and bollards must be prepared and painted under section 99-09900.

**99-02842D Payment**

Not Used

**99-02846 ACCESSIBLE PARKING SIGNS**

**99-02846A General**

**99-02846A(1) Summary**

Scope: This work consists of installing accessible parking signs.

**99-02846A(2) Definitions**

Not Used

**99-02846A(3) Submittals**

Product Data: Manufacturer's descriptive data for sign materials, colors, graphics, and sign fastening details must be submitted.

Certificate of Compliance: Submit a certificate of compliance for the sheet aluminum.

**99-02846A(4) Quality Control and Assurance**

Regulatory Requirements: Accessible parking signs must comply with the requirements in Identification of parking spaces for off-street parking facilities, 24 CA Code of Regs Pt 2 § 1129B.4, and Stopping, Standing, and Parking, CA Veh Code §§ 22500 through 22526.

**99-02846B Materials**

Sign Colors: The color white must comply with the requirements in FED-STD-595, Color No. 17886. The color blue must comply with the requirements in FED-STD-595, Color No. 15090.

Signs:

Single sheet aluminum signs must be fabricated from sheet aluminum alloy 6061-T6 or 5052-H38, not less than 0.063-inch thick (14-gauge) with rounded corners. Alloy and temper designations for sheet aluminum must comply with the requirements in ASTM B 209.

Sheet aluminum must be cleaned and pretreated under ASTM B 449, Class 2.

The Contractor must furnish Type III retroreflective sheeting under ASTM D 4956. The adhesive backing must be pressure sensitive and fungus resistant. Retroreflective sheeting must be applied to sign panels as recommended by the retroreflective sheeting manufacturer without stretching, tearing, or damage.

A protective overlay film of the type, kind, and product that is approved by the manufacturer of the retroreflective sheeting must be applied. Protective overlay film must be premium quality.

The face of each finished sign must be uniform, flat, smooth, and free of defects, scratches, wrinkles, gel, hard spots, streaks, extrusion marks, and air bubbles. The front, back, and edges of the sign panels must be free of router chatter marks, burns, sharp edges, delaminated skins, excessive adhesive over spray and aluminum marks.

Signs must be protected by thorough wrapping, or other methods to ensure that signs are not damaged by weather conditions and during transit. Padding and protective materials must be placed between signs as appropriate. Finished sign panels must be transported and stored by method that protects the face of signs from damage. The Contractor must replace wet, damaged, or defective signs.

Sign Post: Sign post must be commercial quality, standard weight, galvanized steel pipe complying with the requirements in ASTM F 1083. Post must be supplied with galvanized steel post top.

Fastening Hardware: Fastening hardware must be galvanized or cadmium plated.

Concrete: Concrete for sign posts must be commercial quality concrete, proportioned to provide a workable mix suitable for the intended use, with not less than 505 pounds of cement per cubic yard.

**99-02846C Construction**

Sign posts must be set vertically in concrete, in holes excavated to the depth and cross-section shown.

Signs must be fastened rigidly and securely to the sign post.

**99-02846D Payment**

Not Used

## DIVISION 3 CONCRETE AND REINFORCEMENT

### 99-03300 CAST-IN-PLACE CONCRETE

#### 99-03300A General

##### 99-03300A(1) Summary

Scope: This work consists of constructing cast-in-place concrete facilities.

Concrete:

Except for concrete used for minor work, concrete must comply with section 90. The minimum required compressive strength must be as described or 3,600 psi at 28 days, whichever is greater.

Concrete for minor work must comply with section 90-2.

Reinforcement: Reinforcement must comply with section 52, except you may use deformed bars complying with ASTM A 615/A 615M, Grade 60.

##### 99-03300A(2) Definitions

Not Used

##### 99-03300A(3) Submittals

Product Data:

Manufacturer's descriptive data, installation and use instructions for admixtures, expansion joint material, vapor barrier, curing compound, hardener, and sealer must be submitted.

Descriptive data must be delivered to the Engineer at the job site.

Concrete Mix Designs: Submit copies of concrete mix designs.

Certificates of Compliance: Submit a certificate of compliance when required.

##### 99-03300A(4) Quality Control and Assurance

Not Used

#### 99-03300B Materials

##### 99-03300B(1) Concrete Mixes

The amount of cementitious material used per cubic yard of concrete for each building element must comply with the following:

Type	Cementitious Material Content (Pounds/CY)
Concrete (Structural Work): Footings, foundation walls, floor slabs, building frame members, building walls	590 min. <sup>a</sup>
Concrete (Minor Work): For concrete curbs, sidewalks, driveways, gutter depressions, new door openings, and collars	505 min.

Notes:

<sup>a</sup>For concrete designated by compressive strength, the maximum amount of cementitious material must be 800 pounds per cubic yard.

In addition to the above requirements, concrete must comply with section 90-1.02I.

##### 99-03300B(2) Colored Concrete

Not used.

### **99-03300B(3) Form Materials**

Forms for Exposed Finish Concrete:

Forms for exposed surfaces must be plywood, metal or other panel type materials. Plywood must be not less than 5/8 inch thick and without scars, dents, and delaminations. Forms must be furnished in largest practical pieces to minimize number of joints.

Plywood must comply with the requirements of U. S. Product Standard PS-1 for Exterior B-B (Concrete Form) Class I.

Forms for edges of slabs must be nominal 2-inch solid stock lumber, plywood, or metal forms.

Forms for Unexposed Finish Concrete: Forms for unexposed finish concrete surfaces must be plywood, lumber, metal, or other acceptable material.

Forms for Cylindrical Columns or Supports: Forms for cylindrical columns must be metal, fiberglass reinforced plastic, paper, or fiber tubes. Paper or fiber tubes must be constructed of laminated plies using water-resistant adhesive with wax-impregnated exterior for protection against weather or moisture.

Form Ties: Form ties must be factory fabricated, removable or snapoff metal ties for use as necessary to prevent spreading of forms during concrete placement.

Form Oil: Form oil must be commercial quality form oil which will permit the ready release of the forms and will not discolor the concrete.

### **99-03300B(4) Reinforcement**

Not Used

### **99-03300B(5) Epoxy**

Epoxy must be furnished as 2 components which must be mixed together at the site of the work.

Epoxy Resin Adhesive: Epoxy resin adhesive must comply with State of California Specification No. 8040-21M-08 or other epoxy suitable for bonding new concrete to old.

Epoxy Mortars: Epoxy mortar and epoxy mortar surface treatment must consist of a commercial quality, trowelable mixture consisting of epoxy and sand. Epoxy must have a pull-off strength of not less than 1,000 psi and a 90-percent cure in 24 hours. Epoxy must be of the type that requires no primer as a bonding agent.

Sand:

Sand for use in epoxy mortars must be clean and must have a moisture content of not more than 0.50-percent when tested under California Test 226.

Sand for epoxy mortar surface treatment must be graded such that 100-percent passes the No. 100 sieve.

### **99-03300B(6) Related Materials**

Anchor Bolts and Anchor Rods, Nuts and Washers:

Headed and Unheaded Anchor Bolts and Anchor Rods: Comply with ASTM F 1554. Use Grade 36 unless a higher grade is shown.

Nuts: Comply with ASTM A 563.

Washers:

1. Washers bearing on wood surfaces must be commercial quality.
2. Washers bearing on steel surfaces must comply with ASTM F 436, Type 1.
3. Plate washers must comply with ASTM A 36/A 36M.

Exposed anchor bolts and anchor rods, nuts and washers must be hot-dipped galvanized.

Expansion Joint Material: Expansion joint material must be commercial quality asphalt impregnated pressed fiber sheets, 1/2-inch minimum thickness.

Vapor Barrier: Vapor barrier must be not less than 15 mils thick and must comply with the requirements of ASTM E 1745, Grade A. Tape for overlapped seams must be as recommended by the manufacturer of the vapor barrier.

Bond Breaker: Bond breaker must be Type I asphalt saturated organic felt or such other material authorized by the Engineer.

Nonskid Abrasive Aggregate: Nonskid abrasive aggregate must be commercial quality aluminum oxide, silicon carbide, or almandite garnet grit particles; screen size 12-30 or 14-36.

Type A Control Joints: Type A control joints must be commercial quality, preformed, T-shaped plastic strips with detachable top flange.

Keyed Construction Joint Forms: Keyed construction joint forms must be commercial quality, galvanized metal or plastic, factory fabricated construction joint forms. Forms must produce a rabbeted key type joint.

Divider and Edger Strips: Divider and edger strips must be foundation grade redwood.

Mortar: Mortar must consist of one part cement to 2 parts clean sand and only enough water to permit placing and packing.

Curing Compound: Curing compound must be curing compound no. 6.

Concrete Hardener: Concrete hardener must be commercial quality water borne penetrating type magnesium fluosilicate, zinc fluosilicate or combination thereof.

Concrete Sealer: Concrete sealer must be commercial quality VOC-compliant, silane type sealer with hydrophobic and oleophobic properties.

Nonshrink Grout:

Nonshrink grout must be metallic for concealed areas, nonmetallic for exposed areas.

Grout must be factory packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107; free of oxidizing catalysts and inorganic accelerators, used as dry or damp pack, or mixed to a 20-second flow (CRD C621), without segregation or bleeding at any temperature between 45 deg F and 90 deg F.

Working time of grout must be 30 minutes or more.

## **99-03300C Construction**

### **99-03300C(1) Preparation**

Existing Concrete Construction:

Where fresh concrete joins existing or previously placed concrete or masonry, the contact surfaces of the existing or previously placed material must be roughened, cleaned, flushed with water and allowed to dry to a surface dry condition immediately prior to placing the fresh concrete. The roughened surface must be no smoother than a wood trowelled surface. Cleaning of the contact surfaces must remove laitance, curing compounds, debris, dirt and such other substances or materials which would prevent bonding of the fresh concrete.

Abrasive blast methods must be used to clean horizontal construction joints to the extent that clean aggregate is exposed.

Exposed reinforcing steel located at the contact surfaces which is to be encased in the fresh concrete must be cleaned to remove any substance or material that would prevent bonding of the fresh concrete.

Forms:

Forms must be mortar tight, true to the dimensions, lines, and grades shown, securely fastened and supported, and of adequate rigidity to prevent distortion during placing of concrete.

Forms for exposed surfaces must be constructed with triangular fillets not less than 3/4" x 3/4" attached so as to prevent mortar runs and to produce smooth straight chamfers at all sharp edges of the concrete.

Form fasteners must be removable without chipping, spalling, heating or otherwise damaging the concrete surface. Form ties must be removed to a depth of at least one inch below the surface of the concrete.

The inside surfaces of forms must be cleaned of all dirt, mortar and foreign material. Forms must be thoroughly coated with form oil prior to use.

Forms must not be stripped until at least 40 hours after placing concrete, except soffit forms and supports must not be released or removed until at least 10 days after placing concrete.

Anchorage and embedded items must be placed and rigidly secured at their planned locations prior to placing concrete.

Reglets or embedded flashing must be installed on concrete forms before the concrete is placed.

Redwood dividers must have 16d galvanized nails partially driven into both vertical faces at 18 inches on center.

#### Vapor Barrier:

Vapor barrier must be installed under the manufacturer's instructions and must be protected with a 3-inch layer of clean uncompacted sand cover.

Unless otherwise shown, vapor barrier must be placed under portions of the floor slab scheduled to receive finish flooring.

#### Placing Reinforcement:

If authorized, you may use plastic supports to hold reinforcement in position.

Set wire ties with ends directed into concrete, away from exposed concrete surfaces.

Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

**Ground Bar:** A continuous reinforcing steel bar must be installed in the building foundation at the location shown for the electrical ground bar. The use of epoxy coated reinforcing bar is not permitted. The end of the ground bar must extend beyond the concrete surface and must be protected from damage by construction operations.

#### **99-03300C(2) Placing Concrete**

Concrete must be placed under section 51-1.03D.

Concrete must be deposited and consolidated in a continuous operation within limits of construction joints, until the placing of the panel or section is completed.

When concrete is to be placed in large areas requiring more than two pours, concrete must be placed in alternate long strips between construction joints and the final slab infilled.

#### **99-03300C(3) Colored Concrete**

Not used

#### **99-03300C(4) Finishing Concrete Surfaces**

Finishing Unformed Surfaces:

Slabs must be placed full thickness to finish elevation and leveled to screeds by use of long straightedges. The screeds must be set to grade at approximately 6-foot centers. After leveling, screeds must be removed and the surface must be floated with wooden floats.

Type A control joint strips must be inserted into the floated concrete so that the bottom of the top flange is flush with the finish elevation. Strips must be standard manufactured lengths and must be placed on an approximate straight line. The top flange of the strips must be removed after the concrete has set and cured.

The floated surface must be trowelled with steel trowels. Troweling must form a dense, smooth and true finish. Walkways, pedestrian ramps, stairs and outdoor slabs for pedestrian traffic must be given a non-slip broom finish unless a different finish is described.

The application of cement dust coat will not be permitted.

Steel trowel finish and broom finish will not be required for slabs to receive exposed aggregate finish nor for slabs to be covered with ceramic tile.

Concrete floor surfaces to receive ceramic tile must be floated to grade and then, before final set of the concrete, the floated surfaces must be roughened with stiff bristled brushes or rakes.

Finished surfaces of floor slabs must not deviate more than 1/8 inch from the lower edge of a 10-foot long straight edge.

#### Finishing Formed Surfaces:

Formed concrete surfaces must be finished by filling holes or depressions in the surface, repairing all rock pockets, and removing fins. All surfaces of formed concrete exposed to view must have stains and discolorations removed, unsightly bulges removed, and all areas which do not exhibit the required smooth, even surface of uniform texture and appearance must be sanded with power sanders or other authorized abrasive means until smooth, even surfaces of uniform texture and appearance are obtained.

Cement mortar, patching and finishing materials used to finish exposed surfaces of concrete must closely match the color of surrounding surfaces.

Nonskid Abrasive Aggregate Finish: Where shown, walkways must receive a nonskid abrasive aggregate (grit) finish. The grit must be applied uniformly at the rate of not less than 0.3 pound per square foot and tamped into the floated concrete surface while the concrete is plastic. The grit must be buried about 0.7 diameter of each particle into the concrete.

#### **99-03300C(5) Curing Concrete**

Freshly placed concrete must be protected from premature drying and excessive cold or hot temperatures.

Floor slabs must be cured by the water method as specified for structures. Initial curing of floor slabs must start as soon as free water has disappeared from the concrete surface.

Concrete surfaces, other than floor slabs, must be cured by the forms-in-place method or the water method as specified for structures.

Concrete curbs, sidewalks, collars, and gutter depressions may be cured by the curing compound method.

#### **99-03300C(6) Protecting Concrete**

Vehicles, equipment, or concentrated loads weighing more than 300 pounds individually and material stockpiles weighing more than 50 pounds per square foot will not be permitted on the concrete within 10 calendar days after placing.

#### **99-03300C(7) Special Treatments**

Concrete Hardener:

Chemical concrete hardener must be applied to the floor surfaces shown, prior to the application of concrete sealer. Surfaces must be clean and dry before the application of hardener.

The solution must be applied under the manufacturer's instructions.

After the hardener has dried, the surface must be mopped with water to remove encrusted salts.

Concrete Sealer: Concrete sealer must be applied to the concrete surfaces designated on the plans under the manufacturer's instructions for heavy duty use. The sealer must be applied to dry concrete surfaces.

Epoxy Resin Adhesive: Epoxy resin adhesive must be applied to concrete surfaces shown. Epoxy resin adhesive must be mixed and applied under the manufacturer's instructions.

Epoxy Mortars:

Epoxy for use as a binder in epoxy mortars must be thoroughly mixed together before the aggregate is added, and unless otherwise specified, the mix proportions must consist of one part binder to approximately 4 parts of aggregate, by volume.

All surfaces against which epoxy mortars are to be applied must be free of rust, paint, grease, asphalt, and loose or deleterious material.

#### **99-03300D Payment**

Not Used

#### **99-03603 DRILL AND BOND DOWELS**

##### **99-03603A General**

##### **99-03603A(1) Summary**

Scope: This work consists of drilling holes in existing concrete and installing and bonding bar reinforcing steel dowels into such drilled holes in existing concrete.

##### **99-03603A(2) Definitions**

Not Used

##### **99-03603A(3) Submittals**

Not Used

##### **99-03603A(4) Quality Control and Assurance**

Not Used

##### **99-03603B Materials**

Bonding Material: The bonding material must be magnesium phosphate concrete, either single component (water activated) or dual component (with a prepackaged liquid activator), as authorized by the Engineer.

Dowels: Dowels must be bar reinforcing steel, under section 99-03300.

##### **99-03603C Construction**

Installation:

The holes must be drilled by methods that will not shatter or damage the concrete adjacent to the holes. The diameter of drilled holes must be 1/2 inch larger than the nominal diameter of the dowels unless otherwise shown.

Immediately prior to placing the dowels, the holes must be cleaned of dust and other deleterious materials, and the holes must be dry.

Sufficient bonding material must be placed in the hole so that no voids remain after the dowels are inserted.

Dowels which fail to bond or are damaged before new concrete is placed must be removed and replaced.

Magnesium phosphate concrete must be formulated for minimum initial set time of 15 minutes and minimum final set time of 25 minutes at 70°F. The materials, prior to use, must be stored in a cool, dry environment.

Mix water used with water activated material must be free from oil and impurities and contain not more than 2,000 parts per million as Cl nor more than 1,500 parts per million of sulfate as SO<sub>4</sub>.

The quantity of water for single component type or liquid activator for dual component type to be blended with the dry component, must be within the limits recommended by the manufacturer and must be the least amount required to produce a pourable mix.

Magnesium phosphate concrete must not be mixed in containers or worked with tools containing zinc, cadmium, aluminum, or copper metals.

The surface of any dowel coated with zinc or cadmium must be coated with a colored lacquer before installation of the dowel. The lacquer must be allowed to dry thoroughly before embedment of said dowels.

#### **99-03603D Payment**

Not Used

### **DIVISION 4 MASONRY**

#### **99-04230 CONCRETE MASONRY UNITS**

##### **99-04230A General**

##### **99-04230A(1) Summary**

This work includes:

1. Concrete masonry units
2. Mortar and grout
3. Bar reinforcement
4. Ties and anchors

##### **99-04230A(2) Related Work**

Water Repellent Coating: Comply with section 99-07182.

##### **99-04230A(3) Definitions**

**CMU:** Concrete masonry unit.

##### **99-04230A(4) Performance Requirements**

Masonry Compressive Strength: Provide masonry that develops the compressive strength (f'm) shown at 28 days.

##### **99-04230A(5) Submittals**

Product Data: Submit manufacturer's descriptive data for each type of masonry unit, accessory, and manufactured product.

Samples: Submit two sample CMUs for each color and architectural finish.

Certificates of Compliance: Submit certificate of compliance for CMUs, aggregate for grout, and ready-mixed grout.

Grout Mix Design: Submit a grout mix design for each grout mix proposed for use. Submit a revised grout mix design for any proposed change to the proportions of an authorized grout mix.

Shop Drawings: Submit calculations and shop drawings for temporary supports of masonry lintels. Design and construct temporary supports to provide the necessary rigidity and to support loads that will be applied. Shop drawings and calculations must be sealed and signed by an engineer who is registered as a civil engineer in the State.

Qualification Data: Submit qualification data for proposed testing laboratory.

Special Inspector Final Report: The special inspector must submit a final signed report to the Engineer and to you stating whether the work requiring special inspection, to the best of the inspector's knowledge,

complies with the authorized plans, specifications, and the applicable workmanship provisions of these special provisions and the 24 CA Code of Regs Pt 2.

**Field Quality Control Plan:**

Submit a written Field Quality Control Plan that identifies the inspector, the testing laboratory, and the procedures to be used. The plan must comply with these specifications and the CBC.

Designate a Masonry Quality Control Manager (MQCM) in the Field Quality Control Plan. The MQCM must be directly responsible to you for the quality of masonry, including materials and workmanship, performed by you and your subcontractors.

The MQCM must be the sole individual responsible to you for submitting, receiving, and approving all correspondence, required submittals, and reports to and from the Engineer.

The MQCM must not be employed or compensated by any subcontractor, or by other persons or entities hired by subcontractors, who will provide other services or materials for the project. The MQCM may be your employee.

**99-04230A(6) Quality Control and Assurance**

**Masonry Preconstruction Testing:**

Employ and pay all costs for the services of a testing laboratory experienced in performing preconstruction masonry tests.

The testing laboratory must comply with ASTM E 329.

Perform preconstruction testing to determine masonry compressive strength for each grout mix to be used under one of the following 24 CA Code of Regs Pt 2 test methods:

1. § 2105.2.2.1, except the grout must comply with § 2105.2.2.1.2, "Concrete Masonry," 3.3.2.
2. § 2105.2.2.2. The grout compressive strength must also be tested under ASTM C 1019 and be equal to or greater than the masonry compressive strength, but not less than 2,000 psi.

The grout compressive strength at 28 days must be 85 percent or more of the minimum required grout compressive strength.

The testing laboratory must report test results to the Engineer and you, on the same day the tests are made.

Do not perform masonry work until the required masonry and grout compressive strengths are attained.

**Single Source Responsibility:**

For each product required, obtain exposed CMUs of a uniform color and architectural finish from a single source and from a single manufacturer.

Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from a single source or producer for each aggregate.

**99-04230A(7) Delivery, Storage and Handling**

**Delivery:** Deliver masonry materials to the project in an undamaged condition.

**Storage:**

Store CMUs on elevated platforms in a dry location. If CMUs are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If CMUs become wet, do not install until they are dry.

Store cementitious materials on elevated platforms and in a dry location. Do not use cementitious materials that have become damp.

Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

Handling: Prevent damage, contamination, corrosion, or other deterioration to masonry materials when handling.

### **99-04230A(8) Project Conditions**

Protection of Masonry: Cover partially completed masonry, tops of walls, projections, and sills with waterproof sheeting when construction is not in progress.

Stain Prevention:

Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

Protect the base of walls from rain-splashed mud and from mortar splatter by spreading coverings on the ground and over wall surfaces.

Protect sills, ledges, and projections from mortar droppings. Protect surfaces of window and door frames, and other similar products with painted and integral finishes, from mortar droppings.

### **99-04230B Materials**

#### **99-04230B(1) Concrete Masonry Units**

Concrete Masonry Units:

Provide CMUs of nominal size, color, and architectural finish as shown. Provide hollow, load bearing, light weight or medium weight, open-ended CMUs that comply with ASTM C 90.

Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.

#### **99-04230B(2) Masonry Lintels**

Masonry Lintels: Construct built-in-place masonry lintels from bond beam CMUs, with reinforcing bars placed as shown.

#### **99-04230B(3) Mortar and Grout Materials**

Mortar Materials:

Mortar: Comply with ASTM C 270.

Cement: Comply with ASTM C 150, Type II, low alkali portland cement.

Lime: Comply with ASTM C 207, Type S.

Aggregate: Comply with ASTM C 144, with maximum 10 percent passing the No. 100 sieve.

Coloring for Mortar: Chemically inert, fade resistant mineral oxide or synthetic type.

Premixed Mortar: A premixed packaged blend containing only cement, lime, and sand, with or without color, that requires only water to prepare for use as masonry mortar. Packages of premix must bear the manufacturer's name, brand, contents, weight, and color identification.

Grout Materials:

Grout must comply with ASTM C 476, coarse grout, except for grout proportions. Grout proportions must comply with "Grout Mixes" in section 99-04230B(6).

Cementitious material must comply with section 90-1.02B.

Aggregate: Comply with ASTM C 404, except 100 percent of the coarse aggregate must pass the 3/8-inch sieve. Soundness loss must not exceed 10 percent when tested under California Test 214.

**99-04230B(4) Reinforcement**

Bar Reinforcement: Comply with ASTM A 615/A 615 M, Grade 60, or ASTM A 706/A 706 M.

**99-04230B(5) Ties and Anchors**

Anchors, Ties, Angles, and Metal Lath: Commercial quality and galvanized.

Anchor Bolts and Anchor Rods, Nuts and Washers:

Headed and Unheaded Anchor Bolts and Anchor rods: Comply with ASTM F 1554. Use Grade 36 unless a higher grade is shown.

Nuts: Comply with ASTM A 563.

Washers: Comply with ASTM F 436.

**99-04230B(6) Mortar and Grout Mixes**

Dry Pack Mortar: One part portland cement to not over 3 parts of clean sand, mixed with a minimum amount of water for hydration and packing.

Mortar Mix: Proportion by loose volume with one part cement, 1/4 to 1/2 part hydrated lime, and 2-1/4 to 3 parts aggregate. Tint with coloring to match the masonry units.

Premixed Mortar: Packages of premixed mortar must consist of one part cement, 1/4 to 1/2 part hydrated lime, and 2-1/4 to 3 parts aggregate, and no other ingredients.

Grout Mixes:

Grout proportions must be determined by one of the following methods:

1. Proportioned by volume complying with ASTM C 476, Table 1.
2. Specified compressive strength complying with "Grout Mix Design" in section 99-04230A(5).

Mix with sufficient water to produce a mix consistency suitable for pumping without segregation. Provide grout with a slump of 8 to 11 inches.

Nonshrink Grout: Comply with ASTM C 1107, match color with the mortar.

Aggregate: Measure in a damp, loose condition.

**99-04230C Construction****99-04230C(1) Installation**

Comply with 24 CA Code of Regs Pt 2 § 2104. Comply with tolerances specified in § 2104 unless otherwise shown.

Lay masonry units in running bond, unless otherwise shown.

Roughen, clean, and lightly wet the contact surfaces of existing material where fresh masonry joins concrete or masonry. The roughened surface must be at least as rough as a wood troweled surface. Remove laitance, curing compounds, debris, dirt, and any substance which decreases bond to the fresh masonry.

Erect masonry only when the ambient air temperature is above 40 degrees F.

If masonry is erected when the ambient air temperature exceeds 100 degrees F, keep surfaces of masonry moist with water for at least 24 hours. Uniformly apply water with a fog spray at time intervals required to keep the surfaces moist, but no more than 3 hours between applications.

Firmly secure anchors, bolts, dowels, reglets, and other miscellaneous items to be cast into the wall in place before grout is poured.

#### Laying Masonry Units:

1. Lay CMUs dry.
2. Keep cells dry during laying of units in inclement weather by covering incomplete walls. Do not use wooden boards and planks as covering materials. Extend covering down each side of masonry walls approximately 2 feet.
3. Keep chases free from debris and mortar.
4. Use bond beam units with an opening at each cross web at horizontal reinforcing bars.
5. Make cuts with a masonry saw to neat and true lines. Do not use blocks with excessive cracking or chipping of the finished surfaces exposed to view.
6. Leave openings to inset outlet boxes, access control keypads, intrusion detection sensors, and similar components in to masonry, with concealed wiring.

#### Bar Reinforcement:

Position bar reinforcement as shown and securely hold in position with either wire ties or spacing devices near the ends of bars and at intervals not exceeding 192 bar diameters. Wire must be 16-gauge or heavier. Do not use wooden, aluminum, or plastic spacing devices. Tolerances for the placement of vertical reinforcement in walls and flexural elements must be  $\pm 1/2$  inch. Tolerances for longitudinal reinforcement in walls must be  $\pm 2$  inches.

The minimum spacing for splices in vertical reinforcement for masonry walls must be 4 feet plus lap.

Do not place bar reinforcement in the plane of mortar joints.

#### Mortar:

Mortar joints must be approximately 3/8 inch thick. Lay units with all head and bed joints filled solidly with mortar for the full width of masonry unit shell. Shove head joints tight. Exposed joints must be concave and tooled smooth, unless otherwise shown.

Mortar that has been mixed more than one hour must not be retempered.

Preserve the unobstructed vertical continuity of the grout during mortar placement in joints. Any overhanging mortar projecting more than 1/2 inch, or other obstruction or debris must be removed from the inside of cells.

#### Pointing:

During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application as shown.

Remove splashes, stains, and spots on the faces of the masonry exposed to view.

#### **99-04230C(2) Lintels**

Temporarily support formed-in-place lintels for a minimum of 15 days after the wall has been completed.

#### **99-04230C(3) Grouting**

Place CMUs full height of the masonry wall before grouting, or place CMUs full height of the grout pour before grouting.

For grout pours over 5 feet in height, provide cleanouts in the bottom course at every cell containing vertical reinforcement, at a maximum spacing of 32 inches. Each cleanout must be at least 3 inches square. After cell inspection, seal cleanouts before filling with grout.

Place grout in a continuous pour in grout lifts. Grout lifts must not exceed 5 feet. The interruption between placing successive grout lifts must be no more than one hour. If the interruption is more than one hour, another grout pour must be used.

Solidly fill cells with grout. For each grout lift, consolidate grout in the cells at the time of placement by vibrating and reconsolidated after excess moisture has been absorbed but before plasticity is lost.

Between grout pours, form a horizontal construction joint by stopping the grout a minimum of 1-1/2 inches below the top of the last course, except if the joint is at a bond beam, the joint must be 1/2 inch below the top of the bond beam unit or at the top of the wall.

#### **99-04230C(4) Field Quality Control**

You must perform structural tests of masonry to verify the masonry construction complies with 24 CA Code of Regs Pt 2 § 1704 and § 2105.

Testing laboratories used in the work must not be employed or compensated by any subcontractor, or by other persons or entities hired by subcontractors, who will provide other services or materials for the project.

Testing:

Perform testing of masonry for every 5,000 square feet of CMU wall area, or portion thereof.

Determine masonry compressive strength under "Masonry Preconstruction Testing" in section 99-04230A(6).

Any work not meeting the requirements of 24 CA Code of Regs Pt 2 § 2105 must be redone and retested. Sampling, inspecting, reworking, and retesting of material will be done at your expense.

#### **99-04230C(5) Repairs and Protection**

Remove and replace CMUs that are loose, chipped, broken, stained, do not match adjoining units, or are otherwise damaged. Install new units in fresh mortar to match adjoining units, and point joints to eliminate evidence of replacement.

Protect completed masonry from freezing for a period of at least 5 days.

#### **99-04230D Payment**

Not Used

## **DIVISION 5 METALS**

### **99-05120 STRUCTURAL STEEL FOR BUILDINGS**

#### **99-05120A General**

##### **99-05120A(1) Summary**

This work consists of fabricating, assembling, and erecting structural steel.

##### **99-05120A(2) Definitions**

**seismic-load-resisting system (SLRS):** Elements of structural-steel frame designated as SLRS or along grid lines designated as SLRS shown, including columns, beams, and braces and their connections.

**structural steel:** Elements of the structural steel frame essential to support the design loads, including:

1. Wide Flanges
2. Hollow Structural sections
3. Angles
4. Channels

##### **99-05120A(3) Submittals**

Product Data: Submit product data for items to be incorporated into the work, including structural steel, high strength fastener assemblies, and alternative connectors.

## Shop Drawings:

Submit shop drawings that include the following:

1. A comprehensive list of all structural steel elements to be used as described under AISC 303, section 2.1, "Definition of Structural Steel."
2. Sequence of shop and field assembly and erection, welding sequence and procedures, and welding nondestructive testing (NDT) sequence and procedures.
3. Identification of welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
4. Location of butt welded splices on a layout drawing of the entire structure.
5. Location and details of any temporary supports that are to be used.
6. Type, size, and length of bolts, distinguishing between shop and field bolts. Identify high-strength bolted connections.
7. Identification of members and connections of the seismic-load-resisting system.
8. Identification of locations and dimensions of protected zones.
9. Identification of demand critical welds.
10. Any changes proposed in the work, details of connections and joints exposed to the weather, and details for connections not dimensioned on the plans. If changes are proposed or connections are designed, submit design calculations stamped and signed by an engineer who is registered as a Civil or Structural Engineer in the State of California. The expiration date of the registration must be shown.

Shop Drawings for Falsework: Submit shop drawings and calculations for falsework for use during the erection of structural steel. Design and construct the falsework to provide the necessary rigidity, and to support the applied loads. Shop drawings and calculations must be sealed and signed by an engineer who is registered as a civil engineer in the State.

Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Submit WPSs and PQRs under AWS D1.1/D1.1M for each welded joint whether prequalified or qualified by testing, including the following:

1. Power source (constant current or constant voltage).
2. Electrode manufacturer and trade name, for demand critical welds.

Qualification Data: Submit fabricator and welder qualifications.

Certificates of Compliance: Submit a certificate of compliance for structural steel products. Include mill test certificates for each heat number of steel used in the work.

## Final Drawings:

At the completion of each structural steel building, submit one set of reduced prints on 60-pound (minimum) bond paper, 11 inches x 17 inches, of the corrected original tracings of all authorized shop drawings for each building. Include an index prepared specifically for the drawings for each building containing sheet numbers and titles on the first reduced print in the set for each building. Arrange reduced prints for each building in the order of drawing numbers shown in the index.

The edge of the corrected original tracing image must be clearly visible and visually parallel with the edges of the page. Provide a clear, legible symbol on the upper left side of each page to show the amount of reduction, and provide a horizontal and vertical scale on each reduced print to facilitate enlargement to original scale.

## **99-05120A(4) Quality Control and Assurance**

Fabricate, assemble, and erect structural steel under AISC 303, 325, 341, and 360.

Welding: Weld under AWS D1.1/D1.1M and AWS D1.8/D1.8M.

## Welding Qualifications:

Qualify procedures and personnel under AWS D1.1/D1.1M.

Welders and welding operators performing work on bottom-flange, demand-critical welds must pass the supplemental welder qualification testing, under AWS D1.8/D1.8M. FCAW-S and FCAW-G must be considered separate processes for welding personnel qualification.

**99-05120A(5) Delivery, Storage, and Handling**

Load, transport, unload, and store structural materials so they are kept clean and undamaged. Store materials to permit access for inspection and identification.

Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Provide covers for protection of materials.

**99-05120B Materials**

**99-05120B(1) General**

Steel Bars, Plates, Channels, Angles, and Shapes (other than W-shapes): For each yield stress shown, comply with the following:

1. ASTM A 36/A 36M, when minimum yield stress is 36 ksi.
2. ASTM A 572/A 572M, Grade 50, when minimum yield stress is 50 ksi.

W-shapes: Comply with ASTM A 992/A 992M.

Pipe: Comply with ASTM A 53/A 53M, Grade B, standard weight, unless otherwise shown.

Hollow Structural Sections: For each yield stress shown, comply with the following:

1. ASTM A 500/A 500M, Grade B, when minimum yield stress is 42 ksi for round shapes, and when minimum yield stress is 46 ksi for square and rectangular shapes.
2. ASTM A 500/A 500M, Grade C, when minimum yield stress is 46 ksi for round shapes, and when minimum yield stress is 50 ksi for square and rectangular shapes.

**99-05120B(2) Bolts, Connectors, and Anchors**

Stud Connectors: Comply with ASTM A 108, AISI Grades 1018 through 1020, cold drawn, either semi- or fully kilned.

Anchor Bolts and Anchor Rods, Nuts and Washers:

Headed and Unheaded Anchor Bolts and Anchor Rods: Comply with ASTM F 1554. Use Grade 36 unless a higher grade is shown.

Nuts: Comply with ASTM A 563.

Washers:

1. Washers bearing on wood surfaces must be commercial quality.
2. Washers bearing on steel surfaces must comply with ASTM F 436, Type 1.
3. Plate washers must comply with ASTM A 36/A 36M.

Exposed anchor bolts and anchor rods, nuts and washers must be hot-dipped galvanized.

Machine Bolts, Nuts, and Washers:

Machine Bolts: Comply with ASTM A 307.

Nuts: Comply with ASTM A 563.

Washers: Commercial quality.

High Strength (HS) Fastener Assemblies:

HS Bolts: Comply with ASTM A 325 or A 490 when shown.

Nuts: Comply with ASTM A 563.

Washers: Comply with ASTM F 436, Type 1.

Direct Tension Indicators: Comply with ASTM F 959.

Tension Control Bolts: Comply with ASTM F 1852.

### **99-05120B(3) Mortar**

Mortar: Use one part cement, measured by volume, to 2 parts clean sand and only enough water to permit placing and packing.

### **99-05120B(4) Shop Fabrication**

Shop Fabrication and Assembly:

1. Cuts must not deviate more than 1/16 inch from the intended line. Remove roughness, notches, and gouges.
2. At points of loading, bearing stiffeners must be square with the web. At least 75 percent of the stiffener must be in contact with the flanges.
3. Finished members must be true to line and be free from twists, kinks, warps, dents, and open joints. Finished members must have square corners and smooth bends
4. Exposed edges and ends of metal must be dressed smooth, with no sharp edges, and with corners slightly rounded.
5. Mark and match-mark materials for field assembly.
6. Complete structural steel assemblies, including welding of units, before shop-priming operations.

Stud Connectors: Prepare steel surfaces as recommended by manufacturer of stud connectors. Use automatic end welding of stud connectors under AWS D1.1/D1.1M and manufacturer's instructions.

Connections:

1. Clean abutting surfaces at connections.
2. Do not cut or weld at the job site, except as shown on the authorized shop drawings or authorized by the Engineer.
3. Cut, drill, or punch holes perpendicular to steel surfaces. Finished holes for bolts must be cylindrical. Sub-punch and sub-drill holes  $\frac{1}{4}$  inch smaller in diameter than the diameter specified for the finished hole.

Bolted Connections:

Fabricate steel to steel bolted connections with machine bolts or HS fastener assemblies when shown.

Machine Bolts: Snug tighten.

HS Fastener Assemblies:

Assemble and install HS fastener assemblies under RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

Joint Type:

1. Snug tightened when no joint type is shown.
2. Pretensioned or slip critical when joint type is shown as such.

Galvanize HS fastener assemblies, or equivalent fasteners, by mechanically deposited coating process.

The bolt head type and head location must be consistent within a joint.

Install nuts on side of member least exposed to view.

Welded Connections: Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

Holes for Other Work: Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarged holes by burning. Drill holes in bearing plates.

### **99-05120B(5) Shop Finishes**

Shop prime structural steel members, except those to receive sprayed-fireproofing.

Clean and coat steel surfaces of shop primed members under section 99-09900.

HS Bolted Connections: Contact surfaces of HS bolted connections and ungalvanized anchorage assemblies must be coated before assembly. The total thickness of primer on each faying surface of slip-critical joints must be between 1 mil and the maximum allowable dry film thickness determined under the RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

### **99-05120B(6) Source Quality Control**

Welded Connections: Test and inspect welded connections under AWS D1.1/D1.1M and the following:

Inspection:

1. Comply with AISC 341, section Q5.2, except for CJP groove welds not receiving ultrasonic testing, perform magnetic particle testing on 100% of each root weld pass and each final weld pass of these welds.
2. Perform magnetic particle testing on 25% of each PJP groove weld. The Engineer will select the locations for testing. The cover pass must be ground smooth before testing.

Acceptance Criteria:

1. Ultrasonic Testing: Comply with AWS D1.1/D1.1M, Table 6.2 for statically loaded nontubular connections
2. Magnetic Particle Testing: Comply with AWS D1.1/D1.1M, Clause 6, Part C.

Repairs:

1. If repairs are required, perform NDT on the repaired portion and re-inspect the weld by performing additional NDT on the entire length of the unrepaired portion of the weld under "Source Quality Control."
2. NDT of repaired work must be performed at your expense.

### **99-05120C Construction**

#### **99-05120C(1) Erection**

Set structural steel accurately in locations and to elevations indicated.

Setting Bases and Bearing Plates:

Clean concrete and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

Set base plates and bearing plates for structural members on wedges or other adjusting devices.

Solidly pack mortar between bearing surfaces and base or bearing plates so there are no voids. Neatly finish exposed surfaces and allow to cure.

Field Splices:

Field splices must be made only at the locations shown on authorized shop drawings or authorized by the Engineer.

Accurately assemble parts in their final position as shown and in true alignment with related and adjoining work before final fastening.

Support parts to provide a vibration free, rigid, and secure installation.

### **99-05120C(2) Field Connections**

Assembly and installation of bolted connections must comply with "Bolted Connections" under "Shop Fabrication."

### **99-05120C(3) Field Quality Control**

Testing and inspection of field-welded connections must comply with "Welded Connections" under "Source Quality Control."

### **99-05120C(4) Field Finishes**

Touch-up Painting: After erection, clean field welds, bolted connections, and abraded areas of shop paint under SSPC-SP 2 or SSPC-SP 3. Apply one coat of the same coating as applied for shop painting to the cleaned areas.

After touch-up painting, coat all surfaces with a second prime coat, and finish coats when specified, to comply with section 99-09900.

### **99-05120D Payment**

Not Used

## **99-05210 OPEN WEB STEEL JOISTS**

### **99-05210A General**

#### **99-05210A(1) Summary**

This work includes:

Long-span steel joists.

#### **99-05210A(2) Definitions**

**SJI:** Steel Joist Institute.

**SJI Specifications:** SJI's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

**Special Joists:** Steel joists or joist girders requiring modification by manufacturer to support non uniform, unequal, or special loading conditions that invalidate load tables in the SJI specifications.

#### **99-05210A(3) Submittals**

Product Data: Submit manufacturer's descriptive data and installation instructions. Submit quality control manual and welder qualifications for field welding.

Shop Drawings:

Submit shop drawings and design calculations for the steel joists, permanent bracing, continuity angles, and connection details. Include the following:

1. Show layout, location and identification of each steel joist, number, type, and spacings of steel joists. Include joining and anchorage details, bridging, joist accessories, splice and connection locations and details, and attachments to other construction.
2. Show size and shape of truss members and both temporary and permanent bracing members.
3. Calculations for design of steel joists, bracing, and connections must include a list of applied loads and load combinations with the resulting member forces and member stresses. Design steel joists and connections for the chord forces shown.
4. Shop drawings and calculations must be sealed and signed by an engineer who is registered as a civil engineer in the State.
5. If the design calculations contain or consist of computerized or tabulated calculations, the values pertaining to the design must be identified, described, or indexed in such a manner that a design review can be performed.

Certificates of Compliance: Submit a certificate of compliance for steel joists.

Manufacturer Qualification: Submit manufacturer qualification as an informational submittal.

#### **99-05210A(4) Quality Control and Assurance**

Manufacturer Qualification: The manufacturer must be certified by the SJI to manufacture steel joists under the SJI specifications.

Codes and Standards: Design steel joists and permanent bracing for the loads shown and other applied loads, including fire sprinkler systems. The design must comply with the CBC and the SJI specifications.

Field Welding: Qualify procedures and personnel for field welding under AWS D1.1/D1.1M, "Structural Welding Code - Steel."

Identification: Stamp or mark each joist with a location identification mark or symbol.

#### **99-05210A(5) Delivery, Storage, and Handling**

Protect steel joists from corrosion, deformation, and other damage during delivery, storage, and handling. Provide covers for protection of materials.

#### **99-05210B Materials**

##### **99-05210B(1) General**

Open Web Steel Joists: Comply with the SJI specifications for LH-Series. Steel joists must be tapered and designed to support the loads shown.

Bearing Plates, Fasteners, and Accessories: Comply with the authorized shop drawings.

Anchors: Comply with the specifications for anchors in section 99-05500.

##### **99-05210B(2) Fabrication**

Fabricate steel joists under the SJI specifications.

Build camber into the steel joists if required by the design.

##### **99-05210B(3) Shop Finishes**

Clean and prepare surfaces under one of the following:

1. SSPC-SP 1 and SSPC-SP 2
2. SSPC-SP 1 and SSPC-SP 3
3. The coating manufacturer's instructions.

Shop Paint: Comply with SSPC-Paint 15. Apply one coat.

Apply and cure the coating under the coating manufacturer's instructions.

#### **99-05210C Construction**

##### **99-05210C(1) Erection**

Installation of steel joists must comply with the authorized shop drawings. Accurately cut steel joists and bracing members to provide tightly fitted joints and connections.

Remove and replace damaged steel joists at your expense, except when field repair is authorized by the Engineer. Repairs must comply with the manufacturer's instructions.

##### **99-05210C(2) Installation**

Install steel joists and accessories plumb, square, and true to line. Securely fasten steel joists to supporting construction under SJI specifications, steel joist manufacturer's instructions, and the authorized shop drawings. Do not field cut or otherwise alter steel joists without the authorization of the Engineer.

Install temporary bracing and erection bridging, connections, and anchors to ensure that steel joists are stabilized during construction.

Bearing plates must have full bearing after the supporting members have been plumbed and properly positioned, before placing superimposed loads.

Comply with specifications for welding, appearance and quality of welds, and methods used in correcting welding work under AWS D1.1/D1.1M, "Structural Welding Code - Steel." Exposed welds must be ground smooth and flush.

Install and connect bridging concurrently with steel joist erection before construction loads are applied. Distribute temporary loads so that the design carrying capacity of any steel joist is not exceeded. Do not apply loads to bridging during construction or in the completed work.

Secure permanent bracing before any sustained permanent loads are applied to the steel joist system.

### **99-05210C(3) Field Finishes**

After installation, clean and prepare field connections, rust spots, and abraded surfaces of shop-primed steel joists and accessories under SSPC-SP 2 or SSPC-SP 3. Prime or reprime the cleaned and prepared surfaces with the same or compatible type of coating used in the shop priming.

Coatings: Comply with the specifications in section 99-09900. Clean and prepare steel surfaces under the manufacturer's instructions. The final finish color must be authorized by the Engineer.

### **99-05210D Payment**

Not Used

### **99-05310 METAL DECK**

#### **99-05310A General**

##### **99-05310A(1) Summary**

Scope: This work consists of installing metal deck.

Metal deck includes ribbed sheet steel decking units, bent plates, accessories, fasteners and other components required for a rigid, secure, and complete installation.

##### **99-05310A(2) References**

The design, fabrication, and erection of metal deck must comply with the applicable requirements of the American Iron and Steel Institute (AISI) publication, "North American Specifications for the Design of Cold Formed Steel Structural Members," the applicable Steel Deck Institute (SDI) "Code of Standard Practice," and applicable "Specifications and Commentary" in its "Design Manual for Composite Decks, Form Decks and Roof Decks" (Publication 31).

Welding must comply with AWS D1.3, "Structural Welding Code - Sheet Steel."

##### **99-05310A(3) Definitions**

Not Used

##### **99-05310A(4) Submittals**

Product Data: Submit manufacturer's descriptive data for each type of deck and for accessories.

Shop Drawings: Submit shop drawings showing complete erection layouts, details, dimensions, deck section properties. Drawings must show types and gages, fastening methods, including the location, type and sequence of connections, sump pans, cut openings, surface finishes and temporary supports or bracing.

The metal deck supplier must submit a fastening schedule and calculations showing that the metal roof panels, clips, and fasteners comply with the span and design loads shown and the wind uplift requirements of the CBC. The fastening schedule and calculations must be sealed and signed by an engineer who is registered as a civil engineer in the State

Certificates of Compliance: Submit a certificate of compliance for metal decking.

##### **99-05310A(5) Quality Control and Assurance**

Qualification of Field Welding:

Welding processes and welding operators must be qualified under "Welder Qualification," procedures in AWS D1.1, "Structural Welding Code - Steel."

Welding decking in place is subject to inspection and testing. Defective work must be removed and replaced with acceptable work.

### **99-05310A(6) Delivery, Storage, and Handling**

Metal deck units and accessories must be transported, stored, and erected in a manner that will prevent corrosion, distortion, or other damage.

Deck units must be stored off the ground with one end elevated to provide drainage.

### **99-05310B Materials**

#### **99-05310B(1) General**

Acceptable Manufacturers: Verco Manufacturing Co.; Nucor Corp; Vulcraft Group; ASC Profiles; or equal.

Deck Units:

Deck units, closures, and plates must be fabricated from galvanized sheet steel complying with ASTM A 653/A 653M, Grade 33 [230], and ASTM A 924/A 924M, Structural Steel (SS).

Galvanizing must comply with ASTM A 924/A 924M, G60 [Z180].

Miscellaneous Steel Shapes: Miscellaneous steel shapes must comply with ASTM A 36/A 36M.

Anchor Clips, Vent Clips, Flashing, Saddle Plates, Flexible Closure Strips, and Other Accessories: Anchor clips, vent clips, flashing, saddle plates, flexible closure strips, and other accessories must be as recommended by the decking manufacturer.

#### **99-05310B(2) Fabrication**

Deck units must be formed to span 3 or more supports, with flush, telescoped, or nested 2-inch laps at ends and interlocking or nested side laps unless otherwise shown.

Deck units must comply with the configurations, metal thickness, depth and width, and section properties shown.

End bearing must be not less than 1½ inches.

Metal Closure Strips: Metal closure strips for opening between deck units and other construction must be fabricated from the same gage and material as the adjacent deck units. Strips must be formed to provide tight-fitting closures at end of cells or flutes and sides of decking.

Roof Sump Pans: Sump pans must be fabricated from single piece of galvanized sheet steel with level bottoms and sloping sides to direct water flow to drain. Sump pans must be of adequate size to receive roof drains and with bearing flanges not less than 3 inches wide. Pans must be recessed not less than 1½ inches below roof deck surface unless otherwise shown or required by deck configuration. Holes for drains must be cut in the field.

Cleaning: When spray-on fireproofing is specified, the decking manufacturer must supply decking free of amounts of oil or lubricants which would significantly impair the adhesion of the spray-on fireproofing.

### **99-05310C Construction**

#### **99-05310C(1) General**

Not Used

#### **99-05310C(2) Installation**

Deck units and accessories must be installed under the manufacturer's instructions, SDI Publication 31, and authorized shop drawings.

Units must be placed on supporting steel framework, adjusted in place and properly aligned before being permanently fastened. Ends of units must have positive bearing over structural supports.

Cutting and fitting must present a neat and true appearance with exposed burrs removed. Openings through the decking must be cut square and must be reinforced as recommended by the decking manufacturer.

The metal deck must not be used as a working platform before deck units are fastened in place. Supplies, equipment or other loads must not be stored on the deck. Mechanical equipment or other loads must not be hung from metal roof decking.

**Welding:**

Welding must comply with AWS D1.1 and D1.3, and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.

Welding washers must be used where recommended by the manufacturer.

**Fastening Roof Deck Units:** Roof deck units must be fastened to supporting steel members as shown.

**Fastening Side Laps:** Side laps of adjacent deck units must be fastened as shown.

**Roof Sump Pans:** Roof sump pans must be placed over openings provided in roof and welded to top decking surface. Welds are to be spaced at not more than 12 inches with at least one weld in each corner. Cut opening in sump bottom to accommodate drain size indicated.

**Field Painting:**

Immediately following erection, field welds, bolted connections and abraded areas must be cleaned with a wire brush.

Galvanized surfaces must be touched-up with galvanizing repair paint recommended by the manufacturer.

**99-05310D Payment**

Not Used

**99-05500 BUILDING MISCELLANEOUS METAL**

**99-05500A General**

**99-05500A(1) Summary**

Scope: This work consists of fabricating and installing building miscellaneous metal.

Building miscellaneous metal consists of the following:

1. Plates

Including all anchors, fastenings, hardware, accessories, and other supplementary parts necessary to complete the work.

**99-05500A(2) References**

Codes and Standards: Welding of steel must comply with AWS D 1.1, "Structural Welding Code - Steel" and D 1.3, "Structural Welding Code - Sheet Steel."

**99-05500A(3) Definitions**

Not Used

**99-05500A(4) Submittals**

Product Data: Submit manufacturer's specifications, anchor details, and installation instructions for products used in miscellaneous metal fabrications.

Shop Drawings: Shop drawings of fabricated items must be submitted.

**99-05500A(5) Quality Control and Assurance**

Shop Assembly: Preassemble items in shop to the greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark all units for reassembly and installation.

Inspection and Tests: Materials and fabrication procedures must be subject to inspection and tests by the Engineer, in mill, shop, and field.

## **99-05500B Materials**

### **99-05500B(1) General**

Steel Bars, Plates, and Hot-rolled Shapes: Steel bars, plates, and hot-rolled shapes must comply with ASTM A 36/A 36M.

Galvanized Sheet Steel: Galvanized sheet steel must comply with ASTM A 653/A 653M. Galvanizing must be G60.

Checkered Floor Plates: Checkered floor plates must be commercial quality steel with standard raised pattern.

Pipe: Pipe must be commercial quality standard steel pipe.

Hollow Structural Sections: Hollow structural sections must comply with ASTM A 500/A 500M, Grade B, or A 501.

Bolts, Studs, Threaded Rods, Nuts, and Washers:

Bolts, studs, and threaded rods for general application must comply with ASTM A 307 or F 1554, Grade 36.

Nuts must comply with ASTM A 563.

Washers bearing on wood surfaces must be commercial quality. Washers bearing on steel surfaces must comply with ASTM F 844 or F 436.

Fittings: Brackets, bolt, threaded studs, nuts, washers, and other fittings for railings and handrailings must be commercial quality pipe and fittings.

Expansion Anchors: Expansion anchors must be ICC approved for the purpose intended, integral stud type anchor or internally threaded type with independent stud, hex nut, and washer.

Powder Driven Anchors: Powder driven anchors must be plated, spring steel alloy drive pin or threaded stud type anchors for use in concrete or steel. Spring steel must comply with ASTM A 227, Class 1. The diameter, length, and type of shank and the number and type of washer must be as recommended by the manufacturer for the types and thickness of material being anchored or fastened.

Resin Capsule Anchors: Stud anchors for resin capsule anchors must comply with ASTM A 307 or F 1554, Grade 36, threaded steel rod with hex nut and washer and sealed glass capsule or cartridge containing an adhesive composed of unsaturated polyester resin and benzol peroxide coated quartz sand. Resin capsule must be Hilti; Molly; or equal.

Drainage Grates: Drainage grates must be fabricated from steel bars as specified herein; ductile iron castings complying with ASTM A 536, Grade 65-45-12; or carbon steel castings complying with ASTM A 27, Grade 65-35.

Mortar: Mortar must consist of one part cement, measured by volume, to 2 parts clean sand and only enough water to permit placing and packing.

### **99-05500B(2) Shop Fabrication**

Workmanship and Finish:

Workmanship and finish must be equal to the best general practice in modern shops.

Miscellaneous metal must be clean and free from loose mill scale, flake rust and rust pitting, and must be well formed and finished to shape and size with sharp lines and angles. Bends from shearing or punching must be straightened.

The thickness of metal and details of assembly and support must give ample strength and stiffness.

Built-up parts must be true to line and without sharp bends, twists, and kinks. Exposed ends and edges of metal must be milled or ground smooth, with corners slightly rounded.

Joints exposed to the weather must be made up to exclude water.

Galvanizing: Items indicated on the plans to be galvanized must be hot-dip galvanized after fabrication. The weight of galvanized coating must be at least 1½ ounces per square foot of surface area, except drainage grates must have at least 2 ounces per square foot of surface area.

Painting: Building miscellaneous metal items that are not galvanized must be cleaned and coated with 1 prime coat prior to erection under section 99-09900. After erection, surfaces must be coated with a second prime coat, and finish coats when specified, to comply with the requirements specified under section 99-09900.

Loose Bearing and Leveling Plates: Loose bearing and leveling plates must be provided for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area. Plates must be drilled to receive anchor bolts. Galvanize after fabrication.

Drainage Pipes, Frames and Grates:

Drain piping must have connections sealed watertight.

Drainage grates must have end bars of the same cross section as support bars. Connections between end bars and support bars of structural steel must be welded all around.

Drainage frames must be angles and plates as shown.

Drainage grates and frames must be match marked.

Steel Pipe Railings and Handrailings:

Pipe handrailing must consist of handrailing elements supported by metal brackets (wall type) or handrailing elements supported by tubular steel posts (post type).

Ends of railing pipe must be closed, except for a 1/8-inch diameter weep hole at the low point.

All corners on railings must be rounded. Simple and compound curves must be formed by bending pipe in jigs to produce uniform curvature; maintain cylindrical cross-section of pipe throughout the bend without buckling, twisting or otherwise deforming exposed surfaces of the pipe.

Wall brackets, end closures, flanges, miscellaneous fitting and anchors must be provided for interconnections of pipe and attachment of railings and handrails to other work. Inserts and other anchorage devices must be provided for connecting railings and handrails to concrete or masonry.

Steel railing must be galvanized after fabrication. After galvanizing, all elements of the railing must be free of fins, abrasions, rough or sharp edges, and other surface defects and must not be kinked, twisted, or bent.

## **99-05500C Construction**

### **99-05500C(1) General**

Anchorage:

Anchorage devices and fasteners must be provided for securing miscellaneous metal in-place construction; including threaded fasteners for concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

Cutting, drilling, and fitting must be performed as required for installation of miscellaneous metal fabrications. Work is to set accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels.

Loose Leveling and Bearing Plates: Plates must be set on wedges or other adjustable devices. Anchor bolts must be snug tightened after the plates have been positioned and plumbed. Mortar must be packed solidly between bearing surfaces and plates to ensure that no voids remain.

Steel Pipe Railings and Handrailings:

Railings must be adjusted prior to anchoring to ensure matching alignment at abutting joints. Secure posts and railing ends to building construction.

Resin capsule anchors must not to be used for anchoring railings and handrailings.

Powder Driven Anchors: Powder driven anchors must be installed with low velocity powder actuated equipment to comply with the manufacturer's instructions and State and Federal OSHA regulations.

Resin Capsule Anchors: Resin capsule anchors must be installed in compliance with the manufacturer's instructions.

Bolted connections not otherwise specified or shown on drawings must be snug-tightened.

### **99-05500C(2) Damaged Surfaces**

Galvanized surfaces that are abraded or damaged must be repaired by thoroughly wire brushing the damaged areas and removing all loose and cracked coating. The clean areas must then be painted with 2 spot applications of a coating complying with the requirements in the Detailed Performance Standards of the Master Painters Institute (MPI) and listed on MPI List Number 18, Primer, Zinc Rich, Organic, and meeting the requirements under section 99-09900.

### **99-05500D Payment**

Not Used

### **99-05510 LADDER**

#### **99-05510A General**

##### **99-05510A(1) Summary**

This work consists of furnishing and installing a ladder in accordance with the details shown on the plans and these special provisions.

##### **99-05510A(2) Submittals**

Product Data: Submit manufacturer's descriptive data for products.

Shop Drawings: Submit shop drawings of ladders. Each drawing must show the plan and elevations.

##### **99-05510A(3) Quality Control and Assurance**

Not Used.

##### **99-05510A(4) Delivery, Storage, and Handling**

Load, transport, unload, and store so the ladder is kept clean and undamaged. Store to permit access for inspection and identification.

#### **99-05510B Materials**

##### **99-05510B(1) General**

Steel Ladder:

Design and construction of steel ladders shall comply with ANSI A14.3 unless otherwise indicated.

Galvanize ladders including brackets and fasteners.

Prime ladders, including brackets and fasteners with zinc-rich primer.

Siderails: Siderails must be continuous steel flat bars with eased edges. Fit rungs in the centerline of the siderails, plug-weld and grind smooth on outer rail faces. Provide non-slip surfaces on top of each rung either by coating the rung with aluminum oxide granules set in epoxy resin adhesive or by using a type of manufactured rung filled with aluminum oxide grout.

Platform: Provide a platform as indicated. It must be fabricated from welded or pressure-locked steel bar grating supported by steel angles.

Steel Ladder Safety Cages:

Design and construction of ladder safety cages must comply with ANSI A14.3 unless otherwise indicated.

Prime Hoops: 1/4 by 4 inch.

Secondary Intermediate Hoops: 1/4 by 2 inch flat bar hoops.

Vertical bars: 3/16 by 1 1/2 inch flat bars secured to each hoop.

Galvanize ladder safety cages including brackets and fasteners.

Prime ladder safety cages including brackets and fasteners with zinc-rich primer.

#### Roof Access Ladder:

Design and construction of aluminum ladders shall comply with ANSI A14.3 unless otherwise indicated.

Siderails: Siderails must be 16 inches apart unless otherwise indicated. Siderails must be continuous extruded aluminum tubes, not less than 3/4 inch deep and not less than 1/8 inch thick.

Rungs: Rungs must be extruded aluminum tubes not less than 3/4 inch deep and not less than 1/8 inch thick with ribbed surfaces. Fit rungs in the center line of the siderails, fasten by welding or with stainless-steel fasteners or brackets and aluminum rivets.

Platforms: Provide a platform as indicated. It must be fabricated from pressure-locked aluminum bar grating supported by extruded aluminum framing. Limit the opening in the grating to no more than 1/2 inch in the least dimension. Support each ladder with welded or bolted aluminum brackets.

Provide a minimum 72 inch high hinged security door with padlock hasp at the foot of the ladder to prevent unauthorized ladder use.

#### **99-05510C Construction**

##### **99-05510C(1) Erection**

The ladder must be installed with the top level and the siderails rigidly and securely fastened to the wall.

Anchors for the legs must be installed in accordance with the manufacturer's instructions.

##### **99-05510D Payment**

Not Used

#### **SECTION 055213 - PIPE AND TUBE RAILINGS**

##### **PART 1 - GENERAL**

###### **1.1 SUMMARY**

###### A. Section Includes:

1. Hot dipped galvanized extra strong schedule 80 steel pipe guard railings.
2. Horizontal stainless-steel cable infills.

###### **1.2 ACTION SUBMITTALS**

###### A. Product Data: For the following:

1. Manufacturer's product lines of mechanically connected railings.
2. Railing brackets.
3. Grout, anchoring cement, and paint products.

###### B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

###### C. Samples: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including top rails, guard posts, and balusters.
2. Fittings and brackets.
3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.
  - a. Show method of connecting and finishing members at intersections.

### **1.3 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For testing agency.
- B. Welding certificates.
- C. Mill Certificates: Signed by manufacturers of stainless-steel and galvanized products certifying that products furnished comply with requirements.
- D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.
- E. Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.
- F. Evaluation Reports: For post-installed anchors, from ICC-ES.

### **1.4 QUALITY ASSURANCE**

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1, "Structural Welding Code - Steel."
  - 2. AWS D1.6, "Structural Welding Code - Stainless Steel."

### **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

### **1.6 FIELD CONDITIONS**

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Source Limitations: Obtain each type of railing and cable infill from single source from single manufacturer.

### **2.2 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.
- B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Infill of Guards:
    - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
    - b. Infill load and other loads need not be assumed to act concurrently.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
  - 1. Temperature Change: 120 deg F, ambient.

### **2.3 METALS, GENERAL**

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
  - 1. Provide type of bracket with predrilled hole for exposed bolt anchorage and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

## **2.4 STEEL AND IRON**

- A. Tubing: ASTM A 513.
- B. Pipe: ASTM A 53/A 53M, Type F , Grade B, (Schedule 80) unless another grade and weight are required by structural loads.
  - 1. Provide galvanized finish for exterior installations and where indicated.
- C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

## **2.5 STAINLESS STEEL**

- A. Horizontal Stainless Steel Cable Infill
  - 1. Cable Infill: ASTM A492, Type 316 stainless steel wire.
    - a. Orientation: Horizontal.
    - b. Spacing: 4inches on center
    - c. Finish: Passivated using ASTM B912

## **2.6 FASTENERS**

- A. General :Provide the following:
  - 1. Hot-Dip Galvanized Guard Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.
  - 2. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Fasteners for Interconnecting Railing Components:
  - 1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
  - 2. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

## **2.7 MISCELLANEOUS MATERIALS**

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Shop Primers: Provide primers that comply with Section 099600 "High-Performance Coatings."]

- E. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
  - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- F. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- G. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- H. Intermediate Coats and Topcoats: Provide products that comply with Section 099600 "High-Performance Coatings."
- I. Epoxy Intermediate Coat: Complying with MPI #77 and compatible with primer and topcoat.
- J. Polyurethane Topcoat: Complying with MPI #72 and compatible with undercoat.
- K. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- L. Nonshrink, Nonmetallic Grout: ASTM C 1107/C 1107M.
- M. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
  - 1. Water-Resistant Product: At exterior locations and where indicated provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

## **2.8 FABRICATION**

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with either welded or nonwelded connections unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.

3. Remove flux immediately.
  4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- I. Form Changes in Direction as Follows:
    1. As detailed.
  - J. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
  - K. Close exposed ends of railing members with prefabricated end fittings.
  - L. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
  - M. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
  - N. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
  - O. For railing posts set in concrete, provide steel not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.
  - P. Horizontal stainless-steel infills: Fabricate infill cables from stainless steel.

## **2.9 STEEL AND IRON FINISHES**

- A. Galvanized Railings:
  1. Hot-dip galvanize indicated steel railings, including hardware, after fabrication.
  2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
  3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
  4. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
  5. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.
  1. Railings Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  2. Railings Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  3. Other Railings: SSPC-SP 3, "Power Tool Cleaning."
- D. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

- E. Shop-Painted Finish: Comply with Section 099600 "High-Performance Coatings."
  - 1. Color: Match Engineer's sample.
- F. High-Performance Coating: Apply epoxy intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.
  - 1. Color: Match Engineer's sample.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

Not Used

#### **3.2 INSTALLATION, GENERAL**

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
  - 1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
  - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
  - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

#### **3.3 RAILING CONNECTIONS**

- A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.
- B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

#### **3.4 ANCHORING POSTS**

- A. Anchor posts to metal surfaces as required by conditions, connected to posts and to metal supporting members as follows:
  - 1. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

#### **3.5 ATTACHING RAILINGS**

- A. Anchor railing ends at walls with round flanges anchored to wall construction and connected to railing ends using nonwelded connections].

### **3.6 ADJUSTING AND CLEANING**

- A. Clean steel railing by washing thoroughly with clean water and soap and rinsing with clean water.
- B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
  - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.

### **3.7 PROTECTION**

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

## **99-05810 EXPANSION JOINT COVER ASSEMBLIES**

### **99-05810A General**

#### **99-05810A(1) Summary**

Scope: This work consists of installing vertical and horizontal expansion joint assemblies, fillers, and sealers for expansion and seismic joints.

#### **99-05810A(2) Definitions**

Not Used

#### **99-05810A(3) Submittals**

Product Data: Submit manufacturer's descriptive data and installation instructions for vertical and horizontal expansion joint assemblies, seals, and sealants.

#### **99-05810A(4) Quality Control and Assurance**

Not Used

### **99-05810B Materials**

Acceptable Manufacturers: D. S. Brown Co.; General Tire Engineered Construction Products; Watson Bowman and Acme Corp. (Wabco); or equal.

Expansion joint closures and seals must be aluminum extrusions and neoprene or silicone rubber seals of the type and size to suit the construction as shown.

Aluminum Retainers and Cover Plates: Aluminum retainers and cover plates must comply with ASTM Designation: B 221M, 6063-T5, anodized, of the configuration and size indicated or recommended by the expansion control system manufacture.

Visual Seals: Visual seals must be dense neoprene or dense silicone synthetic rubber complying with ASTM C 864, 70 durometer hardness, plus or minus 5.

Functional Seal: Functional seal must be closed cell neoprene synthetic rubber complying with ASTM C 509, medium density.

Fasteners: Fasteners must be the expansion joint assembly manufacturer's standard corrosion resistant fasteners.

Sealant: Sealant must be as recommended by the expansion joint assembly manufacturer.

### **99-05810C Construction**

#### **99-05810C(1) Preparation**

Surface Preparation: Supporting joint surfaces must be prepared as recommended by the manufacturer. Edges of the substrate must be level and sound.

**99-05810C(2) Installation**

Expansion joint cover assemblies must be installed and set to the proper width for the ambient temperature at the time of setting.

Nominal width must be based on an ambient width shown.

Expansion joint cover assemblies must be set according to the manufacturer's instructions.

**99-05810C(3) Cleaning**

Unused materials, containers, and equipment must be removed from the work area.

Surfaces that are stained, marred or otherwise damaged must be cleaned and repaired.

**99-05810D Payment**

Not Used

**DIVISION 6 WOOD AND PLASTICS****99-06100 ROUGH CARPENTRY****99-06100A General****99-06100A(1) Summary**

Scope: This work must consist of furnishing and installing materials and performing rough carpentry work including wood framing, furring, and sheathing.

Rough carpentry includes carpentry work not specified as part of other sections and which is generally not exposed.

**99-06100A(2) Definitions**

Not Used

**99-06100A(3) Submittals**

Product Data: Manufacturer's material data and installation instructions must be submitted for gypsum sheathing, framing hardware, and underlayments.

Wood Treatment Data:

Chemical treatment manufacturer's instructions must be submitted for the handling, sorting, installation, and finishing of treated materials.

For each type of preservative treatment used, certification by treating plant must include type of preservative solution and pressure process used, net amount of preservative retained and conformance with the applicable standards of the American Wood Protection Association.

For each type of fire-retardant treatment, include certification by treating plant that the treated material complies with the applicable standards and other requirements.

**99-06100A(4) Quality Control and Assurance**

Not Used

**99-06100A(5) Delivery, Handling, and Storage**

Delivery and Storage: Materials must be kept under cover and dry. All materials must be protected from exposure to weather and contact with damp or wet surfaces with blocking and stickers. All lumber, plywood and other panels must be stacked in such a manner to provide air circulation within and around the stacks.

## **99-06100B Materials**

### **99-06100B(1) Lumber**

Lumber must be manufactured to comply with PS 20, "American Softwood Lumber Standard," and with applicable grading rules of inspection.

Softwood lumber must be quality grade stamped or must be accompanied by a certificate of inspection. Inspection certificates or grade stamps must indicate compliance with the grading requirements of WWPA, WCLIB, RIS, or other approved lumber inspection agencies.

All lumber used must be nominal sized and dressed S4S unless otherwise described.

Framing lumber must be solid stock lumber, Douglas Fir-Larch, and the grades indicated under WCLIB or WWPA rules. Moisture content must not exceed 19 percent and must be grade stamped "S-Dry."

### **99-06100B(2) Dimension Lumber**

Except as otherwise shown, lumber must have the following grades.

Vertical Framing Lumber:

Vertical framing lumber, nominal 2" x 2" through 4" x 4", must be Construction grade or better.

Vertical framing lumber, nominal 2" x 6" through 4" x 6", must be No. 2 or better.

Horizontal Framing Lumber:

Horizontal framing lumber, nominal 2" x 4" and wider, including joists and rafters, must be No. 2 or better.

Horizontal framing lumber, nominal 4" x 4" and wider, including joist and rafters, must be No. 1 or better.

Exposed Framing Lumber: Exposed framing lumber which is not concealed and is to receive a stain or natural finish must be the same grade and species as indicated for structural framing and hand selected for appearance.

Miscellaneous Lumber:

Miscellaneous lumber for support or attachment of other work including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping and similar members must be not less than No. 2 or better.

Lumber in contact with concrete or masonry construction must be pressure treated Douglas Fir-Larch.

### **99-06100B(3) Timbers**

Timbers (Nominal 5 inches or Thicker): Timbers must be No. 1 or better.

### **99-06100B(4) Plywood Panels**

Plywood panels must comply with Voluntary Product Standard PS 1, "Structural Plywood," or its predecessor, "Construction and Industrial Plywood."

Plywood panels must be Group 1 unless otherwise noted.

Each plywood panel must be factory marked with APA or other trademark evidencing compliance with grade requirements.

Structural Plywood Wall Sheathing: Structural plywood wall sheathing for walls must be APA RATED SHEATHING, Exposure 1. Thickness and grade must be as shown.

Structural Plywood Roof Sheathing:

Structure plywood roof sheathing must be APA RATED SHEATHING, Exposure 1. Span rating, thickness and grade must be as shown.

Structure plywood roof sheathing in exposed overhangs must be APA RATED SHEATHING, A-C, Exterior, Group 1. Thickness must be the same as the remainder of the sheathing.

Plywood Decking: Plywood decking must be APA RATED STURD-I-FLOOR, Exposure 1, with tongue-and-groove edges. Span rating and thickness must be as shown.

**99-06100B(5) Miscellaneous Materials**

Rough Carpentry Hardware:

Steel plates and rolled sections must be mild, weldable steel, complying with AISI grades 1016 through 1030 except 1017.

Nails, screws, bolts, nuts, washers must be commercial quality. Exposed fasteners must be hot dipped galvanized or stainless steel. Fasteners for use with preservative treated wood must be hot dip galvanized.

Joist hangers, clips and other standard framing hardware must be ICC approved, commercial quality, galvanized sheet steel or hot dipped galvanized, of the size shown.

Expansion anchors and powder driven anchors must comply with section 99-05500.

Nails: Nails must comply with ASTM F 1667. "Common" nails must comply with the following table:

Nail Size	Length (inches)	Diameter (inches)
8d	2½	0.131
10d	3	0.148
16d	3½	0.162

Building Paper: Building paper must be kraft type waterproofing building paper, Type I (No. 15) asphalt saturated roofing felt or high density, bonded polyethylene fiber building paper.

Adhesive: Adhesive for plywood glue-nailed systems must comply with APA Specification: AFG-01.

**99-06100B(6) Wood Treatment By Pressure Process**

Preservative Treatment:

Preservative treatment must be copper naphthenate, pentachlorophenol or water-borne arsenicals (ACA, CCA or ACZA).

The following items must be treated:

Wood cants, nailers, curbs, equipment support bases, blocking, stripping and similar members in connection with roofing, flashing, vapor barriers and waterproofing.

Wood sills, sleepers, blocking, furring and other similar members in contact with concrete or masonry. All holes, daps and cut ends of treated lumber must be thoroughly swabbed with 2 applications of copper naphthenate.

Fire Retardant Treatment: Fire retardant treatment must be paintable, odorless fire retardant preservative applied by pressure treating methods.

**99-06100C Construction**

Wood Framing:

Wood framing must comply with Chapter 23 of the California Building Code.

Framing members must be of sizes and spacing shown. Unless otherwise shown, structural members must not be spliced between supports.

Wood framing must be accurately cut and assembled to provide closely fitted members. Framing must be erected true to the lines and grades shown and must be rigidly secured in place as shown

and as required by recognized standards. Bracing must be placed wherever necessary to support all loads on the structure during erection.

The size and spacing of fasteners and the edge distance for nails must be as shown.

Nailing schedule must be as shown and must comply with the California Building Code.

Wall coverings exposed to the weather must have a backing of building paper applied weatherboard fashion to the framing or sheathing. Backing must be lapped 2 inches at horizontal joints, 6 inches at vertical joints and 12 inches at building corners.

#### Stair Framing:

Stair framing members must be of the size and spacing shown.

Stringers must be notched to receive treads, risers and supports. Effective depth remaining must be not less than 3½ inches.

#### Plywood Panels:

Plywood panels must be attached to the framing as described. All structural plywood sheathing (both roof and wall) must be nailed with "Common" nails.

Plywood decking must be glued and nailed to the framing system.

Plywood sheathing must be nailed to the framing system and must be continuous over 2 or more supports. Roof and floor panels must be installed with the long dimension across the supports, with end joints staggered 4 feet. Wall sheathing must have all edges blocked. Spacing between panels must be 1/8 inch.

#### **99-06100D Payment**

Not Used

#### **99-06150 JOIST TRUSSES**

##### **99-06150A General**

##### **99-06150A(1) Summary**

Scope: This work consists of designing, fabricating, and erecting pre-engineered, factory fabricated joist trusses.

Joist trusses must have wood chords and metal tubular webs.

##### **99-06150A(2) Definitions**

Not Used

##### **99-06150A(3) Submittals**

Product Data: Submit manufacturer's data for lumber, adhesives, and accessories.

#### Shop Drawings:

Submit complete shop drawings, erection drawings, if required, and design calculations for the pre-engineered joist trusses, permanent bracing and connection details. Submittals must be authorized prior to the start of fabrication.

Shop drawings and calculations must be sealed and signed by an engineer who is registered as a civil engineer in the State.

Shop drawings must show the lumber size, species and grades for the truss chords and temporary and permanent bracing members. Joint and connection details must be shown.

Shop drawings must include a location plan which shows the location and identification of each joist truss.

Calculations for the design of the joist trusses, bracing and connections must include a list of applied loads and load combinations with the resulting member forces and member stresses.

If the design calculations contain or consist of computerized or tabulated calculations, the values pertaining to the design must be identified, described or indexed in such a manner that a design review can be performed.

Certificates of Compliance: Submit a certificates of compliance for joist trusses.

**99-06150A(4) Quality Control and Assurance**

Codes and Standards: Joist trusses and permanent bracing must be designed for the loads shown and other applied loads, including fire sprinkler systems. The design must comply with the CBC, the "National Design Specification for Wood Construction" by the American Forest and Paper Association, and the "Timber Construction Manual," by the American Institute of Timber Construction (AITC). Joist trusses must be ICC approved.

**99-06150A(5) Delivery, Storage, and Handling**

Trusses must be transported and handled in such a manner as to prevent damage due to warping, distortion and moisture.

Joist trusses must be stored off the ground.

**99-06150B Materials**

**99-06150B(1) General**

Joist Truss:

Factory fabricated pre-engineered joist trusses with wood chords and metal webs. Trusses must be sized to fit the locations shown. Lumber species and grades must be as shown on the authorized shop drawings. Lumber must bear grade marks of a recognized grading association and the moisture content of the lumber must be within the amount specified in the referenced specifications.

Web members of the joist trusses must be tubular steel. The diameters and thickness of the web members must be as required by the design.

Connectors and Fasteners: Connectors and fasteners must be as shown on the authorized shop drawings.

**99-06150B(2) Shop Fabrication**

Trusses and bracing members must be accurately cut to provide tightly fitted joints and connections.

Connectors, fasteners and other hardware accessories must be coordinated for placement in the proper locations and positions.

Camber, if required by the design, must be built into the trusses.

Each truss must be stamped or marked with a location identification mark or symbol and with the name and address of the manufacturer.

**99-06150C Construction**

Joist trusses must be erected plumb and true and must be secured rigidly in place in complying with the truss manufacturer's instructions.

Fasteners and connectors must be placed as shown and as instructed by the truss manufacturer.

Bracing must be installed during erection to hold the trusses plumb and true and in a safe position until sufficient permanent construction is in place to provide full stability.

All permanent bracing must be secured in place before any sustained permanent loads are applied to the joist truss system.

Materials loaded on joist truss system are to be located in such a manner to ensure that the design load of the trusses are not exceeded.

**99-06150D Payment**

Not Used

## **99-06200 FINISH CARPENTRY**

### **99-06200A General**

#### **99-06200A(1) Summary**

Scope: This work consists of installing materials and performing finish carpentry, including exterior and interior trim, plywood soffits and panels and plywood and softwood paneling, as shown on the plans and these special provisions.

Finish carpentry includes carpentry work not specified as part of other sections and which is generally exposed to view.

#### **99-06200A(2) Definitions**

Not Used

#### **99-06200A(3) Submittals**

Product Data: Submit manufacturer's specifications and installation instructions for each item of factory-fabricated siding and paneling.

Samples: One sample must be submitted to the Engineer at the job site for each species and cut or pattern of finish carpentry as shown below:

Exterior standing and running trim: 2 feet long by full board or molding width, finished on one side and one edge.

Interior standing and running trim: 2 feet long by full board or molding width, finished on one side and one edge.

Siding: 2 feet long, finished on one side and one edge.

Exterior plywood for transparent finish: 2 feet long by panel width, finish must be applied to upper half of each piece.

Plywood paneling: 2 feet long by full panel width, finished on one side.

#### **99-06200A(4) Quality Control and Assurance**

Factory Marks: Each piece of lumber and plywood must be marked with type, grade, mill and grading agency identification. Marks must be omitted from surfaces to receive transparent finish. A mill certificate stating that material has been inspected and graded complying with the requirements must be furnished if marks cannot be placed on concealed surfaces.

#### **99-06200A(5) Delivery, Storage, and Handling**

Delivery: Carpentry materials must be delivered after painting, wet work and similar operations have been completed.

Protection: Finish carpentry materials must be protected during transit, delivery, storage and handling to prevent damage, soiling and deterioration.

### **99-06200B Materials**

Softwood Lumber: Softwood lumber must comply with PS 20, "American Softwood Lumber Standard," with applicable grading rules of inspection.

Plywood: Plywood must comply with Voluntary Product Standard PS 1, "Structural Plywood," or its predecessor, "Construction and Industrial Plywood."

Hardwood Lumber: Hardwood lumber must comply with the National Hardwood Lumber Association (NHLA) rules.

Woodworking: Woodworking must comply with WI "Architectural Woodwork Standards," custom grade

Lumber sizes indicated must be nominal sizes except as indicated by detailed dimensions. Lumber which is to be dressed or worked and dressed must be manufactured to the actual sizes as required by PS 20.

Lumber that is to receive a transparent finish (stained or clear) must be made of solid lumber stock.

Lumber that is to be painted may be solid or glued-up lumber at the contractor's option.

Glued-up lumber for exterior finish work must comply with ASTM D 2559 for "wet use" and be so certified by the inspection agency.

**Exterior Standing and Running Trim:**

Standing and running trim in the form of boards or worked products must be clear, all heart Redwood.

Trim to be painted must be finished smooth.

Trim which is to be exposed to view and to receive transparent finish (stained or clear) must be saw textured.

**Plywood Siding for Transparent Finish:** Plywood for transparent finish must be 5/8-inch, redwood, APA RATED SIDING 303-6-W, EXT with exterior glue, rough sawn Texture 1-11. Siding must be factory treated with the manufacturer's standard water repellent preservative.

**Plywood Paneling and Wainscoting:** Plywood paneling and wainscoting must be APA Interior Grade A-C, Group 1, Exposure 1 plywood. Thickness must be as shown.

**Interior Standing and Running Trim:**

Standing and running trim to be painted must be paint-grade pine, solid stock or finger jointed.

Standing and running trim to have transparent finish must be solid hardwood, species to be shown.

**Open Shelving:** Open shelving must be 3/4-inch Grade A-C fir plywood with veneer core and 1/2-inch thick solid stock pine edge banding glued and nailed.

**Miscellaneous Materials:**

Nails, screws and other anchoring devices of the type, size, material and finish required must be provided for secure attachment, concealed where possible.

Fasteners and anchorages for exterior use and for use with preservative treated wood must be hot dip galvanized.

Screens for soffit vents must be 4 x 4 or 8 x 8 mesh, galvanized screen. Open area must be not less than 50 percent.

**Preservative Treatment:**

Preservative treatment must be copper naphthenate, pentachlorophenol or water-borne arsenicals (ACA, CCA or ACZA).

Wood members, except those of redwood, in contact with mortar setting beds, concrete block walls, slab on grade and other concrete work, and wood used for roofing cant and curbs must be pressure treated with leach resistant preservative. Each piece of pressure treated lumber must bear the AWPA label.

All holes, daps, or cuts made after treating must be thoroughly swabbed with copper naphthenate.

**Fire Retardant Treatment:** Fire retardant treatment must be paintable, odorless fire retardant preservative applied by pressure treating methods.

**99-06200C Construction**

**99-06200C(1) Installation**

All work must be installed plumb, level, and true with no distortions.

**Standing and Running Trim:**

Standing and running trim must be installed with minimum number of joints possible, using full length pieces to the greatest extent possible.

Exterior joints must be made water-resistant by careful fitting.

## Anchor Finish Carpentry:

Finish carpentry must be anchored to framing or blocking built in or attached directly to the substrate.

Interior carpentry must be attached to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing where required for complete installation. Fine finish nails must be used for exposed nailing, countersunk and filled flush with finished surface and matching final finish where transparent finish is indicated.

Finish exterior siding must be fastened with corrosion resistant nails. The size and spacing of the siding fasteners must be as shown. Nails must be driven flush with the surrounding surfaces, not countersunk. Nails must be located in the grooves of grooved siding whenever possible.

### **99-06200C(2) Adjustment, Cleaning, Finishing, and Protection**

Damaged and defective finish carpentry work must be repaired or replaced.

All exposed or semi-exposed surfaces must be cleaned.

Finish carpentry must be finished under section 99-09900.

### **99-06200D Payment**

Not Used

### **99-06414A CABINETS**

#### **99-06414A General**

#### **99-06414A(1) Summary**

Scope: This work consists of installing wood cabinets and plastic laminate tops, and splashes and returns including tops, ledges, supporting structures, filler panels, knee space panels, and scribes as shown on the plans and these special provisions.

#### **99-06414A(2) Definitions**

Not Used

#### **99-06414A(3) Submittals**

Product Data: Manufacturer's product data for plastic laminates and cabinet hardware must be submitted approval.

Samples: Three samples must be submitted for each of the items shown below:

Plastic laminate, 12 inch x 12 inch for each type, color, pattern surface finish and edging.

Stainless Steel:

- a. Solid Surface: 12 in x 12 in for each color, pattern and edging.
- b. Molded Epoxy Resin: 10 in x 12 in for each type ,color, pattern and surface finish.
- c. Countertop support bracket.
- d. Edge molding: standard manufacturer's color and sample palette.

Shop Drawings: Shop drawings for cabinets showing location of cabinets, dimensioned plans and elevations, attachment devices, and other components must be submitted. Shop drawings must bear the "WI Certified Compliance Label" on the first sheet of the drawings. Provide rough-ins in drawings for mechanical and electrical services where required.

Certificates of Compliance:

Prior to delivery to the job site, the cabinet manufacturer must submit a WI Certified Compliance Certificate 1) indicating the products that will be furnish for this job and 2) certifying that they will fully meet all the requirements of the grade or grades specified.

WI Certified Compliance Label must be stamped on all cabinet work.

Each plastic laminate top must bear the WI Certified Compliance Label.

Prior to completion of the contract, a WI Certified Compliance Certificate for Installation must be delivered to the Engineer.

**99-06414A(4) Quality Control and Assurance**

Codes and Standards: Cabinets and swinging gates must be manufactured and installed in under the "Architectural Woodwork Standards" of the Woodwork Institute (WI) requirements for the grade or grades specified or shown.

Samples: Provide a full size base and wall cabinet showing actual construction and materials used, including counter tops.

Deliver samples to the site.

Accepted samples maybe incorporated into the Work.

**99-06414A(5) Delivery, Storage, and Handling**

Protection: Cabinets must be protected during transit, delivery, storage and handling to prevent damage, soiling, and deterioration.

**99-06414B Materials**

**99-06414B(1) Acceptable Manufacturers**

Manufacturers: High pressure decorative laminates must be Wilsonart; Formica Corp.; Nevamar Corp.; or equal.

**99-06414B(2) Manufactured Units**

Cabinets must be fabricated to the dimensions, profiles, and details shown with openings and mortises precut, where possible to receive hardware and other items and work.

Fabrication, assembly, finishing, hardware application, and other work must be completed to the maximum extent possible prior to shipment to the job site.

Laminate Clad Cabinets:

Laminate clad cabinets must be custom grade, flush overlay construction.

Laminate cladding must be high pressure decorative laminate complying with NEMA LD 3. Color, pattern and finish must be as shown. Laminate surface and grade must be as follows:

1. Horizontal and vertical surfaces other than tops must comply with NEMA LD 3, general purpose grade GP-50 (50-mil nominal thickness).
2. Post formed surfaces must comply with NEMA LD 3, post formed grade PF-42 (42-mil nominal thickness).

Laminated Counter Tops and Splashes:

Laminated counter tops and splashes must be WI custom grade.

Surface material must be high pressure laminated plastic complying with NEMA LD-3, 50-mil thickness.

Unless otherwise shown, splashes must be 4 inches high from the surface of the deck. Back splashes must be continuous formed and coved. Side splashes must be top set.

Laminated counter tops must be self edged. Counter tops to receive sinks or plumbing fixtures must have a bullnose.

The underside of tops and backsides of splashes must be covered with an authorized backing sheet.

Molded Epoxy Resin tops: Epoxy Resin tops shall be heavy duty Laboratory type epoxy compound and cured to provide optimum physical and chemical resistance properties. Epoxy Resin tops and

curbs shall be uniform mixture through full thickness. Tops and curbs shall be non-glaring and bonded to form a water tight joint.

Solid-surfacing material countertops: Custom grade, 3/4 inch thickness. Fabricate tops in one piece unless otherwise indicated. Comply with solid-surfacing material manufacturer's written recommendations for adhesives, sealers, fabrication and finishing.

### **99-06414B(3) Cabinet Hardware and Accessory Materials**

Cabinet hardware and accessory materials must be provided for cabinets.

Hardware must be provided with standard US 32 metal plated finish unless noted otherwise on plans.

Drawer Slides: Drawer slides must be side mounting full extension with fully enclosed rolling balls and rollers, concealed slides and bearings, and positive stop. Capacity must be not less than 75 pounds, except capacity must be not less than 100 pounds for heavy duty drawers.

Door Guides: Sliding door guides must be continuous, dual channel, metal guides, top and bottom. Bottom guide must have crowned track.

Shelf Supports: Shelf supports must be adjustable, semi-recessed, chrome finished pressed metal, heavy duty standards and support clip, with one inch adjustment increments.

Cabinet Hinges:

Cabinet hinges must be steel concealed European Style with vertical and horizontal adjustment. One hinge per door will be self closing.

Cabinet hinge manufacturers must be Stanley, Hager, McKinney, or equal.

Cabinet Catches:

Cabinet catches must be self aligning magnetic type in aluminum case with zinc plated steel strike.

Cabinet catch manufacturers must be Stanley, Hager, McKinney, or equal.

Cabinet Pulls:

Cabinet pulls must be 3/8 inch diameter rod, with 1 3/8 -inch projection and 5-inch long.

Cabinet pull manufacturers must be Stanley, Hager, McKinney, or equal.

Flush metal pull: Flush metal pull must be 2 3/4 inch diameter, 3/8 inch deep with zinc chrome-plated matt finish.

Cabinet deadlocks: Cabinet deadlocks must be offset bolt with 1/2 inch throw, made of zinc die cast cylinder housing, with black nylon lock case and nickel polished finish.

Panel fasteners: Panel fasteners shall be made of macrolon and have releases that do not require tools. Cabinet suspension fittings must be manufactured by Hafele, Model Keku suspension fittings P.A,S or approved equal. Panel fasteners must be used on removable access panels including all ADA panels at counter top sinks as indicated on plans.

Cable Grommets: Cable grommets must be two piece sets, 2 3/8 inch in diameter round, with spring closure. Provide grommets for all cables. Cable grommets must be black plastic manufactured by Hafele, Model 429.99.324 or approved equal.

Backsplash Railing System

Backsplash railing system must be made of stainless steel with chrome plated polished finish.

Tubular must be approximately 5/8 inch diameter with decorative end cap and plastic sleeve.

Rail post must be approximately 5/8 inch diameter, press fits over concealed fastening screws.

Shelf must be approximately 18 inch x 10 inch single shelf with open wire grate and plastic caps ends to prevent marring of wall and railing.

Edge molding: Elastomer urethane continuous seamless molding, 75 Shore A Durometer, cross section configuration as shown on plans. Semi soft to accommodate radius or mitered corner conditions. Stain resistant, UV stable, self extinguishing flame retardant, tongue and groove installation with epoxy adhesive. Edge mould products T-edge bull nose.

Countertop support bracket: Prefinished steel welded construction, predrilled mounting holes for both table top and wall mounting, 1100 pound load capacity per pair.

Lavatory protective enclosure: ADA compliant under sink lavatory protective enclosure, protection for wheelchair accessibility, single piece, rigid high impact resistant PVC, nominal wall 0.093", UL listed.

Monitor Suspension System:

Minimum work surface depth 24-inch, suspension frame for monitor with 1/4" tinted and tempered glass viewing surface and glare shield and trim grommet.

Keyboard width shall be 28-inch, with load capacity 44 lbs. Ball bearing slide for keyboard supported. Chromated steel. Variable installation height 2 1/2" to 3 3/4" via 4 slot positions of height-adjustable mounting bracket. Precision slide with holding feature and roll-out prevention.

Finish shall be steel, epoxy powder-coat.

#### **99-06414B(4) Shop Fabrication**

Shop Assembly:

Nails must be countersunk and the holes filled, molds must be neatly mitered and all joints must be tight and true.

As far as practicable, work must be assembled at the mill and delivered to the building ready to be set in place. Parts must be smoothly dressed and interior work must be belt sanded at the mill and hand sanded at the building. After assembly, work must be cleaned and made ready for the specified finish.

Veneer sequence matching must be maintained for cabinets with transparent finish.

All work must be prepared to receive finish hardware. Finish hardware must be accurately fitted and securely fastened as instructed by the manufacturer. Finish hardware must not be fastened with adhesives.

Drawers must be fitted with dust covers of 1/4-inch plywood or hardboard above compartments and drawers except where located directly under tops.

Precut Openings: Openings for hardware, appliances, plumbing fixtures, and similar items must be precut where possible. Openings must be accurately located and templates used for proper size and shape. Edges of cutouts must be smoothed and edges sealed with a water-resistant coating.

#### **99-06414C Construction**

Cabinets: Cabinets must be installed without distortion so that doors and drawers fit openings properly and are accurately aligned. Hardware must be adjusted to center doors and drawers in openings and to provide unencumbered operation. Installation of hardware and accessory items must be completed as indicated on the authorized drawings.

Laminate Tops: Laminate tops must be securely fastened to base units and other support systems as indicated on the authorized drawings.

Cabinet Hardware:

Doors for cabinets must be equipped with one pair of hinges and one catch per leaf, unless otherwise shown. Each door leaf must be equipped with one pull knob.

Drawers up to 24 inches wide must have one cabinet pull and drawers over 24 inches wide must have two cabinet pulls.

**99-06414D Payment**

Not Used

**DIVISION 7 THERMAL AND MOISTURE PROTECTION**

**99-07182 WATER REPELLENT COATING**

**99-07182A General**

**99-07182A(1) Summary**

Scope: This work consists of applying water repellent coating to concrete or masonry surfaces.

The water repellent coating must be applied to all exterior concrete or masonry surfaces and exposed aggregate surfaces as shown.

**99-07182A(2) Definitions**

Not Used

**99-07182A(3) Submittals**

Product Data: Manufacturer's descriptive data, application instructions and general instructions for water repellents must be submitted.

Certificates of Compliance: Submit a certificate of compliance with each shipment of water repellent coating material.

**99-07182A(4) Quality Control and Assurance**

Codes and Standards: Water repellent coatings must comply with all rules and regulations concerning air pollution in the State of California.

**99-07182B Materials**

Water Repellent Coating: Water repellent coating must be clear, colorless, water-based sealer not containing silane, recommended for use on concrete and concrete unit masonry in vertical applications.

Compatibility: Verify compatibility between water repellent coating and anti-graffiti coating when an anti-graffiti coating is specified in section 99-9.

**99-07182C Construction**

Preparation: All surfaces to receive water repellent coating must be dry and cleaned by removing contaminants that block pores of the surface. Cleaning methods must be those recommended by the water repellent manufacturer.

**Application:**

The water repellent solution must be applied under the manufacturer's instructions

The time period between applications of water repellent coating must be not less than 24 hours.

Protection: Surfaces of other materials surrounding or near the surfaces to receive the water repellent coating must be protected from overspray or spillage from the waterproofing operation. Water repellent coating applied to surfaces not intended to be waterproofed must be removed and the surfaces restored to their original condition.

**99-07182D Payment**

Not Used

**99-07210 INSULATION (GENERAL)**

**99-07210A General**

**99-07210A(1) Summary**

Scope: This work consists of installing insulation. Insulation includes related materials such as substrate boards, underlayments, vapor retarders, and cover boards.

Insulation materials must be compatible with existing or new materials incorporated in the building.

**99-07210A(2) Definitions**

Not Used

**99-07210A(3) Submittals**

Product Data:

A list of materials, manufacturer's descriptive data, location schedule, and time schedule must be submitted.

The list of materials to be used must include the trade name, manufacturer's name, smoke developed and flame spread classification, resistance rating and thickness for the insulation materials and accessories.

Schedules:

A location schedule and time schedule must be submitted.

The location schedule must show where each material is to be installed.

The Contractor must provide the Engineer at the job site with an accurate time schedule of the areas of the building to be insulated each day. The time schedule must be submitted 3 working days in advance of the work.

Samples: Samples of insulation material must be submitted to the Engineer at the job site.

**99-07210A(4) Quality Control and Assurance**

Codes and Standards: All insulating materials must be certified to comply with the California Quality Standards for Insulating Materials and must be listed in the Department of Consumer Affairs publication "Consumer Guide and Directory of Certified Insulation Material."

**99-07210A(5) Delivery, Storage, and Handling**

Insulating materials must be delivered to the job site and stored in a safe dry location with labels intact and legible.

Insulating materials must be protected from physical damage and from becoming wet or soiled.

In the event of damage, materials must be repaired or replaced.

**99-07210B Materials**

Not Used

**99-07210C Construction**

Not Used

**99-07210D Payment**

Not Used

**99-07212 BATT AND BLANKET INSULATION**

**99-07212A General**

**99-07212A(1) Summary**

Scope: This work consists of installing batt or blanket insulation.

Batt insulation includes faced and unfaced batts in walls and ceilings, acoustical batts for sound control, and exposed batt or blanket insulation for ceilings and walls.

**99-07212A(2) Definitions**

Not Used

**99-07212A(3) Submittals**

Not Used

## **99-07212A(4) Quality Control and Assurance**

### Laminator's Qualifications:

Laminator for bonding polyethylene vapor-retarder to insulating batts must be approved by the insulation manufacturer.

The name of the laminator must be submitted with the Product Data.

### Codes and Standards:

All batt or blanket insulation, including facings such as vapor barriers, must have a flame-spread rating not to exceed 25 and a smoke density not to exceed 450 when tested under UBC Standard No. 8-1 and ASTM E-84.

The flame-spread and smoke density limitations do not apply to facings on batt insulation installed between ceiling joists, or in roof-ceiling or wall cavities, provided the facing is installed in substantial contact with the surface of the ceiling or wall finish.

## **99-07212B Materials**

### **99-07212B(1) Insulating Materials**

Fiberglass batts must be thermal insulation produced by combining glass fibers with thermosetting resins to comply with ASTM C 665.

Wall Insulation: Wall insulation must be R-19 fiberglass batts with paper-laminate vapor-retarder membrane on one face. Insulation must comply with ASTM C 665, Type II, Class C.

Ceiling Insulation: Ceiling insulation must be R-38 fiberglass batts with paper-laminate vapor-retarder membrane on one face. Insulation must comply with ASTM C 665, Type II, Class C.

Acoustical Insulation: Acoustical insulation must be 3½ inches, unfaced fiberglass insulation batts. Insulation must comply with ASTM C 665, Type I.

### **99-07212B(2) Vapor Retarders**

Polyethylene Vapor-retarder: Polyethylene vapor-retarder must be factory-applied, 3 mils, white polyethylene film, a blend of fiberglass and polyester yarn reinforcement, and metallized polyester film laminated with a flame resistant adhesive, and a Class I flame-spread classification.

### **99-07212B(3) Auxiliary Insulation Materials**

Insulation Tape: Insulation tape must be that recommended by the insulation manufacturer.

Insulation Adhesive: Insulation adhesive must be the type recommended by the insulation manufacturer and complying with the requirements for fire resistance and VOC content.

Impaling Pins: Impaling pins must be self-adhering wire pins with sheet metal retaining clips and protective rubber tips. Adhesive for pins must be that recommended by the pin manufacturer.

Line Wire: Line wire must be commercial quality 20-gage galvanized steel wire.

### **99-07212B(4) Shop Fabrication**

Polyethylene must be factory laminated to fiberglass batts or blankets by an applicator approved by the manufacturer of the batts or blankets.

## **99-07212C Construction**

The vapor retarder on faced batts must be toward the interior and must be fastened to provide a sealed retarder. Punctures and holes in the retarder must be repaired.

Unless otherwise described, insulation must be kept at minimum 3 inches clear of lighting fixtures and heat producing electrical appliances and equipment.

Installing Batt Type Insulation: Insulation batts must be installed to completely fill the space between framing members. Apply a single layer of insulation of required thickness, unless otherwise shown or required to make up total thickness. Installation must comply with the manufacturer's instructions and these special provisions.

### Installing Exposed Insulation:

Exposed insulation must be installed on impaling pins adhered to the substrate at 16-inch centers each direction with a minimum distance of 4 inches to the edge of the batt. Retainer clips must be placed onto the pins so that the batt is slightly compressed. Pins must be cut within ½ inch of the retaining clips and protective rubber caps placed on the ends of the pins.

When line wire is shown, blankets must be supported with line wire spaced at 16 inches on center.

Joints in exposed insulation must be sealed by lapping not less than 4 inches. Exposed insulation must be fastened to framing at top, end and bottom, at perimeter of wall openings and at lap joints.

Overlapping joints must be sealed with insulation adhesives as instructed by vapor retarder manufacturer's printed directions. Butt joints and fastener penetrations must be sealed with insulation tape of the type recommended by the vapor retarder manufacturer. Joints at pipes, conduits, electrical boxes and similar items penetrating the vapor retarder must be sealed.

### **99-07212D Payment**

Not Used

### **99-07214 RIGID WALL INSULATION**

#### **99-07214A General**

##### **99-07214A(1) Summary**

Scope: This work consists of installing rigid wall insulation.

Rigid insulation includes rigid insulation, fasteners, and other materials which are required for the complete installation of the rigid insulation system.

##### **99-07214A(2) Definitions**

Not Used

##### **99-07214A(3) Submittals**

Not Used

##### **99-07214A(4) Quality Control and Assurance**

Codes and standards: Rigid foam insulation must have a flame- spread rating not to exceed 75 and a smoke density not to exceed 450 when tested under UBC Standard No. 8- 1 and ASTM E-84. Rigid foam insulation must comply with UBC Standard 26- 3 to be installed exposed, or without a thermal barrier on the room side of the insulation.

##### **99-07214B Materials**

Rigid insulation: Rigid insulation must be rigid closed cells extruded rectangular boards of polystyrene foam with aluminum foil facing on both sides and an aged thermal resistance of R- 5 per inch, complying with ASTM Designation: C 1289, Type I, Class 1 or 2. Facing on exposed insulation must be white tinted aluminum foil.

Metal furring: Metal furring must be "Z" shape galvanized metal.

Insulation tape: Insulation tape must be as recommended by the insulation manufacturer.

Adhesive: Adhesive must be construction grade panel adhesive as recommended by the insulation manufacturer, complying with VOC requirements.

PVC strips: PVC strips must be interlocking male and female white PVC strips.

Fasteners: Fasteners must be concrete nails; Bostich, Pneumatic Nail System; Buildex, Tapcon Fasteners; or equal.

### **99-07214C Construction**

Installation of rigid insulation:

The preparation of the wall surfaces and the installation of insulation must comply with the manufacturer's instructions and as described herein.

Rigid insulation placed behind plywood or gypsum board must be tight fitting between galvanized metal furring and spaced 2 feet on center. Exposed rigid insulation must be installed tight fitting between PVC strips spaced at 4 feet on center. PVC strips must align with the vertical joints of the plywood below. Adhesive must be applied to the PVC strips and the wall as instructed by the insulation manufacturer.

All joints between insulation boards and between insulation boards must be taped.

Insulation panels with broken or crushed corners or edges must be trimmed free of such defects or must be discarded. Replacement boards less than 12 inches wide must not be used.

Damaged insulation in the completed work must be removed and replaced. Insulation that has been wet or is wet must be considered damaged.

### **99-07214D Payment**

Not Used

### **99-07221 RIGID ROOF INSULATION**

#### **99-07221A General**

##### **99-07221A(1) Summary**

Scope: This work consists of installing rigid roof insulation.

Rigid insulation includes rigid insulation, substrate boards, underlayment, vapor retarders, cover boards, wood nailers, fasteners, and other materials required for the complete installation of the rigid insulation system. Materials and installation must be coordinated with the roof covering system to meet the requirements for a Class 1 Factory Mutual approved assembly.

##### **99-07221A(2) Definitions**

Not Used

##### **99-07221A(3) Submittals**

Not Used

##### **99-07221A(4) Quality Control and Assurance**

Not Used

#### **99-07221B Materials**

Substrate Board:

Glass-mat, water-resistant gypsum substrate, ASTM C 1177, 1/2 inch thick factory primed, with low permeance coating, as recommended by manufacturer for intended application.

Vapor Retarder:

Vapor retarder must have permeance of 0.1 perm or less under ASTM E 96 and must be recommended by roofing system manufacturer for intended application.

Polyethylene Film: ASTM D 4397, not less than 8 mils thick, maximum permeance 0.1 perm.

Reinforced High-Density Polyethylene: Multi-ply high-density polyethylene laminated to high-strength non-woven cord grids:

1. Weight: 40 lb./1000 sq. ft., ASTM D 3776
2. Tear Resistance: 30 lb., ASTM D 2582
3. Permeance: 0.04 perm, ASTM E 96
4. Dart Drop Impact Resistance: 500 g, ASTM D 1709

5. Tensile Strength: 100 lb/4500 psi, 3 inches, ASTM D 882
6. Puncture Strength: 33 lb., ASTM D 4833
7. Useable Temperature Range: -25 to 170 degrees F

Aluminum Foil Polyethylene Laminate: Aluminum foil core laminated to two layers of high-density polyethylene.

1. Weight: 70 lb./1,000 sq. ft., ASTM D 3776
2. Tear Resistance: 16 lb., ASTM D 2582
3. Permeance: 0.00 perm, ASTM E 96
4. Dart Drop Impact Resistance: 1800 g, ASTM D 1709
5. Tensile Strength: 105 lb/2200 psi, 3 inches, ASTM D 882
6. Puncture Strength: 50 lb., ASTM D 4833
7. Useable Temperature Range: -40 to 170 degrees F

Rigid Roof Insulation: Rigid roof insulation must be multilayer, preformed board roof insulation of the following type:

1. Extruded polystyrene (XPS) board complying with ASTM Designation: C 578, Type IV

Rigid roof insulation must have R value of at least R-5.0 per inch (R-38 total R value as installed) and compressive strength of at least 25 psi.

Cover Board:

Glass-mat, water-resistant gypsum substrate, ASTM C 1177, 1/2 inch thick factory primed, with low permeance coating, as recommended by manufacturer for intended application.

Insulation Tape: Insulation tape must be that recommended by the insulation manufacturer.

Adhesives, Sealants, and Primers: Adhesives, sealants, and primers must be those recommended by manufacturer for intended use.

Fastener (Metal Decking): Fastener (metal decking) must be galvanized spring steel barbed clip driven through galvanized one-inch minimum nominal diameter caps; galvanized hardened steel nail with one-inch minimum nominal diameter head and serrated shank to provide back out resistance; or threaded self tapping screw driven through 3-inch minimum nominal diameter galvanized cap.

### **99-07221C Construction**

Preparation:

The preparation of the deck surfaces must comply with the manufacturer's instructions and these special provisions.

Install substrate board with long sides perpendicular to slope and with end joints staggered. Fasten to deck under the roofing manufacturer's instructions.

The deck surface must be made smooth and level.

Installation:

Underlayment must be fastened to nailable decks with randomly located roofing nails.

Install vapor retarder under the manufacturer's instructions.

Insulation panels must be placed in at least 2 layers with end joints staggered and with joints of the second layer offset at least 6 inches from joints in the first layer.

Insulation panels must be oriented with the long side perpendicular to the direction roofing felts are to be laid. End joints between panels must be staggered.

Insulation clips and fasteners must resist the wind uplift classification specified for the roof covering.

The first layer of insulation must be mechanically fastened as instructed by the manufacturer to meet the requirements of Factory Mutual Loss Prevention Data Sheets 1-28 and 1-29. At least one fastener per 2 square feet of insulation panel must be used. Panels that are cracked or broken by the installation of the mechanical fasteners must be replaced.

The completed layer of insulation must be smooth and level, and suitable for the proper bedding of succeeding layers of roofing material.

Insulation must be laid just before application of roofing felts. Units must be laid in parallel courses with transverse joints staggered, in moderate contact with adjoining surfaces.

No more insulation must be laid than can be covered with roofing the same day. Cutoffs of 2 layers of hot mopped Type I (No. 15) asphalt saturated felt must be installed, not less than 4 inches onto completed work and extended out not less than 6 inches onto the deck, at exposed edges of insulation at the end of each day's work. Cutoffs must be removed when work is resumed.

Joints in the top layer of glass fiber roof insulation must be taped with 6-inch wide felt stripping set in hot asphalt mopping.

Continuous joints between insulation units and parallel to decking flutes must not occur over the flute openings. Both units must have full edge bearing on rib tops.

Insulation panels with broken or crushed corners or edges must be trimmed free of such defects or must be discarded. Replacement boards less than 12 inches wide must not be used.

Damaged insulation in the completed work must be removed and replaced. Insulation that has been wet or is wet must be considered damaged.

Install cover board with joints staggered from joints in insulation units. Attach under the manufacturer's instructions.

## **99-07221D Payment**

Not Used

## **SECTION 072500 - WEATHER BARRIERS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

A. Section Includes:

1. Building paper.
2. Building wrap.
3. Flexible flashing.

#### **1.2 ACTION SUBMITTALS**

A. Product Data: For each type of product.

1. For building wrap, include data on air and water-vapor permeance based on testing according to referenced standards.

#### **1.3 INFORMATIONAL SUBMITTALS**

A. Evaluation Reports: For water-resistive barrier and flexible flashing, from ICC-ES.

### **PART 2 - PRODUCTS**

#### **2.1 WATER-RESISTIVE BARRIER**

A. Building Wrap: ASTM E 1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; and UV stabilized; and acceptable to 24 CA Code of Regs.

1. Water-Vapor Permeance: Not less than 20 perms per ASTM E 96/E 96M, Desiccant Method (Procedure A).

2. Air Permeance: Not more than 0.004 cfm/sq. ft. at 0.3-inch wg when tested according to ASTM E 2178.
  3. Allowable UV Exposure Time: Not less than three months.
  4. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
- B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

## **2.2 MISCELLANEOUS MATERIALS**

- A. Butyl Rubber, Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spun bonded polyolefin to produce an overall thickness of not less than 0.040 inch.
- B. Rubberized-Asphalt, Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spun bonded polyolefin to produce an overall thickness of not less than 0.040 inch.
- C. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.
- D. Nails and Staples: ASTM F 1667.

## **PART 3 - EXECUTION**

### **3.1 WATER-RESISTIVE BARRIER INSTALLATION**

- A. Cover exposed exterior surface of sheathing with water-resistive barrier securely fastened to framing immediately after sheathing is installed.
- B. Cover sheathing with water-resistive barrier as follows:
  1. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.
  2. Apply barrier to cover vertical flashing with a minimum 4-inch overlap unless otherwise indicated.
- C. Building Wrap: Comply with manufacturer's written instructions.
  1. Seal seams, edges, fasteners, and penetrations with tape.
  2. Extend into jambs of openings and seal corners with tape.

### **3.2 FLEXIBLE FLASHING INSTALLATION**

- A. Apply flexible flashing where indicated to comply with manufacturer's written instructions.
  1. Prime substrates as recommended by flashing manufacturer.
  2. Lap seams and junctures with other materials at least 4 inches except that at flashing flanges of other construction, laps need not exceed flange width.
  3. Lap flashing over water-resistive barrier at bottom and sides of openings.
  4. Lap water-resistive barrier over flashing at heads of openings.
  5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

## **99-07270 THROUGH-PENETRATION FIRESTOPPING**

### **99-07270A General**

#### **99-07270A(1) Summary**

Scope: This work consists of installing fire stopping materials at penetrations in fire-rated walls, floors, and ceilings.

#### **99-7.04A(2) Definitions**

Not Used

#### **99-07270A(3) Submittals**

Product Data:

A list of materials, manufacturer's descriptive data, and location schedule must be submitted.

Descriptive data must include trade names, manufacturers' names, complete information on the materials to be applied, California State Fire Marshal Listing, the material thickness for the required fire resistance ratings, and the manufacturer's printed instructions for installation. Manufacturer's assembly must be California State Fire Marshal approved.

Certificates of Compliance: Submit a certificates of compliance with each shipment of fire stopping materials.

#### **99-07270A(4) Quality Control and Assurance**

Not Used

#### **99-07270A(5) Delivery, Storage, and Handling**

Delivery: Materials to be applied must be delivered in original unopened packages. Packages must be identified by the manufacturer's label and must bear proper labels for fire resistance classification.

Storage: Materials must be stored above ground, under cover, and in a dry location until ready for use. Packages which have been exposed to moisture before use must be discarded.

#### **99-07270B Materials**

Fire-rated Caulk: Fire-rated caulk must comply with ASTM E 814 and must be rated for use in 2 and 3-hour fire-rated assemblies. Fire-rated caulk must be 3M Brand, Fire Barrier Caulk; Dow Corning, Fire Stop Sealant; Standard Oil, Fyre Putty; or equal.

Wrap Strip: Wrap strip must be nominal 1/4-inch thick intumescent elastomeric material in 2-inch wide strips, faced one side with aluminum foil, and rated for use in 1-hour and 2-hour fire-rated systems.

Packing Material: Packing material must be polyethylene backer rod or nominal one-inch thickness of tightly packed ceramic (alumina silica) fiber blanket, mineral-wool batt or glass fiber insulation material.

Fire-rated Mortar: Fire-rated mortar must be non-asbestos, 47 to 57 pounds per cubic foot air dried density portland cement fly ash through-penetration fire stopping mortar. Fire-rated mortar must comply with ASTM E 814 and must be rated for use in 3-hour fire-rated systems at 3-inch minimum thickness.

Fire Safing Insulation: Fire safing insulation must be inorganic 3.5 pounds per cubic foot minimum density, non-combustible fiber insulation complying with Federal Specifications HH-1-521F, when tested under ASTM E 119 and ASTM E 136 for 3 hour fire resistance.

#### **99-07270C Construction**

Installation: Fire stopping materials must be installed under the California State Fire Marshal Listing and the manufacturer's instructions.

#### **99-07270D Payment**

Not Used

### **99-07411 METAL ROOFING**

#### **99-07411A General**

##### **99-07411A(1) Summary**

Scope: This work consists of installing Standing Sealed Seam preformed metal roofing.

Metal roofing system consists of underlayment, prefinished metal roof panels, gutters, downspouts, concealed fasteners, sealants, and other accessories and components required for a complete, securely fastened, and weathertight installation.

##### **99-07411A(2) System Description**

Design Requirements: The roofing system must comply with the wind design requirements for uplift in Chapter 16 of the CBC and ASCE 7-05 for the wind speed, uplift and exposure shown.

The roofing system must meet the requirements for a structural standing seam metal panel roof system under ASTM E 1514.

Factory formed, Pre-finished, sealed-seam metal roofing system with non-thermal bridging fastening system over rigid insulation substrate. Includes steel framing and support structure, roof panels, flashings, edges, and terminations pre-fabricated and furnished by the roof panel manufacturer.

Install 3/4" insulation between hat channels. Hat channels to be installed over layered installation boards to achieve R-38 insulation value.

### **99-07411A(3) Definitions**

Not Used

### **99-07411A(4) Submittals**

Product Data:

Manufacturer's technical product data, installation instructions, and recommendations for each type of roofing material must be submitted for authorization.

Product data must include the manufacturer's name and a complete material description of all components of the metal roofing system.

Samples:

Material samples must include a 12" x 12" sample of the roofing panel for each color to be installed and a sample of each anchor clip and fastening device.

Shop Drawings:

Shop drawings showing the layout and details of the metal roofing must be submitted.

Shop drawings must show the shape, size, thickness, and method of attachment for each component used in the work; the layout and spacing of fasteners; details of connections and closures; and details for expansion joints and weathertight joints.

Design calculations for the fastening system with the substrate shown must be submitted to verify compliance with the design requirements.

Shop drawings and calculations must be sealed and signed by an engineer who is registered as a civil engineer in the State.

Certificates of Compliance: Submit a certificate of compliance for the metal roofing system.

### **99-07411A(5) Quality Control and Assurance**

Warranty: Manufacturer to provide 30 year limited watertight warranty that includes all metal coping cap, flashings, trims, and penetrations. Installer to provide 4 year workmanship warranty to roof system manufacturer. Panel finish warranty shall be standard peeling and fade warranty as provided by coating manufacturer for a period of 20 years.

Manufacturer's Inspections: The roof system manufacturer will perform jobsite inspections minimum one day per week and provide inspection reports, with photographs, to the Engineer on the quality and progress of the workmanship being performed. Shall notify the Engineer in writing of any failure of the installer to correct items as required by the manufacturer.

### **99-07411A(6) Delivery, Storage, and Handling**

Delivery and Handling: Panels must be protected against damage and discoloration.

Storage: Panels must be stored above ground, with one end elevated for drainage and protected against standing water and condensation between adjacent surfaces.

### **99-07411B Materials**

#### **99-07411B(1) Sheet Material**

Base Metal: Base metal must be cold formed, 0.028 inch nominal (24-gage), galvanized sheet steel complying with ASTM A 653/A 653M, Grade 33 [230] with G90 [Z275] coating, except where a higher strength is required for performance, extra smooth; or cold formed aluminum-zinc alloy-coated,

commercial quality, sheet steel complying with ASTM A 792/A 792M, Grade 40 [275] with AZ55 [AZM 165], coating extra smooth.

Configuration: Metal roofing system must be a standing seam system with standing rib a minimum of 1¾ inches high and spaced 12 inches on center.

### **99-07411B(2) Metal Finishes**

Coatings must be applied before or after forming and fabricating panels, as required for maximum coating performance capability.

Colors or color matches must be as shown or, if not otherwise shown, must be as selected by the Architect from the manufacturer's standard color palette.

Fluoropolymer Coating:

Finish must be the manufacturer's standard 70 percent polyvinylidene fluoride (Kynar or Hylar) coating with a baked on primer (0.2-mil) and a finish coat of 0.8-mil nominal for a total dry film thickness of approximately 1.0-mil nominal. Coating must comply with requirements of AAMA 621.

Interior finish must consist of a 0.15-mil epoxy primer and a backer coat.

### **99-07411B(3) Miscellaneous Metal Shapes**

Flashings, Gutters, and Downspouts: Flashings, gutters, and downspouts must be formed from the same material, gage and in the same finish as the roofing panels.

### **99-07411B(4) Miscellaneous Materials**

Fastener Clips: Fastener clips must be noncorrosive ferrous metal fasteners as recommended by the metal roofing system manufacturer to resist the design loads.

Fasteners: Fasteners must be as recommended by the metal roofing system manufacturer. Sheet metal screws must not be used except to fasten trim and flashings.

Underlayment: Underlayment must be as recommended by the metal roofing system manufacturer, but not less than 30-pound minimum asphalt impregnated fiber glass mat roofing felt.

Red Rosin Sheet: Red rosin sheet must be commercial quality rosin-sized sheathing paper suitable for use as a slip sheet.

Sealant and Sealant Tape: Sealant and sealant tape must be as recommended by the roofing manufacturer.

Closures: Closures must be rubber, neoprene, closed cell plastic or prefinished metal.

### **99-07411B(5) Shop Fabrication**

Unless otherwise shown, or specified herein, roof panels must be fabricated in continuous lengths for the length of the roof, from ridge or peak to eave, except such length must not exceed the manufacturer's maximum production length. Flashings must be fabricated in the longest practical lengths.

Roofing panels must be factory formed. Field formed panels are not acceptable.

## **99-07411C Construction**

### **99-07411C(1) Installation**

Underlayment: The roof and fascia panels must be installed over underlayment. Underlayment must be laid parallel to the eaves, shingle fashion with 6-inch edge laps and 12-inch end laps and must be fastened as instructed by the metal roofing system manufacturer.

Roof Panels:

The roof system must be installed and fastened complying with the details shown and the authorized shop drawings. Cutting and fitting must present a neat and true appearance with exposed burrs removed. Openings through roof panels must be cut square and must be reinforced as instructed by the metal roofing system manufacturer.

Roof panels must be adjusted in place and properly aligned for the detailed conditions before fastening. Panels must not be warped, bowed or twisted. The surface finish on the panels must not be cracked, blemished or otherwise damaged.

Gaskets, joint fillers, sealants and sealing tape must be installed where indicated on the authorized drawings or as required for weatherproof performance of panel systems.

Fasteners must be concealed and must not be driven through roof panels or batten covers.

#### Miscellaneous Metal Shapes:

Trim, fascia, flashings, gutters, downspouts, scuppers, caps, and other prefinished metal work must be positioned to the correct alignment for each detailed condition. Metal work must be securely attached to backing using fasteners at the spacing shown on authorized shop drawings. Prefinished metal to be installed over concrete, masonry or plaster must be back-coated with asphaltic paint as instructed by the metal roofing system manufacturer.

Roof panels, trim, gutters, and other prefinished metal that are marred, punctured, incorrectly bent, or incorrectly installed will be considered damaged and must be replaced with undamaged units.

Gutters must be fabricated by the metal roofing system manufacturer to the shape and lengths shown. Expansion joints must comply with the manufacturer's instructions and to SMACNA "Architectural Sheet Metal Manual."

The metal roofing system must be installed weathertight. Closures must be tight fitting and must be provided at the ends of panels, at the boundary of the roof, and as indicated on the authorized shop drawings.

#### **99-07411C(2) Clean Up and Close Out**

Clean up:

Adjacent surfaces must be protected during the roofing system installation and sealant work. Excess sealant must be removed as the installation progresses.

Roof panels, molding, trim, and other prefinished metal surfaces must be cleaned after installation as instructed by the manufacturer. Exposed cuts must be touched-up with a matching durable primer and paint as instructed by the metal roofing system manufacturer.

Touch up: Damaged paint surfaces must be touched up by using an air dry touch up paint supplied by the metal roofing system manufacturer. Only a small brush must be used for touching up. No spraying of touch up paint is to be performed.

Damaged Units: Panels and other components of the work which have been damaged or have deteriorated beyond successful repair must be removed and replaced.

#### **99-07411D Payment**

Not Used

### **SECTION 99-074213 INSULATED METAL WALL PANELS**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

A. Section Includes:

1. Foamed-insulation-core horizontal metal wall panels.

##### **1.2 PREINSTALLATION MEETINGS**

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with the Engineer, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of doors, windows, and louvers. The contractor must notify the Engineer 1 week prior to scheduling the pre-installation meeting.

2. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
3. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
4. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal panels.
5. Review temporary protection requirements for metal panel assembly during and after installation.
6. Review procedures for repair of metal panels damaged after installation.

### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Shop Drawings:
  1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
  2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.
- C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.
  1. Include similar Samples of trim and accessories involving color selection.

### **1.4 INFORMATIONAL SUBMITTALS**

- A. Sample Warranties: For special warranties.

### **1.5 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For metal panels to include in maintenance manuals.

### **1.6 QUALITY ASSURANCE**

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

### **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels during installation.

### **1.8 FIELD CONDITIONS**

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions allow assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

## **1.9 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including rupturing, cracking, or puncturing.
    - b. Deterioration of metals and other materials beyond normal weathering.
  - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  - 2. Finish Warranty Period: 20years from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 72:
  - 1. Wind Loads: As indicated on Drawings.
  - 2. Other Design Loads: As indicated on Drawings.
  - 3. Deflection Limits: For wind loads, no greater than 1/180 of the span.
  - 4. Seismic Performance: Comply with ASCE 7 Section 9, "Earthquake Loads".
  - 5. Metal Framing: Provide minimum 4-inch wide bearing surface for metal wall panels at vertical joints.
- C. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 283 at the following test-pressure difference:
  - 1. Test-Pressure Difference: 1.57 lbf/sq. ft.
- D. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
  - 1. Test-Pressure Difference: 2.86 lbf/sq. ft.
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

- F. Fire-Test-Response Characteristics: Provide metal wall panels and system components with the following fire-test-response characteristics, as determined by testing identical panels and system components per test method indicated below by UL or another testing and inspecting agency acceptable to the SFM. Identify products with appropriate markings of applicable testing agency.
  - 1. Fire-Resistance Characteristics: Provide materials and construction tested for fire resistance per ASTM E 119(ANSI/UL 263).
  - 2. Surface-Burning Characteristics: Provide wall panels with a flame-spread index of 25 or less and a smoke-developed index of 450 or less, per ASTM E 84.

## **2.2 FOAMED-INSULATION-CORE METAL WALL PANELS**

- A. General: Provide factory-formed and -assembled horizontal metal wall panels fabricated from two metal facing sheets and insulation core foamed in place during fabrication, and with rain screen-designed pressure-equalized horizontal joint, configured with weep-hole-vented chamber to maintain equalized atmospheric pressure reducing potential for moisture drive into wall assembly. Joints between panels must be designed to form weathertight seals. Include accessories required for weathertight installation.
  - 1. Insulation Core: Foamed-in-place urethane-modified isocyanurate foam using a non-CFC blowing agent, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively.
    - a. Closed-Cell Content: 90 percent when tested according to ASTM D 6226.
    - b. Density:2.7 lb/cu. ft. when tested according to ASTM D 1622.
    - c. Compressive Strength: Minimum 20 psi when tested according to ASTM D 1621.
    - d. Shear Strength: 26 psi when tested according to ASTM C 273/C 273M.
- B. Concealed-Fastener, Foamed-Insulation-Core Metal Wall Panels: Formed with factory sealed tongue-and-groove panel edges; designed for sequential installation by interlocking panel edges and mechanically attaching panels to supports using concealed clips or fasteners.
  - 1. Metallic-Coated Steel Sheet: Facings of zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
    - a. Nominal Thickness: 0.030 inch].
    - b. Exterior Finish: Three-coat fluoropolymer.
      - 1) Color: Match Engineer's samples.
    - c. Interior Finish: Siliconized polyester.
      - 1) Color: As selected by Engineer from manufacturer's full range] .
  - 2. Panel Coverage: 24 inches nominal.
  - 3. Panel Thickness: 2.0 inches.
  - 4. Thermal-Resistance Value (R-Value): R-14> according to ASTM C 1363.

## **2.3 LAMINATED-INSULATION-CORE METAL WALL PANELS**

Not Used

## **2.4 HONEYCOMB-CORE METAL WALL PANELS**

Not Used

## **2.5 MISCELLANEOUS MATERIALS**

- A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
  - 1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
  - 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
  - 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- C. Metal spacer: Provide metal spacer as required by the manufacturer to provide adequate air gap between panels and wall vapor barrier.
- D. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- E. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- F. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
  - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, non sag, non toxic, non staining tape 1/2 inch wide and 1/8 inch thick.
  - 2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
  - 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

## 2.6 FABRICATION

- A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
  - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
  - 2. Seams: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

3. Sealed Joints: Form non expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

- a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

## **2.7 FINISHES**

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Steel Panels and Accessories:
  1. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
  1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
  2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
    - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

### **3.3 METAL PANEL INSTALLATION**

- A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise

indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal wall panel manufacturer.

1. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Section 99-07910"Joint Sealants."

### **3.4 INSULATED METAL WALL PANEL INSTALLATION**

A. General: Apply continuous ribbon of sealant to panel joint on concealed side of insulated metal wall panels as vapor seal; apply sealant to panel joint on exposed side of panels for weather seal.

1. Fasten foamed-insulation-core metal wall panels to supports with fasteners at each lapped joint at location and spacing and with fasteners recommended by manufacturer.
2. Apply panels and associated items true to line for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
3. Provide metal-backed washers under heads of exposed fasteners on weather side of insulated metal wall panels.
4. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
5. Provide sealant tape at lapped joints of insulated metal wall panels and between panels and protruding equipment, vents, and accessories.
6. Apply a continuous ribbon of sealant tape to panel side laps and elsewhere as needed to make panels weathertight.

B. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

- C. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that are permanently watertight.
  - 1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to achieve waterproof performance.
  - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

### **3.5 FIELD QUALITY CONTROL**

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal wall panel installation, including accessories.
- C. Metal wall panels will be considered defective if they do not pass test and inspections.
- D. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

### **3.6 CLEANING AND PROTECTION**

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

## **99-07425 FIBER-REINFORCED CEMENTITIOUS WALL PANEL**

### **99-07425A General**

#### **99-07425A(1) Summary**

Scope: This work must consist of furnishing and installing manufactured fiber-reinforced cementitious (FRC) wall panel systems in accordance with the details shown on the plans and these special provisions.

FRC wall panel systems must include all components, underlayments, and fasteners required for a complete wall panel assembly, including matching escutcheons for pipe and conduit penetrations.

#### **99-07425A(2) Definitions**

Not Used

#### **99-07425A(3) References**

##### **American Society of Testing and Materials (ASTM):**

ASTM B 209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate. ASTM C 645 Standard Specification for Nonstructural Steel Framing Members.

ASTM C 1185 Standard Test Methods for Sampling and Testing Non-Asbestos Fiber-Cement Flat Sheet, Roofing and Siding Shingles, and Clapboards.

ASTM C 1186 Standard Specification for Flat on-Asbestos Fiber-Cement Sheets.

ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials.

ASTM E 228 Standard Test Method for Linear Thermal Expansion of Solid Materials With a Vitreous Silica Dilatometer.

ASTM G 155-05 Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials.

#### **99-07425A(4) Performance Requirements**

**Design Requirements:** FRC systems must conform to the wind design requirements for uplift or outward pressures in accordance with Chapter 16 of the CBC for the wind speed and exposure shown on the plans.

**Deflection Limits:** FRC wall panel assemblies must withstand wind loads with horizontal deflections no greater than 1/300 of the span anywhere in the panel.

**Thermal Movements:** Allow for thermal movements from ambient and surface temperature changes by preventing buckling, overstressing of components, failure of connections, and other detrimental effects based on surface temperatures of materials due to both solar heat gain and nighttime skyheat loss.

#### **99-07425A(5) Submittals**

Product Data:

Manufacturer's technical product data, installation instructions, and recommendations must be submitted for approval.

Product data must include the manufacturer's name and a complete material description of all components of the FRC wall panel systems.

Provide manufacturer's written statement that FRC wall panels are free from efflorescence.

#### **99-07425B Materials**

Samples:

Material samples must include a 12" x 12" sample for each type of panel and color to be installed and a sample of each anchor clip and fastening device.

#### **99-07425B(1) Shop Drawings:**

Shop drawings must be submitted that include the shape, size, thickness, and method of attachment for each component used in the work; the layout and spacing of fasteners; details of connections and closures; and details for expansion joints and weathertight joints.

#### **99-07425B(2) Mockups:**

Provide full-scale sample installation of materials at areas indicated on the drawings for review by the Owner. Mock-up will serve as a basis for acceptable detailing and construction tolerances.

#### **99-07425B(3) Design Calculations:**

Design calculations must be submitted to verify compliance with the performance requirements described above.

Design calculations must be stamped and signed by an engineer who is registered as a Civil or Structural Engineer in the State of California. The expiration date of the registration must be shown. The Engineer's signature must be original.

**99-07425B(4) Quality Assurance**

Certificates of Compliance: Certificates of compliance must be furnished for the FRC wall panel systems in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

**99-07425B(5) Delivery, Handling and Storage**

Delivery and Handling: FRC wall panels must be protected against damage and discoloration. Unload, store and erect FRC wall panels in a manner to prevent bending, warping, twisting, and surface damage.

Storage: Panels must be stored above ground. Stack FRC wall panels horizontally on platforms or pallets, covered with suitable weathertight, UV resistant and ventilated covering.

**99-07425B(6) Products Metal Furring**

Metal furring: Must be material conforming to ASTM B 209, allowing for maritime conditions. Furring type and nominal thickness as required to meet performance requirements. Sizes as shown on the plans.

Fasteners for metal furring must be of type, material, size, corrosion-resistance holding-power, and other properties required of fasten metal furring members to substrates and to each other.

**99-07425B(7) Miscellaneous Materials**

Panel fasteners must be stainless steel rivets with rubber washer supplied by panel manufacturer. Two stainless steel fixed point sleeves per panel. Rivets to be color-matched to FRC panels.

Field applied panel edge impregnation material must be supplied by manufacturer of panels.

Underlayment/building paper: As recommended by the manufacturer of panels.

**99-07425B(8) FRC Wall Panels**

Provide wall panels factory-fabricated from single sheets of FRC cut into shapes and sizes, and drilled for installation as shown on plans. Include attachment system components and accessories required for installation.

FRC wall panel material. Portland cement; ground limestone; polyvinyl alcohol; and cellulose fibers, without asbestos, fiberglass or formaldehyde, complying with ASTM C 1186 Type A, grade III. Panels reinforced with only cellulose fibers will not be accepted. Panels must be air-cured; autoclaved cured panels must not be accepted. Panels must be resistant to UV per ASTM G 155-05: Change in E value less than or equal to 1.8 for 1000 hours of exposure, less than or equal to 2.2 for 1500 hours, and less than or equal to 2.5 for 2000 hours of exposure. Panels must be noncombustible with the following surface burning characteristics when tested per ASTM E 84: Flame-Spread Index 0 and Smoke-Developed Index 15 or less.

Panel thickness must be 5/16 inch, weighing 3.1 pounds per square foot. Panel sizes must be as shown on the plans.

Exterior finish: Smooth as shown on the plans. Provide factory-applied acrylic top coating, sealing all surfaces and edges. Colors as selected from manufacturer's standard range of colors.

**99-07425B(9) Fabrication**

Fabricate FRC wall panels and accessories at the factory to the greatest extent possible. Including drilling of holes for fasteners and other penetrations. Locate holes from edge of panel no less than distance recommended by the manufacturer.

**99-07425B(10) Replacement Panels and Accessories**

Provide a minimum of 3 replacement panels for each color used. Provide replacement rivets, 2% of the quantity used for each color.

## **99-07425C Construction**

### **99-07425C(1) Execution**

#### **Installation**

Install FRC wall panel assemblies according to the manufacturer's written instructions and in orientation, shape, sizes, and locations indicated on approved shop drawings. Install panels perpendicular to cross furring unless otherwise indicated on the shop drawings. Anchor furring, panels, and other components of the work securely in place, with provisions for thermal and structural movement.

### **99-07425C(2) Clean up and Close out**

#### **Clean up:**

Adjacent surfaces must be protected during FRC wall panel installation.

FRC wall panels must be cleaned after installation as recommended by the manufacturer. Exposed cuts must be repaired or touched-up as recommended by the manufacturer.

Damaged panels and other components of the work which have been damaged or have deteriorated beyond successful repair must be removed and replaced.

### **99-07425D Payment**

Not Used

## **SECTION 075423 - THERMOPLASTIC POLYOLEFIN (TPO) ROOFING**

### **PART 1 - GENERAL**

#### **A. Section Includes:**

1. Mechanically fastened thermoplastic polyolefin (TPO) roofing system.
2. Vapor retarder.
3. Roof insulation.

### **1.2 DEFINITIONS**

- A. Roofing Terminology: Definitions in ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

### **1.3 PREINSTALLATION MEETINGS**

- A. Preinstallation Roofing Conference: Conduct conference at Project site.

1. Meet with the Engineer, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review temporary protection requirements for roofing system during and after installation.
8. Review roof observation and repair procedures after roofing installation.

### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work, including:

1. Base flashings and membrane terminations.
2. Tapered insulation, including slopes.
3. Roof plan showing orientation of steel roof deck and orientation of roofing, fastening spacings, and patterns for mechanically fastened roofing.
4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

C. Samples for Verification: For the following products:

1. Sheet roofing, of color required.
2. Walkway pads or rolls, of color required.

### **1.5 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For Installer and manufacturer.
- B. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
  1. Submit evidence of compliance with performance requirements.
- C. Product Test Reports: For components of roofing system, tests performed by manufacturer and witnessed by a qualified testing agency.
- D. Sample Warranties: For manufacturer's special warranties.

### **1.6 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For roofing system to include in maintenance manuals.

### **1.7 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: A qualified manufacturer that is UL listed and FM Global approved for roofing system identical to that used for this Project.
- B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

### **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
  1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

### **1.9 FIELD CONDITIONS**

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

### **1.10 WARRANTY**

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
  1. Special warranty includes roofing, base flashings, roof insulation, fasteners, cover boards, roofing accessories, vapor retarder, and other components of roofing system.

2. Warranty Period: 20 years from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Source Limitations: Obtain components including roof insulation fasteners, vapor retarder, and cover board for roofing system from manufacturer approved by membrane roofing manufacturer.

### **2.2 PERFORMANCE REQUIREMENTS**

- A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.
  1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
  2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.
- B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.
- C. Roofing System Design: Tested by a qualified testing agency to resist the following uplift pressures:
  1. Corner Uplift Pressure: 54 lbf/sq. ft.
  2. Perimeter Uplift Pressure: 36 lbf/sq. ft.
  3. Field-of-Roof Uplift Pressure: 21 lbf/sq. ft.
- D. FM Global Listing: Roofing, base flashings, and component materials shall comply with requirements in FM Global 4450 or FM Global 4470 as part of a built-up roofing system, and shall be listed in FM Global's "RoofNav" for Class 1 or noncombustible construction, as applicable.
  1. Fire/Windstorm Classification: Class 1A-90.
  2. Hail-Resistance Rating: MH.
- E. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
- F. Energy Star Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.
- H. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- I. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

### **2.3 TPO ROOFING**

- A. Fabric-Reinforced TPO Sheet: ASTM D 6878, internally fabric- or scrim-reinforced, uniform, flexible TPO sheet.
  1. Thickness: 80 mil, nominal.
  2. Exposed Face Color: White

### **2.4 AUXILIARY ROOFING MATERIALS**

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.
  1. Liquid-type auxiliary materials shall comply with VOC limits of 24 CA Code of Regs Pt 11 and with local requirements if more stringent.

2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content:
  - a. Plastic Foam Adhesives: 50 g/L.
  - b. Gypsum Board and Panel Adhesives: 50 g/L.
  - c. Multipurpose Construction Adhesives: 70 g/L.
  - d. Fiberglass Adhesives: 80 g/L.
  - e. Single-Ply Roof Membrane Adhesives: 250 g/L.
  - f. Single-Ply Roof Membrane Sealants: 450 g/L.
  - g. Nonmembrane Roof Sealants: 300 g/L.
  - h. Sealant Primers for Nonporous Substrates: 250 g/L.
  - i. Sealant Primers for Porous Substrates: 775 g/L.
  - j. Other Adhesives and Sealants: 250 g/L.
- B. Sheet Flashing: Manufacturer's standard unreinforced TPO sheet flashing, 80 mil thick, minimum, of same color as TPO sheet.
- C. Bonding Adhesive: Manufacturer's standard.
- D. Slip Sheet: Manufacturer's standard, of thickness required for application.
- E. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
- F. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, prepunched.
- G. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roofing to substrate, and acceptable to roofing system manufacturer.
- H. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

## 2.5 SUBSTRATE BOARDS

Not used

## 2.6 VAPOR RETARDER

- A. Polyethylene Film: ASTM D 4397, 6 mils thick, minimum, with maximum permeance rating of 0.13 perm.
  1. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

## 2.7 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by TPO roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Global-approved roof insulation.
- B. Extruded-Polystyrene Board Insulation: ASTM C 578, Type X, 1.3-lb/cu. ft. minimum density, square edged.
- C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches unless otherwise indicated.
- D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

## 2.8 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with roofing.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roof insulation[ and cover boards] to substrate, and acceptable to roofing system manufacturer.

- C. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch, factory primed.

## **2.9 ASPHALT MATERIALS**

Not used

## **2.10 BALLAST**

Not used

## **2.11 WALKWAYS**

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads, approximately 3/16 inch thick and acceptable to roofing system manufacturer.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:
  - 1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
  - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
  - 3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Install insulation strips according to acoustical roof deck manufacturer's written instructions.

### **3.3 ROOFING INSTALLATION, GENERAL**

- A. Install roofing system according to roofing system manufacturer's written instructions.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- C. Polyethylene Film: Loosely lay polyethylene-film vapor retarder in a single layer over the first layer of insulation, with the vapor retarder sandwiched in between two layers of insulation in area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches and 6 inches, respectively. Continuously seal side and end laps with tape.
- D. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

### **3.6 INSULATION INSTALLATION**

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.
- C. Install tapered insulation under area of roofing to conform to slopes indicated.
- D. Install insulation under area of roofing to achieve required thickness. Install vapor retarder between the first two layers of insulation. Install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.
- E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

- F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
  - 1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
- G. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
  - 1. Fasten insulation according to requirements in FM Global's "RoofNav" for specified Windstorm Resistance Classification.
- H. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together and fasten to roof deck.
  - 1. Fasten cover boards according to requirements in FM Global's "RoofNav" for specified Windstorm Resistance Classification.
  - 2. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.
- I. Adhere roofing over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing and allow to relax before retaining.

### **3.8 MECHANICALLY FASTENED ROOFING INSTALLATION**

- A. Mechanically fasten roofing over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing and allow to relax before retaining.
  - 1. For in-splice attachment, install roofing with long dimension perpendicular to steel roof deck flutes.
- B. Accurately align roofing, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- C. Mechanically fasten or adhere roofing securely at terminations, penetrations, and perimeter of roofing.
- D. Apply roofing with side laps shingled with slope of roof deck where possible.
- E. In-Seam Attachment: Secure one edge of TPO sheet using fastening plates or metal battens centered within seam, and mechanically fasten TPO sheet to roof deck.
- F. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.
  - 1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet.
  - 2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
  - 3. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.
- G. Spread sealant bed over deck-drain flange at roof drains, and securely seal roofing in place with clamping ring.

### **3.9 LOOSELY LAID AND BALLASTED ROOFING INSTALLATION**

Not used

### **3.10 BASE FLASHING INSTALLATION**

- A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.

- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

### **3.11 WALKWAY INSTALLATION**

- A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

### **3.12 FIELD QUALITY CONTROL**

- A. Testing Agency: Engage a qualified testing agency to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish reports to Engineer.
- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
- C. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

### **3.13 PROTECTING AND CLEANING**

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report to the Engineer.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

## **99-07620 SHEET METAL FLASHING**

### **99-07620A General**

#### **99-07620A(1) Summary**

Scope: This work consists of fabricating and installing sheet metal flashing.

Sheet metal includes metal flashings, counterflashings, straps, gutters, downspouts, roof jacks, gravel stops, reglets, copings, scuppers, conductor heads, and screen type vents.

Alternatives: Premolded roof flashings may be used in lieu of sheet metal flashings where shown or required.

#### **99-07620A(2) Definitions**

Not Used

#### **99-07620A(3) Submittals**

Product Data: Submit manufacturer's material and finish data, installation instructions, and general recommendations for each specified flashing material and fabricated product.

Samples for Initial Selection Purposes: Submit manufacturer's color charts and texture variations for specified sheet materials to be exposed as finished surfaces.

#### **99-07620A(4) Quality Control and Assurance**

Codes and Standards: Sheet metal work must comply with the latest edition of the SMACNA "Architectural Sheet Metal Manual." International Nickel Company: "Stainless Steel Roofing, Flashing and Accessories Volume 3".

Wind Resistance: Fabricate and install flashings at edges of roof in accordance with FM Loss Prevention Data Sheet 1-49 for specified wind zone. Ensure that substrate construction is also in compliance.

Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

Temperature Change Range: 100°F, ambient; 150°F material surfaces

## **99-07620B Materials**

### **99-07620B(1) General**

Galvanized Sheet Steel: Galvanized sheet steel must comply with ASTM A 653/A 653M with G 90 [Z275] coating, not less than 24-gage, unless otherwise shown. Surfaces to be painted must not have factory coatings on galvanizing that cannot be removed by paint thinner.

Sheet Aluminum: Sheet aluminum must be not less than 0.032 inch thick, mill finish, 3003-H14 alloy, complying with ASTM B 209M.

Sheet Lead: Sheet lead must be not less than 0.062 inch thick, complying with ASTM B 749.

Premolded Roof Flashing: Premolded flashing must be premolded neoprene or ethylene propylene diene monomer (EPDM) flashing, resistant to ozone and ultraviolet. Units must have overlapping tab to flash the seam.

Hardware and Fastenings: Hardware and fastening for premolded roof flashings must be stainless steel.

Solder: Solder must comply with ASTM B 32, Alloy Grade Sn50 for zinc-coated steel; ASTM B 32, Alloy Grade Sn60 for stainless steel.

Soldering Flux: Soldering flux must be acid type, complying with Federal Specification: A-A-51145D, Type I, Form A.

Insect Screen: Insect screen must be industrial wire cloth and screen, medium grade, 18 mesh, 0.017-inch diameter, 0.039-inch openings, plain weave, galvanized steel .

Lap Joint Sealant: Lap joint sealant for concealed locations must be a non-drying butyl complying with ASTM C 1311.

Flashing Cement: Flashing cement must be a bituminous plastic cement, asbestos free, complying with ASTM D 4586, Type II.

Sealant: Sealant for exposed locations must be a silicone sealant complying with ASTM C 920.

Primer: Primer must be that recommended by the sealant manufacturer.

Bituminous Coating: Bituminous coating must be a cold-applied asphalt emulsion complying with ASTM D 1187.

## **REGLETS**

General: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces and compatible with flashing indicated.

Surface Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.

Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.

Masonry Type: Provide with offset top flange for embedment in masonry mortar joints.

Counterflashing Wind-Restraint Clips: Provide hold down clips with 1/2 inch kickout to be installed before counterflashing to prevent wind uplift on the counterflashing lower edge. Fabricate the clips of the following materials:

Galvanized Steel: 22 gage; 0.0336 inch thick.

#### **MISCELLANEOUS MATERIALS AND ACCESSORIES**

Solder: Solder shall conform to ASTM Designation: B 32, Alloy Grade Sn50.

Solder for Stainless Steel: ASTM B32; provide 60% tin- 40% lead solder, with acid-chloride type flux, except use rosin flux over tinned surfaces.

Soldering Flux: Soldering flux shall be acid type, conforming to Federal Specification: O-F-506C, Type I, Form A.

Fasteners: Same metal as sheet metal flashing or other noncorrosive metal as recommended by sheet metal manufacturer. Match finish of exposed heads with material being fastened.

Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed; noncorrosive; size and thickness required for performance.

Installation Accessories: Provide joint tape, adhesives, sealers, and fasteners as recommended by flashing manufacturer for indicated applications.

Insect Screen: Insect screen shall be industrial wire cloth and screen, medium grade, 18 mesh, 0.017-inch diameter, 0.039-inch openings, plain weave, galvanized steel conforming to ASTM Designation: E 437.

Lap Joint Sealant: Lap joint sealant for concealed locations shall be a non-drying butyl.

Flashing Cement: Flashing cement shall be a bituminous plastic cement, asbestos free, conforming to ASTM Designation: D 4586, Type II.

Sealant: Sealant for exposed locations shall be a silicone sealant conforming to ASTM Designation: C 920.

Primer: Primer shall be as recommended by the sealant manufacturer.

Coal Tar Paint: Coal tar paint shall be coal-tar epoxy coating conforming to U.S. Corps of Engineers Specification: C-200 or Steel Structures Painting Council Paint Specification: SSPC-16-68T.

#### **99-07620B(2) Shop Fabrication**

Sheet metal must be assembled to SMACNA standards.

Sheet metal must be formed to the sizes, shapes and dimensions shown or as described with angles and lines straight, sharp and in true alignment. The number of joints must be kept to a minimum.

Angle bends and folds for interlocking the metal must be made with full regard for expansion and contraction to avoid buckling or fullness in the metal after it is installed.

Joints in sheet metal work must be closed watertight unless slip joints are specifically required. Watertight joints must be mechanically interlocked and then thoroughly soldered for metals other than aluminum. Watertight joints in aluminum or between aluminum and other metals must be sealed with acrylic sealant.

Sheet metal joints to be soldered must be cleaned with steel wool or other means, pre-tinned and soldered watertight.

All joints must be wiped clean of flux after soldering. Acid flux must be neutralized by washing the joints with sodium bicarbonate.

Flashings must have a 45 degree drip return at bottom edges. Unless otherwise shown, counterflashing must extend not less than 4 inches over roofing or other materials protected by the counterflashing and

must be arranged so that roofing or materials can be repaired without damage to the counterflashing. Where reglets are indicated, counterflashing must be fastened by lead wedges or snap-in flashing.

### **99-07620C Construction**

#### **99-07620C(1) General**

Preparation: Surfaces to receive sheet metal must be clean, smooth and free from defects.

Protection: Aluminum surfaces to be in contact with concrete, mortar, or dissimilar metals must be given a heavy coat of coal tar paint.

#### **99-07620C(2) Installation**

##### Roof Penetration Flashings:

All pipes, ducts, vents and flues passing through roofs must be made waterproof with flashings of storm collars or counterflashings.

Roof penetration flashings must be fabricated from galvanized sheet steel, not less than 24-gage. Size and shape must be as shown.

On built-up roofing, 2 flashings must be furnished for each pipe, vent or flue through roof. Flashings must be constructed so that the lower flashing must sit directly on the roof deck, with the top flashing set over it on top of the roof felts.

The lower flashing must be galvanized sheet metal, 24-gage, and extend 6 inches minimum from outside of the pipe in all directions and 1½ inches above the top of the roofing.

The top flashing must be galvanized sheet steel or sheet lead as shown.

##### Hung Gutters:

Hung gutters must be fabricated from galvanized sheet steel, not less than 24-gage. Gutters must be size and shape as shown.

Gutters must be fabricated in sections not less than 10 feet in length. Use sections as long as practicable for lengths over 10 feet.

Joints must be lapped at least 1½ inches, rivet and solder watertight. Butt type expansion joints, ¾ inch wide, must be provided at midpoint between down spouts and where expansion joints occur in the structure.

##### Downspouts:

Downspouts must be fabricated from galvanized sheet steel, not less than 24-gage. Size and shape must be as shown.

Downspouts must be installed as shown, secured to the wall with straps near top, bottom and at intermediate points not more than 8 feet apart. Straps must extend 2 inches out on wall and be secured with suitable anchors.

Unless otherwise shown, the lower end of downspout must terminate with mitered 45 degree elbow.

Premolded Roof Flashings: Premolded roof flashings must be installed under the manufacturer's instructions.

### **99-07620D Payment**

Not Used

## **SECTION 077100 - ROOF SPECIALTIES**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Copings.
  - 2. Roof-edge specialties.
  - 3. Roof-edge drainage systems.
  - 4. Reglets and counterflashings.

#### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- C. Shop Drawings: For roof specialties.
  - 1. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work.
  - 2. Include details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
  - 3. Indicate profile and pattern of seams and layout of fasteners, cleats, clips, and other attachments.
  - 4. Detail termination points and assemblies, including fixed points.
  - 5. Include details of special conditions.
- D. Samples: For each type of roof specialty and for each color and texture specified.
- E. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.
- F. Samples for Verification:
  - 1. Include Samples of each type of roof specialty to verify finish and color selection, in manufacturer's standard sizes.
  - 2. Include copings, roof-edge specialties, roof-edge drainage systems, reglets and counterflashings made from 12-inch lengths of full-size components in specified material, and including fasteners, cover joints, accessories, and attachments.

#### **1.3 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For manufacturer.
- B. Product Certificates: For each type of roof specialty.
- C. Product Test Reports: For copings and roof-edge flashings, for tests performed by a qualified testing agency.
- D. Sample Warranty: For manufacturer's special warranty.

#### **1.4 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For roofing specialties to include in maintenance manuals.

#### **1.5 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: A qualified manufacturer offering products meeting requirements that are FM Approvals listed for specified class tested to specified design pressure.

- B. Source Limitations: Obtain roof specialties approved by manufacturer providing roofing-system warranty specified in Section 99-07411.
- C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and set quality standards for fabrication and installation.
  - 1. Build mockup of typical roof edge as shown on Drawings.
  - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Engineer specifically approves such deviations in writing.
  - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.
- B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof-specialty installation.

## **1.7 FIELD CONDITIONS**

- A. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.
- B. Coordination: Coordinate roof specialties with flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

## **1.8 WARRANTY**

- A. Roofing-System Warranty: Roof specialties are included in warranty provisions in Section 075423 Thermoplastic Polyolefin (TPO) Roofing.
- B. Special Warranty on Painted Finishes: Manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. General Performance: Roof specialties must withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. FM Approvals' Listing: Manufacture and install copings roof-edge specialties that are listed in FM Approvals' "Roof Nav" and approved for windstorm classification.
- C. SPRI Wind Design Standard: Manufacture and install copings roof-edge specialties tested according to SPRI ES-1 and capable of resisting the following design pressures:
  - 1. Design Pressure: As indicated on Drawings.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components,

failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

## **2.2 COPINGS**

- A. Metal Copings: Manufactured coping system consisting of metal coping cap in section lengths not exceeding 12 feet, concealed anchorage; with corner units, end cap units, and concealed splice plates with finish matching coping caps.
  1. Metallic-Coated Steel Sheet Coping Caps: Zinc-coated (galvanized) steel, nominal 0.034-inch thickness to meet performance requirements
    - a. Surface: Smooth, flat finish.
    - b. Finish: Three-coat metallic fluoropolymer.
    - c. Color: Match Engineer's sample.
  2. Formed Stainless-Steel Sheet Coping Caps: Stainless-steel sheet, nominal 0.031-inch thickness to meet performance requirements.
    - a. Finish: No. 4 (bright, polished directional satin).
  3. Corners: Factory mitered and soldered mechanically clinched and sealed watertight.

## **2.3 ROOF-EDGE SPECIALTIES**

1. Metallic-Coated Steel Sheet Fascia Covers: Zinc-coated (galvanized) steel, nominal 0.034-inch thickness to meet performance requirements.
    - a. Surface: Smooth, flat finish.
    - b. Finish: Three-coat metallic fluoropolymer.
    - c. Color: Match Engineer's sample.
  2. Fascia Accessories: Fascia extenders with continuous hold-down cleats Wall cap Soffit trim. Downspout scuppers with integral conductor head and downspout adapters and perforated screens.
- B. Roof-Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet and a continuous metal receiver with integral drip-edge cleat to engage fascia cover [and secure single-ply roof membrane. Provide matching corner units.
    1. Metallic-Coated Steel Sheet Fascia Covers: Zinc-coated (galvanized) steel, nominal 0.034-inch thickness to meet performance requirements.
      - a. Surface: Smooth, flat.
      - b. Finish: Three-coat metallic fluoropolymer.
      - c. Color: Match Engineer's sample.

## **2.4 ROOF-EDGE DRAINAGE SYSTEMS**

- A. Gutters: Manufactured in uniform section lengths not exceeding [12 feet] <Insert dimension>, with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.

1. Zinc-Coated Steel: Nominal 0.034-inch thickness.
  2. Gutter Supports: Manufacturer's standard supports with finish matching the gutters.
- B. Downspouts: Plain rectangular[, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.
1. Zinc-Coated Steel: 0.034-inch thickness.
- C. Splash Pans: Fabricate from the following exposed metal:
1. Zinc-Coated Steel: Nominal 0.028-inch thickness.
  1. Color: Match Engineer's sample].
- H. Stainless-Steel Finish: No. 4 (bright, polished directional satin).

## 2.5 REGLETS AND COUNTERFLASHINGS

- A. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counter flashing pieces, from the following exposed metal:
1. Zinc-Coated Steel: Nominal 0.028-inch thickness.
  2. Surface-Mounted Type: Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
- B. Counter flashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches and in lengths not exceeding [12 feet:
1. Zinc-Coated Steel: Nominal 0.028-inch thickness.
- C. Accessories:
1. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counter flashing or where reglet is provided separate from metal counter flashing.
  2. Counter flashing Wind-Restraint Clips: Provide clips to be installed before counter flashing to prevent wind uplift of counter flashing lower edge.
- D. Zinc-Coated Steel Finish: [Three-coat metallic fluoropolymer.
1. Color: Match Engineer's sample.
- F. Stainless-Steel Finish: No. 4 (bright, polished directional satin)

## 2.6 MATERIALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation.
- B. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.

## 2.7 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
1. Thermal Stability: ASTM D 1970/D 1970M; stable after testing at 240 deg F.
  2. Low-Temperature Flexibility: ASTM D 1970/D 1970M; passes after testing at minus 20 deg F.

## **2.8 MISCELLANEOUS MATERIALS**

- A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
  - 1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
  - 2. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
  - 3. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.
- B. Elastomeric Sealant: ASTM C 920, elastomeric polyurethanepolymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

## **2.9 FINISHES**

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Coil-Coated Galvanized-Steel Sheet Finishes:
  - 1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with ASTM A 755/A 755M and coating and resin manufacturers' written instructions.
    - a. Three-Coat Metallic Fluoropolymer: AAMA 621. Fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
    - b. Concealed Surface Finish: Apply pretreatment and manufacturer's standard acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.
- C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 UNDERLAYMENT INSTALLATION**

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.
  - 1. Apply continuously under copings roof-edge specialties and reglets and counter flashings.
  - 2. Coordinate application of self-adhering sheet underlayment under roof specialties with requirements for continuity with adjacent air barrier materials.

### **3.3 INSTALLATION, GENERAL**

- A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.
  - 1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
  - 2. Provide uniform, neat seams with minimum exposure of solder and sealant.
  - 3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
  - 4. Torch cutting of roof specialties is not permitted.
  - 5. Do not use graphite pencils to mark metal surfaces.
  
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
  - 1. Coat concealed side of uncoated aluminum and stainless-steel roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
  - 2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.
  
- C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
  - 1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise indicated on Drawings.
  - 2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
  
- D. Fastener Sizes: Use fasteners of sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.
- F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.
- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work. Tin edges of uncoated copper sheets using solder for copper. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

### **3.4 COPING INSTALLATION**

- A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor copings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.
  - 1. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at 40-inch centers manufacturer's required spacing that meets performance requirements.

### **3.5 ROOF-EDGE SPECIALITIES INSTALLATION**

- A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

### **3.6 ROOF-EDGE DRAINAGE-SYSTEM INSTALLATION**

- A. General: Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.
- B. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 12 inches. Attach ends with rivets and seal with sealant to make watertight. Slope to downspouts.
  - 1. Install gutter with expansion joints at locations indicated but not exceeding 50 feet apart. Install expansion-joint caps.
  - 2. Install continuous leaf guards on gutters with noncorrosive fasteners, hinged to swing open for cleaning gutters.
- C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c.
  - 1. Provide elbows at base of downspouts at grade to direct water away from building.
- D. Splash Pans: Install where downspouts discharge on low-slope roofs. Set in elastomeric sealant.
- E. Parapet Scuppers: Install scuppers through parapet where indicated. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
  - 1. Anchor scupper closure trim flange to exterior wall and seal or solder to scupper.
  - 2. Loosely lock front edge of scupper with conductor head.
  - 3. Seal or solder exterior wall scupper flanges into back of conductor head.
- F. Conductor Heads: Anchor securely to wall with elevation of conductor top edge 1 inch below gutter discharge.

### **3.7 REGLET AND COUNTERFLASHING INSTALLATION**

- A. General: Coordinate installation of reglets and counterflashings with installation of base flashings.
- B. Embedded Reglets: See Section 033000 "Cast-in-Place Concrete" for installation of reglets.
- C. Surface-Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches over top edge of base flashings.
- D. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 4 inches over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches and bed with butyl sealant. Fit counterflashings tightly to base flashings.

### **3.8 CLEANING AND PROTECTION**

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.
- D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

**END OF SECTION 077100**

## **99-07910 JOINT SEALANT**

### **99-07910A General**

#### **99-07910A(1) Summary**

Scope: This work consists of preparing and placing a joint sealant.

The sealed joint consists of tempered hardboard, expanded polystyrene, and a pourable joint seal.

#### **99-07910A(2) Definitions**

Not Used

#### **99-07910A(3) Submittals**

Product Data: Manufacturer's descriptive data, specifications, and installation instructions must be submitted.

#### **99-07910A(4) Quality Control and Assurance**

##### **99-07910B Materials**

Tempered Hardboard: Tempered hardboard must be 1/8-inch minimum thickness, commercial quality suitable for the use intended. Other facing materials may be used provided they furnish equivalent protection.

Expanded Polystyrene: Expanded polystyrene must be commercially available polystyrene board.

Polyethylene Foam: Polyethylene foam must be commercial quality, with a continuous, impervious, glazed top surface, suitable for retaining the liquid sealant in the joint while hardening.

Primer: Primer must be as recommended by the sealant manufacturer.

Joint Sealant: Joint sealant must be a commercial quality, 2 component polyurethane sealant, which must be self-levelling and withstand up to 25 percent movement.

##### **99-07910C Construction**

###### **99-07910C(1) Preparation**

Forming:

Groove for joint seal must be formed to a uniform width and depth and to the alignment shown or as ordered by the Engineer. The completed groove must have a top width within 1/8 inch of the width shown and the bottom width must not vary from the top width by more than 1/16 inch.

At least 24 hours prior to installing the joint seal, the Contractor must repair all spalls, fractures, breaks, or voids in the concrete surfaces of the joint groove.

The lip of the joint must be beveled by grinding as shown.

Cleaning:

Prior to sealing joints, expanded polystyrene, hardboard, concrete spillage, and all foreign material must be removed from the deck to the bottom of the formed joint.

Prior to placing the joint seal, the joint must be cleaned by a method which must include abrasive blast cleaning and then be cleaned with a high pressure air jets to remove all residue and foreign material.

###### **99-07910C(2) Installation**

Materials:

No material must be used which has skinned over or which has settled in the container to the extent that it cannot be easily redispersed by hand stirring to form a smooth uniform product.

Each container of material must be clearly labeled or each delivery of material in the tanks of 2-component equipment must be accompanied with a ticket showing designation (Component A or B), the manufacturer's name, lot or batch number, date of manufacture, date of packaging, and date, if any, beyond which the sealant must not be used.

Primer: A primer must be applied to the sides of the groove and all exposed vertical surfaces in the joint prior to placing the sealant. Primer must be dry at the time of placing the sealant. Contaminated primer must be removed and replaced.

Joint Sealant: The 2-component sealant must be mixed and placed in the groove under manufacturer's instructions. Unmixed liquid components which have been exposed to the atmosphere for more than 24 hours, must not be used.

#### **99-07910D Payment**

Not Used

#### **99-07920 SEALANTS**

##### **99-07920A General**

##### **99-07920A(1) Summary**

Scope: This work consists of applying sealants which are required for this project, but not described elsewhere.

Related Work: Pourable polyurethane joint sealant for joints in concrete decks must comply with "Joint Sealant."

##### **99-07920A(2) Definitions**

Not Used

##### **99-07920A(3) Submittals**

Product Data: Manufacturer's descriptive data and installation instructions for all sealants must be submitted.

Samples: Color samples of all sealants must be submitted. Unless otherwise shown, colors will be selected by the Engineer from the manufacturer's standard colors.

Compatibility and Adhesion Test Reports:

Submit evidence that materials forming joint substrates and joint sealant backings have been tested for compatibility with and adhesion to joint sealants.

Submit interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

Certificates of Compliance: Submit a certificates of compliance for the sealants.

##### **99-07920A(4) Quality Control and Assurance**

Preconstruction Field Adhesion Testing: Before installing sealants, field test adhesion to joint substrates:

Locate test joints where indicated by Engineer.

Conduct field tests for each type of sealant and joint substrate. Test method: Hand pull method under the sealant manufacturer's instructions.

##### **99-07920B Materials**

All sealants, primers and accessories must be non-staining to adjacent exposed surfaces. Products having similar applications and usage must be of the same type and same manufacturer. Gun consistency compound must be used unless otherwise required by the job conditions.

Nonstaining: Products that have undergone testing under ASTM C 1248 or ASTM C 510 and have not stained porous substrates.

Compatibility: Provide joint sealants, backings, and related materials compatible with one another and with joint substrates under conditions of service and application as demonstrated by sealant manufacturer based on testing and field experience.

Acrylic Sealant: Acrylic sealant must be one compound, solvent release acrylic sealant.

Polyurethane Sealant: Multicomponent, nonsag, capable of 50 percent extension and contraction without failure, complying with ASTM C 920. Provide BASF, Sika, Tremco, or equal.

Butyl Sealant: Butyl sealant must be single-component, solvent-release, polyisobutylene sealant complying with ASTM C 1311.

Silicone Sealant: Silicone sealant must be one component, low modulus, non-acid curing building sealant complying with ASTM C 920 and formulated for reduced dirt pickup. Sealant must be tack-free in one hour, must not sag or flow, must be ozone resistant and capable of 100 percent extension and 50 percent contraction without failure. Provide BASF Sonneborn Sonolastic 150, Dow Corning 756 SMS Building Sealant, GE Silicones SilPruf NB SCS 9000, or equal.

Mildew Resistant Silicone Sealant: One component, sanitary type, mildew resistant, formulated with fungicide, intended for damp areas and complying with ASTM C 920. Provide Pecora 898, GE Sealants SCS 1700, Dow Corning 786, or equal.

Acoustical Sealant: Single component, latex, ASTM C 834, nondrying, nonhardening, nonsag, nonstaining, acoustically tested under ASTM E 90, paintable by acrylic or alkyd paints. Provide USG Sheetrock, Pecora AC-20, Owens Corning QuietZone, or equal.

Polysulfide Sealant: Polysulfide sealant must be a two-part, non sag polysulfide base, synthetic rubber sealant formulated from liquid polysulfide polymer.

Backer Rod: ASTM C 1330, Type C (closed-cell material with a surface skin) or Type B (consisting of both open- and closed-cell material) as recommended by manufacturer for application, of size and density to control sealant depth; polyurethane or polyethylene as recommended by sealant manufacturer. Backer rod must be sized such that it must be compressed between 25 percent and 75 percent of its uncompressed diameter during installation in the joint.

Bond Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint.

Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated under anticipated service conditions, as determined from preconstruction joint sealant substrate tests and field tests.

Neoprene: Neoprene must comply with the requirements of ASTM C 542.

#### **99-07920C Construction**

Unless otherwise shown, sealants must be applied under the manufacturer's instructions and ASTM C 1193.

When silicone sealants (or mildew-resistant silicone sealants) are used in locations where painting is required, use sealants formulated to accept paint satisfactorily and demonstrated to do so in preconstruction mockups, or sealants tinted to match adjoining painted surfaces.

Sealants must be applied in a continuous operation for the full length of the joint. Immediately following the application of the sealant, the sealant must be tooled smooth using a tool similar to that used to produce concave masonry joints. Following tooling, the sealant must remain undisturbed for not less than 48 hours.

#### **99-07920D Payment**

Not Used

### **DIVISION 8 DOORS AND WINDOWS**

#### **99-08100 STEEL DOORS AND FRAMES**

##### **99-08100A General**

##### **99-08100A(1) Summary**

This work consists of installing steel doors and frames.

### **99-08100A(2) Definitions**

**ANSI/SDI:** American National Standards Institute/Steel Door Institute.

**ANSI/NAAMM-HMMA:** American National Standards Institute/National Association of Architectural Metal Manufacturers-Hollow Metal Manufacturers Association.

### **99-08100A(3) Submittals**

Product Data: Submit for all products. Include the following:

1. Material descriptions
2. Core descriptions
3. Fire-resistance rating
4. Installation instructions for fire rated assemblies
5. Finishes
6. Construction details

Shop Drawings: Include the following:

1. Elevations of each door design
2. Details of doors, including vertical and horizontal edge details and metal thicknesses
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses
4. Locations of reinforcement and preparations for hardware
5. Details of each different wall opening condition
6. Details of anchorages, joints, field splices, and connections
7. Details of accessories
8. Details of moldings, removable stops, and glazing
9. Where electrified door hardware is described, include details of conduit and preparations for power, signal, and control systems

Door Schedule: Submit a schedule of steel doors and frames using same reference numbers for details and openings shown. Include a description of the type, location and size of each door and frame. Coordinate with door hardware schedule.

Fire-Rated Door Assembly Product Test Reports: Submit comprehensive tests performed by a NRTL for each type of fire-rated door assembly.

### **99-08100A(4) Quality Control and Assurance**

Single Source Responsibility: Obtain steel doors and frames from single manufacturer.

Steel Doors and Frames: Fabricate steel doors and frames under ANSI/SDI A250.8 or ANSI/NAAMM-HMMA 861.

Hardware Reinforcement: Fabricate hardware reinforcement under ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

Fire-Rated Door Assemblies: Furnish assemblies complying with NFPA 80, with all components listed and labeled by a NRTL, for fire-protection ratings shown. Assemblies must be listed by the California State Fire Marshal.

Smoke-Control Door Assemblies: Furnish assemblies complying with UL 1784, with all components listed and labeled by a NRTL. Assemblies must be listed by the California State Fire Marshall. Install assemblies under NFPA 105.

### **99-08100A(5) Delivery, Storage, and Handling**

Deliver steel doors palletized, wrapped, or crated to provide protection during transit and job site storage. Do not use nonvented plastic. Furnish additional protection to prevent damage to finish.

Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

Store steel doors and frames under cover at the job site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on at least 4-inch high wood blocking. Do not store in a way that traps excess humidity.

Furnish at least 1/4-inch space between each stacked door to allow air circulation.

### **99-08100A(5) Coordination**

Coordinate installation of anchorages for steel frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors.

### **99-08100B Materials**

#### **99-08100B(1) General**

Thickness dimensions must be minimum thickness of base metal without coatings.

Steel sheet must comply with the following:

1. Cold rolled must be commercial steel, Type B, ASTM A 1008/A 1008M
2. Hot-rolled must be commercial steel, Type B, ASTM A 1011/A 1011M; free of scale, pitting, surface defects, and pickled and oiled
3. Metallic coated must be commercial steel, Type B, ASTM A 1008/A 1008M with at least A60 metallic coating complying with ASTM A 653/A 653M
4. Stainless steel must be Type 304, ASTM A 666. The stainless steel door must be 1-3/4" thick and made as full flush 14 gage seamless style. Face sheets must be commercially quality stainless steel, Type 304 and # 6 satin finish, gage 14 with no visible seams. Polystyrene core must be permanently bonded to face skins. Provide an 18 ga stainless steel cap to flush out the top and bottom of the door. The hinge edges must be beveled and mortised for heavy weight 4-1/2 or 5 inches hinges.

Frame anchors must be commercial steel, hot dip galvanized complying with ASTM A 153/A 153M. Stainless steel frame and anchors shall be provided by a single manufacturer. The door frames are for 1-3/4 inch doors and must be 3 piece in 304-4 welded. The profile is double rabbet with integral door stops 5/8 inch high. The stainless steel hinge reinforcements must be welded in place, drilled and tapped for fasteners in accordance with ANSI A156.7. The strike jamb must be prepared for 4-7/8 inch universal strike in accordance with ANSI A115.1 and 2. The standard finish is 304-4 satin.

Inserts and fasteners must be commercial steel, hot dip galvanized complying with ASTM A 153/A 153M. Inserts and fasteners for stainless steel door and frames must be stainless steel type A304.

Glazing must comply with section 99-08810. Glazing must be at least 3/16-inch thick.

#### **99-08100B(2) Steel Doors**

##### **99-08100B(2)(a) General**

Steel doors must be at least 1-3/4 inches thick, full flush, seamless hollow metal construction unless otherwise shown. Construct doors with smooth surfaces without visible joints or seams on exposed faces, and the following:

1. Concealed stiffeners and hardware reinforcement from steel sheet, except use stainless steel to match stainless steel face sheets.
2. Furnish beveled edge, 1/8-inch in 2 inches, for single doors. Furnish round vertical edge with 2 1/8-inch radius for double doors.
3. Astragals must be full height, 1/8-inch flat bar or folded sheet strip, at least 0.053 inches thick, and same material as face sheets. Weld on the outside of the active leaf of double doors.

##### **99-08100B(2)(b) Exterior Doors**

Exterior doors must comply with ANSI/SDI A250.4, physical endurance Level A, and the following:

1. Fabricate face sheets, vertical stiffeners, and top and bottom channels from at least 0.053-inch thick metallic-coated steel sheet.

2. Fabricate the steel-stiffened core using vertical stiffeners that extend full-door height. Install stiffeners not more than 6 inches apart and spot weld to both face sheets no more than 5 inches on center. Fill spaces between stiffeners with glass-fiber insulation or mineral-fiber insulation.
3. Top and bottom channels must be continuous and spot welded to both face sheets. The top channel must be flush and the bottom channel must be inverted.
4. Include moisture vents in the bottom channel.

### **99-08100B(2)(c) Interior Doors**

Interior doors must comply with ANSI/SDI A250.4, physical endurance Level B, and the following:

1. Fabricate face sheets, vertical stiffeners, and top and bottom channels from at least 0.042-inch thick steel sheet unless metallic-coated sheet is described
2. Use the manufacturer's standard kraft-paper honeycomb core, polystyrene core, polyurethane core, or steel-stiffened core with glass-fiber or mineral-fiber insulation
3. Top and bottom channels must be at least 0.042 inch thick, same material as face sheets, and spot welded to both face sheets. The top channel must be flush and the bottom channel must be inverted.

### **99-08100B(3) Steel Frames**

#### **99-08100B(3)(a) General**

Steel frames must comply with details shown for type and profile. Frames must be mitered corners, integral stop, and continuously welded unless otherwise shown.

Frames for fire rated doors must be listed and labeled for the same rating shown for the matching door.

Steel frames must be constructed as follows:

1. Interior frames from cold-rolled steel sheet unless metallic-coated sheet is described for door.
2. Exterior frames from metallic-coated steel sheet.
3. Borrowed-light frames from 0.053-inch-thick steel sheet.
4. Sidelight and transom frames from same thickness material as adjacent door frame.
5. Frames for openings 48 inches and less from 0.053-inch thick steel sheet.
6. Frames for openings wider than 48 inches from 0.067-inch thick steel sheet. Include at least 0.093-inch thick steel channel or angle stiffener head reinforcement.

#### **99-08100B(3)(b) Frame Anchors**

Jamb Anchors: Select one of the following methods to suit the wall type shown:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, at least 0.042 inch thick, with corrugated or perforated straps at least 2 inches wide by 10 inches long. For grouted frames or where shown use wire anchors at least 0.177 inch thick.
2. Stud Wall Type: Designed to engage stud, welded to back of frames; at least 0.042-inch thick.
3. Drywall Slip-on Type: Adjustable compression anchors.
4. Post installed Expansion Type for Tilt Up and In-Place Concrete: At least 3/8-inch diameter bolts with expansion shields or inserts. Furnish pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

Floor Anchors: Furnish the same material as frame and at least 0.042-inch thick. Select one of the following attachment methods for the floor shown:

1. Monolithic Concrete Slab: Clip-type anchors, with two holes to receive fasteners.
2. Separate Topping Concrete Slab: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

#### **99-08100B(3)(c) Stops And Moldings**

Moldings for Glazed Lites in Doors: At least 0.032-inch thick, fabricate from same material as door face sheet in which installed.

Fixed Frame Moldings: Form integral with steel frames, at least 5/8 inch high unless otherwise shown.

Loose Stops for Glazed Lites in Frames: At least 0.032-inch thick, fabricate from same material as door face sheet in which installed.

#### **99-08100B(4) Louvers**

Louvers for interior doors must be non-vision inverted Y type. Frame must be cold rolled steel sheet at least 0.042 inches thick, mitered corners, with hidden welds. Frame screws must be on the inside.

Louvers for exterior doors must be dual security grille type. Fabricate frame and blades from metallic coated steel sheet. Fabricate grates from metallic coated steel sheet at least 0.093 inches thick. Blades must be non-vision inverted Y type. Include removable bronze mesh insect screen mounted on the inside.

Louvers in fire-rated assemblies must be factory fabricated, multi-blade adjustable fire damper type. Frame must be cold rolled steel sheet at least 0.053 inches thick, mitered corners, with hidden welds. Include a 160°F fusible link and removable bronze mesh insect screen mounted on the inside of exterior doors. Frame screws must be on the inside.

#### **99-08100B(5) Accessories**

Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

Ceiling Struts: At least 1/4-inch thick by 1-inch wide steel.

Grout Guards: Form from same material as frames and at least 0.016-inch thick.

Sealants: Sealants must be ultraviolet and ozone resistant, gun grade polysulfide or polyurethane, multicomponent, complying with ASTM C 920.

Grout: Furnish grout complying with ASTM C 476, except with a maximum slump of 4 inches, as measured under ASTM C 143.

#### **99-08100B(6) Fabrication**

##### **99-08100B(6)(a) General**

Fabricate steel doors and frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at job site, clearly identify work that cannot be permanently factory assembled before shipment.

Fabricate steel doors and frames to tolerances under SDI 117 or ANSI/NAAMM-HMMA 861.

##### **99-08100B(6)(b) Steel Doors**

Furnish overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where shown. Extend at least 3/4 inch beyond edge of door on which astragal is mounted.

Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold or hot-rolled steel sheet.

Factory cut glazing and louver openings in doors.

##### **99-08100B(6)(c) Steel Frames**

##### **99-08100B(6)(d) Frame Anchors**

Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.

Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.

Jamb Anchors: Unless otherwise shown, furnish number and spacing of anchors as follows:

1. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
  - 1.1. Two anchors per jamb up to 60 inches high.
  - 1.2. Three anchors per jamb from 60 to 90 inches high.
  - 1.3. Four anchors per jamb from 90 to 120 inches high.

2. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
  - 2.1. Three anchors per jamb up to 60 inches high.
  - 2.2. Three anchors per jamb up to 60 inches high.
  - 2.3. Five anchors per jamb from 90 to 96 inches high.
  - 2.4. Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.

Compression Type Anchor: Not less than two anchors in each jamb.

Post installed Expansion Type Anchor: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

#### **99-08100B(6)(e) Stops and Moldings**

Furnish stops and moldings around glazed lites as follows:

1. Form corners of stops and moldings with butted or mitered hairline joints.
2. Furnish fixed stops and moldings welded on the secure side of steel doors and frames for single glazed lites.
3. Furnish fixed and removable stops and moldings for multiple glazed lites so that each glazed lite can be removed independently.
4. Furnish fixed frame moldings on the outside of exterior and on the secure side of interior doors and frames.
5. Furnish loose stops and moldings on the inside of steel doors and frames.
6. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation described.

#### **99-08100B(7) Shop Finishes**

Apply shop primer to steel doors, frames, and louvers. Use manufacturer's standard, fast-curing, lead-free and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria. Primer must be recommended by manufacturer for substrate; and compatible with field-applied coating.

#### **99-08100C Construction**

##### **99-08100C(1) General**

Examine rough-in for embedded and built-in anchors to verify actual locations before frame installation. Proceed with installation only after unsatisfactory conditions have been corrected.

##### **99-08100C(2) Preparation**

Check door frames for square, alignment, twist, and plumb before installation and adjust if necessary. Tolerances are  $\pm 1/16$  inch.

Check the door frame as follows:

1. Squareness at door rabbet on a line 90 degrees from jamb perpendicular to frame head
2. Alignment at jambs on a horizontal line parallel to plane of wall
3. Twist at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall
4. Plumbness at jambs on a perpendicular line from head to floor

Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

Doors, frames, stops, molding, louvers, and accessories must be cleaned, prepared, and painted under section 99-09900 before installation.

If grout contains an antifreezing agent, field apply a bituminous coating to the backside of frames.

### **99-08100C(3) Installation**

#### **99-08100C(3)(a) General**

Install steel doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with manufacturer's written instructions. Install fire rated assemblies under NFPA 80, the SFM, and the manufacturer's written instructions.

After installation, measure frames for squareness, alignment, twist, and plumbness under section 99-08100C(2). Adjust to meet tolerances as required.

Remove grout and other bonding material from exposed surfaces of steel doors and frames immediately after installation.

Install and fit fire rated assemblies under NFPA 80.

Install and fit smoke-control door assemblies under NFPA 105.

#### **99-08100C(3)(b) Steel Frames**

Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove spreaders and braces. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

Where frames are fabricated in sections because of shipping or handling limitations, field splice at accepted locations by welding face joint continuously. Grind, fill, dress, and make splices smooth, flush, and invisible on exposed faces.

Install frames with removable glazing stops located on the secure side of opening.

Install floor anchors for each jamb and mullion that extends to the floor and secure with expansion anchors.

Coordinate installation of frames to allow for solidly filling space between frame and walls with grout or mineral-fiber insulation as shown.

Solidly pack mineral-fiber insulation behind frames set in metal-stud partitions. Fill frames in masonry or concrete walls with grout. Hand trowel grout; do not pump in. Do not allow frames to be deformed or damaged by grout forces.

#### **99-08100C(3)(c) Steel Doors**

Fit steel doors accurately in frames. Shim as necessary. Clearances must be as follows:

1. Jamb and Head: 1/8 inch  $\pm$ 1/16 inch.
2. Between Edges of Pairs of Doors: 1/8 inch  $\pm$ 1/16 inch.
3. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
4. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

#### **99-08100C(3)(d) Glazing**

Install glazing under section 99-08810 and the door manufacturer's written instructions. Secure stops with countersunk machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

#### **99-08100C(4) Adjustments**

Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Replace defective work, including steel doors and frames that are warped, bowed, or otherwise unacceptable.

#### **99-08100C(5) Field Finish Repairs**

After installation, clean field welds, bolted connections, and abraded areas of paint under SSPC-SP 2. Apply one coat of the same coating as applied for painting to the cleaned areas. Use galvanizing repair paint for metallic coated surfaces complying with manufacturer's written instructions.

**99-08100D Payment**

Not Used

**99-08305 ACCESS DOORS****99-08305A General****99-08305A(1) Summary**

Scope: This work consists of installing access doors and frames.

**99-08305A(2) Definitions**

Not Used

**99-08305A(3) Submittals**

Product Data: Submit manufacturer's descriptive data and installation instructions.

**99-08305A(4) Quality Control and Assurance**

Not Used

**99-08305B Materials**

Access Doors: Access doors and frames must be factory assembled and factory primed steel. Door panel must be 0.075 inches thick and door frame must be 0.060 inches thick. The door and frame assembly must have standard screw driver operated cam locks, concealed spring hinges or continuous piano hinge and inside release handle.

**99-08305C Construction**

Access doors must be installed under the manufacturer's instructions.

Sealants used in access door installation must comply with section 99-07920.

Access doors and frames must be painted to match the color of the adjacent surrounding surfaces under section 99-09900.

**99-08305D Payment**

Not Used

**99-08312 OVERHEAD COILING DOORS****99-08312A General****99-08312A(1) Summary**

This work consists of installing overhead coiling doors.

Overhead coiling doors must (1) be constructed for fire door use, (2) close automatically in the event of a fire, and (3) be listed and labeled for the fire rating shown.

**99-08312A(2) Definitions**

Not Used

**99-08312A(3) Submittals**

Submit manufacturer's descriptive data and installation instructions. Submit the manufacturer's color palette for finish color selection.

**99-08312A(4) Quality Control and Assurance**

Not Used

**99-08312B Materials****99-08312B(1) General**

Overhead Coiling Doors:

Overhead coiling doors must be automatic closing, upward coiling, interlocking rolled slat, curtain type shutter fabricated of galvanized sheet steel at least 0.040 inch thick. Doors must have jamb guides, tubular bottom, end locks, counterbalance assembly, and hood. Guides at the jambs must be steel

and must be fabricated under UL requirements. The hood must enclose the coiled, roll-up door and must be fabricated of galvanized sheet steel at least 0.025 inch thick.

Doors must be easily tested and reset without the use of ladders, tools, or equipment, and must not require resetting by a technician after testing.

Smoke Detectors: Smoke detectors must be factory fabricated units compatible with the overhead coiling doors. Smoke detectors must comply with section 99-16722.

#### **99-08312B(2) Shop Finishes**

Galvanized sheet steel surfaces must be factory treated for paint adhesion.

Painting: Galvanized and other metal surfaces must be cleaned, prepared, primed, and factory painted.

#### **99-08312C Construction**

Overhead coiling doors must be installed under the manufacturer's instructions.

#### **99-08312D Payment**

Not Used

#### **99-08362 RAPID ROLL-UP DOORS**

##### **99-08362A General**

##### **99-08362A(1) Summary**

Scope: This work shall consist of furnishing and installing rapid roll-up doors in accordance with the details shown on the plans and these special provisions.

Rapid roll-up doors shall open vertically and shall be electric motor operated of the size and type shown on the plans, with guides, header hoods, door curtains, hardware, fastenings, mechanisms, controls, and all accessories, required for the complete installation and safe operation of the door.

Related Work: Conduit and wiring shall be in accordance with the requirements specified in Section 12-16, "Electrical," of these special provisions.

##### **99-08362A(2) Definitions**

Not Used

##### **99-08362A(3) System Description**

Design Requirements:

Rapid roll-up doors shall be designed to withstand a wind pressure of 20 pounds per square foot of door area and have a near-airtight seal and knock-away feature for easy reassembly upon impact.

Door curtain shall have a temperature service range of -40° F to 180° F.

##### **99-08362A(4) Submittals**

Product Data: Submit manufacturer's descriptive data and installation instructions.

Working Drawings: Working drawings showing door types, sizes, locations, metal gages, hardware provisions, installation details, and other details of construction shall be submitted for approval.

Motor-operated doors shall include wiring diagrams for motors and controls, supporting brackets for motors, location, type, and ratings of motors and safety devices.

##### **99-08362A(5) Contract Closeout Submittals**

Operation and Maintenance Manuals:

Operation and maintenance instructions with parts lists, and manufacturer's warranties and guarantees shall be submitted.

Prior to the completion of the contract, submit 3 identified copies of the operation and maintenance instructions with parts lists for the door assembly, including motor operator, shall be delivered to the Engineer at the jobsite. The instructions and parts lists shall be in a bound manual form and shall be

complete and adequate for the equipment installed. Inadequate or incomplete material shall be returned. The Contractor shall resubmit adequate and complete manuals at no expense to the State.

#### **99-08362A(6) Quality Control and Assurance**

Not Used

#### **99-08362B Materials**

##### **99-08362B(1) Delivery, Storage, and Handling**

Doors and accessories shall be protected from damage during delivery, storage and handling. Manufacturer's brand name shall be clearly visible.

Doors shall be stored in a dry location with adequate ventilation, free from dust and water, and in such a manner as to permit access for inspection and handling. Damaged items which cannot be restored to like-new condition shall be removed and replaced.

##### **99-08362B(2) Warranty**

Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door that do not comply with requirements or that fail in materials, finish, or workmanship for a period of 5 years from the date of Project Completion.

##### **99-08362B(3) Products**

###### **Rapid Roll-Up Door System**

Rapid Roll-up Doors: Doors shall be motor operated, vertically opening, overhead coiling type, and shall be designed for high-cycle use on exterior openings as shown on the plans. Doors shall be springless type, operated by electric power with auxiliary hand chain operation. Doors shall be complete with guides, hardware, fastenings, operating mechanisms and accessories. Doors shall be surface mounted type with guides at jambs set back a sufficient distance from the interior side of the jambs to provide a clear opening width from jamb to jamb and a clear opening height when the door is in the fully open position.

Upon activation, the door curtain shall rapidly ascend and coil around a shaft mechanism located in a hood assembly above the door head. Shaft shall be sized to carry the door load with a deflection of not more than 0.03 inches per foot of opening width. Door system shall be equipped with a braking mechanism actuated by a thru-beam-type photocell detector that will stop the decent of the door if an object is located in the path of the door and reverse the direction of the door.

##### **99-08362B(4) Components**

Door Curtain: Composite assembly, constructed of steel, aluminum and ethylene propylene diene monomer (EDPM) with molded curtain locks located along the vertical edges of the curtain capable of holding the curtain in the door guides under windload conditions. Curtain color: gray.

Jamb Guides: One piece extruded aluminum designed to resist a 20 psf windload over the surface of the curtain, forming a continuous slot of sufficient depth to retain the door curtain and allow it to move freely in the guides. Provide jamb guide steel mounting angles or brackets to securely fasten guides to door jambs.

Bottom Rail: Formed from two steel angles bolted together with a knock-away section centered in the bottom rail to reduce risk of damage during accidental impacts and provide ease of straightening and easy reassembly. Bottom rail shall extend the full width of the curtain and be equipped with a sensing edge to stop and reverse the door if door is obstructed by an object in its path. Sensing edge shall be replaceable without removing the bottom rail from the curtain.

Electrical Operation: 3.2 horsepower, 230 volt, 3 phase motor and sprocketing capable of opening door at speeds of 20 inches per second and close door at 12 inches per second. Door operator designed for high-cycle operations, equipped with rotary screw-type limit switches to control open and close positions with an electro-mechanical brake system to stop and hold door in any position. Operator equipped with built-in manual emergency chain hoist with an electrical interlock to prevent motor operation during use of manual chain hoist. Chain hoist capable of operating door at a pull force of 20 to 30 pounds. Operator controlled by a programmable logic controller (PLC) located in a NEMA 4 enclosure, including an

adjustable closing timer, three push buttons for open, close, and stop functions and a cycle counter. Stop button shall stop door and hold door open at any location.

Red/Green Door Light: Each door shall be equipped with a red/green door light. When door is closed or opening, red light shall be activated. When door is fully opened, green light shall activate. See plans for location of red/green light.

Weatherstripping: replaceable, capable of providing a weathertight seal at door head, jambs, and sill. Type as recommended by the rapid roll-up door manufacturer.

#### **99-08362B(5) Preparation**

Openings shall be prepared to the correct dimensions to receive the rapid roll-up doors. Headers shall be level and jambs shall be plumb. Headers and jambs shall not have projections. Overhead tracks or similar assemblies shall not obstruct openings.

Tracks and supports shall be secured, reinforced, laterally braced and supported as necessary to prevent swaying and vibration of the doors.

#### **99-08362B(6) Installation**

Doors and accessories shall be installed in accordance with the door manufacturer's instructions and the approved shop drawings, and shall provide an installation which will operate freely without binding.

Anchors and inserts for guides, brackets, motors, switches, controllers and other accessories shall be accurately located and installed as shown in the manufacturer's instructions and the approved shop drawings.

Any material or equipment not mentioned herein or shown on the plans which may be necessary for the completion of the installation and the proper operation of the rapid roll-up doors shall be furnished and installed.

#### **99-08362B(7) Field Quality Control**

Manufacturer's Field Service: The Contractor shall arrange to have an authorized representative of the rapid roll-up door manufacturer present, at the time the doors are installed, to assist in the door installation. After doors are installed, doors shall be tested for proper operation and adjustments made so doors operate smoothly, consistently and properly.

#### **99-08362C Construction**

Not used

#### **99-08362D Payment**

Not used

### **99-084126 STOREFRONT ENTRANCES**

#### **99-084126A General**

##### **99-084126A(1) Summary**

Scope: This work shall consist of furnishing and installing interior and exterior entrance doors and storefront framing in accordance with the details shown on the plans and these special provisions.

Related Work: Glazing shall be as specified in under "Glazing" in Section 12-8 "Doors and Windows," of these special provisions.

##### **99-084126A(2) Definitions**

Not Used

##### **99-084126A(3) Performance Requirements**

General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:

Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.

Dimensional tolerances of building frame and other adjacent construction.

Failure includes the following:

1. Deflection exceeding specified limits.
2. Thermal stresses transferring to building structure.
3. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
4. Noise or vibration created by wind and by thermal and structural movements.
5. Loosening or weakening of fasteners, attachments, and other components.
6. Failure of operating units.

Delegated Design: Design aluminum-framed systems, including comprehensive engineering analysis by a qualified professional Civil or Structural Engineer, using performance requirements and design criteria indicated:

Wind Loads: 20 psf.

Seismic and wind loads: See design loads in structural drawings.

Deflection Parallel to Glazing Plane: Limited to  $L/360$  of clear span or 1/8 inch, whichever is smaller.

Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:

1. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
2. Test Durations: 10 seconds.
3. ASTM E 283 requires using a static-air-pressure difference of 1.57 lbf/sq. ft. unless otherwise indicated, which is equivalent to a 25-mph wind. Static-air-pressure difference of 6.24 lbf/sq. ft. (300 Pa) is equivalent to a 50-mph (80-km/h) wind.

Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbf/sqft.

#### **99-084126A(4) Submittals**

Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for storefront system components including frame, hardware, trim, windows, and accessories. Provide product test reports.

Working Drawings: Provide detailed drawings of the aluminum-framed system including installation details, door, hardware and anchor locations, and accessories.

Delegated-Design Submittal: For aluminum-framed systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by a Civil or Structural Engineer registered in the state of California.

Samples for Initial Selection: Manufacturer's color samples consisting of aluminum material showing the full range of colors, textures, and patterns available.

Finish samples shall be submitted. Each sample shall be a representative section of each specified panel with the specified color finish applied to that section. Sections shall be a minimum of 8 inches long, complete with stops and glazing beads, metal panel fasteners and anchors for all substrates on the job.

Operation and Maintenance Data: Provide operation and maintenance manual containing printed instructions for operation, adjustment, care, and maintenance of the door and accessories. Manuals shall be consistent with manufacturer's standard brochures, printed instructions, general operating and troubleshooting procedures, and safety precautions.

Warranties: Sample of special warranties.

#### **99-084126A(5) Quality Control and Assurance**

Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

Product Options: Information on the drawings and in the Special Provisions establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.

Preinstallation Conference: Conduct conference at Project site unless otherwise required.

#### **99-084126A(6) Warranty**

Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

Warranty Period: 5 years from date of Project Completion.

Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.

Warranty Period: 5 years from date of Substantial Completion.

#### **99-084126A(7) Manufacturers**

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following: Vistawall Architectural Products, CMI Architectural, Kawneer Company, or equal.

#### **99-084126B(1) Materials**

Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

Sheet and Plate: ASTM B 209.

Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.

Extruded Structural Pipe and Tubes: ASTM B 429.

Structural Profiles: ASTM B 308/B 308M.

Welding Rods and Bare Electrodes: AWS A5.10.

Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

Structural Shapes, Plates, and Bars: ASTM A 36.

Cold-Rolled Sheet and Strip: ASTM A 1008.

Hot-Rolled Sheet and Strip: ASTM A 1011.

### **99-084126B(2) Framing Systems**

Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

Construction: Thermally broken.

Glazing System: Retained mechanically with gaskets on four sides.

Glazing Plane: As indicated.

Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.

Reinforce members as required to receive fastener threads.

Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts, complying with ASTM A 123 or ASTM A 153.

Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.

### **99-084126B(3) Glazing Systems**

Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.

Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

### **99-084126B(4) Entrance Door Systems**

Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.

Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch-thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.

Coordinate entrance door design in first subparagraph below with hardware requirements. Narrow-stile doors may not accommodate some exit devices.

Door Design: As indicated.

Accessible Doors: Smooth surfaced for width of door in area within 10 inches above floor or ground plane.

Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.

Entrance Door Hardware: As specified under "Finish Hardware" in Section 12-8 "Doors and Windows" of these special provisions.

Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil thickness per coat.

### **99-084126B(5) Fabrication**

Form or extrude aluminum shapes before finishing.

Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

Framing Members, General: Fabricate components that, when assembled, have the following characteristics:

- Profiles that are sharp, straight, and free of defects or deformations.
- Accurately fitted joints with ends coped or mitered.
- Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
- Physical and thermal isolation of glazing from framing members.
- Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
- Provisions for field replacement of glazing from interior.
- Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

Entrance Doors: Reinforce doors as required for installing entrance door hardware.

Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

After fabrication, clearly mark components to identify their locations in Project according to Working Drawings.

#### **99-084126B(6) Finishes**

Finishes shall comply with recommendations relative to applying and designating finishes contained in NAAMM's "Metal Finishes Manual for Architectural and Metal Products". Finish shall be Duranar or Hylar 5000 PVDF comply with requirements of AAMA 2605.

Surfaces shall be cleaned and given conversion coating pre-treatment prior to application of .3 mil dry film thickness of epoxy or acrylic primer following recommendations of finish coat manufacturer.

Finish coat of 70% minimum fluorocarbon resin fused to primed surfaces at temperature recommended by manufacturer, 1.0 mil minimum dry film thickness.

Provide 3 coat system as required for color selected.

#### **99-084126B(6) Miscellaneous Items**

Anchors: Anchors shall be manufacturer's standard.

Glazing: Glazing shall conform to the requirements specified under "Glazing," in Section 12-8.08 of these special provisions.

Backer Rod: Backer rod shall be close cell, non-absorbent, non-staining foam rod compatible with sealant.

Sealant: Sealant shall be ultraviolet and ozone resistant, gun grade polysulfide or polyurethane, single component. Sealant shall conform to Federal Specification: TT-S-227.

#### **99-084126B(7) Installation**

Comply with manufacturer's written instructions.

Do not install damaged components.

Fit joints to produce hairline joints free of burrs and distortion.

Rigidly secure non-movement joints.

Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.

Seal joints watertight unless otherwise indicated.

Metal Protection:

Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.

Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

Set continuous sill members and flashing in full sealant bed to produce weathertight installation.

Install components plumb and true in alignment with established lines and grades, and without warp or rack.

Install glazing as specified under "Glazing" in Section 12-8 "Doors and Windows," of these special provisions.

Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.

Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

#### **99-084126B(7) Field Quality Control**

Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections.

Testing Services: Testing and inspecting of representative areas to determine compliance of installed systems with specified requirements shall take place as follows. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.

Water Spray Test: Before installation of interior finishes has begun, areas designated by Engineer shall be tested according to AAMA 501.2 and shall not evidence water penetration.

Test Area: A minimum area of 75 feet by 1 story of aluminum-framed systems.

Repair or remove work if test results and inspections indicate that it does not comply with specified requirements.

Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

Aluminum-framed assemblies will be considered defective if they do not pass tests and inspections.

Prepare test and inspection reports

#### **99-08362C Construction**

Not used

#### **99-08362D Payment**

Not used

## **99-08510 TRANSLUCENT PANEL WINDOWS**

### **99-08510 General**

#### **99-08510A(1) Summary**

Scope: This work shall consist of furnishing and installing insulated translucent fiberglass panel windows in accordance with the details shown on the plans and these special provisions.

Translucent panel windows shall include double-faced flat sandwich panels, aluminum frames, glazing accessories, fasteners, and frame anchors and such other components, not listed, but required for a rigid, secure, weatherproof, and complete installation.

#### **99-08510A(2) Performance Requirements**

Deflection of entire system shall be no more than  $L/45$ , unless otherwise indicated.

Structural Loads: The translucent panel windows shall be capable of withstanding wind and seismic loads specified in the 2007 CBC.

Air/Water Infiltration: For water penetration, translucent panel windows shall be tested per procedures of ASTM-331, and shall show no water entry at  $WTP=10.00$  psf, at  $5.00$ gph/ft. squared. Test shall be performed before and after uniform loads are applied. For air leakage, system shall be tested per procedures of ASTM E-283, and shall show results on no more than  $0.01$  cfm/ft. squared at  $1.56$  psf ( $25$  mph) and  $0.01$  cfm/ft. squared at  $6.24$ psf ( $50$  mph).

#### **99-08510A(3) Submittals**

Manufacturer's product data: Include construction details material descriptions, profiles and finishes of components.

Working drawings: Include elevations, details, dimensions and attachments to other work shall be submitted for approval. Working drawings shall show the anchorage and means of frame isolation from dissimilar materials.

Design Calculations: provide for the fastening system of the insulated translucent panel windows to other work shall be submitted to verify compliance with CBC requirements.

Working drawings and design calculations shall be stamped and signed by an engineer who is registered as a Civil or Structural Engineer in the State of California. The expiration date of the registration shall be shown. The engineer's signature shall be original.

Product test reports: Provide from a qualified independent testing agency indicating each type and class of panel system complies with the project performance requirements, based on comprehensive testing of current products. Previously completed test reports will be acceptable if for current manufacturer and indicative of products used on this project. Test reports required are:

- Flame Spread and Smoke Developed (ASTM E-84 by UL 723)
- Burn Extent (ASTM D-635)
- Color Difference (ASTM D-2244)
- Impact Strength (UL 972)
- Tensile Bond Strength (ASTM C-297 after aging by ASTM D-1037)
- Shear Bond Strength (ASTM E-72)
- Insulation "U" Factor (by NFRC 100, ASTM C-236, E-1423 and C-1199)
- NFRC Certification - Optional
- Condensation Resistance Factor (AAMA 1503)
- Class A Roof Covering Burning Brand (ASTM E-108)
- Class A Roof System UL listed (UL-790) - Optional
- Class I Fire Approval (FM 4881) - Optional.

Proof of regular, independent quality control monitoring under a nationally recognized building code review and listing program shall be submitted.

Samples: Submit product samples showing thickness, face sheets, colors and insulation 14-inch x 28-inch and factory-finish aluminum in 5" long sections.

Manufacturer's color chart: Show the full range of colors available for factory-finished aluminum.

### **99-08510A(3) Quality Assurance**

Certificate of Compliance: Certificate of compliance shall be furnished for translucent window panels in accordance with the requirements specified in Sec 6-1.07, "Certificate of Compliance," of the Standard Specifications.

Manufacturer: System manufacturer must be listed by a recognized building code authority, including the international Conference of Building Officials, which requires quality control inspections, and fire, structural and water infiltration testing by an approved agency.

Performance Requirement: The manufacturer shall be responsible for the configuration and fabrication of the complete panel system.

Field Measurements: Verify dimensions in system installation areas and indicate if dimensions on shop drawings are actual guaranteed dimensions.

### **99-08510B Materials**

Translucent window panels shall be manufactured from glass fiber reinforced thermoset resins by insulated system fabricator specially for architectural use. Thermoplastic (e.g., polycarbonate, acrylic) faces are not acceptable.

Flammability:

The interior face sheet shall be UL listed and have a flame spread rating no greater than 50 (20) and smoke developed no greater than 250 (200) when tested in accordance with UL 723. Burn extent by ASTM D-635 shall be no greater than 1". Faces shall not deform, deflected or drip when subjected to fire or flame, or become detached when subjected to 300 degree for 25 minutes.

Weatherability:

The exterior face shall have a permanent glass veil erosion barrier integrally embedded to provide maximum long-term resistance to fiber exposure. Sacrificial plastic surface films, coatings or veils not acceptable.

Exterior face sheet shall be smooth, .70" thick and White in color. Interior face sheet shall be .45" thick and White in color. Faces shall not vary more than +/- 10% in thickness and be uniform in color.

Panel system shall be 2-3/4" thick, made of two (2) sheets of translucent fiberglass, bonded by heat and pressure to either an aluminum or composite grid core specifically for architectural use.

Thermal Insulation: Panels shall have a NFRC laboratory tested "U" factor of .23 or .29, thermally broken by ASTM C-236, E-1423 and C-1199. System shall be NFRC certified.

Light and Solar Transmission: Panels shall have a light transmission of 15 per ASTM E-972.

Grid Core:

Grid pattern shall be nominal 12" x 24" shoji and symmetrical about the horizontal centerline for each flat panel.

The thermally broken (aluminum) I-beam grid core shall be 6063-T6 or 6005-T5 with provisions for mechanical interlocking of muntin-mullion and perimeter. Width of I-beam shall be no less than 7/16". The I-beam grid shall be machined to tolerance of not greater than +/- .002".

Thermal break shall be 1" wide minimum.

Panels shall withstand 1200 degree F fire for minimum (1) hour without collapse or exterior flaming.

Thermally broken panels shall give minimum CRF (Condensation Resistance Factor) of 80 by AAMA 1503 measured on the grid line.

Adhesive:

The laminate adhesive shall be heat and pressive resin-type engineered for structural sandwich panel use, with minimum 25 years field use, Adhesive shall pass testing requirements specified by the International Conference of Building Officials "Acceptance Criteria for Sandwich Panel Adhesive".

Minimum strength shall be 750 PSI tensile strength by ASTM C-297 after two (2) exposures to six (6) cycles each of the aging conditions prescribed by ASTM D-1037.

Shear strength by ASTM D-1002 minimum after exposures to five (5) separate aging conditions:

50% Relative Humidity at 73 degree F: 540 PSI

182 degree F: 100 PSI

Accelerated Aging by ASTM D-1037 at room temperature: 800 PSI

Accelerated Aging by ASTM D-1037 at 182 degree F: 250 PSI

500 Hour Oxygen Bomb by ASTM D-572: 1400 PSI

Impact Resistance:

The exterior face sheet shall be uniform in strength, impenetrable by hand-held pencil and impact equal to 70 (230) ft. lbs. Without fracture or tear when impacted by a 3-1/4" diameter. Free-falling per UL 972.

Translucent structural sandwich panel shall be a true sandwich panel of flat fiberglass sheets bonded to a grid core of mechanically interlocking I-beams and shall be laminated under a controlled process of heat and pressure, and deflect no more than 1.9" at 30 psf in 10' by ASTM E-72

The adhesive bonding line shall be straight, cover the entire width of the I-beam and have a neat, sharp edge. In order to insure bonding strength, white spots at intersections of muntins and Mullions shall not exceed 4 for each 40 sq. ft. of panel, nor shall they be more than 3/36" in width.

Panels and aluminum perimeter frame shall be pre-assembled where practical and sealed at the factory. Panels should be shipped to the job site in rugged shipping units, ready for erection.

Perimeter Closure System, Battens, and Aluminum Finishes:

Closure system shall be extruded 6063-T6 and 6063-T5 aluminum clamp-tite screw type.

Curved closure system may be roll formed. (Thermal break system optional for walls)

Aluminum closures to be supplied with 300 series stainless screws (excluding final fasteners to building) and shall be factory sealed to the panels. Aluminum battens and cap plates shall be field installed.

All exposed aluminum to be (mill) (architectural corrosion resistant finish which meet the performance requirements of AAMA 2604, color to be selected from manufacturer's standards)

Flexible sealing tape shall be manufacturer's standard pre-applied to serrated edges of closure system at factory under controlled conditions.

Closure system: Extruded aluminum 6063-T6 and 6063-T5 alloy and temper clamp-tite screw type closure system.

Sealing tape: Manufacturer's standard, pre-applied to closure system at the factory under controlled conditions.

Fasteners: 300 series stainless steel screws for aluminum closures, excluding final fasteners to the building.

Finish: Exposed aluminum to be manufacturer's factory applied finish that meets the performance requirements of AAMA 2604. (Mill).

**99-08510B(1) Examination**

Do not install systems until conditions adversely affecting installation and performance have been corrected.

**99-08510B(2) Preparation**

The general contractor shall prepare openings including isolation dissimilar materials from aluminum system which may cause damage by electrolysis, and shall provide temporary enclosures if required.

Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.

**99-08510B(3) Installation**

The installer shall erect translucent panel system in strict accordance with approved working drawings as supplied by manufacturer, including fastening and sealing. All surfaces shall be cleaned before sealants are applied.

Secure non-moveable joints and accommodate thermal and mechanical movements.

Insure weep holes are correctly installed.

Set perimeter framing in a full bed of sealant compound, or with joint fillers or gaskets to provide weather-tight construction.

Install joint sealant at perimeter joints and within the panel system in accordance with manufacturer's installation instructions.

After other trades have completed work on adjacent material, inspect translucent panel installation and make any adjustment necessary to ensure proper installation and weather-tight conditions.

All staging and lifts required for the complete panel system installation and field measuring shall be provided by and maintained by the general contractor.

**99-08510B Cleaning**

Clean panel system, both sides, after installation according to manufacturer's recommendations.

**99-08362C Construction**

Not used

**99-08362D Payment**

Not used

**99-08425 AUTOMATIC SLIDING DOORS****99-08425A General****99-08425A(1) Summary**

Scope: This work consists of installing electro-mechanical operated automatic sliding doors and appurtenances.

Automatic sliding doors must include sliding door, glass, operators and operator housings, breakaway and failsafe devices where described, frame with header, track, and sliding door controls.

**99-08425A(2) Definitions**

**ANSI/BHMA:** American National Standards Institute/Builders Hardware Manufacturers Association.

**99-08425A(3) Submittals**

Submit the manufacturer's descriptive data and shop drawings of automatic sliding door and frame. Shop drawings must include details of electric control systems, fastenings to walls, ceilings and floors and details of glazing stops. Details must include bite and edge clearance of glass or sheet for specified maximum and minimum expected temperatures and for installation temperatures. Glass panes in doors are expected to undergo temperature variations from 10 to 200 degrees F.

The door manufacturer must have an established parts store and service organization with offices in California. Submit the names and addresses of the manufacturer's authorized service organization and the parts supply store with the data and drawings. Include the length of time such businesses have represented the manufacturer for service and parts supply.

#### **99-08425A(4) Quality Control and Assurance**

#### **99-08425B Materials**

##### **99-08425B(1) General**

Automatic sliding doors must comply with ANSI/BHMA A156.10.

Metal Extrusions: Metal extrusions must be aluminum alloy 6063-T5 complying with ASTM B 221.

Formed Steel Reinforcing: Formed steel reinforcing must be commercial quality weldable steel at least 1/8 inch thick.

Fasteners, Hardware, Weatherstrip and Locks: Fasteners, hardware, weatherstrip and locks must be aluminum, nonmagnetic stainless steel or other corrosion resistant material compatible with aluminum.

Anodic Coating: Anodic coating must be clear complying with ASTM B 580.

Sealant: Sealant must be multi-component, gun grade, polysulfide complying with ASTM C 920.

Glass: Glass must comply with section 99-08810.

##### **99-08425B(2) Automatic Sliding Doors**

Automatic Sliding Doors:

Automatic sliding doors must be architectural grade manufactured for use in commercial and institutional buildings with electro-mechanical operation and emergency breakaway feature.

Automatic sliding doors must be part of a complete package including framing, end posts, sliding door and controls, together with all necessary components all manufactured by a nationally recognized sliding door manufacturer. Components must be fabricated to adequately support and receive the interconnecting framework.

Doors must be heavy-duty 3/8-inch diameter rod bolted construction with 1-3/4 inch thick by 5-inch high door rails, except the top rail must be 2 inches high.

Include integral intermediate height door rails. The door must have nonremovable glazing beads on the exterior side.

The door must be center hung from a one piece trussed trolley with built-in rollers for positive door alignment. The door and trolley must be hung from a removable steel track. Alignment of the door by lateral adjustment must provide positive sealing at the door edges.

An adjustable cantilever support and pivot assembly must allow the panels to swing outward from position without sagging and without the need for a lower door pivot. A corrosion resistant ball detent latch must provide easy release of the sliding door when pushed. Pushing out the door must cut the power to the operator. Anti-riser stops must prevent derailing.

Door height must be adjustable to within 1/4-inch. The automatic sliding door must include security hooking devices. Hooks must latch swingout panels in a closed position when the sliding door reaches the fully closed position. Door holders must be provided in swing-out panels. The lock on the interior of sliding door must have a thumb turn complying with NFPA 101.

The top of the threshold must be flush with the surrounding floor surfaces.

Operator:

The operator must be electrically operated and must include:

1. Built-in separate opening and closing pressure regulators
2. Separate opening and closing checking adjustments
3. Power checking adjustments

4. Control of opening and closing speeds
5. Manual operation with power off
6. Guide rod slide carriage for positive piston rod alignment
7. Fast recycle at any point in stroke
8. Fully adjustable controls

The operator must be listed for the type of installation shown.

The operator must be mounted in the header. Support to the header must be provided by a hinged snap-in cover.

#### Controls:

Sliding door controls must be manufactured by the door manufacturer and must be installed to provide the door operation specified.

The sliding doors Number 10 and 11 must automatically open and close for 2-way traffic by microwave sensors mounted on the door header.

Each manual control station must provide pushbutton control for door operation and a toggle switch to override normal operating control. The toggle switch must immediately close the door for emergency security control.

Each sliding door must be provided with a key switch security lock circuit and solenoid operated security latch. For entrance at doors Number 10 and 11, the controls for releasing the security latch and opening the sliding door must be a key operated lock cylinder and a remote pushbutton control. The closing control must be an adjustable time delay switch. For exit from doors Number 10 and 11, the door must be automatically actuated by the microwave sensor mounted in the header. The sensor controls must not override the solenoid operated security latch.

The key operated lock cylinder must comply with section 99-08700, with aluminum finish and must be installed in the door frame 42 inches above the floor on the outside.

Key control must be keyed to the building lock system under section 99-08710.

Fabrication: Exposed aluminum surfaces must be given a clear anodized coating. Surfaces to be anodized must be free of scratches, porosity, inclusions, roll and die marks, cold-sheets, and cracks detrimental to the appearance and performance of the coating.

#### **99-08425C Construction**

##### **99-08425C(1) General**

Not Used

##### **99-08425C(2) Installation**

The sliding door and frame must be set plumb and true and must be anchored rigidly and securely. The door must be adjusted to operate freely from all positions without binding.

Framework must be sealed weathertight.

Wiring for the electrical controls and energy supplies must comply with section 99-16.

All installation work for the sliding door and frame must comply with the manufacturer's instructions and the details described.

Two manual control stations and necessary control transformers must be installed under section 99-15 and section 99-16.

Glazing: Glazing must be installed by the manufacturer under section 99-08810. Glazing stops must be sealed weathertight.

#### Operational Adjustments:

You must have the manufacturer's technical representative inspect the completed installation and make necessary adjustments for proper operation of the automatic sliding door.

You must notify the Engineer at least 3 business days before the manufacturer's technical representative will be at the job site.

Proper operation must include the proper functioning of the door, controls, mechanical and electrical equipment and appropriate shielding of the sensing equipment. Shielding must confine the sensitivity of operation and the activating field to a limited area accepted by the Engineer. Adjustments must eliminate unwanted opening and closing of the sliding door caused by the following:

1. Passing vehicles and reflections from people or moving objects outside the activating fields
2. Self-induced operation due to movement of the door or its mechanisms
3. Any other malfunction

#### **99-08425D Payment**

Not Used

#### **99-08520 WINDOWS**

##### **99-08520A General**

##### **99-08520A(1) Summary**

Scope: This work consists of installing windows.

##### **99-08520A(2) Definitions**

**CSA:** Canadian Standards Association.

**WDMA:** Window and Door Manufacturers Association.

##### **99-08520A(3) Submittals**

Submit manufacturer's descriptive data, installation instructions, and schedule. Submit the manufacturer's color palette for finish color selection.

Manufacturer's descriptive data and installation instructions must show window elevations, plan views, full size sections, anchoring details to all substrates, anchors, and hardware.

Installation schedule must show location, size, and type for each window.

Product Test Reports: Submit product test reports based on evaluation of comprehensive tests performed by a qualified testing agency for each type, class, grade, and size of aluminum window.

Certificates of Compliance: Submit certificates of compliance for all windows.

##### **99-08520A(4) Quality Control and Assurance**

##### **99-08520B Materials**

##### **99-08520B(1) General**

Windows must be Commercial Class aluminum prime windows unless otherwise shown.

Windows must comply with AAMA/WDMA/CSA 101/I.S.2/A440 and must meet C30 or CW30 Performance Class and Grade unless otherwise shown. Windows must bear the AAMA label.

Glazing for windows must comply with section 99-08810.

##### **99-08520B(2) Delivery, Storage, and Handling**

Windows must be delivered in original, unopened, unbroken containers, wrappings, or bags with labels bearing the brand name, name of manufacturer or supplier, standard of manufacture, and product description.

Windows and accessories must be stored off the ground, kept dry, and fully protected from weather and damage.

##### **99-08520B(3) Windows**

Door and Transom Windows: Door and transom windows must be door or door frame manufacturer's standard window framing, glazing stops, and glazing accessories.

Fixed Windows: Fixed windows must be non-operable glazed panel inserted into a frame to include muntins, glazing stops, and glazing accessories.

Projected Windows:

Projected windows must be equipped with glazing accessories, replaceable weatherstripping, vent screens, operating handles, and locks on top hinged vents.

One operating pole must be provided for every 10 windows installed 6 feet or more above the floor. The operating pole and window operating handle must be compatible. The bottom of the pole must be no more than 3 feet from finish floor.

Horizontal Sliding Windows: Horizontal sliding windows must be horizontal slide windows with tightly contacting, weatherstripped, meeting stiles, self-lubricating rollers, glazing accessories, tubular sill, snap locks, and push handle. Vents must be screened.

Casement Windows: Casement windows must be outward opening, fixed lites, with extruded glazing stops, and glazing accessories. Casement windows must be screened, with tightly closing vents with extension hinges or sliding type pivots, locking handles, and roto-type operator.

Hung Windows:

Hung windows must be single hung, with vertically operating vents, tightly weatherstripped meeting stiles, tubular sash head and sill extrusions, and heavy duty sweep lock.

Sash must have block and tackle balances. Spiral or helical balances must not be used.

Hung windows must include extruded glazing stops, glazing accessories, and vent screens.

Aluminum: Aluminum must be aluminum alloy 6063-T5 complying with ASTM B 221.

Screws, Fasteners, and Window Accessories: Screws, fasteners, and window accessories must be non-corrosive metals compatible with aluminum, except guides may be vinyl and rollers may be nylon. Locks, operators, strikes, keepers, and other metal hardware must match window finish.

Weatherstripping: Weatherstripping must be continuous, replaceable type, wool pile mounted in metal or double runs of ultraviolet resistant neoprene or vinyl.

Vent Screen: Vent screen must be aluminum frame with 18 by 14 mesh aluminum screening and polyvinyl-chloride splines. Screen frames must be removable from the interior. Screen frame must match window finish.

Sealant: Sealant for installation of windows into wall openings must be single-component, polyurethane, self-leveling, non-sag, and must comply with ASTM C 920.

Tape: Tape must be compatible with sealant.

#### **99-08520B(1) Shop Fabrication**

Frame and sash must be accurately machined and fitted to hairline joinery that develops the members. Joints must be factory sealed weathertight.

Outward opening vents without roto-type operators must be provided with adjustable sliding friction type hold-open assemblies.

Sash must be removable from the interior only. Sash must have concealed condensation weeps to the outside.

Window finish must be a 2-coat high performance fluoropolymer finish complying with AAMA 2604 and containing 70 percent polyvinylidene fluoride resin.

#### **99-08520C Construction**

##### **99-08520C(1) General**

Not Used

### **99-08520C(1) Installation**

Window units must be set straight, level, plumb and in true alignment in prepared openings. Windows must be centered in openings. Clearance between the window unit and the building framing must be from 3/16 to 1/4 inches at the sides and 1/2 inch at the top. Ventilator sash must be adjusted after glazing for easy, smooth and proper operation.

The installation must be flashed and sealed weathertight.

All aluminum surfaces in contact with masonry, steel or other incompatible materials must be isolated with pressure sensitive tape, zinc chromate primer, bituminous paint or other material per the window manufacturer instructions and authorized by the Engineer.

### **99-08520D Payment**

Not Used

### **99-08710 DOOR HARDWARE**

#### **99-08710A General**

##### **99-08710A(1) Summary**

Scope: This work consists of installing mechanical door hardware and electrified door hardware for swinging doors.

##### **99-08710A(2) Design Requirements**

Hardware must be free of defects, blemishes, and excessive play. Obtain each kind of hardware from 1 manufacturer for (1) latch and locksets, (2) exit devices, or (3) hinges and closers.

Furnish hardware items required to complete the work complying with performance level and design intent. Comply with the manufacturers' instructions for installation.

Furnish the manufacturer's updated item where specified item is now obsolete.

Furnish hardware with suitable fasteners to complete work.

Furnish ANSI/BHMA A156 Operational Grade 1 and Security Grade 1 for door hardware unless otherwise specified.

Fire-Rated Door Assemblies: Furnish door hardware (1) rated for use, (2) listed by the SFM, and (3) complying with NFPA 80.

Smoke-Control Assemblies: Furnish door hardware (1) rated for use, (2) listed by the SFM, (3) complying with UL 1784, and (4) installed under NFPA 105.

Maintenance Tools: Furnish a complete set of specialized tools for continued adjustment, maintenance, removal, and replacement of door hardware.

##### **99-08710A(3) Definitions**

**BHMA:** Builders Hardware Manufacturers Association.

**NRP:** Non-removable pin.

**SFIC:** Small format interchangeable core.

**SFM:** CA State Fire Marshall.

##### **99-08710A(4) Submittals**

Product Data: Submit for all products. Include the following:

1. Manufacturer's technical information and catalog cuts for each door hardware item. Include style, function or type, grades, size, and finish.
2. Fasteners and other pertinent information.
3. Explanation of abbreviations, symbols, and codes contained in schedules.
4. ANSI/BHMA certification.
5. SFM listing and UL approval where specified.

6. Installation details for door hardware.
7. Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.

Shop Drawings:

Submit locations of door hardware sets, cross-referenced to drawings, both on floor plans and in door schedule. Include identification number, location, hand, fire rating, and material of each door and frame.

Submit details of electrified door hardware, including:

1. Power, signal, and control wiring diagrams. Include conductor numbers.
2. Schematic diagrams of interface of electrified door hardware and building intrusion and security systems.

Door Hardware Schedule: Submit door hardware sets with all items required for each door. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, style, thickness, hand, function, and finish of door hardware.

Closeout Documents:

Include closeout documents in the "Maintenance and Operations Manual" before completion of the work. Submit 1 copy of PDF files on CD or DVD.

Closeout documents must include the following:

1. Index.
2. Parts list.
3. Operating instructions.
4. Maintenance instructions.

Incomplete or inadequate documentation will be returned for correction and resubmittal.

**99-08710A(5) Quality Control and Assurance**

**99-08710A(5)(a) General**

Floor Stops must comply with California Access Compliance Reference Manual Policy No. 99-08, *Door Stops and Other Floor-Mounted Obstructions*.

**99-08710A(5)(b) Regulatory Requirements**

Door hardware and installation must comply with 24 CA Code of Regs Pt 2 and the following table:

Door hardware item	ANSI/BHMA Standard
Full mortise hinges	ANSI/BHMA A156.1
Cylindrical locksets	ANSI/BHMA A156.2
Automatic flush bolts, panic devices, exit only devices, and coordinators	ANSI/BHMA A156.3
Door closers	ANSI/BHMA A156.4
Lock cylinders, single cylinder deadbolts and electric strikes	ANSI/BHMA A156.5
Push plates, pull plates, kick plates, and mop plates	ANSI/BHMA A156.6
Mortise locksets	ANSI/BHMA A156.13
Manual flush bolts, floor stops, wall stops, door stops, and wall bumpers	ANSI/BHMA A156.16
Materials and finishes	ANSI/BHMA A156.18
Thresholds	ANSI/BHMA A156.21
Door gasketing, automatic door bottoms, door shoes with rain drip, door sweeps, door top weatherstrips, and overhead door drips	ANSI/BHMA A156.22
Electromechanical locks	ANSI/BHMA A156.23
Keying systems	ANSI/BHMA A156.28
Electric strikes and frame mounted actuators	ANSI/BHMA A156.31
Hardware preparation in steel doors and steel frames	ANSI/BHMA A156.115
Hardware preparation in wood doors with wood or steel frames	ANSI/BHMA A156.115W

**99-08710A(5)(c) Certificates**

Product Certificates: From manufacturer; that electrified door hardware is approved for use on types and sizes of labeled fire-rated doors and complies with listed fire-rated door assemblies.

**99-08710B Materials**

**99-08710B(1) General**

Furnish door hardware sets for each door as described.

Furnish electrified door hardware from the same manufacturer as mechanical door hardware. Electrified door hardware must be listed and labeled by a NRTL. Manufacturers may perform electrical modifications that are listed by a NRTL.

Exit doors must be operable from the inside at all times with single motion and without the use of a key, special knowledge, or effort.

Plans show direction of swing or hand of each door leaf. Furnish each item of hardware for proper door movement.

**99-08710B(2) Hinges**

Hinges must be full mortise, five knuckle, ball bearing construction and comply with the following:

1. Heavy Weight Hinges:
  - 1.1. Interior: Type 8111
  - 1.2. Exterior: Type 5111, use NRP with set screw on out swinging exterior doors

Where electrified hinges are shown, use the specified full mortise hinge with manufacturer's electric thru wire type; 4 28-gauge wires, 3.5 amperes continuous; 16 amperes pulse. Omit NRP if a different pin is required for electrical wiring.

**99-08710B(3) Mechanical Locks and Latches**

**99-08710B(3)(a) General**

Lock Throw: Comply with length of bolts required for labeled fire-rated doors and the following:

1. Cylindrical Lockset: At least 1/2-inch latchbolt throw

2. Mortise Lockset: At least 3/4-inch latchbolt throw
3. Deadbolt: At least 1-inch bolt throw

Lock Backset: 2-3/4 inches, unless otherwise described.

Strike: Manufacturer's standard strike for each lock bolt or latchbolt, with strike box and curved lip extended to protect frame. Furnish (1) flat-lip strike for three-piece antifriction latchbolts where instructed by the lock manufacturer, (2) extra-long-lip strike for frames with applied wood casing trim, or (3) manufacturer's specific aluminum strike box for aluminum frames.

#### **99-08710B(3)(b) Cylindrical Locksets**

Cylindrical locksets must be series 4000, non handed steel lock chassis, SFIC, self aligning trim with concealed through bolts. Include the following:

1. Lever: Curved with return. . On exterior doors, free wheeling exterior lever when locked.
2. Rose: Chromium, flat with rounded edge.
3. Latchbolt: Chrome, square corner. Same manufacturer as lockset.
4. Screws: Supplied with lockset.

Entrance lockset must be Function F109 with dual levers and roses. Passage lockset must be Function F75 with dual levers and roses. Privacy lockset must be Function F76A, dual levers and roses, with coin turn outside and thumbscrew turn inside.

#### **99-08710B(3)(c) Mortise Locksets**

Mortise locksets must be series 1000, non handed steel lock case, SFIC, self aligning trim with concealed screws. Include the following:

1. Lever: Curved with return. . On exterior doors, free wheeling exterior lever when locked.
2. Escutcheon: Stainless steel with standard cylinder.
3. Rose: Stainless steel, flat with rounded edge.
4. Latchbolt: Anti friction latchbolt, supplied with lockset.
5. Screws: Supplied with lockset.

Exit lockset must be Function F12, dual levers with exterior escutcheon and interior rose, and 1-inch throw stainless steel deadbolt. Passage lockset must be Function F01 with dual levers and roses. Privacy lockset must be Function F22, dual levers and roses, with coin turn outside and thumbscrew turn inside.

#### **99-08710B(3)(d) Auxiliary Locks**

Single cylinder deadbolt must be Function E2151, free spinning solid brass cylinder collar and security shield, non handed, steel alloy deadbolt with anti-saw center, SFIC, with concealed through bolts.

#### **99-08710B(3)(e) Lock Cylinders**

Lock cylinders must be a master key system.

Lock cylinders must be tumbler type, constructed from nickel silver, and same manufacturer as locking devices. Cylinders must be SFIC type, interchangeable cores with six pin barrels, and face finished to match lockset.

Temporary cores must be SFIC type with interchangeable cores with six pin barrels. Temporary cores must be a change key system. Temporary cores and keys must not be the Department's permanent keying system or furnished on the same keyway or key section as the Department's permanent keying system. Temporary cores will remain Department property.

Keys must be nickel silver and same manufacturer as locking devices. Furnish 2 change keys per temporary core. Furnish 2 blank keys per permanent core. Stamp change key bows and blank key bows "State of California" and "Do Not Duplicate."

#### **99-08710B(4) Electric Strikes**

Not Used.**99-08710B(5) Electromechanical Locks**

Electromechanical locks must use the specified mortise lockset, and be locked outdoor type, fail-safe, motor or solenoid driven, 24 volts DC, mechanical override, with strike that suits frame.

**99-08710B(6) Flush Bolts**

Manual Flush Bolts: Function L04251 set or Function L02461 set as required, non handed, 1/2-inch bolt head, 3/4-inch min bolt throw, and dust proof strikes.

**99-08710B(7) Accessories For Pairs Of Doors**

Coordinators: Type 21A, flush bolts, manufacturer's coordinated channel or filler, active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates. Include built-in, adjustable safety release.

**99-08710B(8) Surface Closer**

Door Closers: Surface mounted, aluminum cover, non handed, field adjustable sizes 1 through 6, parallel arm set with hold open and stop. Include separate adjusting valves for closing, latching speed, and backcheck. Use drop brackets at narrow head rails.

**99-08710B(9) Exit Devices**

Panic Devices: Type 3 with push pad, mortise lockset with SFIC cylinder, Function 08 outside trim with free wheeling lever when locked and exterior escutcheon. UL and SFM listed for Panic Exit. Use Type 2 with push pad for inactive leaf.

Exit Only Devices: Type 1 with push pad, Function 01 exit only trim. UL and SFM listed for Panic Exit. Use Type 2 with push pad for inactive leaf.

**99-08710B(10) Operating Trim**

Push Plates and Pull Plates: Beveled edges, stainless steel, and size 16 by 4 inches. Push plate must be Type J301. Pull plate must be Type J405, with one-inch diameter round pull and 1 1/2-inch standoffs on 8-inch centers.

**99-08710B(11) Protective Trim Unit**

Kickplates and Mop Plates: Beveled edges, stainless steel, countersunk screw holes, width 2 inches less than door width for single doors, and 1-inch less than door width each for door pairs. Kickplate must be Type J102, 12 inches tall. Mop plate must be Type J103, 6 inches tall.

**99-08710B(12) Mechanical Stops and Holders**

Floor Stops: Dome type, Type L12141 or L12161 as required, countersunk screw holes, non marring rubber bumper, and height for threshold or non threshold door frame as required.

Wall Stops and Door Mounted Stops: Wall type, 3 1/2-inch projection, Type L12011 or L12021 as required, countersunk screw holes, and non marring rubber tip.

Wall Bumpers: Wall type bumper, Type L22101 or L22201 as required, no visible screw holes, and convex rubber pad.

**99-08710B(13) Door Gasketing**

Automatic Door Bottoms: Heavy duty, full mortise, mill finished aluminum with silicone insert, end covers, and strike plates.

Door Shoe with Rain Drip: Mill-finished aluminum with neoprene insert, end covers, and formed rain drip.

Door Sweep: Mill-finished aluminum and neoprene.

Overhead Door Drip: Mill-finished aluminum 2-1/2 inches wide.

Door Gasketing: Bumper-type resilient inserts with retainer strips and surface applied. Perimeter seals must meet performance tests for heat, cold, air leakage, and smoke. At astragals, furnish a compression bulb resilient pressure sensitive door gasketing. Materials must be NRTL listed where used with labeled assemblies.

**99-08710B(14) Thresholds**

Thresholds must be factory non-slip mill-finished aluminum, nominal 6 inches wide unless otherwise shown, and full width of opening described.

Threshold bedding sealant must be weatherproof silicone sealant and adhesive.

**99-08710B(15) Shop Fabrication**

Manufacturer's Nameplate: Do not use products that have manufacturer's name or trade name displayed in a visible location except with required fire-rated labeling. Manufacturer's identification will be permitted on lock cylinder rims.

Base Metals: Furnish door hardware items of base metal specified, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware items. Do not use a manufacturer's standard materials or forming methods if different from the specified standard.

Fasteners: Screws must comply with commercially recognized industry standards for application intended. Furnish Phillips oval-head screws finished to match surface of door hardware. Furnish fire-rated fasteners for labeled assemblies for the following:

1. Hinges mortised to wood doors or frames.
2. Strike plates to wood frames.
3. Closers to wood doors and frames.
4. Surface hinges to steel doors.
5. Closers to steel doors and frames.
6. Surface-mounted exit devices to steel doors and frames.
7. Spacers or sex bolts for through bolting of hollow-metal doors.

Do not use aluminum fasteners. Furnish noncorrosive fasteners for exterior door gasketing applications.

**99-08710B(16) Finishes**

Interior Hardware: Standard Finish 626 (US 26D), satin chromium.

Exterior Hardware: Standard Stainless Steel Finish 630 (US 32D), satin stainless steel. Where shown, use Standard Finish 626 (US 26D), satin chromium.

Factory Covering: Apply a strippable, temporary protective covering to exposed finishes before shipping.

**99-08710C Construction****99-08710C(1) General**

Doors and Frames: Doors and frames must be set square, plumb, and properly prepared before hardware installation.

**99-08710C(2) Examination**

Doors and Frames: Examine doors and frames for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting door hardware installation.

Electrified Door Hardware: Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

**99-08710C(3) Installation**

Furnish heavy weight hinges for (1) interior doors with closers or panic devices, (2) interior doors wider than 3'-5", and (3) exterior doors. You must use 4 1/2-inch hinges unless otherwise described.

Furnish standard weight hinges for interior doors unless otherwise specified. For doors 2'-0" wide you must use 3-inch hinges. For doors wider than 2'-0" you must use 3 1/2-inch hinges.

Hardware items must be accurately fit, securely applied, adjusted, and lubricated to comply with the manufacturer's instructions. Hardware items must operate without binding or excessive play.

Hinges must be installed at equal spacing with the end hinges not more than 9 5/8 inches from the top and bottom of the door. Kickplates and mop plates must be mounted on the push side of the doors, 1 inch up from bottom edge.

Thresholds must be set in a continuous bed of bedding sealant.

Mechanical stops on concrete surfaces must be attached with expansion anchoring devices. Mechanical stops mounted elsewhere must be attached with wood screws. Do not locate stops in the path of travel.

Hardware, except hinges, must be removed from surfaces to be painted before painting. Do not install surface-mounted items until finishes have been completed on substrates involved. Painting must comply with section 99-09900.

Furnish all dogging keys, closer valve keys, lock spanner wrenches, other factory furnished installation aids, instructions, and maintenance guides to the Engineer.

Install continuous weatherstripping at each edge of exterior door leaf. Seal finish must match adjacent frame color.

#### **99-08710C(4) Lock Cylinders**

Install temporary cores in all lockable doors during construction.

Furnish permanent cores and keys to the Engineer before Contract acceptance. The Department will install permanent cores.

#### **99-08710C(5) Cleaning and Protection**

Clean adjacent surfaces soiled by door hardware installation.

Clean hardware items as necessary to restore proper function and finish.

Furnish final protection and maintain conditions that ensure that door hardware is without damage or deterioration before Contract acceptance.

#### **99-08710C(6) Adjusting**

Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of HVAC equipment.

Electric Strike: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.

#### **99-08710C(7) Door Hardware Schedule**

Furnish hardware sets as specified in the following tables:

DOOR HARDWARE SET 1 (Public Entrance)

No.	Item	Description	Quantity
1	Top and bottom offset pivots	By door manufacturer	1
2	Intermediate power transfer offset pivot	By door manufacturer	1
3	Electrified Mortise lockset	Electromagnetic lock, request to exit function with, free-wheeling lever	1
4	Power supply		1
5	Exit device		
6	Card reader	Outside	1
7	Surface closer	w/ hold open and stop	1
8	Gasketing	Door top weather stripping	1
9		Door shoe w/rain drop	1
10		Overhead door drip	1
11		Integral gasketing	1
12	Threshold	Aluminum	1
13	Protective trim unit	Kick plate	1

DOOR HARDWARE SET 2 (Private Entrance)

No.	Item	Description	Quantity
1	Top and bottom offset pivots	By door manufacturer	1
2	Intermediate power transfer offset pivot	By door manufacturer	1
3	Electrified Mortise lockset	Electromagnetic lock, request to exit function with, free-wheeling lever	1
4	Power supply		1
5	Card reader	Outside	1
6	Surface closer	w/ hold open and stop	1
7	Gasketing	Door top weather stripping	1
8		Door shoe w/rain drop	1
9		Overhead door drip	1
10		Integral gasketing	1
11	Threshold	Aluminum	1
12	Protective trim unit	Kick plate	1

DOOR HARDWARE SET 3 (Public Restroom)

No.	Item	Description	Quantity
1	Full Mortise Hinges	Heavy	3
2	Mortise lockset	Privacy, w/ 'occupied' indicator	1
3	Surface closer	w/ hold open and stop	1
4	Gasketing	Door top weather stripping	1
5		Door shoe w/rain drop	1
6		Overhead door drip	1
7		Integral gasketing	1
8	Threshold	Aluminum	1
9	Protective trim unit	Kick plate	1

DOOR HARDWARE SET 4 (Exterior Storage)

No.	Item	Description	Quantity
1	Full Mortise Hinges	Heavy, one concealed electric	3
2	Electrified Mortise lockset	Electromagnetic lock, request to exit function with, free-wheeling lever	1
3	Power supply		
4	Card reader	Outside	
5	Surface closer	w/ hold open and stop	1
6	Gasketing	Door top weather stripping	1
7		Door shoe w/rain drop	1
8		Overhead door drip	1
9		Integral gasketing	1
10	Threshold	Aluminum	1
11	Protective trim unit	Kick plate	1

DOOR HARDWARE SET 5 (Private Hall)

No.	Item	Description	Quantity
1	Hardware	By automatic sliding door manufacturer	
2	Card reader	Vestibule 1 side	1

DOOR HARDWARE SET 6 (Office)

No.	Item	Description	Quantity
1	Full Mortise Hinges	Heavy, one concealed electric	3
2	Electrified cylindrical lockset	Electromagnetic lock, request to exit function	1
3	Power supply		
4	Card reader	Outside	
5	Mechanical stops	Wall mounted	1
6	Protective trim unit	Kick plate	1

DOOR HARDWARE SET 7 (Private Hall)

No.	Item	Description	Quantity
1	Full Mortise Hinges	Heavy, one concealed electric	3
2	Electrified cylindrical lockset	Electromagnetic lock, request to exit function	1
3	Power supply		
4	Card reader	Outside	
5	Surface closer	w/ hold open and stop	1
6	Protective trim unit	Kick plate	1

DOOR HARDWARE SET 8 (Private Office)

No.	Item	Description	Quantity
1	Full Mortise Hinges	Heavy	3
2	Mortise latch		1
3	Surface closer	w/ hold open arm	1
4	Mechanical stops	Wall mounted	1
5	Protective trim unit	Kick plate	1

DOOR HARDWARE SET 9 (Assembly Exit)

No.	Item	Description	Quantity
1	Full Mortise Hinges	Heavy	3
2	Exit device	Mortise	1
3	Surface closer	w/ hold open arm	1
4	Mechanical stops	Wall mounted	1
5	Protective trim unit	Kick plate	1

DOOR HARDWARE SET 10 (Intox)

No.	Item	Description	Quantity
1	Full Mortise Hinges	Heavy, one concealed electric	3
2	Electrified cylindrical lockset	Electromagnetic lock, request to exit function	1
3	Power supply		
4	Card reader	Both side of opening	
5	Mechanical stops	Wall mounted	1
6	Protective trim unit	Kick plate	1

DOOR HARDWARE SET 11 (Private Hall)

No.	Item	Description	Quantity
1	Top and bottom offset pivots	By door manufacturer	1
2	Intermediate power transfer offset pivot	By door manufacturer	1
3	Electrified Mortise lockset	Electromagnetic lock, request to exit function with, free-wheeling lever	1
4	Power supply		1
5	Card reader	Outside	1
6	Surface closer	w/ hold open and stop	1
7	Threshold	Aluminum	1
8	Protective trim unit	Kick plate	1

DOOR HARDWARE SET 12 (Public Inspection Area)

No.	Item	Description	Quantity
1	Full Mortise Hinges	Heavy	3
2	Mortise latch set	Passage	1
3	Surface closer	w/ hold open and stop	1
4	Gasketing	Door top weather stripping	1
5		Door shoe w/rain drop	1
6		Overhead door drip	1
7		Integral gasketing	1
8	Threshold	Aluminum	1
9	Protective trim unit	Kick plate	1

DOOR HARDWARE SET 13 (Private Storage, Double Door)

No.	Item	Description	Quantity
1	Full Mortise Hinges	Heavy	6
2	Cylindrical lock set	Entrance w/ free-wheeling lever	1
3	Flush bolts, top and bottom		1
4	Surface closer	w/ hold open and stop	2
5	Gasketing	Door top weather stripping	2
6		Door shoe w/rain drop	2
7		Overhead door drip	2
8		Integral gasketing	2
9	Threshold	Aluminum	2
10	Protective trim unit	Kick plate	2

## DOOR HARDWARE SET 14 (Private Restroom)

No.	Item	Description	Quantity
1	Full Mortise Hinges	Heavy	3
2	Push/Pull set		1
3	Surface closer	w/ hold open arm	1
4	Mechanical stops	Wall mounted	1
5	Protective trim unit	Kick plate	1

### **99-08710D Payment**

Not Used

### **99-08810 GLAZING**

#### **99-08810A General**

#### **99-08810A(1) Summary**

Section 99-08810 includes specifications for installing glazing.

Glazing for windows, doors, and other glazed openings includes:

1. Glass
2. Acrylic sheets
3. Polycarbonate sheets

#### **99-08810A(2) Definitions**

**SHGC:** Solar Heat Gain Coefficient.

**Surface:** Surfaces of lites numbered inward with the exterior surface being the 1st surface.

#### **99-08810A(3) Submittals**

##### **99-08810A(3)(a) General**

Submit manufacturer's product data including catalog cuts, performance data, installation instructions, and additional documentation.

Submit the installation schedule. Each location must include the location, size, and glazing type.

Submit adhesion and compatibility testing reports. Test each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants. Testing will not be required if data is submitted based on previous testing of current sealant products and glazing materials matching those submitted.

For materials that fail tests, submit manufacturer's instructions for corrective measures, including use of specially formulated primers.

#### **99-08810A(4) Quality Control and Assurance**

Not Used

#### **99-08810A(5) Labels**

Each individual pane of heat strengthened or tempered glass must bear an identification label complying with ASTM C 1048.

Each individual pane of bullet-resistant glass or plastic must bear an identification label of performance complying with UL 752 or ASTM F 1233.

Safety glass must be permanently labeled under 24 CA Code of Regs, pt 2, § 2406.

## **99-08810B Materials**

### **99-08810B(1) General**

Glass must be clear glass unless otherwise shown and comply with ASTM C 1036 and the following:

1. Tempered glass must also comply with ASTM C 1048.
1. Heat strengthened glass must also comply with ASTM C 1048.
2. Laminated glass must also comply with ASTM C 1172.

Furnish glass thicknesses specified unless otherwise shown.

Acrylic sheets must comply with ASTM D 4802.

### **99-08810B(2) Glazing**

Float Glass:

Float glass must be Type I, Class 1, Quality-Q3 glass. Float glass thickness must be:

1. 1/8-inch thick for panes less than 10 square feet
2. 3/16-inch thick for panes between 10 and 28 square feet
3. 1/4-inch thick for panes over 28 square feet

Patterned Glass: Patterned glass must be Type II, Class 1, Form 3, Quality-Q5, Finish-F1 glass and either Pattern P1 or P2. Patterned glass must be 1/8-inch thick.

Tempered Glass: Tempered glass must be Kind-FT, Condition-A, Type 1, Class 1, and Quality-Q3 glass.

Heat Strengthened Glass: Heat strengthened glass must be Kind-HS, Condition A, Type 1, Class 1, and Quality-Q3 glass.

Laminated Glass: Laminated glass must be safety glass, Kind-LT, and fabricated from 2 pieces of float glass fused to plastic interlayers. The outer lite must be clear. Laminated glass must be at least 1/4-inch thick.

Low-e Coated Glass: Low-e coated glass must be clear float glass complying with ASTM C 1376 with a clear coating.

Insulating Glass Assemblies:

Insulating glass assemblies must be low-e coated, insulating glass.

Insulating glass assemblies must be factory assembled sealed lites of glass separated by a dehydrated interspace with desiccant spacer with dual seals, and qualified under ASTM E 2190.

The outdoor lite must be clear float glass. The indoor lite must be clear float glass. The glass assembly must have a maximum nighttime U-factor of 0.28, a maximum daytime U-factor of 0.26, and a maximum SHGC of 0.27.

Bullet Resistant Glass: Bullet resistant glass must have a power rating of "Medium – Small Arms" under UL 752 Level 1, or an equivalent rating under ASTM F 1233, Ballistics Class HG3, "Handgun – Medium, Jacketed." Exterior surface must be mar-resistant. Bullet resistant glass must be one of the following:

1. Laminated glass fused to clear plastic interlayers
2. Laminated polycarbonate sheets
3. Glass-clad polycarbonate complying with ASTM C 1349.

Security Glass: Security glass must be clear, Kind GCP Single Core, glass clad polycarbonate complying with ASTM C 1349. Outer lites must be heat-strengthened glass or chemically strengthened glass with a 1/8-inch thick polycarbonate core. Polycarbonate sheets must be Type 1 complying with Appendix X1. Security glass interlayers must comply with Appendix X2.

Miscellaneous Materials: Seals, caulks, putties, setting blocks, shims, tapes, compression seals, felt, spacers, and channels must be top grade, commercial quality, complying with the glass or sheet

manufacturer instructions and complying with GANA *Glazing Manual* and the IGMA *North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use*.

### **99-08810C Construction**

#### **99-08810C(1) General**

Safety glass must be installed under 24 CA Code of Regs Pt2 § 2406.

#### **99-08810C(2) Installation**

Glazing must be installed under the GANA *Glazing Manual* and the IGMA *North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use*.

Cut edges of tinted glass must comply with the glass manufacturer's instructions. The glazier must inspect each edge of tinted glass. Panes with edges that do not comply with the manufacturer's standards for tinted glass edges for sunny elevations will not be allowed.

Panes must be bedded fully and evenly, set straight and square within panels so that the pane is entirely free of any contact with metal edges and surfaces.

For panes on the exterior of buildings, the glazing on both sides of the panes must provide a watertight seal and watershed. Seals must extend no more than 1/16-inch beyond the holding members. A void must be left between the vertical edges of the panes and the glazing channel. Weep systems must be provided to drain condensation to the outside.

Panes in assemblies using extruded gasket glazing must be set under the assembly manufacturer's instructions using gaskets and stops supplied by the manufacturer.

Laminated glass must be set on setting blocks.

Whenever welding or burning of metal is in progress within 15 feet of glazing materials, a protective cover must be provided over exposed surfaces.

#### **99-08810C(3) Replacement and Cleanup**

Panes must be kept clean of cement and plaster products, cleansers, sealants, tapes and all other foreign material that may cause discoloration, etching, staining, or surface blemishes to the materials.

Excess sealant left on the surface of the glass or surrounding materials must be removed during the work life of the sealant.

Solvents and cleaning compounds must be chemically compatible with materials, coatings and glazing compounds. Cleaners must not have abrasives that scratch or mar the surfaces.

The protective covering on plastic sheet surfaces must not be removed until construction is completed or 2 weeks after glazing, whichever is shorter. The covering must be removed before adhesives dry sufficiently to adhere to the sheet during removal rather than the protective membrane.

Acrylic sheets must be protected against scuffs, scratches and marring of the surface during construction and any such damaged sheet must be replaced or restored to like new condition. Restoration work must comply with the manufacturer's instructions.

All broken, scratched, or cracked glass must be replaced before Contract acceptance.

Paint, dirt, stains, labels, and surplus glazing compound must be removed without scratching or marring the surface of the panes or metal work, except do not remove etched labels.

### **99-08810D Payment**

## **DIVISION 9 FINISHES**

### **99-09250 GYPSUM WALLBOARD**

#### **99-09250A General**

##### **99-09250A(1) Summary**

Scope: This work consists of installing and finishing gypsum wallboard.

Where assembly fire ratings are shown, construction must provide the fire resistance under the applicable standards in the *Fire Resistance Design Manual* published by the Gypsum Association.

#### **99-09250A(2) Definitions**

Not Used

#### **99-09250A(3) Submittals**

Product Data: Submit manufacturer's descriptive data and installation instructions.

#### **99-09250A(4) Quality Control and Assurance**

Not Used

#### **99-09250B Materials**

##### **99-09250B(1) General**

Use mold-, moisture-, and water-resistant gypsum board as backing boards for (1) tile, (2) rigid sheet wall covering, and (3) wainscoting. You may use cementitious backer board.

Use mold- and moisture-resistant joint tape and finishing compound with mold-, moisture-, and water-resistant gypsum board.

##### **99-09250B(2) Delivery and Storage**

Materials must be delivered in original packages, containers or bundles bearing brand name, applicable standard of manufacture, and name of manufacturer or supplier and must be kept dry and fully protected from weather and direct sunlight exposure. Gypsum wallboard must be stacked flat with adequate support to prevent sagging or damage to edges, ends and surfaces.

##### **99-09250B(3) Gypsum Wallboard**

Gypsum Wallboard: Gypsum wallboard must comply with ASTM C 1396. Gypsum board must be Type X with tapered edges.

Mold-, Mildew-, and Moisture-Resistant Gypsum Board: Mold-, moisture-, and water-resistant gypsum board must achieve a mold resistance rating of 10 under ASTM D 3273 and evaluated under ASTM D 3274. Furnish one of the following types:

1. Glass mat water-resistant gypsum panel with glass mat facings and water-resistant fiber-reinforced gypsum core, and complying with ASTM C 1658/C 1658M. Glass mat water-resistant gypsum panel must be Georgia-Pacific DensArmor Plus Fireguard Paperless Interior Drywall, or equal.
2. Fiber-reinforced water-resistant gypsum panel, unfaced with water-resistant core, and complying with ASTM C 1278/C 1278M. Fiber-reinforced water-resistant gypsum panel must be US Gypsum Fiberock Aqua-Tough Interior Gypsum Panel, or equal.
3. Gypsum panel with paper faces treated with an antimicrobial agent and containing core additives to add resistance to mold, mildew, and moisture and complying with ASTM C 1396/C 1396M. Gypsum panel must be National Gypsum Gold Bond XP Fire Shield Gypsum Wallboard, or equal.

Joint Tape and Joint and Finishing Compound: Joint tape and joint and finishing compound must comply with ASTM C 475.

Mold and Moisture Resistant Joint Tape and Finishing Compound: Mold and moisture resistant joint tape and finishing compound must comply with ASTM C 475. Joint tape must be glass mesh or as recommended by gypsum board manufacturer. Joint compound must be setting-type joint or as recommended by gypsum board manufacturer. Compound must achieve a mold resistance rating of 10 under ASTM D 3273 and evaluated under ASTM D 3274.

Corner Beads, Metal Trim and Control Joints: Corner beads, metal trim and control joints must be galvanized steel of standard manufacture.

Resilient Metal Channel: Resilient metal channel must be galvanized sheet steel channels of standard manufacture designed to reduce sound transmission through wood frame partitions.

Fasteners: Fasteners must be gypsum wallboard nails complying with ASTM C 514 or steel drill screws complying with ASTM C 1002.

Cementitious Backer Board: Cementitious backer board must be non-asbestos fiber-mat reinforced cementitious backer board complying with ASTM C 1325.

### **99-09250C Construction**

Install wallboard panels on ceilings and soffits with the long dimension of the panels perpendicular to the framing members. Install wallboard panels on walls with the long dimension of the panels either parallel or perpendicular to the framing members. The direction of the panels must be the same on any 1 wall or partition assembly.

Edges of wallboard panels must be butted loosely together. All cut edges and ends must be smoothed as needed for neat fitting joints.

All edges and ends of gypsum wallboard panels must coincide with the framing members, except those edges and ends which are perpendicular to the framing members. End joints on ceilings and on the opposite side of partition assemblies must be staggered.

Gypsum wallboard panels for shear wall sheathing or fire resistive assemblies must be fastened to all framing members. Gypsum wallboard panels at other locations and gypsum wallboard finish over plywood sheathed shear walls must be fastened to all framing members except at the following locations:

At internal angles formed by ceiling and walls, first install ceiling panels with the fasteners terminating at a row 7 inches from the walls, except for walls parallel to ceiling framing. Wall panels must butt the ceiling panels. The top row of wall panel fasteners must terminate 8 inches from the ceiling.

At internal vertical angles formed by the walls, fasteners must not be installed along the edge or end of the panel that is installed first. Fasteners must be installed only along the edge or end of the panel that butts and overlaps the panel installed first.

Adhesives must not be used for securing wallboard to framing.

Except where closer spacing is shown, spacing of fasteners must not exceed (1) 7 inches for nails, (2) 12 inches for screws, and (3) 8 inches for screws at the perimeter of panels for fire resistive assemblies having metal framing.

Use Type S steel drill screws to fasten wallboard to metal framing. Use nails or Type W steel drill screws to fasten wallboard to wood framing. Screws must not be used in fire resistive assemblies unless otherwise shown.

Fasteners must be located at least 3/8 inch from wallboard panel edges and ends. Nails must penetrate into wood framing at least 1-1/8 inches. Screws must penetrate into wood framing at least 5/8 inch. All metal fasteners must be driven slightly below surface level without breaking the paper or fracturing the core.

Metal trim must be installed at all free edges of panels, where wallboard panels abut dissimilar materials and at locations shown. Corner beads must be installed at external corners. Control joints must be installed at the locations shown.

Joints in mold-, moisture-, and water-resistant gypsum board must not be taped or filled and dimples at the fastener heads must not be patched. Edges of cuts and holes in backing board must be sealed with a primer or sealer that is compatible with the wall covering or wainscoting adhesive to be used.

All other joints must be filled and finished with joint tape and at least 3 coats of joint compound (1) between face panels, (2) the internal angles formed by ceiling and walls and (3) the internal vertical angles formed by walls. Tape in the corners must be folded to comply with the angle of the corner. Tape at joints and corners must be embedded in joint compound.

Dimples at nail and screw heads, dents, and voids or surface irregularities must be patched with joint compound. Each patch must consist of at least 3 coats and each coat must be applied in a different direction.

Flanges of corner beads, control joints and trim must be finished with a least 3 coats of joint compound.

Each coat of joint compound must be feathered out onto the panel surface and must be dry and lightly sanded before applying the next coat. The finished surfaces of joint compound at the panel joints, internal angles, patches and at the flanges of trim, corner beads and control joints must be flat and true to the plane of the surrounding surfaces and must be lightly sanded.

Good lighting of the work area must be provided during the final application and sanding of the joint compound.

Surfaces of wallboard to be textured must receive an orange peel texture, unless otherwise shown.

#### **99-09250D Payment**

Not Used

#### **99-09315 CERAMIC AND QUARRY TILE**

##### **99-09315A General**

##### **99-09315A(1) Summary**

Scope: This work consists of installing ceramic tile.

Ceramic tile includes glazed wall tile, patterned porcelain tile, matte porcelain tile, textured porcelain tile, polished porcelain tile, trim tile, setting materials, grouts, and other materials required for a complete installation.

##### **99-09315A(2) Definitions**

Not Used

##### **99-09315A(3) Submittals**

Product Data:

Submit manufacturer's descriptive data, a list of materials to be used, and installation instructions.

Submit data for (1) each type of tile, (2) mortar and setting bed materials, (3) bond coat materials and additives, (4) grout materials, and (5) additives.

Submit friction reports for tile products to be used on floors and other pedestrian surfaces.

Samples: Samples must include 2 individual samples of each type and color of tile and trim to be installed and must be of the same size, shape, pattern and finish as the tile and trim to be installed.

##### **99-09315A(4) Quality Control and Assurance**

Single Source Responsibility: Each type and color of tile, grout, and setting materials must be obtained from a single source.

Master Grade Certificates: Each shipment of tile to the job site must include a Master Grade Certificate issued by the tile manufacturer.

##### **99-09315A(6) Project Conditions**

Tile work must be protected and environmental conditions maintained during and after installation to comply with the reference standards and manufacturer's instructions.

##### **99-09315B Materials**

##### **99-09315B(1) General**

Ceramic Tile: Ceramic tile must comply with ANSI A137.1 for types and grades of tile described. Ceramic tile must be Standard Grade.

Tile Installation Materials: Tile installation materials must comply with ANSI A108/A118/A136.1 with products and materials indicated for setting and grouting.

Tile Color and Size: Color and tile size will be selected by engineer from manufacturer's standard palette.

Slip Resistant Tile: Slip resistant tile must have a static coefficient of friction of not less than 0.6 for walking surfaces and 0.8 for ramps under ASTM C 1028.

### **99-09315B(2) Delivery, Storage, and Handling**

Tile and packaged materials must be delivered to the job site in sealed, unbroken, unopened containers with the labels intact. Tile containers must bear the Standard Grade label.

Materials must be stored and handled in such a manner to prevent damage or contamination by water, freezing, or foreign matter.

### **99-09315B(3) Tile Products**

Glazed Wall Tile:

Glazed wall tile must be machine made, dust pressed white body clay, plain face with cushion edges and a glossy glaze finish. Tile must be 5/16-inch nominal thickness.

Glazed wall tile trim must match material, size and finish of wall tile. Use bullnose trim on free edges of tiled wall areas. Use bullnose runner trim on outside corners. Do not use beads. Use cove trim on reentrant corners.

Matte Porcelain Tile:

Matte porcelain tile must be machine made, unpolished, dust pressed natural porcelain clay, and plain face. Tile must be 5/16-inch nominal thickness. Matte porcelain tile must be slip resistant.

Matte porcelain trim tile must include cove base at walls and single piece intersecting cove base at corners.

### **99-09315B(4) Setting Materials**

Materials for portland cement mortar installation must comply with ANSI A108.1 for the installation method described, unless otherwise shown.

Membrane must be a waterproof membrane for ceramic tile installation complying with ANSI A118.10.

Reinforcement must be 2 by 2 inches, W0.3 by W0.3 galvanized welded wire reinforcement complying with ASTM A 185 except for minimum wire size. Reinforcement must be furnished in flat sheets.

Metal lath must be self furring, galvanized, flat expanded type weighing at least 2.5 pounds per square yard and complying with ASTM C 847. Factory assembled metal lath and paper backing may be used where reinforcement over paper is shown.

Tile Bond Coat: Tile bond coat must be latex-portland cement prepackaged mortar mix, incorporating a dry acrylic resin, and complying with ANSI A118.4. Mortar must be suitable for exterior use and be labeled for the type of tile to be placed. Only water must be added to the mortar.

Epoxy Bond Coat: Epoxy bond coat must be a 2 part prepackaged epoxy mortar mix complying with ANSI A118.3 and suitable for exterior use. Mortar must be labeled for the type of tile to be placed.

### **99-09315B(5) Grouting Materials**

Tile Grout: Tile grout must be latex-portland cement prepackaged grout mix, incorporating a dry acrylic resin, and complying with ANSI A118.6. Grout must be suitable for exterior use and be labeled for the type of tile to be placed. Only water must be added to the grout.

Epoxy Grout: Epoxy grout must be a 2 part prepackaged epoxy grout complying with ANSI A118.3 and suitable for exterior use. Grout must be labeled for the type of tile to be placed.

Grout Pigment: Grout pigment must be chemically inert, fade resistant mineral oxide or synthetic type. Color must be as shown.

### **99-09315B(6) Sealants**

Sealant for vertical expansion joints must be a medium modulus silicone or polyurethane. Match color of exposed sealant to grout color in adjoining tile sealed joints.

Sealant for horizontal joints must be a 2-part polyurethane type material with a Shore Hardness of 35 to 45. Match color of exposed sealant to grout color in adjoining tile sealed joints.

### **99-09315B(7) Mortar Beds**

Mortar beds for walls must be proportioned of one part cement, 1/2 part hydrated lime, 6 parts damp sand by volume and only enough water to provide the necessary workability. Ingredients must be dry mixed, water added, and materials blended to produce a stiff mix. Mortar bed must be at least 3/4 inch thick.

Mortar beds for floors must be proportioned of one part cement, 1/10 part hydrated lime, 5 parts damp sand by volume and only enough water to provide the necessary workability. Ingredients must be dry mixed, water added, and materials blended to produce a stiff mix. Mortar bed must be at least 1-1/4 inch thick.

### **99-09315B(8) Miscellaneous Materials**

**Sand:** Sand must be a natural or manufactured sand complying with ASTM C 144, except that no more than 10 percent must pass the No. 100 sieve.

**Sealers:**

Sealers for grout must be a penetrating proprietary compound designed for sealing grout. Silicone sealers must not be used.

**Cement:** Cement must comply with ASTM C 150, Type I.

**Hydrated Lime:** Hydrated lime must comply with ASTM C 206, Type S, or ASTM C 207, Type S.

**Water:** Water must be clean and potable.

**Metal Edge Strips:** Metal edge strips must be stainless steel terrazzo strips, 1/8 inch wide at the top edge with integral provisions for anchorage to mortar bed or substrate.

**Marble Thresholds:**

Marble thresholds must comply with ASTM C 503 for exterior use and be abrasion resistance.

Marble threshold must be uniform in color and finish and fabricated to sizes and profiles shown and must provide a smooth transition between tile surfaces and adjoining finished floor surfaces.

**Cementitious Backer Board:** Cementitious backer board must be non-asbestos fiber-mat reinforced cementitious backer board complying with ASTM C 1325.

**Shower Pan:** Shower pan must be flexible PVC sheeting complying with ASTM D 4551, Grade 40, and manufactured for use as a shower membrane. Solvent cement must be per the manufacturer's instructions.

### **99-09315C Construction**

#### **99-09315C(1) General**

**Temperatures:**

Unless otherwise specified in the manufacturer's installation instructions, maintain the ambient temperature between 50 and 100 degrees F in tiled areas during installation and for 7 days after completion. Exterior work areas must be shaded from direct sunlight during installation.

Tile must not be installed when the temperature of the substrate is greater than 90 degrees F or is frost covered.

**Illumination:** Interior work areas must be illuminated to provide the same level and angle of illumination as will be available during final inspection.

#### **99-09315C(2) Preparation**

Concrete, mortar, or masonry substrate surfaces which are to receive a mortar bed must not vary more than 1/4-inch in 8 feet from the required plane and must be true, plumb at vertical surfaces, and square at intersection edges.

Surfaces to receive a mortar setting bed or a bond coat must be cleaned to assure a tight bond to the applied material. Cleaning must leave the surface thoroughly roughened and free from laitance, coatings, oil, sand, dust and loose particles.

Saturate the cleaned surfaces with water just before placing mortar or coat the cleaned surfaces with fresh neat cement slurry. If the surface is saturated with water, excess water must be removed and the wetted surfaces uniformly dusted with portland cement. The slurry or wetted cement dust must be broomed to completely coat the surface with a thin and uniform coating just before placing the mortar.

Substrates must be inspected to insure that grounds, anchors, plugs, recessed frames, bucks, drains, electrical work, mechanical work, and similar items in or behind the tile are installed before beginning placing tile.

### **99-09315C(3) Mixing**

Mixing: Mortar and grout must be mechanically mixed under the referenced standards and manufacturer's instructions to accurately proportion materials and water or additive content. Mixing equipment and mixer speeds, mixing containers, mixing time, and other procedures need to produce mortars and grout of uniform quality with optimum performance characteristics must comply with the referenced standards and manufacturer's instructions.

### **99-09315C(4) Schedule**

Wall Tile:

Wall tile must be nominal 4 by 4 inch glazed wall tile.

Install tile on mortar bed using a tile bond coat and grout under the *TCNA Handbook for Ceramic, Glass, and Stone Tile Installation, Method W 222*.

Install tile on gypsum wallboard using a tile bond coat and grout under the *TCNA Handbook for Ceramic, Glass, and Stone Tile Installation, Method W 243*.

Install tile on cementitious backer board using a tile bond coat and grout under the *TCNA Handbook for Ceramic, Glass, and Stone Tile Installation, Method W 244*.

Install tile on concrete and masonry must be on a mortar bed using tile bond coat and grout under the *TCNA Handbook for Ceramic, Glass, and Stone Tile Installation, Method W 211*.

Floor Tile: Floor tile must be nominal 4 by 4 inch matte porcelain tile. Install tile on mortar bed using a tile bond coat and grout under the *TCNA Handbook for Ceramic, Glass, and Stone Tile Installation, Method F 112*.

### **99-09315C(5) Installation**

#### **99-09315C(5)(a) General**

Tile installation must comply with applicable portions of ANSI A108/A118/A136.1 and *TCNA Handbook for Ceramic, Glass, and Stone Tile Installation*.

All tile must be installed on a bond coat over a setting bed. The setting bed must be (1) a cured cement mortar bed, (2) a prepared, dimensionally stable substrate of concrete, or masonry, or (3) cementitious backer board or other cementitious material.

The back face of the tile must be free of paper, adhesives, fiber mesh, resins, or other materials affecting the bond of the tile to the bedding material.

Tile sheets must have permanent edge bonding or temporary mounting materials on the exposed face. Water soluble or absorbent adhesives must not be used for edge bonding. Temporary mounting materials must allow observation during tile setting operations.

Tile work must extend into recesses and under or behind equipment and fixtures, to form a complete covering without interruptions unless otherwise shown. Work must be terminated neatly at obstructions, edges and corners without disrupting pattern or joint alignments.

Intersections and returns must be accurately formed. Cutting and drilling of tile must be performed without marring visible surfaces. Cut edges of tile abutting trim, finish or built-in items must be carefully ground to

produce straight aligned joints. Tile must be closely fit to electrical outlets, piping, fixtures and other penetrations such that plates, collars, or covers overlap the tile.

Cementitious backer board must be installed under ANSI A118.11.

#### **99-09315C(5)(b) Mortar Bed Placement**

The mortar bed, including reinforcement if shown, must be placed, consolidated, and finished to the required thickness.

The mortar bed surface must be true and pitched as shown, without high or low spots. The mortar bed surface must not vary more than 1/8 inch in 8 feet from a plane parallel to the finished tile surface when tile is installed on a cured mortar bed.

In no case must the allowed tolerances result in offsets between adjoining tiles, low spots on finished tile surfaces that can pond water, or finished tile surfaces that are not plumb or not true.

Pea gravel mortar must be tightly compacted so as to fill all voids in the aggregate. Obtain compaction using a stand-up wooden tamper weighing not less than 35 pounds or using a motor driven tamper and leveler.

Pea gravel mortar beds must be damp cured under cover for not less than 72 hours at a temperature of at least 70 degrees F.

Cement mortar beds to receive a tile bond coat must be damp cured under cover for a minimum of 48 hours at a temperature of at least 70 degrees F.

Cement mortar beds to receive an epoxy bond coat must be damp cured under cover for a minimum of 96 hours at a temperature of at least 70 degrees F and allowed to dry thoroughly prior to setting tile.

#### **99-09315C(5)(c) Shower Pan**

Substrate must be thoroughly cleaned before forming the shower pan. Drain must be a bolt-down clamping ring type with weepholes, installed such that the lip of the drain is flush with the subfloor.

Shower pan must be turned up for a distance of at least 6 inches in room areas and 3 inches above curb level in curbed spaces, with sufficient material to fold over and fasten to outside face of curb. Corners must be dog-eared and folded between pan and studs. Material must be nailed in the top inch of the upstand only.

Shower pan material must be cut exactly to the size of the drain opening. Do not trim out to bolt holes. Pierce the pan material to accommodate bolts with a tight fit. Place adhesive or mastic between pan and subdrain.

#### **99-09315C(5)(d) Tile Bond Coat**

The tile bond coat mortar must be mixed under the manufacturer's instructions. The consistency of the mixture must be such that ridges formed with the recommended notched trowel must not flow or slump. Reworking will be allowed provided no water or materials are added. The setting bed surfaces must be dampened before placing the bond coat as necessary for tile installation, but the setting bed must not be soaked. Setting bed surfaces for epoxy bond coat must be dry.

The bond coat must be floated onto the cured mortar bed surface with sufficient pressure to cover the surface evenly with no bare spots. The surface area to be covered with the bond coat must be no greater than the area that can be tiled while the bond coat is still plastic. The bond coat must be combed with a notched trowel under the manufacturer's instructions no more than 10 minutes before installing tile. Tile must not be installed on a skinned-over bond coat.

#### **99-09315C(5)(e) Installing Tile**

Tile must be installed under the manufacturer's instructions and must be set solid and well bonded to the substrate.

Tile set on a tile bond coat must be installed under ANSI A108.5. Tile set on an epoxy mortar must be installed under ANSI A108.6.

Cut tiles must be made with saws. Cut edges must be rubbed with an abrasive stone to bring the edge of the glaze slightly back from the body of the tile. Cuts must be accurately made to neatly fit the tile in place. Cut edges must not be butted against other tile. Cut tile must be at least half the size of a full size tile.

Tile must completely cover wall areas behind mirrors and fixtures.

Tile must be installed so that the finished tile surface does not vary more than 1/8 inch in 8 feet from the finished tile surface shown. In no case must there be offsets in adjoining tiles, low spots on finished tile surfaces that can pond water, or finished tile surfaces that are not plumb or true in the completed tile work.

Tiles must be firmly pressed into the freshly notched bond coat. Tile on interior surfaces must be tapped and beat into a true surface and to obtain at least 80 percent coverage by the mortar on the back of each tile. Tile on exterior surfaces must have 100 percent coverage and must be back-buttered immediately before setting the tile.

If tile is face mounted, the paper and glue must be removed within one hour after tile is installed. All tiles that do not meet the requirements for joint and surface tolerances must be adjusted or replaced.

Mortar that exudes into the grout spaces between tiles must be removed to the bottom of tile.

Marble Thresholds: Marble thresholds must be set in same type of setting bed as abutting tile unless otherwise shown.

Joints: Joints between tile must be continuous both vertically and horizontally. Joints must be straight and of uniform and equal width. Where tiles on adjoining surface are the same size, the joints must also align. Joint width must be per the tile manufacturer's instructions.

#### **99-09315C(5)(f) Grouting Tile**

Grout must be mixed, applied and cured under the manufacturer's instructions and under ANSI A108.10 for cement grout and ANSI A108.9 for epoxy grout.

Spacers, strings, ropes, pegs, glue, paper, and face mounting material must be removed before grouting. Joints between glazed wall tile must be wetted if they have become dry. Joints for epoxy mortar must be dry.

Grouting must not begin until at least 48 hours after installing tile.

A maximum amount of grout must be forced into the joints between tiles under the manufacturer's instructions. The grout must be finished (1) to the depth of the cushion for cushion edge tile and (2) flush with the surface for square edge tile. All gaps and skips in the grout spaces must be filled.

Mortar or mounting mesh must not show through the grouted joints.

The finished grout must have a uniform color and must be smooth without voids, pinholes or low spots.

Expansion joints must be kept free of grout or mortar.

Grout must be protected from freezing or frost for at least 5 days after installation.

#### **99-09315C(5)(g) Miscellaneous Materials**

Expansion Joints:

Expansion joints must be installed at the perimeter of all tile floors and at all substrate control joints and changes in the substrate material. Exterior expansion joint spacing must not exceed 16 feet in any direction.

All expansion joints must be made with sealant over backer rods. The thickness of sealant at the center of expansion joints must not exceed the width of the joint. Joint edges must be primed under the sealant manufacturer's instructions.

Edge Strips: Edge strips must be installed at openings where thresholds have not been shown and the tile floor abuts other flooring materials at the same level. Edge strips must be installed centered under the closed door, or where there is no door, centered in the opening.

Sounding Tile: Tiled surfaces must be sounded with a metal bar or chain for improperly bonded tiles or setting beds. Tiles or setting beds that emit a hollow sound must be replaced.

Replacement: Cracked, chipped, broken, or otherwise defective tiles must be removed and replaced. All tiles that differ more than 1/16-inch in elevation from adjacent tile edges must be removed and replaced.

#### **99-09315C(5)(h) Curing**

After the installation of tile and the grouting of joints, the tile and grout must be cured by keeping the surface continuously damp for at least 72 hours. Curing materials must not stain the tile or grouted joints. Curing methods must not erode away the grout.

After grouting, horizontal tiled surfaces must be closed to traffic, and all tiled surfaces must be kept free from impact, vibration or shock for at least 72 hours.

Sealing Unglazed Quarry Tile: Sealer must be applied to unglazed quarry tile only. The sealer must be applied under the manufacturer's instructions.

#### **99-09315C(6) Cleaning and Protection**

Cleaning Tile Surfaces:

All exposed tile surfaces must be cleaned of all grout haze upon completion of grouting. Acids and chemicals used to clean tile must comply with the tile manufacturer's instructions. Cleaners must not be harmful to materials or surfaces of abutting floors, walls, and ceilings. Rinse tile work thoroughly with clean water before and after using acid or chemical cleaners. After cleaning and rinsing, polish tile surfaces using a soft cloth.

Tile work must be cleaned and polished immediately before Contract acceptance. All dirt, grime, stains, paints, grease, and other discoloring agents or foreign materials must be removed.

Protection: Tile surfaces damaged by construction operations must be retiled

#### **99-09315D Payment**

Not Used

#### **99-09614 DETECTABLE WARNING SURFACE**

##### **99-09614A General**

##### **99-09614A(1) Summary**

This work consists of installing detectable warning surfaces.

##### **99-09614A(2) Definitions**

Not Used

##### **99-09614A(3) Submittals**

Submit manufacturer's descriptive data, color and texture samples, installation instructions, and warranty documentation. Submit 2 samples, each at least 6 by 6 inches.

##### **99-09614A(4) Quality Control and Assurance**

Not Used

##### **99-09614A(5) Warranty**

The manufacturer must provide a 5-year warranty for the detectable warning surface, guaranteeing replacement when there is a defect in the dome shape, color fastness, sound-on-cane acoustic quality, resilience, or attachment. Begin warranty period upon Contract acceptance.

#### **99-09614B Materials**

##### **99-09614B(1) General**

Detectable warning surfaces must be listed on the Authorized Material List.

Detectable warning surface must be prefabricated, flush mounting, truncated dome panels. Dimensions and spacing must be as shown. The color of the detectable warning must be yellow complying with FED-STD-595, Color No. 33538.

Adhesives, fasteners, and sealant must comply with the manufacturer's instructions.

**99-09614B(2) Delivery, Storage, and Handling**

Deliver materials to the job site in the manufacturer's original and unopened containers that bear labels showing type of material. Package finished surfaces with protective wrappings to protect panels from residue before and during installation.

**99-09614C Construction**

Install securely under the manufacturer's installation instructions.

**99-09614D Payment**

Not Used

**99-09659 RESILIENT BASE**

**99-09659A General**

**99-09659A(1) Summary**

Scope: This work consists of installing resilient base.

**99-09659A(2) Definitions**

Not Used

**99-09659A(3) Submittals**

Submit the manufacturer's descriptive data, installation instructions, and samples of resilient base. Samples must be at least 2 inches in length. Submit the manufacturer's color palette for finish color selection.

**99-09659A(4) Quality Control and Assurance**

**99-09659B Materials**

Resilient Base: Resilient base must be manufacturer's best grade, rubber base, with premolded internal and external corner pieces. The height and color must be as shown.

Adhesive: Adhesive must be per the base manufacturer's instructions.

**99-09659C Construction**

Bases must be firmly and completely attached to walls with adhesive and must be accurately scribed to trim, molding, and cabinets. All joints must be tight fitting. Bases between premolded corners or other termini must be (1) installed continuous or (2) installed using 4-foot minimum standard manufactured lengths. Filler pieces must be not less than 18 inches.

**99-09659D Payment**

Not Used

**99-09661 VINYL COMPOSITION TILE**

**99-09661A General**

**99-09661A(1) Summary**

Scope: This work consists of installing vinyl composition tile.

Vinyl composition tile consists of vinyl composition tile, edger strips, floor wax, and tile manufacturer's recommended primers and adhesives.

**99-09661A(2) Definitions**

Not Used

**99-09661A(3) Submittals**

Manufacturer's descriptive data, installation instructions, color and pattern samples must be submitted. Samples of tile must be 12" x 12" in size.

**99-09661A(4) Quality Control and Assurance****99-09661B Materials**

Vinyl Composition Tile: Vinyl composition tile must be semi-flexible, 3/32-inch minimum thickness, 12" x 12" tile complying with ASTM F 1066, Type IV. Color and pattern must be as shown.

Primer, Leveling Compound Crack Filler and Adhesives: Primer, leveling compound crack filler and adhesives must be waterproof types as recommended by the tile manufacturer.

Wax: Wax must be water emulsion, self-polishing type containing not less than 16 percent wax solids, wetting agents, and a nonslip agent. The wax must meet UL antislip standards.

Edger Strips: Edger strips must be commercial quality, stainless steel or aluminum.

**99-09661C Construction****99-09661C(1) Preparation**

Before placing adhesives, all surfaces to receive vinyl composition tile must be made free of localized depressions or bumps. Bumps must be ground flat. Holes, depressions, and cracks must be filled with crack filler or leveling compound.

Immediately prior to application of the tile flooring, the surface to be covered must be thoroughly dry, free of paint, oil, grease, mortar, plaster droppings, scaly surfaces, or other irregularities and must be broom clean. Primer, when recommended, must be thoroughly brushed on the surface at the rate recommended by the adhesive manufacturer and must be completely dry before the application of adhesives.

The rooms where tile is to be installed must be maintained at a temperature of at least 70°F for not less than 72 hours before installation, during installation and for 5 days after installation.

**99-09661C(2) Application**

Tile must be laid to a true, straight, smooth and even finished surface in accordance with the manufacturer's instructions. Joints must be tight fitting. Floor covering must be placed before floor mounted fixtures are installed. After tile has been set, the finished surface must be rolled and crossrolled with a roller weighing 100 pounds or more.

Edger strips must be installed at free edges.

Where tile patterns between rooms differ, the pattern break at openings must occur at the centerline of the common wall.

Upon completion of the tile application, all stains, surplus adhesive, dirt and debris resulting from the work must be removed and the floor left broom clean. Tile must be protected from damage at all times during construction. As a last order of work, tile must be washed with soap and warm water, rinsed, and then polished under the tile manufacturer's instructions. Not less than 2 applications of wax must be placed on the tile flooring.

Patching Existing Tiled Floors:

Tile for patching existing floors must closely match the color and pattern of the existing adjacent floor tile, except tile of contrasting color and pattern may be used when authorized by the Engineer.

If the size of existing tile on floors which are to be patched cannot be matched, enough existing tile must be removed to permit the installation of full sized 12" x 12" tiles. The limits of existing tile removal and new tile installation must be authorized by the Engineer.

Replacement of Existing Tile: Replacement of existing tile flooring where ordered by the Engineer is change order work.

**99-09661D Payment**

Not Used

## **99-09680 CARPETING**

### **99-09680A General**

#### **99-09680A(1) Summary**

Scope: This work consists of installing carpeting.

#### **99-09680A(2) Definitions**

Not Used

#### **99-09680A(3) Submittals**

Product Data: Submit manufacturer's descriptive data for carpet, pattern line, carpet cushion and adhesives, and installation instructions. Submit the manufacturer's standard colors for color selection.

Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

Maintenance Data: Include maintenance procedures, recommendations for maintenance materials and equipment, and suggested schedule for cleaning.

Samples: Carpet colors will be selected from the manufacturer's standard color and pattern line by the Engineer. After the color and pattern have been selected, one sample of carpet and carpet cushion at least 24" x 24" in size shall be submitted for approval.

Samples: Samples must include individual samples of each carpet and carpet cushion to be installed. After the color and pattern have been authorized, submit one sample at least 24 by 24 inches of the (1) carpet and (2) carpet cushion.

Maintenance Instructions: Submit the manufacturer's instructions for maintenance of the installed carpet. Include methods and frequency for maintaining optimum condition under anticipated traffic and use conditions.

#### **99-09680A(4) Quality Control and Assurance**

Single Source Responsibility: Materials must be produced by a single manufacturer for each type of carpet.

Installer Qualifications: Flooring contractor to be a specialty contractor normally engaged in this type of work and shall have prior experience in the installation of these types of materials

Reference: Backing Material Identification ASTM D 629 Average Finish Pile Weight ASTM 5848 Finish Pile Thickness ASTM 7241 or ASTM 6859, ASTM 5823. Flammability-Small Scale Ignition Test ASTM D 2859 Flammability- Flooring Radiant Panel ASTM 648 Smoke Density ASTM 662 Indoor Air Quality ASTM D 5116.

#### **99-09680A(5) Warranty**

Special Warranty for Carpet:

Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.

Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.

Failures include, but are not limited to:

1. Excessive Surface Wear: More than 10% loss of pile fiber weight
2. Excessive Static Electricity: More than 3.0 kV per AATCC 134
3. Resiliency Loss of the Backing: More than 10% loss of backing resiliency
4. Delamination
5. Edge Ravel
6. Zippering

Warranty Period: 25 years from date of project completion.

## **99-09680B Materials**

### **99-09680B(1) General**

Carpeting and carpeting materials must be rated by the manufacturer as suitable for heavy pedestrian traffic and as suitable for use under chairs with casters.

### **99-09680B(2) Delivery, Storage, and Handling**

Materials must be delivered to the job site in original factory wrappings and containers, clearly labeled with manufacturer, brand name, quality or grade, fire hazard classification, and lot number.

Materials must be stored in original undamaged packages and containers inside well ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity. Store materials in area of installation for minimum period of 48 hours prior to installation. The maximum amount of moisture evacuation from the floor is 3.0 pounds per 1,000 square feet in 24 hours. The acceptable pH level of the substrate is between 7.0 and 9.0. Contractor is responsible for floor testing.

Maintain minimum 65 degrees F ambient temperature and 65% Relative Humidity for 72 hours prior to, during, and 48 hours after installation.

Do not install carpet until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.

### **99-09680B(3) Carpet**

Carpet must be third generation nylon, continuous filament yarn with a woven polypropylene backing. Yarn must be solution dyed. Carpet construction must be textured loop, 1/8-inch gauge minimum, with pile height between 5/32 to 1/4 inch, and a yarn weight of at least 28 ounces per square yard. Carpet must be permanently anti-static.

Extra Materials: After completion of the work, not less than 2 percent of each type and color of full size carpet units shall be delivered to the Engineer at the jobsite. Accessories shall be furnished to properly complete the installation. Extra materials shall be packaged with protective covering for storage and identified with labels describing contents.

### **99-09680B(4) Carpet Accessories**

Carpet Cushion: Carpet cushion must be closed cell foamed rubber sheet, made from styrene-butadiene rubber, at least 5/32 inch thick, and weighing at least 62 ounces per square yard. Cushion must have a top and bottom facing that will prevent liquid from being absorbed into the cushion.

Adhesives:

Carpet cushion to floor adhesive must be pressure sensitive adhesive per the cushion manufacturer's instructions.

Carpet to carpet cushion adhesive must be a premium quality, multi-purpose carpet adhesive, compatible with the carpet backing and per the carpet cushion manufacturer's instructions.

Primer, Sealant, Leveling Compound and Crack Filler: Primer, sealant, leveling compound and crack filler must be per the carpet cushion manufacturer's instructions.

Seaming Adhesive: Hot-melt seaming adhesive or similar product per the carpet cushion manufacturer's instructions. Use for taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

Edge Strips: Edge strips must be commercial quality stainless steel or aluminum.

## **99-09680C Construction**

### **99-09680C(1) General**

Protect the carpet from heavy traffic or wear for 24 hours after installation.

Furnish protective methods and materials to ensure that carpeting will be without deterioration or damage until Contract acceptance.

### **99-09680C(2) Preparation**

Surfaces to receive carpet must be free of cracks, localized depressions and bumps. Bumps must be ground flat and holes, depressions, and cracks must be filled with leveling compound or crack filler.

Before installing carpet and carpet cushion, the surface must be dry broomed clean and free from paint, oil grease, mortar, plaster droppings, wax, or other materials that will interfere with the adhesives.

New concrete must be cured for at least 30 days and be free from parting or curing compound that interfere with the adhesives. Concrete surfaces must be checked for dusting. Sealer must be applied to dusting concrete surfaces.

Carpet, carpet cushion and adhesives must be stored at a temperature of at least 65 degrees F and a humidity of not more than 65 percent for at least 24 hours before installation. Locations where carpet is to be installed must be maintained between 65 to 90 degrees F for at least 72 hours before and for 5 days following installation.

Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
2. Subfloor finishes comply with requirements specified in Division 3 Section 12-3.01 "Cast-in-Place Concrete" for slabs receiving carpet tile.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

Prepare sub-floor to comply with criteria established in Manufacturer's installation instructions. Use only preparation materials that are acceptable to the Manufacturer.

1. Remove all deleterious substances from substrate(s) that would interfere with or be harmful to the installation.
2. Remove sub-floor ridges and bumps. Fill cracks, joints, holes, and other defects.

Verify that sub-floor is smooth and flat within specified tolerances and ready to receive carpet.

Verify that substrate surface is dust-free and free of substances that would impair bonding of product to the floor.

Verify that concrete surfaces are ready for installation by conducting moisture and pH testing. Results must be within limits recommended by Manufacturer.

There will be no exceptions to the provisions stated in the Manufacturer's installation instructions.

### **99-09680C(3) Installation**

Applying Primer or Sealer: Primer or sealer must be thoroughly brushed on the surface under the adhesive manufacturer's instructions and must be thoroughly dry before application of adhesives.

Installing Cushion:

Install carpet cushion onto a continuous film of adhesive. Apply adhesive under the manufacturer's instructions. Cushion must be installed in the longest length possible with consideration for traffic patterns and seam placement.

When cushion adhesive is tacky, place cushion onto the adhesive and adjust as necessary to ensure there is no gap at seams and full contact is made with adhesive. Air bubbles must be smoothed out to provide a level surface.

Installing Carpet:

Install carpet, including seaming techniques and seaming cement, under the carpet manufacturer's instructions.

Spread the carpet full width on cushion for 24 hours before installation.

Trim seam edges using appropriate seam cutting tools before applying adhesives. Seams must not be cut where cutting tools will penetrate the carpet cushion. Carpet seams must be at right angles to the cushion seams and not directly over the cushion seams.

Spread carpet adhesive uniformly over the cushion under the manufacturer's instructions. After sufficient time, carpet must be firmly pressed into the adhesive using a roller weighing approximately 50 pounds to ensure carpet has full contact with adhesive. Carpet must be rolled in both directions.

Install carpet in wall to wall continuous lengths with widths as wide as possible. True cut edges and treat edges to form non-raveling seams where exposed. Trim excess carpet to the wall using a wall trimmer adjusted to net trim.

Where carpet patterns or floor finish between rooms differ, pattern or material break must occur at the centerline of the common wall, except at door openings the break must occur at the centerline of the closed door.

Install edge strips at free edges.

#### **99-09680C(4) Cleaning**

Debris and unusable scraps must be removed. Carpet must be vacuumed using a commercial machine with face-beater element.

Soiled spots, excessive adhesive or other unsightly material on the carpet must be removed under the carpet manufacturer's instructions. Where spots cannot be removed, replace the carpet. Trim protruding face yarns using sharp scissors.

Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

#### **99-09680C(5) Extra Materials**

After completion of the work, at least 2 percent of each type and color of carpet and cushion, as well as usable scraps, must be delivered to the Engineer at the job site.

#### **99-09680D Payment**

Not Used

#### **99-09900 PAINTING**

##### **99-09900A General**

##### **99-09900A(1) Summary**

Scope: This work consists of preparing surfaces to receive coatings and applying coatings.

The coatings specified in this section are in addition to any factory finishes, shop priming, or surface treatment described.

##### **99-09900A(2) Definitions**

**Detergent Wash:** Removal of dirt and water-soluble chemicals by scrubbing with a solution of detergent and water, and removal of all solution and residues with clean water.

**Hand Cleaning:** Removal of dirt, loose rust, mill scale, excess base material, filler, aluminum oxide, chalking paint, peeling paint, or paint that is not firmly bonded to the surfaces by using hand or powered wire brushes, hand scraping tools, power grinders, or sandpaper and removal of all loose particles and dust prior to coating.

**Mildew Wash:** Removal of mildew by scrubbing with a solution of detergent, hypochlorite-type household bleach, and warm water, and removal of all solution and residues with clean water.

##### **Abrasive Blasting:**

Removal of loosely adhering paint, dirt, rust, mill scale, efflorescence, weak concrete, or laitance, must be by the use of airborne abrasives. Loose particles, dust, and abrasives must be removed by blasting with clean, oil-free air.

Abrasives must be limited to mineral grit, steel grit, or steel shot, and must be graded to produce the surface profile recommended in the manufacturer's data sheet.

**Steam Cleaning:** Removal of oil, grease, dirt, or other foreign matter by using steam generated by commercial steam cleaning equipment, from a solution of water and steam cleaning compounds, and removal of all residues and cleaning compounds with clean water.

**TSP Wash:** Removal of oil, grease, dirt, paint gloss, and other foreign matter by scrubbing with a solution of trisodium phosphate and warm water, and removal of all solution and residues with clean water.

**Water Blasting:** Removal of dirt, loose scale, chalking, or peeling paint by low-pressure water cleaning. Water blasting must be performed under SSPC-SP12 and must produce a surface cleanliness meeting SSPC-SP12-WJ4. Equipment used must have a minimum flow rate of 1.5 gpm. If a detergent solution is used, it must be biodegradable and must be removed from all surfaces with clean water.

### **99-09900A(3) Submittals**

Product Data:

Manufacturer's descriptive data, a materials list, and color samples must be submitted.

Product descriptive data must include product description, manufacturer's instructions for product mixing, thinning, tinting, handling, site environmental requirements, product application, and drying time.

Materials list must include manufacturer's name, trade name, and product numbers for each type coating to be applied.

Samples: Submit color samples. Samples must be manufacturer's color cards, nominally 2 by 3 inches for each color of coating shown. Color samples for stains must be submitted on wood of the same species, color, and texture as the wood to receive the stain.

Certificates of Compliance: Submit certificates of compliance for products required to comply with SSPC standards.

### **99-09900A(4) Quality Control and Assurance**

Not Used

### **99-09900A(5) Site Environmental Requirements**

Coatings must be applied under the environmental constraints specified in the manufacturer's instructions. These conditions must be maintained until the coating has cured and is ready for recoat.

Continuous ventilation must be provided during application of the coatings.

Adequate lighting must be provided while surfaces are being prepared for coatings and during coating applications.

### **99-09900A(6) Maintenance Stock**

Upon completion of coating work, deliver a full one-gallon container of each type and color of finish coat and stain used to the Engineer. Containers must be tightly sealed, have the manufacturer's standard product label, and be labeled with color, texture, and room locations where used.

### **99-09900B Materials**

#### **99-09900B(1) General**

Products for each coating system must be from a single manufacturer and must comply with the Detailed Performance Standards of the Master Painters Institute (MPI). Each product must be shown on the MPI Approved Products List unless otherwise specified.

#### **99-09900B(2) Delivery, Storage, and Handling**

Products must be delivered to the site in sealed, labeled containers and stored in a well-ventilated area at an ambient air temperature of at least 45 degrees F. Container labeling must include manufacturer's

name, type of coating, trade name, color designation, drying time, and instructions for tinting, mixing, and thinning.

### **99-09900C Construction**

#### **99-09900C(1) Inspection**

Coatings must not be applied until surface preparation has been authorized by the Engineer. Notify the Engineer at least 3 business days before application of coatings.

#### **99-09900C(2) Surface Preparation**

Prepare surfaces for coating under the coating manufacturer's instructions unless otherwise specified.

Remove hardware, cover plates, light fixture trim, and similar items before preparing surfaces for coating. Following the application of the finish coating, the removed items must be reset in their original locations.

#### **Wood:**

Lightly sand exterior surfaces no more than 24 hours before applying coatings.

Apply a sealer under the coating manufacturer's instructions to knots, sap, pitch, tar, creosote, and other bleeding substances.

After applying the prime coat, all nail holes, cracks, open joints, dents, scars, and surface irregularities must be filled, hand cleaned, and spot primed to provide smooth surfaces before applying finish coats.

Irregularities in wood surfaces to receive a transparent stain finish must be filled and hand cleaned after the first coat of stain has been applied. The color of the filler must match the color of the stained wood.

Irregularities in wood surfaces to receive a clear finish must be filled and hand cleaned before applying coatings. The color of the filler must match the color of the coated wood.

#### **Galvanized Metal:**

New surfaces must be roughened by hand sanding or light abrasive blasting. Galvanizing must not be removed during cleaning or roughening.

Damaged or corroded areas must be cleaned and given 2 spot applications of a coating that complies with the Detailed Performance Standards of the MPI, and listed on MPI List "Number 18, Primer, Zinc Rich, Organic."

**Steel and Other Ferrous Metals:** Surface must be cleaned under SSPC-SP 1. Surface profile must be as required for the coating system specified.

**Aluminum and Other Non-ferrous Metals:** Surface must be cleaned under SSPC-SP 1.

**Gypsum Board:** Holes, cracks, and other surface imperfections must be filled with joint compound or suitable filler before applying coatings. Taped joints and filled areas must be hand sanded to remove excess joint compound and filler.

**Cement Plaster:** New plaster must be cured at least 14 days before coating. Cracks, holes, and surface imperfections must be filled with patching plaster and hand textured to match adjacent surfaces.

**Concrete and Concrete Masonry Unit:** New material must be cleaned and prepared under SSPC-SP 13. Cracks and voids must be filled with cement mortar patching material. Concrete must be cured until the surface moisture is below the level specified in the coating manufacturer's instructions.

#### **Previously Coated Surfaces:**

Dirt, oil, grease, or other surface contaminants must be removed by water blasting, steam cleaning, or TSP wash. Minor surface imperfections must be filled as specified for new work. Mildew must be removed by mildew wash. Chalking paint must be removed by hand cleaning. The surfaces of existing hard or glossy coatings must be abraded to dull the finish by hand cleaning or light abrasive blasting. Abrasive blasting must not be used on wood or non-ferrous metal surfaces.

Chipped, peeling, blistered, or loose coatings must be removed by hand cleaning, water blasting, or abrasive blasting. Bare areas must be pretreated and primed as specified for new work.

### **99-09900C(3) Application**

Coatings must be applied under the manufacturer's instructions and at the application rates recommended by the manufacturer to achieve the dry film thickness stated in the coating technical data sheet.

Mixing, thinning and tinting must comply with the manufacturer's instructions. After thinning, the coating must comply with the regulatory requirements.

Coatings must be applied only when surfaces are dry and properly prepared.

Cleaning and painting must be scheduled so that dust and other contaminants from the cleaning process do not fall on wet, newly coated surfaces.

Materials required to be coated must have coatings applied to all exposed surfaces, including the tops and bottoms of wood and metal doors, the insides of cabinets, and other surfaces not normally visible from eye level.

#### **Surface Finish Application:**

Each coat must be applied to a uniform finish. Finished surfaces must be free of surface deviations and imperfections such as skips, cloudiness, spotting, holidays, laps, brush marks, runs, sags, curtains, ropiness, improper cutting in, overspray, drips, ridges, waves, and variations in color and texture.

Each application of a multiple application finish system must closely resemble the final color coat, except each application must provide enough contrast in shade to distinguish the separate applications.

#### **Work Required Between Applications:**

Each application of material must be cured under the coating manufacturer's instructions before applying the next coating.

Enamels and clear finishes must be lightly sanded, dusted, and wiped clean between applications.

Stain blocking primer must be spot applied whenever bleeding substances are visible through the previous application of a coating.

**Timing of Applications:** The first application of the coating system must be during the same work shift that the final surface preparation was performed. Additional coats must be applied as soon as the required drying time of the preceding coat, specified in the coating manufacturer's instructions, has been met.

#### **Application Methods:**

Coatings must be applied by brush, roller or spray. Rollers must not leave a stippled texture in the paint film. Extension handles for rollers must not be greater than 6 feet in length.

If spray methods are used, surface deviations and imperfections such as overspray, thickness deviations, lap marks, and orange peel must be considered as evidence the work is unsatisfactory and the Contractor must apply the remainder of the coating by brush or roller, as authorized by the Engineer.

**Back Priming:** The first application of the coating system must be applied to all wood surfaces (face, back, edges, and ends) of wood materials that are not factory coated, immediately upon delivery to the job site. Surfaces of interior finish woodwork that adjoin concrete or masonry must be coated with one application of exterior wood primer before installation.

**Patches in Previously Coated Surfaces:** Where patches are made on surfaces of previously coated walls or ceilings, the entire surface to corners on every side of the patch must be coated with at least 1 application of the finish coat.

Finishing Mechanical and Electrical Components:

Shop primed mechanical and electrical components must be finish coated under the coating system specified for the substrate material. Louvers, grilles, covers, and access panels on mechanical and electrical components must be removed and coated separately.

Interior surfaces of air ducts which are visible through grilles or louvers must be coated with one application of flat black enamel, to the limit of the sight line.

Conduit, piping, and other mechanical and electrical components visible in the finished work must be painted.

Both sides and all surfaces, including edges and back of wood mounting panels for electrical and telephone equipment must be finish coated before installing equipment.

**99-09900C(4) Cleaning**

Upon completion of all operations, the coated surfaces must be thoroughly cleaned of dust, dirt, grease, or other unsightly materials or substances.

Surfaces marred or damaged as a result of your operations must be repaired, to match the condition of the surfaces before the beginning of your operations.

**99-09900C(4) Protection**

Provide protective devices, such as tarps, screens or covers, as necessary to prevent damage to the work and to other property or persons from all cleaning and painting operations.

Paint or paint stains on surfaces not designated to be painted must be removed at your expense and the original surface must be restored.

**99-09900C(5) Coating System**

The surfaces to be coated must be as described. When a coating system is not described for a surface to be finish coated, use the coating system as specified below for the substrate material. The number of applications specified for each coating system specified is a minimum. Additional coats must be applied if necessary to obtain a uniform color, texture, appearance, or required dry film thickness.

**SYSTEM 1 - CEMENT PLASTER AND CONCRETE**

2 Finish Coats:

- Flat: Latex, Exterior, MPI Gloss Level 1, MPI List Number 10
- Semi-Gloss: Latex, Exterior, MPI Gloss Level 5, MPI List Number 11

**SYSTEM 2- CONCRETE MASONRY UNIT**

One Prime Coat:

- Block Filler: Latex, Interior/Exterior MPI List Number 4

2 Finish Coats:

- Flat: Latex, Exterior, MPI Gloss Level 1, MPI List Number 10
- Semi-Gloss: Latex, Exterior, MPI Gloss Level 5, MPI List Number 11

**SYSTEM 3 - GALVANIZED METAL**

2 Finish Coats:

- Flat: Latex, Exterior, MPI Gloss Level 1, MPI List Number 10
- Eggshell-like: Light Industrial coating, Water Based, Exterior, MPI Gloss Level 3, MPI List Number 161
- Semi-Gloss: Light Industrial coating, Water Based, Exterior, MPI Gloss Level 5, MPI List Number 163

Gloss: Light Industrial coating, Water Based, Exterior, MPI Gloss Level 6, MPI List Number 164

#### SYSTEM 4 - GYPSUM BOARD

One Prime Coat:

Primer Sealer: Latex, Interior, MPI List Number 50

2 Finish Coats:

Flat: Latex, Interior, MPI Gloss Level 1, MPI List Number 53

Velvet-like: Latex, Interior, MPI Gloss Level 2, MPI List Number 44

Semi-Gloss: Latex, Interior, MPI Gloss Level 5, MPI List Number 54

Gloss: Latex, Interior, MPI Gloss Level 6, MPI List Number 114

#### SYSTEM 5 - STEEL AND OTHER FERROUS METALS, NON-CORROSIVE ENVIRONMENT

VISIBLE IN FINISHED WORK:

2 Prime Coats:

Shop Primer: Coating meeting the requirements of SSPC-Paint 15

Field Primer: Rust Inhibitive, Water Based, MPI List Number 107

2 Finish Coats:

Flat: Latex, Exterior, MPI Gloss Level 1, MPI List Number 10

Eggshell-like: Light Industrial coating, Water Based, Exterior, MPI Gloss Level 3, MPI List Number 161

Semi-Gloss: Light Industrial coating, Water Based, Exterior, MPI Gloss Level 5, MPI List Number 163

Gloss: Light Industrial coating, Water Based, Exterior, MPI Gloss Level 6, MPI List Number 164

NOT VISIBLE IN FINISHED WORK:

2 Prime Coats:

Shop Primer: Coating meeting the requirements of SSPC-Paint 15

Field Primer: Rust Inhibitive, Water Based, MPI List Number 107

NOT VISIBLE IN FINISHED WORK:

2 Prime Coats:

Primer: Rust Inhibitive, Water Based, MPI List Number 107

#### SYSTEM 6 - WOOD, CLEAR FINISH

2 Finish Coats:

Semi-Gloss: Varnish, Waterborne, Clear, MPI List Number 129

Gloss: Varnish, Waterborne, Clear, MPI List Number 130

Topcoat for Multi-colored coating, Clear, MPI List Number 121

#### SYSTEM 7 - WOOD, PAINTED

1 Prime Coat:

Primer: Latex for Exterior Wood, MPI List Number 6

2 Finish Coats:

Flat: Latex, Exterior, MPI Gloss Level 1, MPI List Number 10  
Low Sheen: Latex, Exterior, MPI Gloss Level 3/4, MPI List Number 15  
Semi-Gloss: Latex, Exterior, MPI Gloss Level 5, MPI List Number 11  
Gloss: Latex, Exterior, MPI Gloss Level 6, MPI List Number 119

#### SYSTEM 8 - WOOD, STAINED

One Prime Coat:

Primer: Latex for Exterior Wood, MPI List Number 6

2 Finish Coats:

Solid Hide: Stain, Exterior, Water based, MPI List Number 16

#### SYSTEM 9 - WOOD, TRANSPARENT STAIN FINISH

2 Finish Coats:

Semi-Transparent: Stain, Exterior, Water based, MPI List Number 156

#### **99-09900C(6) Color Schedule**

Colors must be as shown.

#### **99-09900D Payment**

Not Used

#### **99-09952 VINYL WALLCOVERING**

##### **99-09952A General**

##### **99-09952A(1) Summary**

Scope: This work consists of installing vinyl wall covering.

##### **99-09952A(2) Definitions**

Not Used

##### **99-09952A(3) Submittals**

Product descriptive data, installation instructions, and samples of the vinyl wall covering must be submitted. After the texture and pattern have been authorized, submit 1 sample at least 6 by 6 inches.

##### **99-09952A(4) Quality Control and Assurance**

##### **99-09952B Materials**

Vinyl Wall covering: Vinyl wall covering must be scrubbable, colorfast, stain-resistant vinyl complying with (1) Federal Specification CCC-W-408, Type II and (2) ASTM F 793, Category V, Type 2. Vinyl wall covering must have a total weight of at least 24 ounces per linear yard of material that is 54 inches wide. Color pattern and texture must be as shown.

Paste: Paste must be per the wall covering manufacturer's instructions and must contain mildew inhibitors.

##### **99-09952C Construction**

##### **99-09952C(1) General**

Not Used

##### **99-09952C(2) Preparation**

Surfaces to receive vinyl wall covering must be smooth, clean, and free of irregularities. Cracks, holes, and depressions must be filled and bumps must be removed. Fillers must be compatible with the wall covering and paste to be used.

**99-09952C(3) Installation**

Install vinyl wall covering under the manufacturer's instructions.

The installed wall covering must have tight-fitting butt-joints and must be free of air bubbles, wrinkles, open joints, mismatched sheets, loose edges, or other defects. Locate joints no closer than 4 inches from external corners. Internal corner joints must be butt joined.

Remove paste from the exposed surfaces of installed wall covering. Where paste cannot be removed, replace the wall covering.

**99-09952D Payment**

Not Used

**99-09953 FIBERGLASS REINFORCED PLASTIC PANELS****99-09953A General****99-09953A(1) Summary**

Scope: This work consists of installing FRP panels and trim molding.

**99-09953A(2) Definitions**

**FRP:** fiberglass reinforced plastic.

**99-09953A(3) Submittals**

Submit manufacturer's descriptive data, installation instructions, and finish options.

Installation instructions must show the FRP panel manufacturer's method of installation.

Submit the manufacturer's standard color palette for FRP panels and trim molding. Color will be selected from the manufacturer's standard color palette by the Engineer.

**99-09953A(4) Quality Control and Assurance**

Not Used

**99-09953B Materials**

**FRP Panels:** FRP panels must have a Class A flame-spread rating and minimum nominal thickness of 0.090 inch. FRP panels must be Marlite, Class I/A FRP; Kemlite, Fire-X Glasbord; or equal.

**Trim Molding:** Trim molding must be the FRP manufacturer's standard vinyl molding with nailing flanges and a 3/8-inch deep channel of sufficient width to receive panels and sealant.

**Adhesives and Sealants:** Adhesives and sealants must be per the FRP panel manufacturer's instructions.

**99-09953C Construction****99-09953C(1) General**

Not Used

**99-09953C(2) Installation**

Install the FRP panels and trim molding under the manufacturer's installation instructions.

Nail the trim molding through the flange into solid wood backing. All nails must be concealed by the FRP panels in the completed installation. Trim must be one continuous piece along each wall unless the wall length exceeds the manufacturer's standard trim length. If more than one trim piece is used on one wall, the pieces must be approximately equal length and at least 4 feet in length. All FRP panel edges must be covered by a trim molding.

FRP panels must be one continuous piece along each wall unless the wall length exceeds the manufacturer's standard panel length. If more than one panel piece is used on one wall, the panels must be approximately equal length and at least 4 feet in length.

**99-09953C(3) Clean-up**

Protect adjacent surfaces from adhesive and sealant. Remove excess adhesive and sealant as the installation progresses using a solvent or cleaning agent under the FRP panel manufacturer's instructions.

**99-09953D Payment**

Not Used

**DIVISION 10 SPECIALTIES**

**99-10120 TACKBOARDS**

**99-10120A General**

**99-10120A(1) Summary**

Scope: This work consists of installing tackboards.

**99-10120A(2) Definitions**

Not Used

**99-10120A(3) Submittals**

Manufacturer's descriptive data, color and texture samples, and installation instructions must be submitted. Color and texture will be selected by the Engineer after the award of the contract.

**99-10120A(4) Quality Control and Assurance**

Not Used

**99-10120B Materials**

Tackboards: Tackboards must be textured plastic coating on cotton-fabric, pressure laminated to ¼-inch thick cork underlayment. Cork underlayment must be bonded to a ¼-inch thick hardboard backing. Tackboard dimensions must be as shown.

Border Moldings: Border moldings must be factory applied, extruded clear anodized aluminum trim.

**99-10120C Construction**

Tackboards must be installed rigidly, securely, plumb and true, and under the manufacturer's instructions.

**99-10120D Payment**

Not Used

**99-10125A(4) Quality Control and Assurance**

**99-10162 METAL TOILET PARTITIONS**

**99-10162A General**

**99-10.04A(1) Summary**

Scope: This work consists of installing metal toilet partitions.

**99-10162A(2) System Description**

Metal toilet partitions consists of panels, doors, pilasters and shoes, headrails, urinal screens, fasteners, anchorages, and hardware. Internal reinforcement must be provided at all fasteners, anchorages, hardware, and accessories.

Doors, panels, pilasters, and urinal screens must be stainless steel with a No. 4 satin finish.

**99-10162A(3) Definitions**

Not Used

**99-10162A(4) Submittals**

Manufacturer's descriptive data, catalog cuts, and installation instructions must be submitted.

Submit shop drawings that show the plan layout, door and panel elevations, and all details required for the complete installation and anchorage of the partition system.

### **99-10162A(5) Quality Control and Assurance**

Not Used

### **99-10162B Materials**

Doors and Panels:

Doors and panels must be flush, one-inch thick, formed of two 0.030-inch (22-gage) Type 304 stainless steel sheets over a honeycomb core. Doors and panels must have formed edges sealed with a continuous oval crown locking strip, and must be mitered, welded, and finished at the corners.

Doors must have controlled action hinges, with vertical pintle and ball bearing roller operating on adjustable cams, or moving parts of nylon and stainless steel. Top pivots must be recessed into edges of doors.

Doors must be provided with slide bar latch and a combination coat/hat hook and door stop, except as otherwise specified.

Doors on stalls designated as accessible must be furnished with an automatic door closing device and U-shaped door pulls, located immediately below the latch on the inside and outside of the door.

Pilasters: Pilasters must be 1-1/4 inches thick, of the same construction as the doors and panels, except face sheets must be 0.036-inch (20-gage) minimum thickness, with adjustable, leveling base.

Pilasters: Pilasters must be 1-1/4 inches thick, of the same construction as the doors and panels, except face sheets must be 0.048 inch stainless steel (18-gage), with adjustable, leveling base incorporating two 3/8-inch diameter stud expansion anchors with leveling nuts.

Headrails: Headrails must be anodized aluminum, 1" x 1-1/2" minimum, with exposed ends capped.

Urinal Screens: Urinal screens must be wedge type, wall-mounted, and of the same construction as the doors and panels, except face sheets must be 0.040-inch (20-gage) minimum thickness. All fasteners must be concealed.

Fasteners and Anchorages: Fasteners and anchorages must be stainless steel with vandal resistant heads.

Hardware: Hardware must be highly polished chromium plated, cast alloy, or heavy duty anodized aluminum.

Pilasters Anchors: Pilasters anchors must be integral stud anchor type or internally threaded expansion sleeve type with single cone expander. Self-drilling type anchorage must not be used.

Pilaster Shoes: Pilaster shoes must be one-piece, stainless steel, with concealed hold down clips, and of sufficient height to completely cover the base and anchors.

### **99-10162C Construction**

#### **99-10162C(1) Installation**

Metal toilet partitions must be installed rigidly, securely, plumb, true, and under the manufacturer's instructions. Tops and bottoms of doors must align with tops and bottoms of panels, and all horizontal lines must be level.

Blocking must be provided in walls to receive anchorages.

Panels must be anchored with at least 3 brackets at each wall and pilaster. Two anchors must be used to fasten each pilaster base to the floor.

Doors must not bind during opening and closing. The clearance between the door edges and pilasters must be uniform, equidistant, and must not exceed 3/16 inch. Hinges must be adjusted to hold doors ajar when unlatched. Doors on stalls designated as accessible must return to the closed position.

Drilling, cutting, and fitting of wall and floor finishes must be concealed by the completed installation.

**99-10162C(2) Clean-up**

Toilet partitions must be cleaned, polished, and free of all defects. Chipped, dented, scratched, or otherwise damaged work must be replaced at the Contractor's expense.

**99-10162D Payment**

Not Used

**99-10202 LOUVERS****99-10202A General****99-10202A(1) Summary**

Scope: This work consists of installing louvers.

**99-10202A(2) Definitions**

Not Used

**99-10202A(3) Submittals**

Manufacturer's descriptive data and installation instructions must be submitted.

**99-10202A(4) Quality Control and Assurance**

Not Used

**99-10202B Materials**

Louvers:

Louvers must be factory fabricated units of extruded aluminum alloy not less than 0.081 inch thick (12-gage) or galvanized steel sheet, ASTM A 653, G90 zinc coating, not less than 0.064 inch thick (16-gage) with standard "Z" type blades, and removable bronze 16 x 16 mesh insect screens mounted on the inside of the units.

Gravity units must have blades center pivoted on a 3/8-inch diameter aluminum rod set in stainless steel ball bearings with cadmium plated races. Blades of gravity louvers must be equipped with vinyl bulb seals on the edges.

Louvers must have integral caulking strips and retaining beads.

The finish on louvers must be baked on primer and fluorocarbon polymeric resin.

**99-10202C Construction****99-10202C(1) Installation**

Louvers must be installed under the manufacturer's instructions. The completed louver installation must be weather tight.

**99-10202C(2) Painting**

Not Used

**99-10202D Payment**

Not Used

**99-10350 FLAGPOLE****99-10350A General****99-10350A(1) Summary**

Scope: This work consists of designing and installing a groundset flagpole and foundation.

**99-10350A(2) Definitions**

Not Used

**99-10350A(3) Submittals**

Manufacturer's descriptive data and installation instructions must be submitted.

**99-10350A(4) Quality Control and Assurance**

Not Used

**99-10350B Materials**

Flagpole: Flagpole must be tapered, 35-foot exposed height, 6063-T6 aluminum alloy pole with 6-inch diameter aluminum ball, ball bearing non-fouling truck with aluminum body and 4-inch diameter aluminum sleeves, 9-inch cast aluminum cleat and 5/16-inch polypropylene rope halyards with flag clasps. Aluminum must be clear anodized after fabrication.

Metal Sleeve, Sand, Wedges, and Sealant for Flagpole Foundation: Metal sleeve, sand, wedges, and sealant for flagpole foundation must be as recommended by the flagpole manufacturer. Metal sleeve must be capped and must have a ground spike with support plate.

Concrete: Concrete must comply with section 99-03300 and must contain not less than 590 pounds of cement per cubic yard.

**99-10350C Construction**

The flagpole must be erected plumb and rigid under the manufacturer's instructions. Sand must be consolidated before placing sealant.

**99-10350D Payment**

Not Used

**99-10443 METAL SIGNS****99-10443A General****99-10443A(1) Summary**

Scope: This work consists of installing metal emergency pump shutoff signs.

**99-10443A(2) Definitions**

Not Used

**99-10443A(3) Submittals**

Manufacturer's descriptive data, colors, graphics, and fastening details must be submitted.

**99-10443A(4) Quality Control and Assurance**

Not Used

**99-10443B Materials**

Signs:

Signs must be sheet steel, not less than 0.048 inch thick (18-gage) with a baked-on enamel coating.

Signs must have a white background with contrasting red letters. Red letters must be 2 inches minimum in height.

Fasteners: Fasteners must be as recommended by the sign manufacturer.

**99-10443C Construction**

Sign inscriptions must read as shown.

Each sign must be located as shown and must be fastened in place with a minimum of 6 fasteners for each sign.

**99-10443D Payment**

Not Used

**99-10445 SIGNS****99-10445A General****99-10445A(1) Summary**

Scope: This work consists of installing signs.

### **99-10445A(2) Definitions**

Not Used

### **99-10445A(3) Submittals**

Product Data: Manufacturer's descriptive data for sign materials, graphics, and fastening hardware must be submitted.

Manufacturer's standard color palette for acrylic signs must be submitted. The Engineer will select background and character colors from the standard color palette.

Certificate of Compliance: Submit a certificate of compliance for the sheet aluminum.

### **99-10445A(4) Quality Control and Assurance**

Regulatory Requirements: Identification, directional, informational, exit, and accessibility signs and symbols must comply with the Identification symbols, 24 CA Code of Regs Pt 2 § 1115B.6, and Signs and identification, § 1117B.5.

### **99-10445B Materials**

Sign Colors: The color white must comply with FED-STD-595, Color No. 17886. The color blue must comply with FED-STD-595, Color No. 15090. The color black must comply with FED-STD-595, Color No. 17038.

Signs:

Signs must be scratch resistant, non-static, fire retardant, washable acrylic laminate with a non-glare surface, not less than 1/8-inch thick.

International symbol of accessibility entrance sign may be a pressure sensitive decal.

Symbols: Symbols must be scratch resistant, non-static, fire retardant, washable acrylic. Symbol colors must be in contrast to door color.

Self-Luminous Sign (Exit):

Self-luminous sign must be internally illuminated, self-luminous exit sign powered by permanent integral tritium gas source. Sign must be listed by the California State Fire Marshal.

Sign housing must be ABS molding. Faceplate must be acrylic.

Fastening Hardware and Material: Fastening hardware and material must be as recommended by the sign manufacturer. Fasteners must be noncorrosive.

### **99-10445C Construction**

Signs and symbols must be fastened or secured to clean, finished surfaces under the sign manufacturer's instructions. Signs must be installed at a location and height as shown.

Metal signs must be attached securely with galvanized or cadmium plated fasteners.

### **99-10445D Payment**

Not Used

## **99-10501 WARDROBE LOCKERS**

### **99-10501A General**

#### **99-10501A(1) Summary**

Scope: This work consists of installing wardrobe lockers.

#### **99-10501A(2) Definitions**

Not Used

#### **99-10501A(3) Submittals**

Product Data:

Manufacturer's descriptive data, installation instructions, and standard color palette must be submitted.

Unless otherwise shown, the color will be selected by the Engineer from the standard color palette after the award of the contract.

#### **99-10501A(4) Quality Control and Assurance**

Not Used

#### **99-10501B Materials**

##### **99-10501B(1) General**

Available Manufacturers: Metal lockers must be Art Metal Products; Lyon Metal Products; Republic Storage Systems; or equal.

Lockers:

Lockers must be standard, factory fabricated steel units. Framing must be 0.060 inch thick (16-gage) and face sheets must be 0.024 inch (24-gage), except door face sheets must be 0.060 inch (16-gage).

Lockers must be equipped with the following: hat shelf located approximately 10 inches below the top of the wardrobe locker, side to side coat rod, coat hook, louver vents at top and bottom of door, nonbreakable grip and turn handle, provisions for a padlock, lockbar with 3-point latching contact with door frame and 1 1/2 pair full looped leaf hinges.

The approximate dimensions of the wardrobe lockers must be 15 inches wide, 18 inches deep and 72 inches high.

Closed Base: Closed base must be the manufacturer's standard continuous 6-inch base, fabricated of the same material and designed for use with the lockers provided. Bottoms must be flanged inward for stiffening. Bases must have the same finish as the locker units.

Top: Top must be the manufacturer's standard continuous sloping top with end closure as needed, fabricated of the same material and designed for use with the lockers provided. Tops must have the same finish as the locker units.

##### **99-10501B(2) Shop Fabrication**

Shop Assembly:

Lockers must be fabricated square, rigid, and without warp, with metal faces flat and free of dents or distortion.

Frame joints and seams must be welded. Exposed welds must be ground smooth. Hinge and latch connections must be welded or riveted.

Bolts must be used for assembly and mounting lockers components. Bolt or rivet heads on fronts of locker doors or frame must not be exposed.

Factory Finish: Lockers must be chemically pretreated with degreasing and phosphatizing process. Wardrobe lockers must have a baked enamel finish on all surfaces, exposed and concealed.

##### **99-10501C Construction**

Lockers must be mounted on closed bases at locations shown under the manufacturer's instructions for plumb, level, rigid, and flush installation.

Wardrobe lockers must be bolted together at tops and bottoms. The backs of the end lockers must be bolted to wall anchors with 1/4-inch bolts installed near the tops of the wardrobe lockers as instructed by the locker manufacturer.

Trim, sloping tops, and metal filler panels, if required, must be installed using concealed fasteners to provide flush, hairline joints against adjacent surfaces.

The number of lockers must be as shown.

**99-10501D Payment**

Not Used

**99-10502 WOOD BENCHES****99-10502A General****99-10502A(1) Summary**

Scope: This work consists of installing wood benches.

**99-10502A(2) Definitions**

Not Used

**99-10502A(3) Submittals**

Manufacturer's descriptive data and installation instructions must be submitted.

**99-10502A(4) Quality Control and Assurance**

Not Used

**99-10502B Materials**

Acceptable Manufacturers: Manufacturers must be Penco Products, Inc.; Republic Storage Systems, Inc.; Interior Steel Equipment Co.; or equal.

Seat: Seat must be factory fabricated, laminated seat units of solid birch or other suitable, dense hardwood and manufacturer's standard clear coating. Seat units must be approximately 9½ inches wide by 1¼ inches thick, in lengths as shown. Edges of the seat must be rounded and all surfaces must be smooth and free of splinters which would snag clothing or skin.

Supports Assemblies: Supports assemblies must be standard steel pedestal assemblies with continuously welded top and bottom flange fittings. Flanges must have provisions for fasteners to the floor and securing to the bench. Pedestal diameter must be not less than 1¼ inches. Pedestal color and finish must be selected from the manufacturer's standard colors.

Fasteners: Fasteners for fastening seat units and support assemblies must be the manufacturer's standard fasteners for the purpose intended.

**99-10502C Construction**

Bottom flange fittings of the support assemblies must bear solidly on the floor without rocking and must be fastened rigidly and securely to the floor under the manufacturer's instructions.

**99-10502D Payment**

Not Used

**99-10522 FIRE EXTINGUISHERS AND CABINETS****99-10522A General****99-10522A(1) Summary**

Scope: This work consists of installing fire extinguishers with cabinets or mounting brackets.

**99-10522A(2) References**

Fire Extinguishers must comply with the requirements in California Code of Regulations, Title 19 Division 1, Chapter 3, "Portable Fire Extinguishers."

**99-10522A(3) Definitions**

Not Used

**99-10522A(4) Submittals**

Product Data: Manufacturer's descriptive data and installation instructions must be submitted.

**99-10522A(5) Quality Control and Assurance**

Codes and Standards: Fire extinguishers must be Underwriters Laboratories or Factory Mutual Laboratories approved for the type, rating, and classification of extinguisher specified.

## **99-10522B Materials**

### **99-10522B(1) Manufacturers**

Acceptable Manufacturers: Manufacturers must be J. L. Industries; Larsen's Manufacturing; Potter-Roemer; or equal.

### **99-10522B(2) Components**

Fire Extinguisher: Fire extinguisher must be fully charged, multi-purpose dry chemical type, with charge indicator, hose and nozzle, and attached service record tag. Fire extinguisher must be of the capacity and type rating shown.

Fire Extinguisher Cabinet:

Fire extinguisher cabinet must be factory fabricated, constructed of steel with a clear plastic panel in a steel door frame, and must have a baked enamel finish. Color to be selected by the Engineer from the manufacturer's standard colors.

Fire extinguisher cabinet must be surface mounted, or semi-recessed as shown.

## **99-10522C Construction**

### **99-10522C(1) Installation**

Fire extinguishers must be installed in locations and at mounting heights shown, or if not shown, at a height of 48 inches from the finished floor to the top of the fire extinguisher.

Fire extinguisher mounting brackets and cabinets must be attached to structure, square and plumb, under the manufacturer's instructions.

### **99-10522C(2) Identification**

Cabinet-mounted: Extinguishers in cabinets must be identified with letter spelling "FIRE EXTINGUISHER" applied to the cabinet door. Letter size, styles, and color must be selected by the Engineer from manufacturer's standard arrangements.

### **99-10522C(3) Servicing**

Fire extinguishers must be serviced, charged, and tagged not more than 5 days prior to contract acceptance.

## **99-10522D Payment**

Not Used

## **99-10670 FREE STANDING STEEL SHELVING**

### **99-10670A General**

#### **99-10670A(1) Summary**

Scope: This work consists of installing free standing steel shelving.

#### **99-10670A(2) Definitions**

Not Used

#### **99-10670A(3) Submittals**

Manufacturer's descriptive data, installation instructions, and standard color palette must be submitted. The color will be selected by the Engineer after the award of the contract.

#### **99-10670A(4) Quality Control and Assurance**

Not Used

## **99-10670B Materials**

Shelving: Shelving must be factory fabricated steel shelves and supports capable of supporting loads of 25 pounds per square foot of shelf area. Shelves must not deflect more than 5/16 inch when subjected to the loads specified herein and must show no permanent deflection after removal of such loads. Shelves must be supported and attached by means of clips. Studs or bolts must not be used. Shelves must be

adjustable in vertical increments of 3 inches or less. Shelving must be of the approximate dimensions and number shown and must have a baked enamel finish.

**99-10670C Construction**

Free standing steel shelving must be installed under the manufacturer's instructions.

**99-10670D Payment**

Not Used

**99-10801 TOILET AND SHOWER ACCESSORIES**

**99-10801A General**

**99-10801A(1) Summary**

Scope: This work consists of installing toilet and shower accessories.

**99-10801A(2) Definitions**

Not Used

**99-10801A(3) Submittals**

Product Data: Manufacturer's descriptive data, installation instructions, and details must be submitted.

**99-10801A(4) Quality Control and Assurance**

Regulatory Requirements: Accessibility products must conform to Accessibility to Public Buildings, Public Accommodations, Commercial Buildings and Publicly Funded Housing, 24 CA Code of Regs Pt 2 §§ 1101B-1135B. Grab bars and folding shower seats must comply with Grab bars, tub and shower seats, 24 CA Code of Regs Pt 2 § 1115B.7.

**99-10801B Materials**

Toilet Tissue Dispenser: Toilet tissue dispenser must be dual roll, surface mounted, stainless steel with satin finish, and approximately 6" x 11-1/2" x 6" in size. Dispenser must utilize standard toilet tissue rolls. The top roll must automatically drop into place after the bottom roll is depleted. One dispenser per toilet stall.

Combination Paper Towel Dispenser and Waste Receptacle: Combination paper towel dispenser and waste receptacle must be semi-recessed, stainless steel with satin finish, and approximately 17" x 56" x 7-1/2" in size with 4-inch skirt. The paper towel dispenser must have a capacity of 1,000 single fold paper towels. The waste receptacle must have a capacity of at least 8 gallons. Quantity must be as shown.

Toilet Seat Cover Dispenser: Toilet seat cover dispenser must be surface mounted, stainless steel with satin finish, approximately 15" x 11-1/2" x 2" in size. One dispenser per toilet stall and wheelchair accessible compartment.

Napkin Receptacle: Napkin receptacle must be surface mounted, stainless steel with satin finish, hinged top and bottom, approximately one-gallon capacity container with disposable liner. One receptacle per women's toilet stall.

Waste Receptacle: Waste receptacle must be surface mounted, stainless steel with satin finish, and a capacity of at least 12 gallons. One receptacle per toilet room.

Clothes Hook: Clothes hook must be stainless steel with two prongs. Quantity must be as shown.

Paper Towel Dispenser: Paper towel dispenser must be surface mounted, stainless steel with satin finish, with a capacity of 1,000 single fold paper towels. One dispenser per lavatory.

Liquid Soap Dispenser: Liquid soap dispenser must be surface mounted, heavy-duty plastic dispenser for industrial use with a capacity of at least 24 ounces. Maximum operating force must be 5 pounds. One dispenser per lavatory.

Powdered Soap Dispenser: Powdered soap dispenser must be surface mounted, white enameled sheet steel dispenser with a capacity of at least 30 ounces. The dispenser must have an adjustable soap dispensing mechanism and a lockable top. Maximum operating force must be 5 pounds. One dispenser per lavatory.

Mirror, Wall Hung: Mirror, wall hung must be Number 1 quality, 1/4-inch thick, electrolytically copper plated float or plate glass mirror with nonmoisture-absorbing filler. Mirror must have a heavy gage galvanized steel back and stainless steel frame. The frame must have a satin finish and must be mitered and welded and the corners must be ground smooth. Fasteners must not penetrate surfaces of the frame exposed to view. Mirror must be guaranteed against silver spoilage for not less than 10 years. Quantity must be as shown.

Grab Bar: Grab bar must be stainless steel with satin finish, and concealed, integral mounting flanges.

Combination Soap Dispenser-utility Shelf: Combination soap dispenser-utility shelf must be stainless steel with satin finish. Liquid soap dispenser must have a capacity of at least 100 ounces and an unbreakable refill indicator. Maximum operating force must be 5 pounds. Quantity must be as shown.

Folding Shower Seat: Folding shower seat must be factory fabricated in teakwood or solid phenolic with drainage slots, Type 304 stainless steel tube frame with satin finish, wall bracket, and hinge. Teakwood slats must be factory stained and varnished.

Shower Curtain: Shower curtain must be flame resistant, one-way draw, nylon reinforced, anti-bacterial vinyl fabric. Curtain must be approximately 72 inches x 72 inches.

Shower Curtain Rod: Shower curtain rod must be stainless steel, fixed mounted shower rod with stainless steel mounting plates.

#### **99-10801C Construction**

Toilet and shower accessories must be installed under the manufacturer's instructions. Fasteners for mounting accessories must be concealed and vandal resistant.

Expansion anchors must be used for mounting accessories on masonry or concrete walls.

Toilet and shower accessories must be mounted after painting work is complete.

All toilet room accessories must be mounted plumb, secure, and rigid.

Grab bars, folding shower seats, and their fasteners must be installed to comply with the requirements in Grab bars, tub and shower seats, 24 CA Code of Regs Pt 2 § 1115B.7.

#### **99-10801D Payment**

Not Used

### **DIVISION 11 EQUIPMENT**

Not Used

### **DIVISION 12 FURNISHINGS**

#### **99-12510 HORIZONTAL BLINDS**

##### **99-12510A General**

##### **99-12510A(1) Summary**

Scope: This work consists of installing horizontal blinds.

Horizontal blinds must be standard, factory manufactured assemblies suitable for use on exterior wall windows.

##### **99-12510A(2) Definitions**

Not Used

##### **99-12510A(3) Submittals**

Product Data: Manufacturer's descriptive data, color chips, and installation instructions must be submitted.

**99-12510A(4) Quality Control and Assurance**

Not Used

**99-12510B Materials**

Horizontal Blinds:

Horizontal blinds must be nominal one inch wide, spring tempered virgin aluminum alloy horizontal slats supported by braided polyester ladders. Braided ladders must hold slats at equal spaces, parallel, straight, and must provide tilt control and adequate overlap of slats. The distance between ladders must not exceed 23 inches. Slat tilt must be adjustable by a transparent wand. Blinds must be adjustable to any height using lift cords.

Hardware must be enclosed in a metal head and the opening hardware must be clinched to the head. All metal parts must have a corrosion resistant coating.

**99-12510C Construction**

**99-12510C(1) Installation**

Horizontal blinds must be installed under the manufacturer's instructions.

**99-12510D Payment**

Not Used

**99-12525 SOLAR CONTROL FILM**

**99-12525A General**

**99-12525A(1) Summary**

Scope: This work consists of installing sun control film.

**99-12525A(2) Definitions**

Not Used

**99-12525A(3) Submittals**

Product Data: Manufacturer's descriptive data and installation instructions must be submitted.

**99-12525A(4) Quality Control and Assurance**

Not Used

**99-12525B Materials**

Film:

Film must be commercial quality reflective sun control film of standard manufacture, blue-gray in color, uniform in appearance and with no streaks, banding, pin holes, or thin spots. The reflective metal layer must be protected from ultraviolet degradation.

The film must reduce the effect of heat and sun by not less than the following:

Heat	75 percent
Glare	85 percent
Fade	85 percent

Adhesive: Adhesive must be as recommended by the sun control film manufacturer.

**99-12525C Construction**

Sun control film must be installed on the interior surfaces of the glass openings in the exterior walls shown.

The glass surface must be prepared as recommended by the film manufacturer. Film must be fitted accurately and must be cut neatly and square and must come to within 1/16 inch of seals, stops or glazing compounds. The film must be bonded securely to the glass surface and must be free of bubbles, creases, or marks visible at normal viewing distance.

**99-12525D Payment**

Not Used

**DIVISION 13 SPECIAL CONSTRUCTION**

Not Used

**DIVISION 14 CONVEYING SYSTEMS**

Not Used

**DIVISION 15 MECHANICAL**

**99-15050 MECHANICAL WORK**

**99-15050A General**

**99-15050A(1) Summary**

Scope: This work consists of performing mechanical work.

Mechanical work must include furnishing all labor, materials, equipment and services required for providing heating, ventilating, air conditioning, plumbing and liquefied petroleum gas (LPG) distribution systems.

Earthwork, foundations, sheet metal, painting, electrical, and such other work incidental and necessary to the proper installation and operation of the mechanical work must comply with the requirements described for similar type work elsewhere.

System layouts are generally diagrammatic and location of equipment is approximate. Exact routing of pipes, ducts, etc., and location of equipment is to be governed by structural conditions and obstructions. Equipment requiring maintenance and inspection is to be readily accessible.

Roof penetrations must be flashed and sealed watertight under section 99-07620.

**99-15050A(2) Definitions**

Not Used

**99-15050A(3) Submittals**

Product Data:

A list of materials and equipment to be installed, manufacturer's descriptive data, and such other data as may be requested by the Engineer must be submitted.

Manufacturer's descriptive data must include complete description, performance data, and installation instructions for the materials and equipment described. Control and wiring diagrams, rough-in dimensions for plumbing fixtures, and component layout must be included where applicable.

Manufacturer's descriptive data must be submitted for the following:

- Valves
- Plumbing fixtures
- Water heaters
- Furnace/coil/condensing units
- Radiant heaters
- Exhaust fans/supply fan
- Relief hoods
- Exhaust hoods
- Range hood
- Garbage disposal
- LPG tank/trim
- LPG vaporizer

LPG remote shutdown station  
LPG pneumatic charging station  
Boilers  
Pumps/circulators  
Heat exchanger  
Underground HWS/HWR pre-insulated pipe  
Fire water tank/trim  
Fire water tank foundation  
Fire hydrants  
Fire hose rack assembly  
Fire pump/controller  
Jockey pump/controller

#### **99-15050A(4) Closeout Submittals**

Operation and Maintenance Manuals:

Prior to the completion of the contract, submit 3 identified copies of the operation and maintenance instructions with parts lists for the equipment used. The instructions and parts lists must be indexed and bound in a manual form and must be complete and adequate for the equipment installed. Inadequate or incomplete material must be returned. The Contractor must resubmit adequate and complete manuals at no expense to the State.

Operation and maintenance manuals must be submitted for the following equipment:

Water heaters  
Furnace/coil/condensing units  
LPG vaporizer  
LPG remote shutdown station  
LPG pneumatic charging station  
Boilers  
Fire pump/controller  
Fire water tank

#### **99-15050A(5) Quality Control and Assurance**

Codes and Standards: Mechanical work, including equipment, materials and installation, must comply with the CBC: CMC; CPC; CEC; the California Building Energy Efficiency Standards; and California Code of Regulations, Title 8, Chapter 4, Division of Industrial Safety (DIS).

#### **99-15050A(6) Warranty**

Warranties and Guarantees: Manufacturer's warranties and guarantees for materials or equipment used in the work must be delivered to the Engineer at the job site prior to acceptance of the contract.

#### **99-15050A(7) System Identification**

Piping, Ducts, Valves and Equipment:

Identification of piping, ducts, valves, and equipment must be as shown or as follows:

Above Ground Piping and Ducts: Markers must be provided on lines which are either exposed or concealed in accessible spaces. For piping systems, except drain and vent lines, indicate the fluid conveyed or its abbreviation; either by preprinted markers or stenciled markings, and include arrows to show the direction of flow. Colors must comply with ANSI Standard: A13.1. Locate markers at ends of lines, near major branches and other interruptions including equipment in the line, where lines pass through penetrations in floors, walls or ceilings or otherwise pass into inaccessible spaces, and at 50-foot maximum intervals along exposed portions of the lines. Marking of short branches and repetitive branches for equipment connections is not required.

Valves: Valve tags must be provided on all valves of each piping system, excluding check valves, valves within equipment, faucets, stops and shut-off valves at fixtures and other repetitive terminal units. Provide brass or plastic laminate tags. Prepare and submit a tagged

valve schedule, listing each valve by tag number, location and piping service. Valve schedule must be mounted in a glazed frame at a location authorized by the Engineer.

Equipment: All equipment must be identified with a plastic laminated, engraved nameplate, which bears the unit mark number as indicated on the drawings (for example, AC-4). Provide 1/2-inch high lettering, white on black background. Nameplates must be permanently secured to the unit.

**99-15050B Materials**

Not Used

**99-15050C Construction**

Not Used

**99-15050D Payment**

Not Used

**99-15060 PIPE, FITTINGS, AND VALVES**

**99-15060A General**

**99-15060A(1) Summary**

Scope: This work consists of installing pipes, fittings, and valves. Pipe, fittings, and valves must include such plumbing and piping accessories and appurtenances, not mentioned, that are required for the proper installation and operation of the plumbing and piping systems.

All piping insulation and wrapping material must comply with the requirements under section 99-15250.

The pipe sizes shown are nominal inside diameter. No change in the pipe size shown will be permitted without authorization from the Engineer.

The pipe and fitting classes and material descriptions must be as described. No change in class or description will be permitted without authorization from the Engineer.

**99-15060A(2) Definitions**

Not Used

**99-15060A(3) Submittals**

Test Reports: Certified test reports signed by Contractor and supervisor who performed testing work.

**99-15060A(4) Quality Control and Assurance**

Codes and Standards: Pipe, fittings, and valves must be installed under the CPC, the manufacturer's instructions, and the requirements described herein.

**99-15060B Materials**

**99-15060B(1) Pipe and Fittings (Class and Description)**

A1: Schedule 40 galvanized steel pipe complying with ASTM A 53, with 150 psi galvanized malleable iron banded screwed fittings and galvanized steel couplings. The weight of the zinc coating must be not less than 90 percent of that specified in ASTM A 53.

A2: Schedule 40 galvanized steel pipe complying with ASTM A 53, with black cast iron recessed drainage fittings. For rainwater leaders, neoprene-gasket compression couplings, Smith Blair, Dresser, or equal, must be used. The weight of the zinc coating must be not less than 90 percent of that specified in ASTM A 53.

A3: Schedule 5 steel pipe complying with ASTM A 135 with pressfit fittings and couplings for service as designated.

A4: Pipe and fittings must be UL or FM listed, ferrous (Schedule 20 minimum) or copper (Type L minimum), suitable for the working pressure involved but not less than 175 psi. Pipe and fittings must comply with NFPA 13, "Standard for the Installation of Sprinkler Systems" (1999 edition), requirements.

B1: Schedule 40 black steel pipe complying with ASTM A 53, with screwed fittings suitable for working pressure involved, but not less than 175 psi. Fittings must be listed for fire protection.

B2:

Schedule 40 black steel pipe complying with ASTM A 53, with 150 psi black malleable iron banded screwed fittings and black steel couplings.

Steel pipe coating, where required, must be factory applied plastic. Pipe coating must be X-Tru-Coat (20-mil thickness); 3M Company, Scotchkote 6533 fusion bonded epoxy powder coating (12-mil thickness); or equal.

B3: Schedule 80 black steel pipe complying with ASTM A 53 grade B, pipe 2 inches in diameter and smaller must have 3,000 psi WOG socket welding fittings and couplings or 2,000 psi WOG threaded forged steel, ASTM A 105. Pipe 2½ inches in diameter and larger must be extra strong weight butt welding fittings and couplings.

C1: Hub and plain end cast iron soil pipe with neoprene gaskets complying with Cast Iron Soil Pipe Institute's Standard 301. Pipe, fittings, and gaskets must be of one manufacturer.

C2: Hubless cast iron soil pipe with neoprene gaskets, corrugated stainless steel shields and stainless steel clamps complying with Cast Iron Soil Pipe Institute's Standard 301. Joint materials must be furnished by pipe manufacturer.

D1: Ductile iron push on joint pipe complying with AWWA C151. Fittings must be push on ductile iron complying with AWWA C153. Joints must be rubber gasketed and designed for a working pressure of 350 psi. Pipe and fittings must be supplied with bituminous outer coating and cement lining. Pipe must be listed for fire protection.

H1: Type DWV hard copper tubing complying with ASTM B 306, with DWV drainage fittings, stop type couplings and threaded adapters.

H2: Type K hard copper tubing complying with ASTM B 88, with wrought copper or cast bronze solder joint pressure fittings, stop type couplings and threaded adapters. Solder must be lead-free.

H3: Type L hard copper tubing complying with ASTM B 88, with wrought copper or cast bronze solder joint pressure fittings, stop type couplings and threaded adapters. Solder must be lead-free.

P1: Polyvinyl chloride (PVC) gravity sewer plastic pipe and fittings complying with ASTM D 3034, Standard Dimension Ratio (SDR) 35, with integral bell and bell and spigot rubber gasketed joints or complying with ASTM D2665 with solvent welded fittings. Rubber gaskets must comply with ASTM F 477. Stainless steel clamps with rubber boots must not be used.

P2: Polyvinyl chloride (PVC) plastic pipe and fittings complying with ASTM D 2241, Type I, Grade 1, Standard Dimension Ratio (SDR) 21, rated for 200 psi working pressure at 73°F, NSF approved. Pipe must have bell ends complying with ASTM D 3139 with triple edge rubber sealing ring. For pipe sizes 2-inch diameter and smaller, plain end pipe with solvent welded fittings ASTM D 2241, Type I, Grade 1, Standard Dimension Ratio (SDR) 21, rated for 200 psi may be used.

P3: Polyvinyl chloride (PVC) standard weight pipe and fittings, Schedule 40, complying with ASTM D 1785. Pipe must meet or exceed requirements of NSF Standard No. 14. Pipe must have bell ends complying with ASTM D 2672. For pipe sizes 3 inches and smaller, plain end pipe with solvent welded fittings complying with ASTM D 2241, may be used.

P4: Polyvinyl chloride (PVC) plastic pipe and fittings must comply with AWWA C900, Class 150, Standard Dimension Ratio (SDR) 18. Pipe must have bell end with a solid cross section elastomeric ring complying with ASTM D 1869. Pipe must be listed for fire protection.

P5: Polyethylene plastic gas pipe and fittings complying with ASTM D 1248 and D 2513 with Standard Dimension Ratio (SDR) 11, rated for 60 psi working pressure at 73°F, socket type fittings, joined by heat fusion.

P7: Cross-linked Polyethylene tube (PEX) with oxygen barrier complying with ASTM F876/F877 and International Standard 9001. Tubing must be flexible thermoplastic type rated for 100 psi working pressure at 180°F. Tube must have a 25-year warranty.

Unions (for Steel Pipe): Unions (for steel pipe) must be 250 psi, threaded malleable iron, ground joint, brass to iron seat, galvanized or black to match piping.

Unions (for Copper or Brass Pipe): Unions (for copper or brass pipe) must be 150 psi cast bronze, ground joint, bronze to bronze seat with silver brazing threadless ends or 125 psi cast brass, ground joint, brass to brass seat with threaded ends.

Unions (for Brass Waste and Flush Pipes): Unions (for brass waste and flush pipes) must be slip or flange joint unions with soft rubber or leather gaskets. Unions must be placed on the fixture side of the traps.

Dielectric Waterway: Dielectric waterway must be a premanufactured unit that incorporates an insulated interior lining at least 3 inches in length between the 2 pipes being connected while maintaining metal to metal contact on the exterior surface. Dielectric water way must be listed by IAPMO (International Association of Plumbing and Mechanical Officials).

Insulating Union: Insulating union or flange as applicable must be suitable for the service on which used. Connections must be constructed such that the 2 pipes being connected are completely insulated from each other with no metal to metal contact. Insulating couplings must not be used. Insulating union must be F. H. Maloney; Central Plastics; EPCO; or equal.

Insulating Connection (to Hot Water Tanks): Insulating connection (to hot water tanks) must be 6-inch minimum, flexible copper tubing with dielectric union at each end and designed to withstand a pressure of 150 psi and a temperature of 200°F.

### **99-15060B(2) Valves**

Gate Valve (2½-inch and smaller):

Gate valve (2½-inch and smaller) must be bronze body and trim, removable bonnet and non rising stem, threaded ends, Class 125 and same size as pipe in which installed. Gate valve must be Crane, 438; Nibco, T-113; Jenkins, 310J; or equal.

Gate valve in nonferrous water piping systems may be solder joint type with bronze body and trim. Valve must be Crane, 1330; Nibco, S-111; Jenkins, 452J; or equal.

Ball Valve: Ball valve must be two piece, minimum 400 psi WOG, bronze body and chrome plated or brass ball with full size port, threaded ends. Valve must be Nibco, T-580; Watts, B-6000; Kitz, 58; or equal.

LPG Gas Valve: LPG gas valve must be listed, 250 psi (minimum) WOG bronze ball valve. Valve must be Jenkins, Model 30-A; Crane, Accesso; Watts; or equal.

Check Valve (1½-inch and smaller): Check valve (1½-inch and smaller) must be silent spring loaded type, threaded bronze body, nylon or teflon disc, beryllium or stainless steel helical spring and shaft, Class 125 and same size as pipe in which installed. Check valve must be Nibco/Scott, T-480; CPV, 36; Kitz, 26; or equal.

Check Valve (2-inch and larger): Check valve (2-inch and larger) must be silent wafer type, full faced for installation between 125 psi flanges, iron body with bronze trim, nylon or teflon disc, stainless steel helical spring and shaft, Class 125 and same size as pipe in which installed. Check valve must be APCO, Series 300; CPV, 10D; Metraflex, Series 900; or equal.

Pressure Reducing Valve (PRV): Pressure reducing valve (PRV) must be direct acting, spring loaded diaphragm type control valve with balanced single seat, bronze body, bronze trim and screwed connection. PRV must be completely self-contained and must require no external sending pipes or outside control medium. The outlet pressure of the PRV must be adjustable within a range of 25 psi to 60 psi.

### **99-15060B(3) Faucets and Hydrants**

Hose Faucet: Hose faucet must be compression type, angle pattern, wall flange at exterior locations, box and stop at interior locations, tee handle, 3/4-inch female thread with hose end, chrome finish for locations inside building, rough brass finish for others. Hose faucet must be supplied with an integral or nonremovable threaded outlet vacuum breaker which meets the requirements of the American Society of Sanitary Engineering (ASSE) Standard: 1011. Hose faucet must be Nibco; Chicago; or equal.

Wall Hydrant:

Wall hydrant must be 3/4-inch, exposed, nickel bronze head with bronze casing, and integral vacuum breaker. Operating key must be provided. Wall hydrant must be J. R. Smith, Model 5609 QTSAP; Josam, Model 71070; Wade, Model 8630-89; or equal.

Wall hydrant must be 3/4-inch, non-freeze type, exposed, nickel bronze head with bronze casing, integral antisiphon vacuum breaker, hinged cover, and stainless steel recessed box. Wall hydrant must comply with ANSI/ASME A112.21.3M. Operating key for control valve must be provided. Wall hydrant must be Jay R. Smith Model 5509 QT, Josam Model 71050, Zurn, Model 1310; or equal.

Fire Hose Rack Assembly:

Fire hose rack assembly must include angle valve, hose rack, rack nipple, lined rack hose, hose coupling, fog nozzle and all other appurtenances required for complete operation. Sizes and quantities are as shown. Contractor must verify existing fire hose rack cabinet size prior to submitting and ordering equipment.

Fire Hydrant: Fire hydrant must be dry-barrel type and comply with the requirements of AWWA C502. Fire hydrant must have 6-inch inlet, and have one 4-inch outlet steamer hose and two 2½-inch outlets. Fire hydrant must be Jones, American Darling, Mueller or equal.

### **99-15060B(4) Cleanouts**

Cleanout Through Wall: Cleanout through wall must be cast iron cleanout tee type with polished stainless access plates. Plug must be countersunk brass or bronze with tapered threads. Cleanout must be Wade, No. W-8460; Smith, No. 4532; Zurn, No. 1445; or equal.

Cleanout Through Floor:

Cleanout through floor must have nonslip scoriated nickel bronze access plate and adjustable frame with square pattern top for ceramic tile and round pattern top for other finishes. Where floors are constructed with a membrane, access frame must be provided with membrane clamping flange. Plug must be countersunk brass or bronze with tapered threads. Cleanout must be Wade, 6000 Series; Smith, 4021 Series; Zurn, No. 1400; or equal.

Cleanout through floors in exterior locations must be heavy duty, floating pipe type with cast iron cover. Cleanouts must be Wade, No. 6000 TY; Smith, No. 4231; Zurn, No. 1474; or equal.

Cleanout to Grade: Cleanout to grade must be cast iron ferrule type. Plug must be countersunk brass or bronze with tapered threads. Cleanout to grade must be Wade, No. W-8450; Smith, 4420; Zurn, No 1440; or equal.

### **99-15060B(5) Miscellaneous Items**

Water Hammer Arrestor: Water hammer arrestor must be Type "K" hard-drawn copper body with piston. Arrestor compression chambers must be pneumatically charged. Water hammer arrestors must be tested and certified under the Plumbing and Drainage Institute Standard: PDI-WH201 or ASSE 1010 and sized as shown.

Automatic Trap Primer Valve: Valve must:

1. Be made of cast bronze
2. Include an integral vacuum breaker
3. Have a non-liming internal operating assembly with gasketed bronze cover
4. Have an access panel installed in an accessible location

Provide Zurn Z1022; Precision Plumbing Products Inc. P2-500 for 2 drains or P1-500 for 4 drains; Wade W2400; or equal.

Access Door: Access door must be 16-gage prime coated steel, face mounting square frame, minimum 12" x 12" door with concealed hinge and screwdriver latch.

Compression Stop (Exposed): Compression stop (exposed) must be metal full free waterway, angle type, ground joint union, non-rising stem, molded rubber seat and wheel handle.

Wye Strainer: Wye strainer must be wye pattern, cast iron body and Type 304 stainless steel or monel strainer screen. The strainer screen must have an open area equal to at least 3 times the cross sectional area of the pipe in which it is installed and must be woven wire fabric with 20 mesh or perforated sheet with 0.032-inch maximum diameter holes.

Backflow Preventer: Backflow preventer must be factory assembled with 2 check valves, one pressure differential relief valve, 2 ball valves and 4 test cocks. Backflow preventers must be approved reduced pressure principle devices listed by the County of Los Angeles Department of Health Services, Environmental Health, Cross-Connection and Water Pollution Control Program, 5050 Commerce Drive, Baldwin Park, California 91706, Telephone (626) 430-5290.

Pipe Hanger (for piping supported from overhead): Pipe hanger (for piping supported from overhead) must be Anvil International, Model RH260; Super Strut, C711; or equal.

Pipe Wrapping Tape and Primer:

Pipe wrapping tape must be pressure sensitive polyvinyl chloride or pressure sensitive polyethylene tape having nominal thickness of 20 mils. Wrapping tape must be Polyken, 922; Manville, Trantex VID-20; Scotchrap, 51; or equal.

Pipe wrapping primer must be compatible with the pipe wrapping tape used.

Valve Box: Valve box must be precast high density concrete with polyethylene face and cast iron traffic rated cover marked "WATER," "GAS" or "CO-SS" as applicable. Extension must be provided as required. Valve box must be Christy, B24; Brooks Products Company, Dual-11; BES, C24W; or equal.

Floor Receptor: Floor receptor must be enameled cast iron, 12" x 12" x 8" deep, and must include slotted grate and anti-splash dome strainer. Receptor must be Zurn, J.R. Smith or equal.

Floor Drain: Floor drain must be dura-coated cast iron body and adjustable flashing collar, adjustable nickel bronze 6-inch strainer head with seepage openings and caulk or no-hub outlet. Floor drain must be round or square as shown. Floor drain must be J.R. Smith, 2005/2010; Wade, W-1100; Zurn, Z-415; or equal.

Integral Cleanout Floor Drain:

Floor drain must be integral cleanout type, cast iron body and flashing collar, adjustable nickel bronze 6-inch strainer head and seepage openings and caulk or no-hub outlet. Floor drain shall be round and be J.R. Smith, 2040; Zurn, Z-456; or equal.

Sealants: Provide sealant for pipe installation that is:

1. One component
2. Low modulus
3. Non-acid curing
4. Compliant with ASTM C 920
5. Tack-free in one hour
6. Not subject to sag or flow
7. Capable of 100 percent extension and 50 percent contraction without failure

If other types of sealants are used for other applications, comply with requirements under section 99-07920.

**99-15060C Construction**

**99-15060C(1) Installation of Pipes and Fittings**

Pipe and Fittings: Pipe and fittings must be installed under the following designated uses:

Designated Use	Pipe and Fitting Class
Domestic water (CW and HW) in buildings	H3 or A1
Domestic water underground within 5 feet of the building	A1 or H2
Domestic water underground 5 feet beyond the building	P2, P3, P4, A1 or H2
Fire protection water, underground	B1, D1 or P4
Fire protection water riser	B1, D1 or H3
Fire protection sprinkler piping in building	A1, A3, A4 or B1
Hydronic piping (except in slab)	H2
Sanitary drain piping above ground in building	H1, C1, or C2
Sanitary drain and vent piping underground within 5 feet of the building	C1 or C2
Sanitary vent piping above ground in building	A2, H1, C1, or C2
Sanitary drain pipe, 5 feet beyond the building	C1, C2, or P1
Liquefied petroleum gas (LPG), 125 psi or less, above ground	A1 or B2
LPG, 125 psi or less, underground	P5
LPG, exceeding 125 psi	B3
Equipment drains and relief valve discharge	H3 or A1

**Installing Piping:**

Water piping must be installed generally level, free of traps and bends, and arranged to comply with the building requirements.

Piping installed underground must be tested as described elsewhere in these special provisions before backfilling.

Public use areas, offices, rest rooms, locker rooms, crew rooms, training rooms, storage rooms in office areas, hallway type rooms, and similar type use areas must have concealed piping.

Warehouse rooms, equipment bays, and loft areas must have exposed piping.

Piping must not be run in floor fill, except as shown.

Piping must be installed parallel to walls. All obstructions must be cleared, headroom preserved and openings and passageways kept clear whether shown or not. Piping must not interfere with other work.

Where pipes pass through exterior walls, a clear space around pipe must be provided. Space must be caulked water tight with silicone sealant.

Underground copper pipe must have brazed joints. Underground plastic pipe must be buried with No. 14 solid bare copper wire. Wire ends at pipe ends must be brought up 8 inches and looped around pipe. Tracer Tape must be placed above the sand bedding.

Exposed supply and drain piping in rest rooms must be chrome finished.

Piping for hydronic heating must be installed under section 99-15510.

Gas piping must not be installed under building concrete slabs or structure. An insulating connection and valve must be installed above ground at each building supply.

Gas piping must be pitched to equipment or to low point and provided with an 8-inch minimum dirt leg.

Plastic pipe used for LPG must be below grade outside of building only.

Forty-five degree bends must be used where offsets are required in venting. Vent pipe headers must be sloped to eliminate any water or condensation.

Vent piping must extend a minimum of 8 inches above the roof.

Horizontal sanitary sewer pipe inside buildings must be installed on a uniform grade of not less than ¼ inch per foot unless otherwise shown.

Drainage pipe must be run as straight as possible and must have easy bends with long turns.

Wye fittings and 1/8 or 1/16 bends must be used where possible. Long sweep bends and combination Wye and 1/8 bends may be used only for the connection of branch pipes to fixtures and on vertical runs of pipe.

#### Water pipe near sewers:

Water pipe must not be installed below sewer pipe in the same trench or at any crossing, or below sewer pipe in parallel trenches.

When a water pipe crosses above a sewer pipe, a vertical separation of at least 12 inches between the top of the sewer and the bottom of the water pipe must be maintained.

When water and sewer pipe is installed in the same trench, the water pipe must be on a solid shelf at least 12 inches above the top of the sewer pipe and 12 inches to one side.

#### Pipe Sleeves:

The Contractor must provide sleeves, inserts and openings necessary for the installation of pipe, fittings and valves. Damage to surrounding surfaces must be patched to match existing.

PVC pipe sleeves must be provided where each pipe passes through concrete floors, footings, walls or ceilings. Inside diameter of sleeves must be at least ¾ inch larger than outside diameter of pipe. Sleeves must be installed to provide at least 3/8-inch space all around pipe the full depth of concrete. Space between pipes and pipe sleeves must be caulked watertight.

Pipe Penetrations in Fire Rated Assemblies: Where pipes pass through fire rated wall, floor or ceiling assemblies, the penetration must be protected under section 99-07270.

Cutting Pipe: Pipe must be cut straight and true and the ends must be reamed to the full inside diameter of the pipe after cutting.

Damaged Pipe: Pipe that is cracked, bent or otherwise damaged must be removed from the work.

#### Pipe Joints and Connections:

Joints in threaded steel pipe must be made with teflon tape or a pipe joint compound that is nonhardening and noncorrosive, placed on the pipe and not in the fittings.

The use of thread cement or caulking on threaded joints will not be permitted. Threaded joints must be made tight. Long screw or other packed joints will not be permitted. Any leaky joints must be remade with new material.

Exposed polished or enameled connections to fixtures or equipment must be made with special care, showing no tool marks or threads.

Cleaning and Closing Pipe: The interior of all pipe must be cleaned before installation. All openings must be capped or plugged as soon as the pipe is installed to prevent the entrance of any materials. The caps or plugs must remain in place until their removal is necessary for completion of the installation.

Securing Pipe: Pipe in the buildings must be held in place by iron hangers, supports, pipe rests, anchors, sway braces, guides or other special hangers. Material for hangers and supports must be compatible with the piping or neoprene isolators must be used. Allowances must be made for expansion and contraction. Steel pipe must have hangers or supports every 10 feet. Copper pipe one inch or less in diameter smaller

must have hangers or supports every 6 feet and sizes larger than one inch must have hangers or supports every 10 feet. Plastic pipe must have hangers or supports every 3 feet. Cast iron soil pipe with neoprene gaskets must be supported at each joint. Vertical pipes must be supported with clamps or straps. Horizontal and vertical piping must be securely supported and braced to prevent swaying, sagging or flexing of joints.

**Hangers and Supports:**

Hangers and supports must be selected to withstand all conditions of loading to which the piping and associated equipment may be subjected and within the manufacturer's load ratings. Hangers and supports must be spaced and distributed so as to avoid load concentrations and to minimize the loading effect on the building structure.

Hangers and supports must be sized to fit the outside diameter of pipe or pipe insulation. Hangers must be removable from around pipe and must have provisions for vertical adjustment after erection. Turnbuckles may be used.

Materials for holding pipe in place must be compatible with piping material.

Hanger rods must be provided with locknuts at all threaded connections. Hanger rods must be sized as follows:

Pipe Size	Minimum Hanger Rod Diameter
1/2" to 2"	3/8"
2 1/2" to 3 1/2"	1/2"
4" to 5"	5/8"
6"	3/4"

**Wrapping and Coating Steel Pipe:**

Steel pipe buried in the ground must be wrapped or must be plastic coated as specified herein:

1. Wrapped steel pipe must be thoroughly cleaned and primed as recommended by the tape manufacturer.
2. Tapes must be tightly applied with 1/2 uniform lap, free from wrinkles and voids with authorized wrapping machines and experienced operators to provide not less than 40-mil thickness.
3. Plastic coating on steel pipe must be factory applied. Coating imperfections and damage must be repaired to the satisfaction of the Engineer.
4. Field joints, fittings and valves for wrapped and plastic coated steel pipe must be covered to provide continuous protection by puttying and double wrapping with 20-mil thick tape. Wrapping at joints must extend a minimum of 6 inches over the adjacent pipe covering. Width of tape for wrapping fittings must not exceed 2 inches. Adequate tension must be applied so tape will conform closely to contours of fittings. Putty tape insulation compounds authorized by the Engineer must be used to fill voids and provide a smooth even surface for the application of the tape wrap.

Wrapped or coated pipe, fittings, and field joints must be authorized by the Engineer after assembly. Piping must be placed on temporary blocks to allow for inspection. Deficiencies must be repaired to the satisfaction of the Engineer before backfilling or closing in.

**Thrust Blocks:**

Thrust blocks must be formed by pouring concrete between pipe and trench wall. Thrust blocks must be sized and so placed as to take all thrusts created by maximum internal water pressure.

Plastic pipe underground must be provided with thrust blocks and clamps at changes in direction of piping, connections or branches from mains 2 inches and larger, and all capped connections.

Union: Unions must be installed where shown and at each threaded or soldered connection to equipment and tanks. Unions must be located so piping can be easily disconnected for removal of equipment or tanks. Unions must be omitted at compression stops.

Dielectric Waterway: Dielectric waterway must be provided between metal pipes of different material, and between brass or bronze valves and steel piping.

Insulating Union and Insulating Connection:

Insulating union and insulating connection must be provided where shown and at the following locations:

1. In metallic water, gas and air service connections into each. Insulating connections must be installed on the exterior of the building, above ground and after shut-off valve.
2. In water, gas and air service connections in ground at point where new metallic pipes connect to existing metallic pipes. Install valve box above insulating connection.
3. At points of connections of copper or steel water pipes to steel domestic water heaters and tanks.

Bonding at Insulating Connections: Interior water piping and other interior piping that may be electrically energized and are connected with insulating connections must be bonded under the CEC. Bonding must all be coordinated with electrical work.

Compression Stop: Each fixture, including hose faucets, must be equipped with a compression stop installed on water supply pipes to permit repairs without shutting off water mains. Ball valves may be installed where shown or otherwise authorized by the Engineer.

#### **99-15060C(2) INSTALLATION OF VALVES**

Pressure Reducing Valve: A capped tee connection and strainer must be installed ahead of the pressure reducing valve.

Exterior Valves: Exterior valves located underground must be installed in a valve box marked "Water." Extensions must be provided as required.

#### **99-15060C(3) INSTALLATION OF FAUCETS AND HYDRANTS**

Hose Faucet and Hydrants: Faucets and hydrants must be installed with outlets 18 inches above finished grade.

#### **99-15060C(4) INSTALLATION OF CLEANOUTS**

Cleanouts:

A concrete pad 18 inches long and 4 inches thick must be placed across the full width of trench under cleanout Wye or 1/8 bend. Cast iron soil pipe (C1 or C2) and fittings must be used from Wye to surface. Required clearance around cleanouts must be maintained.

Cleanout risers outside of a building installed in a surface other than concrete must terminate in a cleanout to grade. Cleanout to grade must terminate in a valve box with cover marked "CO-SS". Top of box must be set flush with finished grade. Cleanout plug must be 4 inches below grade and must be located in the box to provide sufficient room for rodding.

Cleanout risers installed in tile and concrete floors, including building aprons and sidewalks, must terminate in a cleanout through floor.

#### **99-15060C(5) INSTALLATION OF MISCELLANEOUS ITEMS**

Water Hammer Arrestor: Water hammer arrestor must be installed so that they are vertical and accessible for replacement. Water hammer arrestor must be installed with access door when in walls or there is no access to ceiling crawl spaces. Access door location must be where shown or as authorized by the Engineer.

LPG Appliance Connection: LPG valve and flexible connector must be provided for gas piping at each appliance. Appropriately rated gas cocks may be used in 1/2-inch LPG pipe. Cock or valve must be within 3 feet of the appliance.

LPG Regulator: LPG regulator must be installed complete with dirt leg, capped test tee, union, insulating union, gas valve and fittings.

Backflow Preventer:

Backflow preventer assembly must include a wye strainer, backflow preventer, fittings and pipe. Assembly components must be the same size as the pipe in which they are installed unless otherwise shown.

Backflow preventer must be installed a minimum of 12 inches above ground and must be the same size as the pipe in which it is installed unless otherwise shown.

Flushing Completed Systems: All completed systems must be flushed and blown out.

Potable Water Piping: Clean and flush domestic water systems with potable supply water. Continue to flush until potable water is maintained throughout entire system.

Drainage and Vent System: Clean and flush with potable supply water until free of all foreign matter.

Chlorination:

The Contractor must flush and chlorinate all domestic water piping and fixtures.

Calcium hypochlorite granules or tablets, if used, must not be applied in the dry form, but must first be dissolved into a solution before application.

The Contractor must take adequate precautions in handling chlorine so as not to endanger workmen or damage materials. All pipes and fittings must be completely filled with water containing a minimum of 50 ppm available chlorine. Each outlet in the system must be opened and water run to waste until a strong chlorine test is obtained. The line must then be closed and the chlorine solution allowed to remain in the system for a minimum of 24 hours so that the line must contain no less than 25 ppm chlorine throughout. After the retention period, the system must be drained, flushed and refilled with fresh water.

## **99-15060C(6) FIELD QUALITY CONTROL**

Testing:

The Contractor must test piping at completion of roughing in, before backfilling, and at other times as directed by the Engineer.

The system must be tested as a single unit, or in sections as authorized by the Engineer. The Contractor must furnish necessary materials, test pumps, instruments and labor and notify the Engineer at least 3 working days in advance of testing. After testing, the Contractor must repair all leaks and retest to determine that leaks have been stopped. Surplus water must be disposed of after testing as directed by the Engineer.

The Contractor must take precautions to prevent joints from drawing while pipes and appurtenances are being tested. The Contractor must repair damage to pipes and appurtenances or to other structures resulting from or caused by tests.

General Tests:

All piping must be tested after assembly and prior to backfill, pipe wrapping, connecting fixtures, wrapping joints and covering the pipe. Systems must show no loss in pressure or visible leaks.

The Contractor must test systems under the following schedule for a period of not less than 4 hours:

Test Schedule		
Piping System	Test Pressure	Test Media
Sanitary sewer and vent	10-foot head	Water
Water	125 psig	Water
LPG	100 psig	Air
Air	125 psig	Air

During testing of water systems, valves must be closed and pipeline filled with water. Provisions must be made for release of air.

Sanitary sewers must be cleared of obstructions before testing for leakage. The pipe must be proved clear of obstructions by pulling an appropriate size inflatable plug through the pipe. The plug must be moved slowly through the pipe with a tag line. The Contractor must remove or repair any obstructions or irregularities.

Sanitary sewer pipes beyond 5 feet perpendicular to the building must be tested for leakage for a period of not less than 4 hours by filling with water to an elevation of 4 feet above average invert of sewer or to top of manholes where less than 4 feet deep. The system must show no visible leaks. The sewer may be tested in sections with testing water progressively passed down the sewer as feasible. Water must be released at a rate that will not create water hammer or surge in plugged sections of sewer.

**Test Procedures:**

**Rough Plumbing (Soil, Waste, and Vent):** Verify piping materials and test upon completion of rough piping installation to ensure watertight system.

**Water Test:** Apply water test to drainage system in its entirety or in sections after rough piping is installed. If applied to the complete system, tightly close each opening in piping, except highest opening, and fill with water to the point of overflow. If the system is tested in sections, tightly plug each opening except the highest opening of the section under test, and fill with water.

1. Do not test a section with less than 10 feet head of water.
2. In testing successive sections, test at least the upper 10 feet of the following section so that each joint or pipe in the building, except the uppermost 10 feet of the system, is subjected to a test with more than a 10 foot head of water.
3. Keep water in system or in the portion under test for at least 15 minutes prior to inspection; the system must be tight at each point.

**Sanitary Systems:** After plumbing fixtures and floor drains are set and traps filled with water, verify drainage system materials and test. Ensure that system is gas tight by a smoke test or peppermint test.

**Water Systems:** When roughing in is completed and before fixtures are set, test hot water return and cold water piping systems at hydrostatic pressure of 150 psi for at least 4 hours to permit inspection of each joint. Where a portion of water piping system is concealed before completion, test portion separately the same as specified for system.

**Exceptions:** Exclude equipment and accessories such as plumbing fixtures or water heaters which may be damaged if subjected to full test pressure.

**Testing Backflow Preventers:**

Backflow preventers installed by the Contractor must be tested at the completion of the supply system installation for proper operation by a certified Backflow Preventer Tester.

The tester must hold a valid certificate as a Backflow Preventer Tester from the county in which the device to be tested is located or, if the county does not have a certification program for Backflow Preventer Testers, the tester must have a certificate from one of the following:

1. The American Water Works Association.
2. A county which has a certification program for Backflow Preventer Testers. The certification under which the tester has been certified must be acceptable to the water purveyor and the local agency having jurisdiction.

Testing for proper operation must comply with the procedures of the county in which the testing is being performed, or, if such procedures are not available in the county, such tests must comply with registration and guidance available from the California Department of Public Health, Division of Drinking Water and Environmental Management, Drinking Water Program, 1616 Capital Avenue, P. O. Box 997377, MS 7400, Sacramento, CA 95899, [www.cdph.ca.gov/programs/Pages/DWP.aspx](http://www.cdph.ca.gov/programs/Pages/DWP.aspx).

The Contractor must notify the Engineer at least 5 days prior to testing backflow preventers. Such tests must be satisfactorily completed after installation of the backflow preventer assemblies and before operation of the systems.

One copy of all test results for each backflow preventer must be furnished to the Engineer.

Full compensation for providing the certified Backflow Preventer Tester and for testing the backflow preventers must be considered as included in the lump sum price paid for building work and no additional compensation will be allowed therefor.

#### **99-15060D Payment**

Not Used

#### **99-15250 MECHANICAL INSULATION**

##### **99-15250A General**

##### **99-15250A(1) Summary**

Scope: This work consists of installing mechanical insulation.

Piping insulation must be installed on all domestic hot and cold water piping, above grade, in non-conditioned spaces.

Piping insulation must be installed on all hydronic supply and return piping, above and below grade.

P-trap, hot water supply pipes and angle valves for lavatories and sinks, except in janitor closets or similar enclosed spaces, must be insulated. There must be no sharp or abrasive surfaces under lavatories or sinks.

Duct insulation must be installed on all rigid ductwork installed in concealed non-conditioned spaces.

Duct liner must be installed in all rectangular ductwork installed in exposed non-conditioned spaces and in exterior locations. Plenum liner must be installed in all plenums in non-conditioned spaces or in walls facing a non-conditioned space.

##### **99-15250A(2) Definitions**

Not Used

##### **99-15250A(3) Submittals**

Test Reports: Certified test reports signed by Contractor and supervisor who performed testing work.

##### **99-15250A(4) Quality Control and Assurance**

Codes and Standards:

Mechanical insulation must comply with California State Energy Commission regulations and, where applicable, must meet ASTM standards.

All materials must bear the label of UL or other approved testing laboratory indicating that the materials proposed for use comply with the required fire hazard ratings.

Pipe safety insulation must comply with section 1115B.2.1.2.2 of the CPC.

### **99-15250B Materials**

All pipe insulation and wrapping material, including adhesives and jackets, located within buildings must be certified to have a composite flame spread rating of not more than 25 and smoke development rating of not more than 450 when tested under ASTM E 84.

Duct insulation and wrapping material, including adhesives and jackets, located within buildings must be certified to have a composite flame spread of not more than 25 and smoke development rating of not more than 50 when tested under ASTM E 84.

Domestic Water and Interior Hydronic Piping Insulation: Piping insulation must be glass fiber molded pipe insulation with factory applied jacket suitable for service temperatures up to 350°F. Covering jacket must have pressure sealing lap adhesive joints. Pipe insulation must have a minimum thermal resistance of R-3. Insulation and jackets must be Owens-Corning, Fiberglass Pipe Insulation with ASJ/SSL All Service Jacket; Manville, Micro-Lok with AP-T All Purpose Jacket; or equal.

Piping Insulation Cement: Insulation cement must be Fenco, All Purpose Cement; Manville, JM375; or equal.

Exterior and In Ground Hydronic Piping Insulation: Piping insulation must be polyurethane foam insulation with a service temperature range of 32°F to 250°F. A 6-mil vapor barrier must be applied over the top off the insulation. The vapor barrier must be installed with an adhesive as recommended by the manufacturer. PVC jacket must be installed on pipe and fittings.

PVC Jacket: PVC jacket must be rated for a service temperature of 175°F. PVC jacket must include covers specifically designed to cover pipe fittings.

Condensate Pipe Insulation: Condensate pipe insulation must be closed cell, elastomeric material in a flexible tubular form. Insulation must have a service temperature range between -40°F and 200°F, a minimum vapor transmission rating of 0.20 perm-inch, and a minimum thermal resistance of R-3.

Pipe Safety Insulation: Pipe safety insulation for P-traps, hot water supply pipes and angle valves must be molded closed cell vinyl or closed cell foam with exterior vinyl surface. Pipe safety insulation must be configured to protect against contact. Pipe safety insulation must be Truebro Inc., Handi Lav-guard; Plumberex Specialty Products, Handy Shield; or equal.

External Duct Insulation: External duct insulation must be 1½ inch thick, one-pound density glass-fiber blanket type. Material and coatings must be fire resistive and must be approved by the State Fire Marshal. External duct insulation must be Fiberglas, Type PF-336; Ultralite, No. 100; Pittsburgh Plate Glass, Superfine; Johns-Manville, Microlite; Silvercote, Silvercel; or equal.

Plenum and Duct Liner: Plenum and duct liner must be one-inch minimum thickness. Material and coatings must be fire resistive and must be approved by the State Fire Marshal. Liner must be Gustin-Bacon, Ultra-Liner duct insulation; Owens-Corning Fiberglas, Type CE; Gustin-Bacon, coated insulation Board No. 90-A; Owens-Corning Fiberglas 1½-pound density coated flexible duct liner; Johns-Manville, MicroBar, or 1½-pound density coated Microlite; Pittsburgh Plate Glass, Superfine 1½-pound density coated interior duct insulation; or equal.

Adhesive: Adhesive must be non-flammable type, water-based, high solids, fast-tacking, pressure-sensitive adhesive recommended by manufacturer for use with insulation, with VOC content not to exceed 50 g/L.

Studs: Studs must be cement-in-place type, pneumatic driven type or percussive welding type, and must have one-inch minimum diameter washers.

Insulation Inserts: Insulation inserts at pipe hangers supports for pipes 2 inches or larger must be calcium silicate, cellular glass, or other acceptable material of the same thickness as the adjacent insulation and not less than 13-pound density.

### **99-15250C Construction**

Insulation materials must be neatly installed with smooth and even surfaces, jackets drawn tight and smoothly cemented down.

Insulation material must not be installed until all pipes or surfaces to be covered are tested for leaks, cleaned and dried, and foreign materials, such as rust, have been removed.

#### Piping Insulation:

Piping insulation must comply with the following, except that unions, unless integral with valves, and flexible connections must not be insulated:

1. Where insulation butts against flanges or is discontinued, insulation must be tapered to pipe to allow for covering jacket to completely seal off end of insulation.  
Insulation must be extended on the valve bodies up to the valve bonnet.  
Extend insulation continuous through pipe hangers and pipe sleeves. At hangers where pipe is supported, provide an insulated protection shield.  
Insulating cement must be applied to fittings, valves, and strainers and troweled smooth to thickness of adjacent covering. Strainer cleanout plugs must remain accessible. Covers fabricated from molded pipe covering may be used in lieu of cement, provided covers are neat and well secured.
2. Jacket flap must be sealed down with factory applied self-sealing lap. Seams must be lapped not less than 1½ inches. Jacket must be secured with aluminum bands installed at 12-inch centers.
3. Exposed outdoor insulation must have an additional 0.016-inch minimum thickness aluminum jacket applied over the completed insulation. The jacket must have a factory applied moisture barrier and must be Childers; Smith; or equal.  
End joints must be lapped with aluminum holding traps located directly over the lap. Additional aluminum holding straps must be placed at 8-inch centers. Jacket at ells and tees must be mitered, or premanufactured fitting jackets must be provided, with additional aluminum holding bands, as required. All joints must be sealed watertight using silicon type, heat resistant sealant.
4. In-ground insulation must have an additional PVC jacket applied over the completed insulation and vapor barrier. PVC jacket must be made watertight with adhesive or sealant as recommended by the PVC jacket manufacturer.

Condensate pipe insulation must be installed on piping before connections are made or the insulation may be slit lengthwise, applied to pipe and sealed with adhesive.

Pipe Safety Insulation: Pipe safety insulation must be installed under the manufacturer's instructions.

#### Duct Insulation:

Ragged edges must be repaired or taped. Coverings must be neatly finished at joints and edges. Each joint must have a 2-inch minimum lap.

Where transitions are made between externally covered ducts and lined ducts, the lined duct must be overlapped 8 inches with external covering.

Insulation must be flush with but not cover control devices, damper controls or access doors.

Before insulation is wrapped around concealed ducts, an adhesive must be spot applied at a maximum of 4-inch centers on each side of the ducts to prevent sagging of the insulation. Insulation must be wrapped entirely around the ducts and must be wired securely in place with No. 16 copper clad wire, metal bands at least ½ inch wide or plastic ties. Supports must be spaced a maximum of 12 inches on center. Metal bands must be installed with the use of a banding machine. Seams in the insulation must be taped.

The finished insulation covering must be even and level and must not contain humps.

#### Plenum and Duct Liner:

Plenums and exposed ducts must be lined with plenum and duct liner. Plenums and ducts must be sized to provide the clear inside dimensions shown after the liner is installed.

The insulation must be applied with coated side exposed to air stream to prevent surface erosion.

The lining must be fastened in place with adhesive and with studs with washers spaced a maximum of 18 inches on center each way.

Applying Adhesive: The adhesive must be liberally applied over entire interior surfaces of ducts or plenums.

Stud Installation:

Studs must be installed as follows:

1. Cement-In-Place Type Studs: Cement-in-place type studs must be cemented in place with adhesives manufactured for this purpose and must be as recommended by the stud manufacturer. Cement-in-place type studs must be used where concrete walls form part of plenum.
2. Percussive Welding Type Studs: Percussive welding type studs must be carefully welded in place with current settings that will not appreciably burn galvanizing on opposite side of the sheet metal.
3. Pneumatic Driven Type Studs: At locations where pneumatic driven type studs are used, hardened steel backup plates or dollies must be used under the sheet metal.

### **99-15250D Payment**

Not Used

### **99-15330 AUTOMATIC FIRE SPRINKLER SYSTEM**

#### **99-15330A General**

#### **99-15330A(1) Summary**

Scope: This work consists of designing and installing an automatic wet pipe type fire sprinkler system for the fire pump house and an automatic dry pipe type fire sprinkler system for the office building and existing inspection building, complete and ready for use. This work also consists of installing an engine-driven fire pump system, designing and installing a fire water tank, designing and installing a fire water tank foundation and installing fire hydrants as shown, complete and ready for use.

The automatic fire sprinkling system must include water flow indicator, check valve, electric alarm bell, valves, sprinkler heads and related appurtenances, valves, piping and fittings.

Design:

The design of the sprinkler system must comply with the code requirements for ordinary hazard occupancies, group 1, and must provide coverage of the building area shown.

#### **99-15330A(2) Definitions**

Not Used

#### **99-15330A(3) Submittals**

Shop Drawings: Complete shop drawings for automatic fire sprinkler system, fire pump system, fire water tank and foundation must be submitted.

State Fire Marshal Approval: Prior to the submittal of the shop drawings, the Contractor must have said drawings stamped "APPROVED" by the State Fire Marshal. Allow 12 weeks for State Fire Marshal review and approval.

#### **99-15330A(4) Quality Control and Assurance**

Codes and Standards: All work must comply with the State Fire Marshal, the National Fire Protection Association (NFPA) Standard No. 13-2013, "Installation of Sprinkler Systems," NFPA Standard No. 20-2013, "Installation of Stationary Pumps for Fire Protection," NFPA Standard No. 22-2013, "Water Tanks for Private Fire Protection," NFPA Standard No. 24-2013, "Installation of Private Fire Service Mains and Their Appurtenances" and the requirements of other regulatory authorities having jurisdiction.

#### **99-15330B Materials**

Fire Pump (Diesel Driven): Fire pump must be a single stage, end suction, horizontal centrifugal pump listed for fire service, and must have the capacity as shown on the plans. The pump casing must be foot

mounted cast iron with bronze fitted construction and packing bearing on a bronze shaft sleeve. Suction and discharge flanges must be standard 125 PSI bolt pattern type. Fire pump must be equipped with coupling guard, stainless steel packing gland, bronze wear rings and base plate drip pan.

Fire pump driver must be a diesel engine. The engine must be mounted on a steel base common with the pump, and must be connected with a flexible type coupling according to the manufacturer's recommendation. After installation, the pump and engine shafts must be aligned according to the coupling manufacturer's recommendation. Fire pump driver must develop sufficient power to drive the pump at the capacity shown on the plans with reserve power. Fuel tank must be sized according to the plans, and must be filled by the Contractor with 50 gallons of diesel fuel.

Fire Pump Controller: The main fire pump controller must be a factory assembled, wired and tested unit and must conform to all of the requirements of the latest edition of the California Electrical Code, Article 695. The controller must be listed or approved by an independent testing laboratory. The controller must bear the label of that testing agency. The controller must be mounted on a steel base common with the fire pump and driver. Fire pump, driver, controller and accessories must be furnished by the pump manufacturer.

Fire Water Tank and Foundation: Fire water tank must be a factory coated, bolted steel water tank, designed in accordance with AWWA D103-97 and NFPA 22, with the capacity and dimensions shown. Fire water tank must be designed for 0.5 feet of freeboard, must have a crowned steel bottom, cast-in-place anchor bolts and a center supported roof with a 1:12 slope. Coatings, hardware and fasteners must be per AWWA D103. Foundation must be designed by tank manufacturer. Tank appurtenances must be as shown.

Automatic Fill Float Valve: Float valve must be bronze with stainless steel float.

Water Flow Indicator: Water flow indicator must be UL or FM listed for fire protection, vane type switch designed for wet pipe systems. Water flow indicator must be designed for minimum flow rate of 10 GPM, and must have an adjustable delay setting of from 0 to 90 seconds. Water flow indicator must be Viking, Model VSR-D; Grinnell, Model F620; Reliable, Model A; or equal.

Check Valve: Check valve must be UL or FM listed, swing type, self draining, iron body with brass trim and rubber clapper with removable cover plate. Check valve must be Viking, Grinnell, Groeniger, or equal.

Alarm Bell: Alarm bell must be UL or FM listed electric bell type, 120 volt AC with a minimum sound rating of 95 decibels at 10 feet. Alarm bell must have a die cast aluminum housing with built-in rubber gasket for dust proof seal for bell striking mechanism. Alarm bell must be Viking, Grinnell, Reliable, or equal.

Pipe and Fittings:

Pipe and fittings must comply with the requirements specified under section 99-15060.

Pipe and fittings for alarm check valve and drain lines must be as recommended by the valve manufacturer.

Pipe Hangers: Pipe hangers must be of types listed as acceptable for specific applications in NFPA No. 13.

Valves:

Valves must be UL or FM listed, outside screw and yoke (OS&Y) rising stem type.

Valves (OS&Y) 2½ inches and larger in size must be Crane, 467; Walworth, 8713F; Nibco Scott, F-607-0; or equal.

Valves (OS&Y) 2 inches and smaller in size must be Crane, 459; Walworth, 873; Nibco Scott, T-104-D; or equal.

Optional; Valves 4 inches and larger may be butterfly type, UL or FM listed, working pressure 175 psi, gear operated, indicator flag, ductile iron body, bronze trim, with provisions for locking. Valve must be provided with mounting block for supervisory switch.

Supervisory Switch: Supervisory switch must be UL or FM listed, for the type of valve supplied, single contact set with tamper resistant cover. Supervisory switch must be suitable for exterior installations.

Sprinkler Head: Sprinkler head must be upright type above ceiling and pendant type below ceiling. Sprinkler head must be brass body, chemical or solder fusing type, with proper temperature rating element. Sprinkler head must be Viking, Grinnell, Reliable, or equal.

Spare Sprinkler Cabinet: Spare sprinkler cabinet must be metal cabinet as recommended by the sprinkler head manufacturer and complying with the NFPA requirements. The cabinet must be painted red.

Fire Department Connection: Fire department connection must be UL or FM listed, horizontal single or double Siamese as required, with 2½-inch inlets, drain cock, caps, chain, and brass nameplate. Inlets must have national standard fire hose coupling screw threads. The fire department connection must be Potter-Roemer, Grinnell, or equal.

Accessories: Drains, test connection, flush connections, pressure gauges, and other accessories must be supplied as required.

Sign: Sign must be sheet steel, not less than 0.030 inch (22-gage) thick, with red letters on a white background and a baked enamel coating.

Heating Cable: Heating cable must be self-regulating and listed for wet locations. Heating cable must be installed in direct contact with pipe, under insulation and jacket. Heating cable capacity must be as shown.

### **99-15330C Construction**

#### **99-15330C(1) Installation**

Sprinkler piping and equipment must be installed under the authorized shop drawings and must be located to avoid interference with the lighting system, access openings, or other piping.

Reductions in pipe size must be made with one piece reduction fittings. Bushings must not be used. Reducers must be installed to connect smaller piping to alarm valve.

Piping:

Fire sprinkler piping must be installed level.

Drain piping and test connections must discharge into the nearest floor drain or to the outside of the building. Discharge piping must not drain across walkways.

Pipe Penetrations in Fire Rated Assemblies: Where pipes pass through fire rated wall, floor or ceiling assemblies, the penetration must be protected under section 99-07270.

Spare Sprinkler Cabinet: The spare sprinkler cabinet must be installed where temperatures will not exceed 100°F at any time. Such location must be authorized by the Engineer. Six spare sprinklers and 2 sprinkler head wrenches must be furnished and placed in the cabinet.

Securing Main Shutoff Valve: A galvanized chain, with a nominal material diameter of at least 7/32 inch, must be provided to lock the main shutoff in the open position. The lock will be Department-furnished.

Signs: Signs and messages must be as required by NFPA No. 13 and the regulatory authorities having jurisdiction. Lettering must be standard-type of the following heights:

Item	Minimum Lettering Height
Nameplate date	1/4"
Drain signs	3/4"
Tamper sign	3/4"

### 99-15330C(2) Field Quality Control

#### Acceptance Tests:

The Contractor must arrange for testing of the automatic fire sprinkler system in the presence of the Engineer and the State Fire Marshal. Three days written notice of said testing must be provided by the Contractor.

The system must be pressure tested for 2 hours at 200 psig. A successful test must have no visible leaks or loss of pressure.

The Contractor must perform such other tests as may be required by the State Fire Marshal.

### 99-15330D Payment

Not Used

### 99-15441 PLUMBING FIXTURES

#### 99-15441A General

##### 99-15441A(1) Summary

This work consists of installing plumbing fixtures and other equipment in buildings.

##### 99-15441A(2) Definitions

**gpf:** Gallons per flush.

**MaP:** Maximum Performance Testing Program, <http://www.map-testing.com>.

##### 99-15441A(3) Submittals

Product Data: Submit for all products. Include the following:

1. Manufacturer's technical information and catalog cuts for each item. Indicate model numbers, water consumption, required options, size, and finish.
2. Fasteners, carriers, supports, and other pertinent information.
3. Explanation of abbreviations, symbols, and codes contained in schedules.
4. NSF 61 certification where required.
5. Maintenance and operating instructions, including spare parts list.

##### 99-15441A(4) Quality Control and Assurance

###### 99-15441A(4)(a) General

The Engineer will inspect all fixtures for proper installation and test for proper operation after all plumbing activities are complete.

###### 99-15441B Materials

###### 99-15441B(1) General

Plumbing fixtures must be white, commercial grade, and of vandal-resistant design. Plumbing fixtures must comply with ASME A 112.19.2 unless otherwise specified.

Plumbing fixtures in contact with potable water must be certified under NSF 61.

Furnish plumbing fixtures with suitable fasteners to complete work. Exposed metal on fixtures, including wall flanges, bolts, nuts, and washers must be polished chrome plated. Exposed metal surfaces on fixture supports must be enameled to match fixtures.

### **99-15441B(2) Water Closets**

Water Closets (WC-1):

Water closets must include the flushometer and appurtenances. Water closets must be 16 to 17-1/2 inches high, low consumption type with no more than 1.6 gpf. Water closets must be floor mounted, vitreous china, siphon jet, elongated bowl, and 1-1/2 inch top spud.

Flushometers must be exposed, brass plated, diaphragm or piston type, with vacuum breaker suitable for use with 1-1/2 inch top spud water closets.

Water Closets (WC-2): Water closets must be high efficiency type with no more than 1.6 gpf. Water closets must be vitreous china, siphon jet, 16 to 17-1/2 inches high, elongated bowl, close-coupled tank, and floor mounted.

Water Closets(WC-2): Water closets must be high efficiency type with no more than 1.6 gpf. Water closets must be vitreous china, siphon jet, elongated bowl, close-coupled tank, and floor mounted.

Water Closet Seats: Water closet seats must be a solid plastic, open front, elongated seat with check hinges.

### **99-15441B(3) Urinals**

Urinals:

Urinals must include the flushometer, wall hangers, and appurtenances. Urinals must be low consumption type with no more than 1.0 gpf. Urinals must be vitreous china, wall hung, washout, 3/4 inch top spud, integral shields, spreader and trap.

Flushometers must be exposed, brass plated, diaphragm or piston type, with vacuum breaker suitable for use with 3/4 inch top spud urinals.

### **99-15441B(4) Lavatories and Sinks**

Lavatories (wall-mounted):

Lavatories must be vitreous china with ledge, grid drain with overflow, and drilled for 4-inch centers. Nominal dimensions must be 20 by 18 inches. Lavatory faucets must be single extra long lever mixing faucet complying with 24 CA Code of Regs Pt 2 § 1115B.4.3. Lavatory must be equipped with temperature controls to limit the hot water supply to 110 degrees F at a flow rate of no more than 0.5 gpm.

Lavatory supports must be concealed type, wall mounted carrier with leveling screws and locking devices. Carriers must be adjustable for type of wall. Include required hardware.

Lavatories (counter-mounted): Lavatories must be self-rimming vitreous china with grid drain with overflow, and drilled for 4-inch centers. Nominal dimensions must be 10 by 18 inches. Lavatory faucets must be single extra long lever mixing faucet complying with 24 CA Code of Regs Pt 2 § 1115B.4.3.

Kitchen Sink :Kitchen sink must be 20 gauge, polished stainless steel, type 304, seamlessly drawn, double bowl, self-rimming with undercoating. Sink must be supplied with stainless steel sink strainers. Nominal sink dimensions must be 33 in x 22 in x 6 in. sink faucet must be single extra long lever mixing faucet, polished chrome plate finish, and complying with 24 CA Code of Regs Pt 2 § 1115B.4.3.

Mop Sinks: Mop sinks must be enameled cast iron, 3-inch trap, vinyl coated rim guard, vacuum breaker faucet with hose, and wall hook. Nominal dimensions must be 28 by 28 inches.

Sinks (Armory and Evidence Rooms):

Sinks must be 20 gauge, polished stainless steel, type 304, seamlessly drawn, single bowl, self-rimming with undercoating. Sink must be supplied with stainless steel sink strainer. Sink must include 3 faucet

holes and one accessory hole to the right (for swing down EEW). Nominal sink dimensions must be 25 in x 22 in x 6 in. Sink faucet must be single extra long lever mixing faucet, polished chrome plate finish, and complying with 24 CA Code of Regs Pt 2 § 1115B.4.3.

### **99-15441B(5) Water Heaters**

Water Heater (EWH):

Water heater must be electric, interlocking non-simultaneous dual elements or single element, glass lined, high density R-16 minimum foam insulation and finished with a steel jacket with enamel finish. Water heaters must be equipped with heat trap fittings, magnesium anodes, cold water drop tube, high temperature energy shut-off device, valved drain and rated for at least 150 psi. Water heaters must be the capacity shown.

Water heaters must comply with the California *Building Energy Efficiency Standards for Residential and Nonresidential Buildings*, 24 CA Code of Regs Pt 6, and the California Energy Commission *Appliance Efficiency Regulations*.

Water heaters must comply with ANSI Z21.10.3.

Water heaters must be equipped with an ASME labeled, tank mounted, pressure and temperature relief valve sized for maximum input.

Water heaters must have a thermal efficiency of at least 95 percent.

Water Heaters, Tankless LPG (TWH-1, TWH-2):

Tankless water heater must be a condensing, wall-mounted unit with integral or remote LCD display panel, On/Off and temperature setting controls, diagnostic and repair indications. The unit must be equipped with safety features including, but not limited to, electronic spark ignition, oxygen depletion sensor, overheating limiter, flame failure safety device and pressure relief valve. The unit must include a concentric, through-the-roof vent termination kit, freeze protection, flush valve kit, condensate collector and neutralizer kit, and wall mounted bracket. The unit must have a minimum energy factor of 0.95. Tankless water heater must be minimum capacity as shown on plans. Tankless water heater must be Rinnai; Noritz; or equal.

Water heaters must comply with the California *Building Energy Efficiency Standards for Residential and Nonresidential Buildings*, 24 CA Code of Regs Pt 6, and the California Energy Commission *Appliance Efficiency Regulations*.

Water heaters must comply with ANSI Z21.10.3 and the ASME Boiler and Pressure Vessel Code.

Water heaters must be equipped with an ASME labeled, tank mounted, pressure and temperature relief valve sized for maximum input.

### **99-15441B(6) Miscellaneous Equipment**

Electric Water Coolers (EWC):

Electric water coolers must be wall mounted, split level, dual height type, wheelchair accessible, with heavy duty galvanized steel frame, one-piece stainless steel top, and stainless steel cabinet. Electric water coolers must have self-closing, front and side mounted pushbar actuators, shielded bubbler, and automatic stream regulator. Electric water coolers must include loose key stop, adjustable thermostat and cast brass p-trap. Compressors must be hermetically sealed, positive start with fan cooled condenser. Electric water coolers must have a 3-wire grounded cord and plug.

Electric water coolers must produce a minimum of 7.6 gallons of 50 degree F water per hour based on an inlet water temperature of 80 degrees F and an ambient room temperature of 90 degrees F.

Garbage Disposal:

Garbage disposal must be ½ hp, and shall have galvanized steel grinding elements, permanently lubricated upper and lower bearings, and an overload protector manual reset.

#### Emergency Eye/Face Wash:

Emergency eye/face wash must be deck mount type, single action swing down lever with eye/face wash head, and must be mounted in the sink accessory hole (Armory and Evidence Rooms). Emergency eye/face wash must include a dust cover, allow water activation and deactivation 30 degrees from the horizontal and be equipped with an 8-1/2 by 11 inch emergency identification sign complying with section 7.4.3 of ANSI Z 358.1.

Emergency eye/face wash must be designated accessible and barrier-free by the manufacturer.

#### Sealant: Sealant must be:

1. One component, low modulus silicone
2. Non-acid curing
3. Designed for plumbing fixture applications
4. Compliant with ASTM C 920
5. Not subject to sag or flow and tack-free in 1 hour
6. Capable of 100 percent extension and 50 percent contraction without failure

#### **99-15441C Construction**

##### **99-15441C(1) General**

Seal fixtures to the wall and floor with sealant bead.

Install wall mounted fixtures on concealed carriers designed to support weight of fixture from the floor. Carriers must be made for the specific fixture to be supported and for the installation conditions.

Furnish fixtures with accessible compression stops.

Wrap hot water supply, trap and tailpiece on lavatories under section 99-15250.

##### **99-15441C(2) Installation**

Install flush valves for fixtures shown as disabled accessible so that the valve handle is on the widest side of the toilet space.

Install water closets under the manufacturer's instructions. Water closets shown as disabled accessible must be installed with disabled accessible flush valve. Install water closet seats.

Install urinals under the manufacturer's instructions. Install mop sink faucets on the wall above the sink-back with the spout outlet 36 inches above the floor.

Install water heaters with seismic restraints, inlet ball valve, insulating connections, and 3/4-inch pressure and temperature relief valve. Install relief valve drain pipe as shown.

##### **99-15441D Payment**

Not Used

#### **99-15443 WHEELCHAIR ACCESSIBLE SHOWER UNIT**

##### **99-15443A General**

##### **99-15443A(1) Summary**

Scope: This work consists of installing a wheelchair accessible shower unit and fittings.

##### **99-15443A(2) Definitions**

Not Used

##### **99-15443A(3) Submittals**

Product Data: Manufacturer's descriptive data, installation instructions, and color palette must be submitted. The color must be selected from the manufacturer's standard product line by the Engineer after approval of the contract.

**99-15443A(4) Quality Control and Assurance**

Codes and Standards: Shower units must comply with the California State Accessibility Standards in the CBC and ANSI Z124.1.2.

**99-15443B Materials**

Shower Stall:

Shower stall must be single unit, single piece construction with dimensions of 60 inches wide, 36 inches deep and no obstruction at the threshold. Shower stall must be fabricated from gel-coated fiberglass or acrylic with a Class I Flame Spread. Shower unit must be reinforced to accommodate the grab bars and seat.

The floor must be slip-resistant, sloping a maximum of ½ inch per foot to a drain located near the rear wall.

Shower unit must be provided with the following fittings and accessories: stainless steel corner grab bar and folding phenolic wheelchair transfer seat, each capable of resisting 250 pounds of lateral, vertical and tensile load, stainless steel soap dish, chromium plated or stainless steel curtain rod, chromium plated steel hand-held shower head with ball joint, chromium plated 60-inch long flexible shower spray hose, chromium plated fixed shower head, chromium plated metal outlet drain with removable strainer, chromium plated single lever control thermostatic mixing valve with control cartridge with no metal to metal wearing surface, a lever operated shower head selector, and vinyl shower curtain with corrosion resistant hooks.

Shower stall units must be Crane; Florestone; or equal.

**99-15443C Construction**

Shower must be installed with the manufacturer's instructions. All joints must be sealed and caulked watertight.

**99-15443D Payment**

Not Used

**99-15485 LIQUEFIED PETROLEUM GAS (LPG) SYSTEM****99-15485A General****99-15485A(1) Summary**

Scope: This work consists of installing a liquefied petroleum gas (LPG) distribution system.

The LPG distribution system must include an LPG storage tank, vaporizer, transfer lines and bulkhead, remote shutdown station, pneumatic charging station and emergency shutoff valves, seismic shutoff valves, first and second stage pressure regulators, pipe, fittings, valves and such other system components necessary for the proper installation and operation of the LPG system.

Permits: The Contractor must obtain the required permits to operate pressure vessels in compliance with the requirements of the State Division of Industrial Safety (DIS), must pay the costs for such permits, and must perform all required tests. Such permits must be posted under glass at the site of the work.

**99-15485A(2) Definitions**

Not Used

**99-15485A(3) Submittals**

Not Used

**99-15485A(4) Quality Control and Assurance**

Codes and Standards: All work performed and materials installed must comply with the requirements in the California Building Standards Code, Title 24, Part 4 and Part 5; the California Code of Regulations, Title 8, Chapter 4, Subchapter I, Article 5; and National Fire Protection Association (NFPA) Standard No. 58-2014.

## **99-15485B Materials**

Tank: Tank must be constructed and stamped for 250 psig working pressure under the ASME Code for "Unfired Pressure Vessels for Petroleum Liquids and Gases." Tank must have certification of testing for 375 psig. Tank must include a rainhood with top opening for relief valve and welded steel supports with provisions for bolting to the concrete foundation. Tank must be painted white.

Vaporizer: Vaporizer must be electric, dry, single core type, capacity as shown. Vaporizer system must include economy operation valve to activate vaporizer upon low tank pressure. Vaporizer must also be explosion proof and include over-pressure relief valve, fusible links for over-temperature protection, concrete pad and all appurtenances required for proper operation.

Tank Valves, Fittings, Regulators and Accessories: Tank valves, fittings, regulators and accessories must be UL listed and labeled. Valves, fittings, regulators and accessories must be as required by the California Codes listed above and must be Rego, Fisher, Rockwell, or equal.

Pipe and Fittings (at the Tank and Underground): Pipe and fittings must comply with section 99-15060.

Warning Signs: Warning signs must be sheet steel, not less than 0.048 inch thick (18-gage) with a baked enamel coating and must have red letters on a white background.

## **99-15485C Construction**

### **99-15485C(1) Installation**

The LPG tank and system components must be installed under NFPA Standard No. 58-2014, the manufacturer's instructions, and the authorized installation drawings.

Foundation:

The tank must be installed on a concrete foundation. The tank installation must include seismic restraint and provisions for expansion and contraction. Neoprene or asphalt impregnated felt anti-corrosion pads must be installed between the saddle and the concrete foundation.

The concrete foundation must be constructed under section 99-03300.

All openings must be capped until ready for field connections. Piping must be supported adequately, with allowance for swing joint movement.

Piping Installation:

Piping must be buried a minimum depth of 36 inches and must be provided with tracer tape.

Tank Finish:

If the tank coating substrate is damaged during installation, the tank must be repaired to its original condition at the expense of the Contractor.

The word "FLAMMABLE" must be painted on each side of the tank. Sign lettering must be standard-type not less than 4 inches in height. The lettering color must be red.

Warning Sign Installation and Application: Four warning signs with the words "NO SMOKING, OPEN FLAMES OR OTHER SOURCE OF IGNITION PERMITTED WITHIN 50 FEET" must be placed at the locations shown. Sign lettering must be standard-type not less than 1½ inches in height. The lettering color must be in sharp contrast to the color of the sign.

### **99-15485C(2) Field Quality Control**

Testing:

After construction, installation and pipe testing, the LPG system must be pressure tested with air or nitrogen. The system must be tested for a minimum time period of 30 minutes at 200 psig. If any leaks are detected during the test, the system must be repaired and retested until no leaks are detected.

After the pressure tests have been completed, the LPG system must be purged 5 times with methanol (methyl alcohol), using one gallon per 1,000 gallons water capacity, to remove moisture from the system.

After testing and purging the system, the tank must be filled to 25 percent of the water capacity of the tank, measured in gallons, with Department-furnished LPG.

An operational test must be performed on the LPG system upon completion of the pressure tests, the purging of the system and the delivery of the Department-furnished LPG fuel. The operational test must consist of operating all LPG equipment for a period of three 24-hour days.

#### **99-15485D Payment**

Not Used

### **99-15500 HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT AND SYSTEMS**

#### **99-15500A General**

##### **99-15500A(1) Summary**

Scope: This work consists of installing and testing heating, ventilating and air conditioning (HVAC) equipment and systems.

The performance rating and electric service of the HVAC equipment must be as shown.

Temperature Controls: Temperature controls including thermostats, relays, timer switches, and other sensor type control devices required for this work must be furnished and installed by the supplier of the heating, ventilating and air conditioning equipment. All temperature control wiring must be installed under section 99-16.

Codes and Standards:

Comply with codes and other requirements specified under section 99-15050.

Equipment and systems must comply with California Energy Commission regulations including the California Building Energy Efficiency Standards and the Appliance Efficiency Regulations and, where applicable, must comply with standards of the Air-Conditioning, Heating, and Refrigeration Institute (AHRI), Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA), and Air Movement and Control Association International (AMCA). Gas-fired equipment must be CSA certified as complying with applicable ANSI standards.

Cooling and refrigeration equipment and components must be certified by AHRI for the performance rating shown, under the AHRI or ARI rating systems. Performance of space heating and hydronic heating equipment and component must be certified by AHRI under the GAMA, I=B=R, ARI, or AHRI rating systems as applicable.

Safety: Equipment must be certified compliant with UL 1995 or with ASHRAE 15, NFPA 90A, and NFPA 90B.

##### **99-15500A(2) Definitions**

Not Used

##### **99-15500A(3) Submittals**

Product Data: Submit product literature and installation instructions for all products including ductwork and accessories. Include energy efficiency ratio (EER) and seasonal energy efficiency ratio (SEER) for cooling equipment, coefficient of performance (COP) for heating equipment, annual fuel utilization efficiency (AFUE) for gas-fired heating equipment, and type and quantity of refrigerant for each cooling unit.

Shop Drawings: For heaters, air conditioners, economizers, fans, dampers, and duct layout on full size sheets, drawn at same scale as the plans or larger scale as needed for clarity, but not less than 1/4 inch scale.

#### **99-15500A(4) Quality Control and Assurance**

Single Source Responsibility: HVAC equipment in each of the following categories must be the products of a single manufacturer:

1. Heating and cooling units
2. Fans and ventilators
3. HVAC controls
4. Ductwork
5. Diffusers, registers, and grilles
6. Dampers
7. Air filters

#### **99-15500B Materials**

##### **99-15500B(1) Heating and Cooling Units**

Furnace:

Furnace must be gas fired, sealed combustion system, high efficiency, listed condensing furnace. Furnace must be CSA certified for LPG, must be equipped with electronically controlled blower and hot surface ignition. Furnace cabinet must have an enamel finish and the primary and secondary heat exchangers must be corrosion resistant construction. Blower must be vibration-isolated.

Furnace must be listed for use of plastic combustion and vent pipe from the unit to the outside of the building. Combustion air and vent pipe must extend through a single concentric terminal assembly supplied by the furnace manufacturer. Dual pipe penetrations must not be allowed.

The fan and fan motor must provide the specified air circulation, with filters, against external static pressure as shown.

Furnace must have multi-speed fan motor with thermal overload protection and must be factory wired for a single power connection, including provisions for optional air conditioning, and low voltage control circuit with a terminal board. Furnace must have auxiliary contacts to de-energize system when smoke detectors indicate the presence of smoke.

Split System Air Conditioner:

Split system air conditioner must include a cased evaporator coil and a remote outdoor condensing unit. Indoor evaporator coil must be a factory assembled unit by the forced air furnace equipment manufacturer. Furnace and cased coil unit must be designed to mate with each other. Unit must be provided with a refrigerant metering device and corrosion-resistant condensate drain pan with drain connections. The wetted coil air friction must not exceed 0.3-inch water column. The cased coil unit must have the same finish as the furnace.

Furnace and related components must comply with requirements under "Furnace" in this section.

Refrigerant lines and condensate drain piping must be as specified elsewhere in these special provisions and as shown. Refrigerant lines must be long-line type, and must be sized to restrict cooling capacity loss to 1 percent based upon manufacturer's guidelines. The required length of the refrigerant lines must be determined by you. Refrigerant line sizing must be submitted with the A/C equipment for approval.

Outdoor condensing unit must be same manufacturer as indoor unit; air cooled, factory assembled, charged and tested, and wired for single point power and control connections. Unit must be enclosed in a weatherproof acoustically lined cabinet with access panels and a baked-on enamel finish. The compressor must be provided with quick start components, pressure relief valve, high and low pressure switches, liquid-line filter-dryer, crankcase heater, short cycling protection, and service valves.

High Intensity Infrared Radiant Heater:

High intensity infrared radiant heater must be electric, infra-red type. All components must be factory assembled. Radiant heater must be provided with an aluminum or steel rectangular reflector, junction box secured to the unit and mounting brackets.

### **99-15500B(2) Fans and Ventilators**

Exhaust Fan (Ceiling Mounted): Exhaust fan must be ceiling mounted, centrifugal type, AMCA certified and must be equipped with grille, backdraft damper and minimum 0.033-inch thick (20 gauge) galvanized steel housing with acoustical insulation. Exhaust fan motor must have permanently lubricated sealed bearings, integral thermal overload protection and disconnect plug, mounted on vibration isolators. Ceiling exhaust fan must be Loren Cook Company, Greenheck Fan Corp., ACME, or equal.

Exhaust Fan (Wall Mounted): Exhaust fan must be wall mounted, AMCA certified and must be equipped with grille, metal housing, backdraft damper, centrifugal fan wheel and bird screen. Fan motor must have permanently lubricated sealed bearings. Fan motor and fan assembly must be isolated from base with rubber vibration isolators. Fan must be completely weatherproof and must have a disconnect means under the hood and fan motor must have integral thermal overload protection. Wall exhaust fan must be Loren Cook Company, Greenheck Fan Corp., ACME, or equal.

Combination Heat/Vent/Light: Combination heat/vent/light must be ceiling mounted, recessed type unit with metal housing, grille and backdraft damper. Ducting size must be as required by the manufacturer. Combination heat/vent/light must be Broan, No. QTX110HFLT; Panasonic, FV-11VHL2; or equal.

Roof Ventilator: Roof ventilator must be stationary, gravity type and rectangular. Roof curb must be supplied by the ventilator manufacturer.

### **99-15500B(3) HVAC Controls**

Radiant Heater Thermostat: Radiant heater thermostat must be line voltage type, single set point range internally adjustable from 40°F to 80°F, and provided with a blank cover.

Thermostat (Office Only): Thermostat must be 24-volt, 7-day programmable, electronic heating/cooling thermostat, with the ability to program the fan-on mode during normal working hours, and fan-off mode during unoccupied periods. Thermostat must be provided with sub-base selector switches for "AUTO-HEAT-OFF-COOL" and fan "AUTO-ON". Thermostat must be auto-changeover type, and have full temperature range setback capacity. Thermostat must be Robertshaw; Honeywell, or equal.

### **99-15500B(4) Auxiliary HVAC Components**

Unless specified herein, all components must be sized and have the characteristics as shown.

Rigid Ductwork: Rigid ductwork must be galvanized steel sheet metal complying with ANSI/SMACNA 006, "HVAC Duct Construction Standards—Metal and Flexible." Galvanized steel must be cleaned by washing with mineral spirit solvent sufficient to remove any oil, grease or other materials foreign to the galvanized coating.

Spiral Duct: Spiral duct must be prefabricated type.

Duct Supports: Duct supports must be hot-dip galvanized steel.

Flexible Ductwork: Flexible ductwork must be UL 181, Class 1 air duct rated and must meet the requirements of NFPA 90A. Duct must have steel helix wire, flexible insulation, minimum thermal resistance of R-8, and flame resistant vapor barrier. Inner and outer surfaces must be non-metallic. Outer surface must be copolymer or mylar, factory applied.

Flexible Connection: Flexible connection must be prefabricated type and must be commercial quality flexible glass fabric coated on both sides with neoprene or hypalon.

Ceiling Diffuser (for Gypsum Board Ceilings): Ceiling diffuser for gypsum board ceilings must be rectangular or square type. Diffuser must be steel with oven baked-on enamel bone white dull finish or extruded aluminum, equipped with a removable core and a standard flanged frame with sponge rubber or felt gasket. Diffuser must have individually adjustable curved blades, counter-sunk screw holes, must be surface mounted, with face velocity less than 600 feet per minute; Titus, 250; Hart and Cooley; or equal.

Return Register (for Gypsum Board Ceilings): Return register for gypsum board ceilings must be rectangular or square, and must be steel with oven baked-on enamel bone white dull finish or extruded aluminum, fixed bar type, die formed louvers set at 45 degrees, ½-inch spacing maximum, surface mounted; Titus; AirMate; or equal.

Balance Damper: Balance damper must be butterfly type, 16-gage (minimum) galvanized steel blade, end bearings with steel shaft and locking and indicator operator.

Air Filter (for Truck Inspection Facilities): Air filter for truck inspection facilities must be throwaway type, 2-inch minimum thickness, must be approved for Class 2 use, must have an average efficiency rating of between 30 and 35 percent as determined when tested under ASHRAE Test Standard 52, and must be mounted in 16-gage galvanized steel holding frames.

Vents and Flues (for Heaters): Vents and flues for heaters must be approved Type B or approved plastic vents for condensing furnaces.

Refrigerant and Condensate Drain Piping: Refrigerant piping must be rigid, Type L copper tubing with brazed solder fittings. The suction line must be insulated, with vapor barrier and must be weatherproofed for exterior installation. Factory sealed tubing must not be used. Condensate drain piping must be schedule 40 PVC.

### **99-15500C Construction**

#### **99-15500C(1) Installation**

Heaters:

Furnaces must be installed in such a manner as to insure adequate furnace clearance and separation of combustion air and circulating air. Appliances must be connected to a rigidly mounted gas pipe supply system by a CSA approved flex connector and gas valve.

Ventilators:

Exhaust ducts connected to exhaust fans must be routed as shown and must terminate in an exhaust plenum and roof ventilator. Duct sizes must be as shown or as recommended by the manufacturer, whichever is larger.

Ventilators must be curb mounted.

Condensate Drains: Air conditioning units must be provided with condensate drain trap and piping. Air gap must be installed where required by code. Interior condensate drain piping must be insulated with foam insulation.

Mounting Heights: Thermostats must be installed as shown and consistent with accessibility requirements.

Temperature Controls:

Install thermostats on interior walls. If installation on an exterior wall is unavoidable, each thermostat installed on an exterior wall must be insulated from the outside wall, and must be provided with an aluminum radiation shield above the thermostat.

Air Outlets: dampers must be furnished and installed for all diffusers. Blocking must be provided on all sides of air outlets between ceiling or wall joists. Collars must be supplied for all outlets and must be taped and sealed in place.

Vents and Flues: Vents and flues must be securely fastened to the building construction, must be provided with a collar at all ceiling penetrations and must terminate with a weather cap fabricated of the same material.

Ducts and Vents:

Ductwork within the building must be installed to clear lighting fixtures, doors, windows and other obstructions. Ductwork must preserve head room and must keep openings and passageways clear whether shown on plans or not.

Ductwork must be installed and braced according to the latest edition of the SMACNA "HVAC Duct Construction Standards—Metal and Flexible."

Slopes in sides at transitions must be approximately one to five. The ductwork system must not contain abrupt changes or offsets of any kind unless otherwise shown.

Where ducts pass through walls, floors or ceilings, galvanized sheet metal or steel angle collars must be installed around the ducts.

Duct sections must be connected by beaded sleeve-type couplings using joint sealer as recommended by the duct manufacturer. Duct sections must be mechanically fastened with pop rivets or sheet metal screws and sealed with mastic or insulated, reinforced silver tape.

Flexible connections must be provided at both inlet and outlet of fan coil and ventilating units.

Sheet metal plenums must be adequately braced and supported from the floor or structure with structural steel angles to prevent sagging, flexing and vibration.

All standing seams and transverse joints of supply, return and exhaust ducts and seams around plenums, fan and coil housings must be sealed with sealant and taped.

### **99-15500C(2) Field Quality Control**

#### **Pre-test Requirements:**

Before starting or operating systems, equipment must be cleaned and checked for proper installation, lubrication and servicing.

In each system, at least one air path, from fan to final outlet, must have all balance dampers open. The final air quantities must be achieved by adjusting the volume dampers or the fan RPM.

Final adjustments and balancing of the systems must be performed in such a manner that the systems will operate as specified and as shown.

The Contractor must replace or revise any equipment, systems or work found deficient during tests.

All automatic operating devices which are pertinent to the adjustment of the aforementioned air systems must be set and adjusted to deliver the required quantities of air and at temperatures specified by the Engineer. All control work must be done in collaboration with the control manufacturer's representative.

#### **Project Completion Tests:**

The Engineer must be notified at least 3 working days in advance of starting project completion tests.

The project completion tests must consist of the following:

1. **Air Systems:** All air systems must be tested and balanced to the conditions set forth on the plans and in these special provisions. This work must be performed by an Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB) certified contractor. The air systems include, but are not necessarily limited to, the following:

- a. Supply air systems
- b. Return air systems
- c. Exhaust air systems

2. **Operational Data:** The tests must include operation of the heating, cooling, and ventilating systems for not less than two 8-hour days, each system must operate at not less than 90 percent of their full specified capacities.

The required data must be accurately measured. The data must be measured during one operational cycle in the presence of the Engineer and must be submitted for authorization.

The following data must be measured and tabulated:

- a. Ambient temperatures and conditions, °F

- b. Supply and return air quantities, CFM, each room
- c. Thermostat set point, °F
- d. Air temperatures at room center, °F
- e. Fan motor amperages and voltages
- f. System static pressures, inches of water column

Comply with additional requirements under section 99-15599.

**99-15500D Payment**

Not Used

**99-15510 HYDRONIC HEATING SYSTEM**

**99-15510A General**

**99-15510A(1) Summary**

Scope: This work consists of installing, connecting to existing and testing a hydronic heating system.

Piping for hydronic heating must comply with section 99-15060.

Thermostats, relays, time switches, and other sensor type control devices required for this work must be installed by the supplier of the heating, ventilating and air conditioning equipment. All temperature control wiring must be installed under section 99-16.

**99-15510A(2) Definitions**

Not Used

**99-15510A(3) Submittals**

Product Data: Underground, pre-insulated pipe, fittings and appurtenances.

Shop Drawings: System layout of underground, pre-insulated piping, fittings and all appurtenances required for complete installation. Anchors, thrust blocks and components for thermal expansion, per the manufacturer's recommendations, must be shown.

**99-15510A(4) Quality Control and Assurance**

Codes and Standards: Equipment and systems must comply with California State Energy Commission Regulations and, where applicable, must be Air-Conditioning, Heating, and Refrigeration Institute (AHRI), CSA International, Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA), and Air Movement and Control Association (AMCA) approved for performance ratings and application shown.

**99-15510B Materials**

Pumps:

Pumps must be close coupled type with non-overloading characteristics. Pumps must not overload the motor above its horsepower rating under any operating conditions with the ratings based on continuous operation. Motor sizes shown are estimated minimum requirements and larger motors must be furnished if necessary to meet non-overloading requirements. Motors must have built-in overcurrent protection.

Pump material must be compatible with the working fluid, and must be sized to meet the operating requirements specified.

Pumps must not be connected to the piping before the piping is thoroughly flushed and cleaned of dirt and grit. After the connections have been made, the system must be filled before starting the pumps. Pumps must not be run dry under any circumstances.

Piping must be supported from the building structure to prevent strain on the pump casings. A final check for alignment of the piping connections must be made after the pump has been secured.

Pumps must be Grundfos, Bell and Gossett, or equal. Pumps must be designed especially for these type of installations. Each pump must have a cast iron case, bronze impeller, mechanical seal, flexible coupling and flanged connections to permit easy removal of the complete unit from the piping system.

**Chemical Feeder:** Chemical feeder must be bypass feeder, pot type with one-gallon minimum capacity. Feeder must be provided with union and ball valve on both the supply and return lines, configured as recommended by the manufacturer.

**Heat Exchanger:** Heat exchanger must be counterflow, plate type with channel, cover plates and connection fittings constructed of Type 316 stainless steel. The heat exchanger must be rated for a working pressure 80 psi and rated for a temperature of at least 300°F.

**Expansion Tank:** Expansion tank must be of welded steel construction and must be ASME inspected and stamped for 125 psi working pressure. The tank must be equipped with drain valve, air charging valve, and gauge glass. Expansion tank must have the capacity shown.

**Gauge Glass:** Gauge glass must be ½ inch in size and of adequate length to indicate the entire contents of the tank. The gauge must be an automatic type with drain cock and must be valved top and bottom to allow changing the glass without draining the tank.

**Air Separator:** Air separator must be furnished and installed as shown and must be rated for gallons per minute. Air separator must be constructed for 125 psi working pressure and comply with ASME boiler and pressure vessel code. Air separator must be Amtrol, Bell & Gossett, or equal.

**Flow Meter:**

Flow meter must be in-line, direct reading, see-through type, rated for 180°F temperature and 125 psi working pressure with accuracy to within 2 percent of full scale reading.

Flow meter on pump discharge must have a maximum scale range of 50 gallons per minute (GPM).

Flow meter must be Blue-White Industries, Hedland Products, or equal.

**Tempering Valve:** Tempering valve must be self-actuated, rated at 125 psi working pressure at 200°F with wrench operated adjustable temperature range set for an outlet temperature as shown, rough bronze construction and bronze trim with union angle strainer and check stops on inlet. Pressure drop across the valve must be a maximum of 1.5 psi at 20 GPM. Valve must be both temperature and pressure compensating.

**Thermometer:**

Thermometer must be liquid dial type, minimum 5-inch diameter, with 2°F graduations and a temperature range that includes 30°F and 175°F.

Accuracy must be within ± one percent.

Thermometer must be provided with extension neck or stem such that the thermometer face is above the surface of insulation or other materials.

Liquid thermometer must be designed for and be installed in a thermowell which projects into the flow stream and is completely immersed in liquid. The thermowell must prevent system fluid loss when the thermometer is removed. Pipe size must be increased at the thermowell where necessary to allow for full flow without excessive resistance.

**Thermocouple:** Thermocouple must be Type J, high temperature, ceramic filter insulated thermocouple with nickel alloy overlaid.

**Pressure Gage:** Pressure gage must be ANSI Standard: B40.1, Grade A, 4½-inch minimum diameter dial, liquid filled with cover, plain case, reset screw, ¼-inch NPT bottom inlet. Gage must read from -25 psig to 75 psig. Each pressure gage must be equipped with a gage cock.

**Gage Cocks:** Gage cocks must be ¼ inch, brass or bronze, 150 psi rated with female and male threaded ends, and tee handle. Gage cocks must be installed at each pressure gauge.

## **99-15510C Construction**

### **99-15510C(1) Installation**

#### Installation of Pipe and Tubing:

Installation of all heating water supply and return pipe must comply with the requirements for cutting, cleaning, closing, securing and insulating of water piping under section 99-15060.

The completed hot water supply and hot water return piping system and the existing slab and unit heater systems must be pressure tested using water pressure at 100 psig for 8 hours. The system must show no loss in pressure. At the conclusion of the pressure test, the system must be filled with a 50-50 solution of glycol and water.

The contractor must be responsible for freeze protecting all new and existing piping prior to the completion of the hydronic system.

### **99-15510C(2) Field Quality Control**

#### Pre-test Requirements:

Before starting or operating systems, equipment and controls must be cleaned and checked for proper installation and operation.

Each separate circuit must have the flows balanced and recorded. The pumping rate for each pump must be adjusted to the value shown.

Final adjustments and balancing of the systems must be performed in such a manner that the systems will operate as specified and as shown.

The Contractor must replace or revise any equipment, systems or work found deficient during tests.

All automatic operating devices which are pertinent to the adjustment of the aforementioned system must be set and adjusted to deliver the required performance at temperatures specified by the Engineer. All control work must be done in collaboration with the control manufacturer's representative.

#### Acceptance Testing:

Prior to completion of hydronic system installation, and before permitting use of the system, the Contractor must fire the boilers and demonstrate all operating and safety controls in the presence of the Engineer.

The Contractor must notify the Engineer at least 3 days in advance of the dates and times tests are to be performed.

Upon completion of mechanical work and pre-test requirements, or at such time prior to contract acceptance as determined by the Engineer, the Contractor must operate and test the complete hydronic heating system for at least 5 consecutive 8-hour days to demonstrate satisfactory overall operation.

### **99-15510C(3) Instruction and Maintenance**

#### Instruction:

The Contractor must instruct State personnel in the proper use, operations and daily maintenance of the hydronic heating system, including the boiler.

Emergency provisions, including emergency access and procedures to be followed at time of operational failure and other building emergencies, must be reviewed.

State personnel must be trained in normal procedures to be followed in checking sources of operation failures or malfunctions.

Immediately prior to substantial completion, the Contractor must conduct a final inspection with State personnel present to determine that control systems and operating devices are operating properly.

Project Completion Tests:

The Engineer must be notified at least 3 days in advance of starting project completion tests.

The project completion tests must consist of the following:

During the test period the following data must be measured and recorded twice a day:

1. Ambient temperature and conditions.
2. Circulating fluid flow through each pump.
3. Slab and air temperature in the service bays and shop areas.

The measurements must be taken prior to 8:00 a.m. each morning and after 1:00 p.m. each afternoon.

At the completion of the test period, the flow rates for each individual circuit of the radiant heating system (the east bay, west bay and unit heaters) must be recorded. Flow rate data must be tabulated and submitted to the Engineer at the job site for authorization.

Comply with additional requirements under Section 99-15555.

**99-15510D Payment**

Not Used

**99-15555 BOILER**

**99-15555A General**

**99-15555A(1) Summary**

Scope: This work consists of installing and testing the LPG fired boilers, equipment and systems.

Temperature Controls: Thermostats, relays, time switches, and other sensor type control devices required for this work must be installed by the supplier of the heating, ventilating and air conditioning equipment. All temperature control wiring must be installed under section 99-16.

**99-15555A(2) Definitions**

Not Used

**99-15555A(3) Submittals**

Not Used

**99-15555A(4) Quality Control and Assurance**

Installer's Qualification: Installation of the boiler must be by the boiler manufacturer or a licensee of the manufacturer, who has not less than 5 years successful experience with the installation of similar boilers and who maintains a service facility within 50 miles of the job site.

Codes and Standards: Equipment and systems must comply with CMC, California State Energy Commission Regulations and, where applicable, must be American Refrigeration Institute (ARI), CSA International, Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA), and Air Movement and Control Association (AMCA) approved for performance ratings and application shown.

**99-15555B Materials**

**99-15555B(1) Manufactured Units**

Boiler:

Boiler must be a packaged unit, ASME inspected and stamped, UL or FM rated, CSA certified for LPG fuel. The unit must be a forced draft, intermittent ignition, modulating type, condensing hot water boiler with 93 percent minimum thermal efficiency, and insulated steel jacket. Boiler must have a

sealed combustion system and be listed for use of plastic combustion and vent pipe from the unit to the outside of the building.

Boiler must be rated for 160 psi minimum and must be equipped with a 50 psi ASME rated pressure relief valve. The boiler operating controls must allow for interruption of the firing circuit without affecting the safety controls.

The entire unit must be finished with a rust, corrosion and heat resistant industrial type enamel paint.

The boiler capacity must be as shown.

### **99-15555B(2) Accessories**

Controls:

The boiler units must include the following controls:

1. Operating low water shut-off
2. Low water safety fuel shut-off with manual reset
3. ASME rated relief valve
4. Adjustable operating control
5. High limit safety control with manual reset
6. Pressure gauge and temperature indicator
7. Flame safety control
8. Safety pilot control
9. Flue gas thermometer
10. Air eliminator
12. Gas pressure regulator and shut-off valve
13. Low pressure and high pressure gas shut-off
14. Pilot gas pressure regulator and shut-off valve

Expansion Tank: Expansion tank must be capacity as shown and of welded construction and must be ASME inspected and stamped for 125 psi working pressure. The tank must be equipped with a drain valve, air charging valve, high level alarm, low level alarm and gauge glass.

Sight Gage: Sight gage must be ½ inch in size and of adequate length to indicate the entire contents of the tank. Gage must be an automatic type with drain cock and must be valved top and bottom to allow changing the glass without draining of the tank.

### **99-15555C Construction**

#### **99-15555C(1) Installation**

Boiler:

The boiler must be installed under the manufacturer's instructions.

The boiler must be installed to provide the minimum access clearances recommended by the manufacturer for servicing and cleaning.

#### **99-15555C(2) Field Quality Control**

Pre-test Requirements:

Before starting or operating the boiler, equipment must be cleaned and checked for proper installation.

All operating controls and safety controls must be independently checked for proper installation and operation.

Acceptance Testing:

Prior to completion of boiler installation, and before permitting use of the boiler, the Contractor must fire the boiler and demonstrate all boiler operating and safety controls in the presence of the Engineer.

The Contractor must notify the Engineer and the inspection department of governing agencies in advance of the dates and times tests are to be performed.

Upon completion of mechanical work and pre-test requirements, or at such time prior to contract acceptance as determined by the Engineer, the Contractor must operate and test installed boiler system for at least 3 consecutive 8-hour days to demonstrate satisfactory overall operation.

Comply with additional requirements under section 99-15599.

**99-15555C(3) Instruction and Maintenance**

Instruction:

The Contractor must instruct State personnel in the proper use, operations and daily maintenance of the boiler.

Emergency provisions, including emergency access and procedures to be followed at time of failure in operation and other building emergencies, must be reviewed.

State personnel must be trained in normal procedures to be followed in checking sources of operation failures or malfunctions.

Immediately prior to substantial completion, the Contractor must conduct a final inspection with State personnel present to determine that control systems and operating devices are operating properly.

Maintenance: The Contractor must provide continuing maintenance and inspection of the boiler for a period of one year following completion of the contract.

**99-15555D Payment**

Not Used

**DIVISION 16 ELECTRICAL**

**99-16010 ELECTRICAL WORK**

**99-16010A General**

**99-16010A(1) Summary**

Scope: This work consists of performing electrical work including furnishing all labor, materials, equipment and services required to construct, connect and install the complete electrical system.

**99-16010A(2) System Description**

System layouts are generally diagrammatic and location of equipment is approximate. Exact routing of conduits and other facilities and location of equipment is to be governed by structural conditions and other obstructions, and must be coordinated with the work of other trades. Equipment requiring maintenance and inspection must be located where it is readily accessible for the performance of such maintenance and inspection.

**99-16010A(3) Definitions**

Not Used

**99-16010A(4) Submittals**

Not Used

**99-16010A(5) Quality Control and Assurance**

Regulatory Requirements: All electrical work performed and materials installed must comply with section 86-1.02 and the CA Code of Regs, Title 24, Part 6, "California Energy Code."

**99-16010B Materials**

Not Used

**99-16010C Construction****99-16010C(1) General**

Not Used

**99-16010C(2) Testing**

After the installation work for the various systems has been completed, each electrical system must be tested in the presence of the Engineer to demonstrate that the electrical systems function properly. The Contractor must make necessary repairs, replacements, adjustments and retests at his expense.

Final inspection for the completed electrical system will take place after all the various systems have been tested.

The Engineer must be notified 15 days in advance of testing and State personnel training on the job site.

**99-16010D Payment**

Not Used

**99-16050 BASIC MATERIALS AND METHODS****99-16050A General****99-16050A(1) Summary**

Scope: This work consists of furnishing and installing the basic materials for the electrical work, including conduits, conductors, fittings, and wiring devices. The basic materials must include those accessories and appurtenances, not mentioned, that are required for the installation and operation of the electrical system.

Related Work:

Roof penetrations must be flashed and sealed watertight to comply with section 99-07620.

Where conduits pass through fire rated walls, floor or ceiling assemblies, the penetrations must be protected to comply with section 99-07270.

**99-16050A(2) Definitions**

Not Used

**99-16050A(3) Submittals**

Product Data:

Submit a list of all materials and equipment to be installed and the manufacturer's descriptive data.

Manufacturer's descriptive data must include catalog cuts, complete description, performance data and installation instructions for the materials and equipment.

**99-16050A(4) Quality Control and Assurance**

Not used

**99-16050B Materials****99-16050B(1) Conduits and Fittings**

Rigid Steel Conduit and Fittings: Rigid steel conduit and fittings must be Type 1 complying with section 86-2.05A.

PVC Coated Rigid Steel Conduit and Fittings: PVC coated rigid steel conduit and fittings must be Type 2 complying with section 86-2.05A.

Electrical Metallic Tubing (EMT) and Fittings:

EMT must be formed of cold rolled strip steel, zinc coated, and interior lined to comply with UL Standard 797 and ANSI C 80.3.

Couplings must be electroplated, rain and concrete tight, gland compression type, steel body couplings with malleable iron nuts.

Connectors must be electroplated, rain and concrete tight, gland compression type, steel body connectors with male hub, malleable iron nut and insulated thermoplastic throat.

#### Flexible Metallic Conduit and Fittings:

Flexible metallic conduit must be fabricated in continuous lengths from galvanized steel strip, spirally wound and formed to provide an interlocking design.

Fittings must be electroplated screw-in type with malleable cast iron body and threaded male hub with insulated throat.

Rigid Non-Metallic Conduit and Fittings: Rigid non-metallic conduit and fittings must be Type 3 complying with section 86-2.05A.

Liquidtight Flexible Metallic Conduit and Fittings: Liquidtight flexible metallic conduit and fittings must be Type 4 complying with section 86-2.05A.

### **99-16050B(2) Cables and Conductors**

#### Conductors:

Conductors must be stranded copper wire of the size shown. Conductors must comply with ASTM B3 and ASTM B8. Conductor size must be based on AWG, except that conductor diameter must be not less than 98 percent of the specified AWG diameter.

Conductor insulation types must be as follows:

1. Conductors in control panel enclosures must be Type MTW.
2. Conductors in wet, underground, or outdoor locations must be Type XHHW-2.
3. All conductors other than Type MTW and XHHW-2 must be Type THHN.

Wire Connections and Devices: Wire connections and devices must be pressure or compression type, except that connectors for No. 10 AWG and smaller conductors in dry locations may be preinsulated spring-pressure type.

### **99-16050B(3) Electrical Boxes**

#### Outlet, Device and Junction Boxes:

Boxes must be galvanized steel boxes with knock-outs and must be the size and configuration best suited to the application shown. Minimum size of outlet, device, or junction boxes must be 4 inches square by 1-1/2 inches deep. Flush-mounted single device and surface mounted light fixture boxes must have four inch square single raised device covers.

Flush-mounted boxes must have stainless steel covers, 0.04 inches thick. Surface-mounted boxes must have galvanized steel covers with metal screws. Cover screws must be metal with finish to match cover finish.

Sectional device plates will not be permitted.

Cast boxes and weatherproof boxes must be cast iron boxes with threaded hubs complying with NEMA FB-1, and must be of the size and configuration best suited to the application shown. Minimum size of outlet, device, or junction boxes must be 4 inches square by 1-7/8 inches deep.

Cast boxes and weatherproof boxes must have cast iron covers with gaskets.

Weatherproof device boxes must have gasketed covers with gasketed hinged flaps to cover switches and receptacles.

#### Communication Outlet Box:

Communication outlet box must be 4-inch square box with faceplate. Boxes on stud walls must have raised device covers.

Faceplate must accommodate modular type communication outlet jacks and include tear-resistant icons showing computer icon for data jacks and telephone icon for telephone jacks.

Communication Outlet Jack: Communication outlet jack must be either data or telephone jacks. Each communication outlet jack must include two data jacks and two telephone jacks installed in the faceplate. Jacks must be as follows:

1. Data jack must be modular RJ-45, for Cat 6, 4 pair UTP cable and must snap into Cat 6 faceplates and/or termination boxes. Data jack must be UL approved.
2. Telephone jack must be modular RJ-11, for Cat 6, 4 pair UTP cable and must snap into Cat 6 faceplates and/or termination boxes.

Pull Boxes:

Pull boxes must comply with section 86-2.06.

Traffic rated pull boxes must comply with section 86-2.06C.

Electrical pull box covers and traffic rated pull box covers must be marked "ELECTRICAL."

Telephone pull box covers must be marked "COMMUNICATION."

#### **99-16050B(4) Receptacles and Switches**

Ground Fault Circuit Interrupter Receptacle, (GFCI): GFCI receptacle must be NEMA Type 5-20R, feed-through type, ivory color, 3-wire, 20-ampere, 125-volt, specification grade, duplex receptacle suitable for wiring with stranded conductors. Receptacle must detect and trip at current leakage of 5 mA and must have front mounted test and reset buttons.

Duplex Receptacle: Duplex receptacle must be NEMA Type 5-20R, 3-wire, 20-ampere, 125-volt, ivory color, specification grade duplex receptacle suitable for wiring with stranded conductors.

Management Information System (MIS) Receptacle: MIS receptacle must be NEMA Type 5-20R, 3-wire, 20-ampere, 125-volt, isolated ground, orange color, specification grade duplex receptacle suitable for wiring with stranded conductors.

Multioutlet Assemblies: Multioutlet assemblies must be 3-wire, 15-ampere, 125-volt, 40-inch long strip, grounding type receptacles spaced 6 inches on center. The assembly must be provided with the necessary entrance end fitting and blank end fitting.

Single Pole Switch: Single pole switch must be 20-ampere, 120/277-volt, quiet type, specification grade, ivory color switch with silver alloy contacts. Switch must be suitable for wiring with stranded conductors.

Dimming Switch: Dimming switch must be a low voltage, corrosion resistant wall mounted ON/OFF plus RAISE/LOWER switch that can control the 0 to 10 V(dc) dimmable LED drivers. Switch must be able to communicate with the other lighting control devices. Power for the switch must be provided by the power pack. Switch must have soft click pushbutton control and single channel of control. Switch must have single on/off, single dimming raise/lower pushbuttons and LED feedbacks. Switch must be ivory in color and must be installed in a wall mounted device box with single raised device cover.

Selector Switch, SS: Selector switch must be rotary action, double-pole, 2-position, 10-ampere, 120-volt switch. Switch contacts must have an inductive pilot duty rating of 60 amperes (make), 6 amperes (break) and 10 amperes (continuous) at 120 volts and 35 percent power factor. Selector switch must have legend plate marked MANUAL-AUTO.

Timer Switch: Timer switch must be a spring wound mechanical timer with a rotary dial. Contacts must be rated 20 amperes at 120 volts. Time adjustments must range from zero to two hours.

#### **99-16050B(5) Occupancy Sensor Switches**

Wall Switch Occupancy Sensor, Type 1:

Wall switch occupancy sensor, Type 1 must be a wall-mounted, passive infrared sensor switch with time delay.

The switch must be rated at 800 watts (minimum) incandescent or 1200-VA (minimum) fluorescent at 120 volts, operate on 120/277 volts and be installed in a device box with single raised device cover.

The switch must be capable of manual on/automatic off mode.

The switch must cover a minimum of 900 square feet of floor area, and have a field of view of not less than 180 degrees.

The switch must be compatible with all electronic ballasts and have no leakage to load in the "OFF" mode.

The time delay off setting must be adjustable from 30 seconds to 30 minutes, initially set at 10 minutes.

Light level adjustment must be adjustable from 3 fc to 180 fc, initially set at 75 fc.

#### Wall Switch Occupancy Sensor, Type 2:

Wall switch occupancy sensor, Type 2 must be a wall-mounted, passive infrared dual relay sensor switch with time delay.

Primary relay must be rated at 800 watts (minimum) incandescent or 1200 VA (minimum) fluorescent at 120 volts.

Secondary relay must be rated at 800 watts (minimum) incandescent or 800 VA (minimum) fluorescent at 120 volts.

The relays in the sensor must be capable of simultaneously controlling 2 different lighting loads or circuits. The second relay must be independent allowing for two-circuit control.

Switch must operate on 120/277 volts and be installed in a device box with single raised device cover.

The unit must have dual manual override switches that can be used to toggle manual on/automatic off mode for each lighting load.

The switch must cover a minimum of 1000 square feet of floor area, and have a field of view of not less than 180 degrees.

Switch must be compatible with all electronic ballasts and have no leakage to load in the "OFF" mode.

The time delay off setting must be adjustable from 30 seconds to 30 minutes, initially set at 10 minutes.

Light level adjustment must be adjustable from 10 fc to 150 fc, initially set at 75 fc.

Switch must have audible alert to indicate impending light shut off.

#### Ceiling Mounted Occupancy Sensor:

Ceiling mounted occupancy sensor must be a low voltage, dual technology (passive infrared and microphonics detection) sensor switch with two interval time delay and integral photocell and must be Title 24 compliant.

The switch must cover a minimum of 2000 square feet of floor area and have a field of view of not less than 360 degrees, conical pattern.

The switch must have LED indicator that remains active at all times in order to verify detection within the area to be controlled.

Switch must have no leakage to load in the "OFF" mode.

The time delay off setting must be adjustable from 30 seconds to 30 minutes, initially set at 10 minutes.

Ceiling mounted occupancy sensor must be supplied with power pack unit; a combination 24 volts DC power supply and 20 ampere line voltage relay. Power supply must be a self-contained transformer with 24 volts DC and minimum 150 mA output. Input voltage to power pack unit must be suitable for 120/277 volts. Relay must be Class B insulating material and have a contact rating of 20 amperes at

120/277 volts. Power pack unit and occupancy sensor must be from the same manufacturer. Power pack unit must be mounted inside a junction box.

### **99-16050B(6) Miscellaneous Materials**

**Auxiliary Relay Pack:** Auxiliary relay pack must include an additional 20 ampere line voltage relay mounted inside a junction box. Relay must be as specified in the occupancy sensor power pack unit.

**Power Pack:** Power pack must be a combination 15 to 24 volts DC power supply and 16 to 20 ampere line voltage switching relay to switch LED drivers. Power pack must be a self-contained with 15 to 24 volts DC and minimum 70 to 110 mA output. Input voltage to power pack unit must be suitable for 120/277 volts. Power pack must be Title 24 compliant and must be able to provide power to all the loads connected to it. Power pack must be white in color and must have a green LED indicator. Power pack unit, occupancy sensor and all the lighting control devices must be from the same manufacturer. Power pack unit must be mounted inside a properly sized junction box. Power pack used in switching lights and plug loads must be equipped with two 20-ampere rated integrated relays.

**Warning Tape:** Warning tape must be 4 inches wide and contain the printed warning "CAUTION ELECTRICAL CONDUIT" in bold 3/4-inch black letters at 30-inch intervals on bright orange or yellow background. The printed warning must be non-erasable when submerged under water and resistant to insects, acids, alkali, and other corrosive elements in the soil. The tape must have a tensile strength of not less than 155 pounds per 4-inch wide strip and must have a minimum elongation of 700 percent before breaking.

**Pull Tape:** Pull tape must be flat woven tape, 1/2 inch wide, of nylon or polypropylene with a minimum tensile strength of 1800 pounds.

**Watertight Conduit Plug:** Watertight conduit plug must be a hollow or solid stem expansion plug complete with inner and outer white polypropylene compression plates and red thermoplastic rubber seal. Seal material must be non-stick type rubber resistant to oils, salt, and alkaline substances.

**Anchorage Devices:** Anchorage devices must be corrosion resistant, toggle bolts, wood screws, bolts, machine screws, studs, expansion shields, or expansion anchors as required by the supporting device.

**Electrical Supporting Devices:**

Electrical supporting devices must be one hole conduit clamps with clamp backs, hot-dipped galvanized, malleable iron.

Construction channel must be 1-5/8 inches x 1-5/8 inches, 12-gage galvanized steel channel with 17/32-inch diameter bolt holes, 1-1/2 inches on center in the base of the channel.

**Ground Rod:** Ground rod must be a 3/4-inch (minimum) galvanized or copper clad steel rod, 10 feet long, and must conform to the requirements in NEMA GR-1.

### **99-16050C Construction**

**Conduit:**

Conduits must be installed to comply with section 86-2.05C and the following:

1. All conduits must be rigid steel except as follows:
  - a. EMT may be used in walls and furred spaces and for exposed work indoors above the switch height.
  - b. Flexible metallic conduit must be used to connect suspended lighting fixtures, motors, HVAC equipment, and other equipment subject to vibration in dry locations.
  - c. Liquidtight flexible metallic conduit must be used to connect motors, HVAC equipment, and other equipment subject to vibration in wet or exterior locations.
  - d. PVC coated rigid steel conduit must be used where shown for base elbows and vertical risers through concrete slabs.
  - e. Rigid non-metallic conduit must be used in underground, exterior locations.

2. Rigid non-metallic conduit bends of 30 degrees or greater must be factory-made long radius sweeps. Bends less than 30 degrees must be made using an authorized heat box.
3. Locations of conduit runs must be planned in advance of the installation and coordinated with the ductwork, plumbing, ceiling and wall construction in the same areas and must not unnecessarily cross other conduits or pipe, nor prevent removal of ceiling tiles or panels, nor block access to mechanical or electrical equipment.
4. Where practical, conduits must be installed in groups of parallel, vertical or horizontal runs and at elevations that avoid unnecessary offsets.
5. Exposed conduit must be installed parallel and at right angles to the building lines.
6. Conduits must not be placed closer than 12 inches from a parallel hot water or steam pipe or 3 inches from such lines crossing perpendicular to the runs.
7. All raceway systems must be secured to the building structures using specified fasteners, clamps and hangers.
8. All metal conduits, fittings, and elbows in contact with soil or concrete must be wrapped with a double layer of 20-mil thick pipe wrapping tape.
9. Single conduit runs must be supported by one hole conduit clamps. Single conduit runs on walls in damp or wet locations must be installed with clamp backs to space conduit off the surface.
10. Multiple conduit runs must be supported with construction channel secured to the building structure. Conduits must be fastened to construction channel with channel compatible pipe clamps.
11. Raceways of different types must be joined using authorized couplings or transition fittings.
12. Expansion couplings must be installed where conduit crosses a building separation or expansion joint.
13. All floor and wall penetrations must be sealed watertight.

#### Conduit Terminations:

Rigid steel conduits must be securely fastened to cabinets, boxes and gutters using 2 locknuts and insulating metallic bushing. EMT must be securely fastened to cabinets, boxes and gutters using connectors. Conduit terminations at exposed weatherproof and cast boxes must be made watertight using hubs.

Grounding bushings with bonding jumpers must be installed on all conduits terminating at concentric knockouts and on all conduits containing service conductors, grounding electrode conductor, and conductors feeding separate buildings.

Rigid non-metallic conduit must be terminated inside the underground pull boxes with an authorized conduit bushing or fitting. All conduits must enter vertically through the bottom of pull boxes.

All future conduits terminated in underground pull boxes or left exposed indoors and outdoors must be provided with watertight conduit plugs.

**Warning Tape:** Warning tape must be placed over each conduit in a trench. Each warning tape must be centered over the conduit and must be placed over the 6 inch layer of sand covering the conduit.

#### Conductor and Cable Installation:

Conductors must not be installed in conduits until all work of any nature that may cause injury is completed. Care must be taken in pulling conductors so that insulation is not damaged. An authorized non-petroleum base and insulating type pulling compound must be used as needed.

All cables must be installed and tested to comply with manufacturer's instructions.

Splices and joints must be insulated with insulation equivalent to that of the conductor.

Six inches of slack must be provided at each outlet and device connection. If the outlet or device is not at the end of a run of conductor, connection must be made with correctly colored pigtails tapped to the runs with splices.

All pressure type connectors and lugs must be retightened after the initial set.

Splices in underground pull boxes and similar locations must comply with section 86-2.09C and section 86-2.09E.

Junction boxes in furred or accessible ceiling spaces must be identified on the cover plate with permanent marking pen denoting the circuits contained in the box.

#### Conductor Identification:

The neutral and equipment grounding conductors must be identified as follows:

1. Neutral conductor must have a white or natural gray insulation except that conductors No. 4 and larger may be identified by distinctive white markers such as paint or white tape at each termination.
2. Equipment grounding conductor may be bare or insulated. Insulated equipment grounding conductors must be green or green with one or more yellow stripes over its entire length. Conductors No. 4 and larger may be permanently identified by distinctive green markers such as paint or green tape at all accessible locations over the entire exposed conductor.

Ungrounded feeder and branch circuit conductors must be color coded by continuously colored insulation, except conductors No. 6 AWG or larger may be color coded by colored tape at each connection and where accessible. Ungrounded conductor color coding must be as follows:

SYSTEM	COLOR CODE
120/240 volt-Single phase	Black, blue
120/240 volt-Three phase	Black, orange, blue

Once grounded and ungrounded insulated conductors are identified with a specific color code, that color code must be used for the entire length of the circuit.

Where more than one branch circuit enters or leaves a conduit, panel, gutter, or junction box, each conductor must be identified by its panelboard and circuit number. All control conductors including control conductors of manufacturer supplied and field wired control devices must be identified at each termination with the conductor numbers shown and shop drawings, where deemed necessary. Identification must be made with one of the following:

1. Adhesive backed paper or cloth wrap-around markers with clear, heat shrinkable tubing sealed over either type of marker.
2. Pre-printed, white, heat-shrinkable tubing.

The identifying numbers of the terminating conductors, as shown on the shop drawings, must be identified on the terminal block marking strip.

#### Outlet, Device and Junction Box Installation:

Where exposed rigid steel conduits are connected to an exposed outlet, device, or junction box at or below switch height, the box must be a cast box.

All boxes must be finished flush with building walls, ceiling and floors except where exposed work is called for.

Raised device covers must be installed on all boxes concealed in concrete, masonry or stud walls.

No unused openings must be left in any box. Knockout seals must be installed to close openings.

Adjustments to locations of outlet, device and junction boxes may be made as required by structural conditions and to suit coordination requirements of other trades.

Boxes in stud walls and partitions must not be mounted back to back. Through-wall boxes will not be allowed.

Boxes installed in metal stud walls must be equipped with brackets designed for attaching directly to the studs or must be mounted on heavy gauge galvanized steel, snap-in box supports.

Fixture outlet boxes installed in suspended ceilings of gypsum board or lath and plaster construction must be mounted on 16-gage metal channel bars attached to main ceiling runners.

Fixture outlet boxes for pendant-mounted fixtures installed in suspended ceilings supporting acoustical tiles or panels must be supported directly from the structures above.

Multiple switches must be installed in standard boxes.

**Pull Box Installation:**

Pull box installation must comply with section 86-2.06A(2) and the following:

1. Top of pull boxes must be flush with surrounding grade or top of curb. In unpaved areas where pull box is not immediately adjacent to and protected by a concrete foundation, pole or other protective construction, the top of pull box must be set at plus one inch above surrounding grade. Pull boxes shown in the vicinity of curbs must be placed adjacent to the back of curb. Pull boxes shown adjacent to lighting standards must be placed on the side of foundation facing away from traffic.

**Ground Rod Installation:** The ground rod must be driven vertically until the top is 6 inches above the surrounding surface. When vertical penetration of the ground rod cannot be obtained, an equivalent horizontal grounding system, authorized by the Engineer, must be installed.

**Anchorage:**

Hangers, brackets, conduit straps, supports, and electrical equipment must be rigidly and securely fastened to surfaces by means of toggle bolts on hollow masonry; expansion shields and machine screws, or expansion anchors and studs or standard preset inserts on concrete or solid masonry; machine screws or bolts on metal surfaces; and wood or lag screws on wood construction.

Anchorage devices must be installed to comply with the anchorage manufacturer's instructions.

**Mounting heights:** Electrical system components must be mounted at the following mounting heights, unless otherwise shown. The mounting height dimensions must be measured above the finished floor to the bottom of the device or component.

Thermostats	3'-8"
Wall switches	3'-8"
Convenience outlets	1'-6"
Telephone and radio outlets	1'-6"

**99-16050D Payment**

Not Used

**99-16432 ELECTRICAL EQUIPMENT**

**99-16432A General**

**99-16432A(1) Summary**

Scope: This work consists of furnishing and installing panelboards, starters, disconnect switches, transformers, and related accessories.

Related Work: Anchorage devices must comply with section 99-16050.

**99-16432A(2) Definitions**

Not Used

**99-16432A(3) Submittals**

Product Data:

Submit a list of materials and equipment to be installed and the manufacturer's descriptive data.

Manufacturer's descriptive data must include complete description, performance data and installation instructions for the materials and equipment. Control and wiring diagrams, rough-in dimensions, and component layout must be included where applicable. All control and power conductors on the shop drawings must be identified with wire numbers.

#### **99-16432A(4) Quality Control and Assurance**

Not Used

#### **99-16432B Materials**

##### **99-16432B(1) Panelboards**

Panelboard P: Panelboard P must be indoor type, surface-mounted, factory assembled, Single-phase, 3-wire, 120/240-volt, AC panelboard at least 20 inches wide with 400-ampere main circuit breaker, insulated groundable neutral, hinged door and molded case branch circuit breakers as shown. Panel must be Square D Company, Westinghouse, General Electric, or equal.

Panelboard S: Panelboard S must be indoor type, surface-mounted, factory assembled, Single-phase, 3-wire, 120/240-volt, AC panelboard at least 20 inches wide with 250-ampere main circuit breaker, insulated groundable neutral, hinged door and molded case branch circuit breakers as shown. Panels must be Square D Company, Westinghouse, General Electric, or equal.

Panelboard T: Panelboard T must be indoor type, surface-mounted, factory assembled, Single-phase, 3-wire, 120/240-volt, AC panelboard at least 20 inches wide with 100-ampere main circuit breaker, insulated groundable neutral, hinged door and molded case branch circuit breakers as shown. Panels must be Square D Company, Westinghouse, General Electric, or equal.

Panelboard R: Panelboard R must be indoor type, surface-mounted, factory assembled, Single-phase, 3-wire, 120/240-volt, AC panelboard at least 20 inches wide with 60-ampere main circuit breaker, insulated groundable neutral, hinged door and molded case branch circuit breakers as shown. Panels must be Square D Company, Westinghouse, General Electric, or equal.

Panelboard PE: Panelboard PE must be indoor type, surface-mounted, factory assembled, 3-phase, 4-wire, 240/120-volt, AC panelboard at least 20 inches wide with 100-ampere main circuit breaker, insulated groundable neutral, hinged door and molded case branch circuit breakers as shown. Panels must be Square D Company, Westinghouse, General Electric, or equal.

Panelboard PW: Panelboard PW must be indoor type, surface-mounted, factory assembled, 3-phase, 4-wire, 240/120-volt, AC panelboard at least 20 inches wide with 100-ampere main circuit breaker, insulated groundable neutral, hinged door and molded case branch circuit breakers as shown. Panels must be Square D Company, Westinghouse, General Electric, or equal.

##### **99-16432B(2) Starters**

Not Used

##### **99-16432B(3) Switches**

Condenser Unit Disconnect Switch: Condenser Unit Disconnect switch must be 2-pole, 240-volt, AC, 60-ampere, fused, heavy duty safety switch in a NEMA-3R enclosure. The fuses must be sized to suit the air conditioning unit furnished.

Rotary Phase Converter Disconnect Switch: Rotary Phase Converter Disconnect switch must be 3-pole, 240-volt, AC, 80-ampere, fused, heavy duty safety switch in a NEMA-3R enclosure. The fuses must be sized to suit the air conditioning unit furnished.

East Bays Heater Panelboard Disconnect Switch: East bays heater panelboard disconnect switch must be 2-pole, 240-volt, AC, 200-ampere, non-fusible, heavy duty safety switch in a NEMA-3R enclosure with provision for padlocking in the "OFF" position.

West Bays Heater Panelboard Disconnect Switch: West bays heater panelboard disconnect switch must be 2-pole, 240-volt, AC, 200-ampere, non-fusible, heavy duty safety switch in a NEMA-3R enclosure with provision for padlocking in the "OFF" position.

Trailer Disconnect Switch: Trailer disconnect switch must be 2-pole, 240-volt, AC, 200-ampere, non-fusible, heavy duty safety switch in a NEMA-3R enclosure with provision for padlocking in the "OFF" position.

Door Operator Disconnect Switch: Door operator disconnect switch must be 3-pole, 240-volt, AC, 30-ampere, non-fusible, general duty safety switch in a NEMA-1 enclosure with provision for padlocking in the "OFF" position.

Exhaust Fan Disconnect Switch: Exhaust fan disconnect switch must be 2-pole, 240-volt, 30-ampere, specification grade, AC switch in a cast metal box with standard galvanized cover.

#### **99-16432B(4) Transformer**

Not Used

#### **99-16432B(5) Miscellaneous Materials**

Rotary Phase Converter: Rotary Phase Converter must be rotary type induction machine, 15-HP, 240-volt single phase input voltage and 240-volt 3-phase output voltage, AC, UL Listed. The converter must reach full speed within 2 to 3 seconds.

Nameplates: Nameplates must be laminated phenolic plastic with white core and black front and back. Nameplate inscription must be in capitals letters etched through the outer layer of the nameplate material.

Warning Plates: Warning plates must be laminated phenolic plastic with white core and red front and back. Warning plates inscription must be in capital letters etched through the outer layer of the nameplate material.

Plywood Backing Board: Plywood backing board for mounting electrical or telephone equipment must be 3/4-inch, APA plywood panels, C-D PLUGGED and touch-sanded, Exposure 1.

#### **99-16432C Construction**

Plywood Backing Board:

Plywood backing board must be securely fastened to walls or other vertical framing.

Surface to be coated must be cleaned of all dirt, excess materials, and filler by hand cleaning.

Exposed surfaces of plywood backing board must be coated to comply with "Wood, Painted" in section 99-09900. The color must match surrounding surfaces, or must be authorized by the Engineer.

Coatings must be applied to comply with the manufacturer's instructions. Each coat must be applied to a uniform finish, free of skips, brush marks, laps or other imperfections.

Existing Panelboards: Provide new circuit breakers, where required to match existing type unless otherwise shown. Provide mounting hardware, bus straps, and related materials for proper circuit breaker installation. Provide new panelboard identification nameplate with designation as shown for each panelboard. Remove existing nameplates where applicable. Provide new typewritten circuit directory reflecting changes.

Panelboard Installation:

Set cabinets plumb and symmetrical with building lines. Train interior wiring to comply with "Conductor and Cable Installation" in section 99-16050. Touch-up paint any marks, blemishes, or other finish damage suffered during installation. Replace cabinets, doors or trim exhibiting dents, bends, warps or poor fit that may impede ready access, security or integrity.

Mounting height must be 5½ feet to the highest circuit breaker handle, measured above the finished floor.

Where "Future" or "Space" is shown, branch connectors, mounting brackets, and other hardware must be furnished and installed for future breaker.

A typewritten directory under transparent protective cover must be provided and set in metal frame inside each cabinet door. Directory panel designation for each circuit breaker must include complete information concerning equipment controlled, including room number or area as shown.

**Equipment Identification:**

Equipment must be identified with nameplates fastened with self-tapping, cadmium-plated screws or nickel-plated bolts.

Nameplate inscriptions must read as follows:

Item	Letter height, inches	Inscription
Panel P	1/4	PANEL P 120/240V, 1 PH, 3W
Panel S	1/4	PANEL S 120/240V, 1 PH, 3W
Panel T	1/4	PANEL T 120/240V, 1 PH, 3W
Panel R	1/4	PANEL R 120/240V, 1 PH, 3W
Panel PE	1/4	PANEL PE 120/240V, 3 PH, 4W
Panel PW	1/4	PANEL PW 120/240V, 3 PH, 4W
Condenser Unit Disconnect Switch	1/4	CONDENSER UNIT DISCONNECT SWITCH
Rotary Phase Converter Disconnect Switch	1/4	ROTARY PHASE CONVERTER DISCONNECT SWITCH
East Bays Heater Panelboard Disconnect Switch	1/4	EAST BAYS HEATER PANELBOARD DISCONNECT SWITCH
West Bays Heater Panelboard Disconnect Switch	1/4	WEST BAYS HEATER PANELBOARD DISCONNECT SWITCH
Boiler Control Panel	1/4	BOILER CONTROL PANEL
Trailer Disconnect Switch	1/4	TRAILER DISCONNECT SWITCH, 200A 120/240V, 1PH, 3W
Communication Cabinet	1/4	COMMUNICATION CABINET

**Warning Plates:**

Warning plates must be attached to designated equipment with self-tapping cadmium-plated screws or nickel-plated bolts.

Warning Sign: Panelboards, Boiler Control Panel warning sign must be adhesive warning sign with the message "Warning: Arc Flash and Shock Hazard Appropriate PPE and Tools Required When Working On This Equipment (with Graphic)".

**99-16432D Payment**

Not Used

**99-16500 LIGHTING**

**99-16500A General**

**99-16500A(1) Summary**

Scope: This work consists of furnishing, installing and connecting all lighting equipment.

## **99-16500A(2) Definitions**

Not Used

## **99-16500A(3) Submittals**

Submit manufacturer's descriptive information, photometric curves, catalog cuts, and installation instructions. Submit wiring diagram and component layout for lighting control stations.

Closeout Document Submittals:

Include in each closeout document:

1. Parts list
2. Operating instructions
3. Maintenance instructions
4. Wiring schematics

Submit three copies of each closeout document in the following manner:

1. One CD with PDF files
2. Two individual 3-ring binders containing paper copies

Incomplete or inadequate documentation will be returned to the Contractor for correction and resubmittal.

## **99-16500A(4) Quality Control and Assurance**

Not Used

## **99-16500B Materials**

### **99-16500B(1) General**

Lighting Fixture Lamps: Lighting fixture lamps must be type and size as described.

Lighting Fixtures: Lighting fixtures must be as described. Outdoor luminaires must be listed and labeled "Fixture Suitable For Wet Locations."

L1: Wall mounted LED exterior, 47-watt LED unit, wet location fully sealed, 20 high efficacy LEDs with aluminum heat sink, class 1 electronic driver with high power factor and 10,000 hours expected life, surge protection, die cast aluminum housing, tempered glass lens, 120 V(AC) operation, integrated photocell and dark bronze power coat finish. The fixture must be Lithonia, WSQ series, Forefront, FRFTWP series, or equal.

L2: Wall mounted LED exterior, 72-watt LED unit, wet location fully sealed, 63 high efficacy LEDs with aluminum heat sink, class 1 electronic driver with high power factor and 10,000 hours expected life, surge protection, die cast aluminum housing, tempered glass lens, 120 V(AC) operation, integrated photocell and dark bronze power coat finish. The fixture must be Lithonia, TWH series, Holophane, W4P series, or equal.

L3: Surface mounted, 24"X48" LED troffer, 47 Watt and 120 Volt LED engine lamp, 4000 minimum delivered lumens at 3500 degree Kelvin, minimum CRI of 80 and minimum delivered L80 performance of 50,000 hours. The fixture must have linear faceted reflector cavity, sloped end plates and advanced optical film. The fixture must be constructed from one-piece cold-rolled steel coated polyester, painted, complete with a single clear acrylic diffuser to provide LED engine concealment and wide distribution. AC LED engine driver must be UL listed, 0-10Volt dimming, 0.9 minimum power factor, complete with internal thermal protection and overload protection. Fixture must come with mounting adapters and hardware required for surface mounting to gypboard type ceiling. Fixture photometric must be tested in accordance to IESNA LM-79. The fixture must be Lithonia, 2VTL4 series or CREE, CR24 series.

L4: Surface mounted, 24"X24" LED troffer, 37 Watt and 120 Volt LED engine lamp, 3200 minimum delivered lumens at 3500 degree Kelvin, minimum CRI of 80 and minimum delivered L80 performance of 50,000 hours. The fixture must have linear faceted reflector cavity, sloped end plates and advanced optical film. The fixture must be constructed from one-piece cold-rolled steel coated polyester, painted, complete with a single clear acrylic diffuser to provide LED engine concealment and wide distribution. AC

LED engine driver must be UL listed, 0-10Volt dimming drive, 0.9 minimum power factor, complete with internal thermal protection and overload protection. Fixture must come with mounting adapters and hardware required for surface mounting to gypboard type ceiling. Fixture photometric must be tested in accordance to IESNA LM-79. The fixture must be Lithonia, 2VTL2 series or CREE, CR22 series.

L5: Pedant mounted, 4"X48" LED troffer, 42 Watt and 120 Volt LED engine lamp, 3000 minimum delivered lumens at 3500 degree Kelvin, minimum CRI of 80 and minimum delivered L80 performance of 50,000 hours. The fixture must have linear faceted reflector cavity, sloped end plates and advanced optical film. The fixture must be constructed from one-piece cold-rolled steel coated polyester, painted, complete with a single clear acrylic diffuser to provide LED engine concealment and wide distribution. AC LED engine driver must be UL listed, 0-10Volt dimming drive, 0.9 minimum power factor, complete with internal thermal protection, passive infrared indoor occupancy sensor and overload protection. Fixture must come with mounting adapters and hardware required for surface mounting to gypboard type ceiling. Fixture photometric must be tested in accordance to IESNA LM-79. The fixture must be Lithonia, 2L2N series or holopha, HZL2N series.

L6: 8" LED recessed wide downlight fixture, self flanged, 120 Volt, 42-watt LED unit, 3000 minimum delivered lumens at 3500 degree kelvin and with CRI of at least 80 and designed lifetime for 50,000 hours. AC LED engine driver must be UL listed, 0-10Volt dimming drive, 0.9 minimum power factor, complete with internal thermal protection, and overload protection.. The fixture must be Cooper lighting, Portfolio LD8A30, Hubbell lighting, Presolite LF8LED8G4, or equal.

L7: 54" LED fixture, 120 Volt, 59-watt LED unit, integrated motion sensor, 4495 minimum delivered lumens at 5700 degree kelvin and with CRI of at least 80 and designed lifetime for 50,000 hours. The fixture housing must be constructed from one piece injected molded, impact resistance, frosted polycarbonate and 20 gauge steel channel complete with a clear transparent, polycarbonate lens with aesthetic rib details and asymmetric optical control film. LED engine driver must be UL listed, 50,000 hour design life. Fixture mounting adapters and trims must be suitable for surface mounting and wet location listed. The fixture must be Lithonia, VAP LED series, Holopha, EVT4 LED series, or equal.

L8: Wall mounted, combination emergency light and illuminated exit sign with supply voltage of 120 Volt, Dual LED lamp head, each lamp head must have a 5.4 Watt LED array. The fixture must be white, compact, low-profile, engineering grade thermoplastic housing, corrosion proof complete with an integrated test switch and visible red pilot light. The fixture must have a sealed and maintenance-free nickel-cadmium battery. "EXIT" letter color must be green. The fixture must be Lithonia ELM2 series; Navilite NXPC series or Hubbell Lighting Products CC series.

L9: Wall mounted, emergency light with supply voltage of 120 Volt, 1.8-watt LED unit, Dual LED lamp head. The fixture must be white, compact, low-profile, adjustable heads, engineering grade thermoplastic housing, corrosion proof complete with an integrated test switch and visible status pilot light. The fixture must have a sealed and maintenance-free nickel-cadmium battery. The fixture must be Lithonia EU2 LED M12 series; Navilite N1L series or Hubbell Lighting Products CU2 series.

L10: Wall mounted, IP65 rated Flood light, 120 Volt, 79-watt LED unit, 3000 degree kelvin and with CRI of at least 80 and designed lifetime for 100,000 hours. The fixture must be dark bronze, gasket sealed die-cast aluminum housing with integral heat sink fins, thermoset power coat finish. The fixture must have integral adjustable knuckle with 1/2-14 NPS threaded pipe, tenon slipfitter and galvanized steel right angle arm. The fixture must be Lithonia DSXF2 series; RAB Lighting LFLOOD 78 or equal.

L11: The fixture must be similar to L5 except the fixture with emergency back up unit.

Photoelectric Unit, PEU: Photoelectric unit must be cadmium sulfide photoelectric control with capacity of 1200-watt incandescent or 1800-watt inductive or fluorescent load, mounting adapter, and EEI-NEMA twist lock receptacle; Fisher, Pierce, Ripley, or equal.

## **99-16500B(2) Fabrication**

Not Used

## **99-16500C Construction**

### Lighting Fixtures:

Lighting fixtures must be mounted securely to comply with the manufacturer's instructions. Mounting methods must be suitable for the particular type of ceiling or support at each location.

The Contractor must provide all supports, hangers, spacers, channels, fasteners and other hardware necessary to support the fixtures.

Fixtures must be set at the mounting heights shown, except heights shown must be adjusted to meet conditions.

### Photoelectric Unit Installation:

Install photoelectric unit PEC above the roof to comply with the manufacturer's instructions and facing north. The exact location must be authorized by the Engineer.

## **99-16500D Payment**

Not Used

## **99-16722 FIRE ALARM AND DETECTION SYSTEM**

### **99-16722A General**

#### **99-16722A(1) Summary**

Scope: This work consists of furnishing and installing a complete and operational fire alarm and detection system.

The system must include all materials necessary for the complete and operational fire alarm and detection system.

The fire alarm and detection system must conform to the 2013 California Electrical Code (CEC) Article 760, the 2013 California Fire Code (CFC) Section 907, the 2013 California Building Code (CBC) Section 907, the 2010 Americans with Disabilities Act (ADA) Standard Section 702 and the 2013 National Fire Protection Association (NFPA) 72.

#### **99-16722A(2) Definitions**

Not Used

#### **99-16722A(3) System Description**

##### Design Requirements:

The fire alarm and detection system must be a low voltage, direct current, zoned, closed circuit, electrically supervised, signaling line circuits, and Class A addressable fire alarm and detection system. The system must consist of fire alarm control panel, manual pull stations, smoke detectors, heat detectors, end-of-line resistors, audio-visual devices, annunciator addressable relay modules and all other necessary appurtenances.

Each addressable initiating device will annunciate its own unique identification number or "address" to the fire alarm control panel.

Every item of the fire alarm and detection system must be listed as a product of a single fire alarm system manufacturer under the appropriate category by UL or FM, and must bear the "UL" or "FM" label. Control equipment must be listed under UL category UOJZ as a single control unit. Partial listing will not be acceptable. The alarm system components must be listed by the California State Fire Marshal.

#### **99-16722A(4) Submittals**

##### Product Data:

Submit manufacturer's descriptive information and installation instructions.

Installation instructions must include brand name and catalog reference of equipment supplied, wiring diagrams, battery calculations, voltage drop calculations, riser diagrams and floor plans showing all

devices and conduit and conductor sizes. A fire matrix table for the sequence of operation must be included in the submittals.

Shop Drawings: Submit complete shop drawings.

State Fire Marshal Approval: Prior to the submittal of the shop drawings, you must have drawings stamped "APPROVED" by the State Fire Marshal. Allow 12 weeks for State Fire Marshal review and approval.

#### **99-16722A(5) Quality Control and Assurance**

Not Used

#### **99-16722B Materials**

Fire Alarm System:

The system must be wired, connected, and left in first-class operating condition. The system must be electrically supervised, 4-wire Class A system, and must use closed loop initiating device circuits with individual zone supervision, individual indicating appliance circuit supervision, incoming and standby power supervision.

The system must be an addressable fire alarm system complete with built-in or portable reprogramming capabilities so that all reprogramming or reconfiguration of the fire alarm system can be accomplished without removal of any solid-state devices. Hardware, software, and passwords used in programming the system and the I/O Map must be submitted to the Engineer.

The system alarm operation subsequent to the alarm activation of any manual station, automatic detection device, or sprinkler flow switch must be as follows:

1. The appropriate initiating device circuit's red LED must flash on the control panel and the annunciator until the alarm has been silenced at the control panel or the annunciator. Once silenced, this same LED must latch on. A subsequent alarm received after silencing must flash the subsequent zone alarm LED on the control panel.
2. A pulsing alarm tone must occur within the control panel until silenced.
3. All alarm-indicating appliances must sound in a Continuous Ringing Alarm until silenced by the Alarm Silence Switch at the control panel or the annunciator.
4. All visual alarm lamps must operate in a continuous pattern until extinguished by the Alarm Reset Switch.
5. Activate a supervised signal to notify specified notifying parties.

The alarm indicating appliances may be silenced by authorized personnel upon entering the locked control panel and operating the Alarm Silence Switch or by use of the key operated switch at the annunciator. A subsequent zone alarm must reactivate the signals.

The system must include the following electrical power requirements:

1. The control panel must receive 120 V ac power via a dedicated standby circuit.
2. The system must be provided with sufficient battery capacity to operate the entire system upon loss of normal 120 V ac power in a normal supervisory mode in accordance with NFPA 72. The system must automatically transfer to the standby batteries upon power failure. All battery charging and recharging operations must be automatic. Batteries, once discharged, must recharge at a rate to provide a minimum of 80 percent capacity in 12 hours.
3. The supervised standby battery power must operate the entire system for 4 hours under normal conditions. At the end of 4 hours, the standby battery must power the system under fire alarm conditions for 5 minutes.
4. All circuits requiring system-operating power must be 24-Volt DC and must be individually fused at the control panel.
5. Faults on ancillary circuits must not interfere with the operation of the alarm and detection system.

#### Activation of Standpipe or Sprinkler Tamper Switch and Trouble Silence Switch:

1. The activation of any standpipe or sprinkler tamper switch must activate a distinctive system supervisory audible signal and illuminate a "Sprinkler Supervisory Tamper" LED at the system control panel and the annunciator. There must be no confusion between valve tamper activation and opens and grounds on fire alarm initiation circuit wiring.
2. Activating the Trouble Silence Switch must silence the supervisory audible signal while maintaining the Sprinkler Supervisory Tamper LED indicating the tamper contact is still activated.
3. Restoring the valve to the normal position must cause the audible signal and LED to pulse.
4. Activating the Trouble Silence Switch must silence the supervisory audible signal and restore the system to normal.

#### Fire Alarm Control Panel:

Fire alarm control panel must be surface-mounted, locking cabinet, completely self-contained control panel suitable for 120-volt, AC, input power with separate terminals for all external wires and end-of-line resistors installed within the control panel. Panel must be capable of communicating with addressable relay modules. When a device is activated, the panel must display the actual device and reference zone where the device is located and the associated zone number.

Each addressable device must have a unique address. The manufacturer must program each address to a system input zone and correlate to output operations as indicated. Non-functioning, non-addressed and non-programmed devices must report trouble. Provide for site modification to the addressable programming. Provide for removal and replacement of devices without the necessity of readdressing any other devices.

Provide installation flexibility by ensuring that the physical sequence (placement) of the devices on the loop need not determine the device address. Installation tables must be furnished by you to identify all device addresses.

The control panel must comply with the following:

1. Compatible with Simplex 4100, Notifier 640 or equivalent
2. Minimum 12 reference zones and expandable to 16 zones
3. Digital dialer communicator
4. Audible trouble signal, silencing switch and trouble pilot light
5. Solid state, modular construction
6. Fan shut down relays
7. 24-hour standby batteries, battery charger with automatic transfer on loss of utility company power and retransfer upon restoration of utility power
8. Indicating lights for normal power failure, battery power failure, audible alarm, and silencing switch
9. Low battery reporting

**Manual Pull Station:** Manual pull station must be single-action, addressable, non-coded, closed circuit, pull down type pull station mounted on a standard electrical outlet box. The manual pull station actuating contact must function continuously until reset. The pull station must have provisions for fire drill and testing. Manual pull station must be capable of being reset with the same key as for the fire alarm control panel. By using the key, authorized personnel can activate the manual pull station.

**Smoke Detector:** Smoke detector must be ionization type detector with dual chamber with sensitivity control and plug-in detector head. One chamber must be for detection and the other for changes in ambient parameters. The smoke detector must have integral LED light to indicate operation of the smoke detector.

#### Duct-mounted Smoke Detector:

Duct-mounted smoke detector must be similar to the space smoke detector except it must have the following additional features:

1. Sampling tube

2. Uniform sensitivity between 500 feet to 3,000 feet per minute air velocity
3. Test jack

Heat Detector: Heat detector for automatic detection of fire must be of compact and rugged construction employing rate-of-rise and fixed temperature methods of detecting fires. The heat detectors must be addressable and must have twist-and-lock type plug-in detector head, and low profile.

Audio-visual Device: Audio-visual device must be addressable, vibrating type horn with flashing light and adjustable volume control and must conform to the following requirements.

Audible alarm must provide:

1. A sound pressure level of at least 15 decibels (dB) above the average ambient sound level in the room or space, or 5 dB above the maximum sound level having a duration of 60 seconds, whichever is greater.
2. The minimum sound pressure level must be 60 dBA,
3. The maximum must be 110dBA at the minimum hearing distance.

Visual alarm must have the following:

1. Visible alarm must be provided in entrance, hallways, restrooms, and other common use areas as indicated on the plans.
2. No place in corridors or any rooms requiring visual alarm must be more than 50 feet from the signal in the horizontal plane.
3. Visible alarm must be placed 80 inches above the highest floor level or 6 inches below the ceiling, whichever is lower.
4. The Lamp must be a xenon strobe type or equivalent.
5. The color must be clear or nominal white (i.e., unfiltered or color filtered white light).
6. The maximum pulse duration must be two-tenths of one second with a maximum duty cycle of 40 percent. The pulse duration is defined as the time interval between initial and final points of 10 percent of maximum signal.
7. The intensity must be a minimum of 75 candela.
8. The flash rate must be a minimum of 1 Hz and a maximum of 3 Hz.

Addressable Relay Module: Addressable relay module must be an addressable relay that will provide the system it is associated with a dry contact output for equipment shutdown. Dry contact must be rated for the control voltage and current being interrupted. Relay module must be compatible with the fire alarm control panel. Addressable relay module must be provided with a properly sized surface mounted back box.

Annunciator: Annunciator must be a flush mounted eight zone LED annunciator that is capable of communicating with the fire alarm control panel to display the same message displayed by the fire alarm control panel.

### **99-16722C Construction**

#### **99-16722C(1) Installation**

Install the fire alarm system to comply with the manufacturer's instructions. Do not modify the recommended alarm system type or components type, or replace, without prior written authorization from the Engineer.

Conduit and Conductors:

Fire alarm system wiring must be installed in conduits to comply with section 99-16050. Conduit size must be as recommended by the fire alarm system manufacturers except that conduits must be not less than 1/2-inch diameter, trade size. Within the office areas and rooms with finished ceiling and furred wall, conduits must be concealed in ceiling or walls. All other conduits must be exposed conduit.

Conductors and cables for the fire alarm system must be as recommended by the fire alarm system manufacturer.

No wiring other than that directly associated with fire alarm detection system must be permitted in these conduits. Wiring splices must be avoided to the extent possible and if needed, they must be made only in junction boxes and must be connected with crimp-type connectors. Wire nut-type connections are not acceptable.

All conduits entering or leaving the terminal cabinets and junction boxes must be numbered in a logical and consecutive manner. A number must be used only once.

All conductors must be tagged, labeled, and color-coded. Color-coding must be by wire insulation, not taping or banding. The numbering and color-coding must be continuous for each circuit wire.

Wire must be numbered at each connection, termination, and junction point. Each group of wires must be tagged with its destination at each panel, terminal box, or junction box. Identification must be made with one of the following:

1. Adhesive backed paper or cloth wrap-around markers with clear, heat shrinkable tubing sealed over either type of marker.
2. Pre-printed, white, heat-shrinkable tubing.

### **99-16722C(2) Field Quality Control**

Testing: Perform operational tests for the fire alarm system in the presence of the Engineer. The operational tests must demonstrate that all functions of the system operate in the manner described in the manufacturer's literature and that the system is stable under normal vibration and shocks to components. Notify the Engineer not less than 10 days in advance of performing the operational tests.

Monitoring:

Provide monitoring services for the facility for one year after the acceptance of the contract. The services must include a toll-free telephone line connecting to the 24-hour on call monitoring station. Monitoring station must contact designated site representative in the event of alarm and dispatch an immediate on-site response to the alarm location if the site representative cannot be reached or verification of the cause of the alarm cannot be determined.

Monitoring services after the first year will be handled by the State.

### **99-16722C(3) Training**

Training: Provide four hour of on-site training on the use, operation, and, maintenance of the system for not more than 8 designated State employees. Notify the Engineer not less than 10 days in advance of proposed training class.

### **99-16722D Payment**

Not Used

## **99-16724 INTRUSION ALARM SYSTEM**

### **99-16724A General**

#### **99-16724A(1) Summary**

Scope: This work consists of furnishing and installing a complete and operational intrusion alarm system.

The system must include all necessary materials for a complete and operational intrusion alarm system.

#### **99-16724A(2) Definitions**

Not Used

#### **99-16724A(3) System Description**

Design Requirements:

The intrusion alarm system must be a low voltage, direct current, zoned alarm system, and consist of a control panel, magnetic contact switches, combination detectors, multiple switch contact monitors, glass break discriminators, panic switch, amplified speaker and manual keypad stations. Each zone must be "supervised, Class B circuit." The end of line resistor must be installed in the control panel.

The alarm system must self-test and report status of individual zones.

The alarm system must provide an automatically rechargeable back-up power supply system in case of building power interruption.

The alarm system components must be U.L. or F.M. Listed. The system proposed must be approved by the Federal Communication Commission (FCC).

#### **99-16724A(4) Submittals**

Product Data:

Submit manufacturer's descriptive information and installation instructions.

Installation instructions must include manufacturer and catalog reference, and model number of equipment to be furnished, conduit and conductor sizes, wiring diagram, and floor plan showing locations of multiple switch contact monitor and devices.

#### **99-16724A(5) Quality Control and Assurance**

Installer Qualification: The installer of the security alarm system must be licensed by the State Department of Consumer Affairs, Bureau of Collection and Investigative Services. License numbers and expiration dates must be included on all correspondence.

#### **99-16724B Materials**

Control Panel:

The control panel must be a surface-mounted, locking cabinet, completely self-contained control panel suitable for 120-volt, AC, input power with separate terminals for all external wires.

The control panel must meet the following requirements:

1. Compatible with Simplex 4100, Notifier 640 or equivalent
2. Minimum 12 reference zones and expandable to 16 zones
3. Digital dialer communicator;
4. 12-volt auxiliary power supply;
5. Rechargeable battery (8 hour minimum);
6. Battery charger;
7. Low battery reporting;
8. Silent alarm signaling;
9. System connected to RJ31X or RJ38X telephone jack or equivalent;
10. Line test every twenty-four (24) hours
11. 120-volt, AC, input
12. Front accessible control and indication digital keypad.

Magnetic Contact Switch:

Magnetic door switch for pedestrian door must be a 2-section, self-lock mounting type switch, and must be compatible with the material of the door on which it is installed. The switch must be epoxied in the switch housing. Magnetic contact switches must be the type capable of being concealed on the top of the door frame.

Magnetic contact switches for the overhead vehicle doors must be 2-section, extra heavy-duty, floor mounting type switch with stainless steel armored cable.

Switch must be housed in a non-magnetic case.

Glass Break Discriminator: Glass break discriminator must be an acoustic glass break detector. Detector must respond to energy of breaking windows using piezo-electric crystal microphone. Sensor coverage pattern must be directional, detecting breakage of uncovered glass in a 34-foot wide area at a distance of 11½ feet minimum. The sensor must be housed in a fire retardant ABS housing.

Digital Keypad: The remote digital keypad must be flush mounted on a sheet metal box. Each digital keypad must have two separate SPDT outputs contact with selectable timings (10, 30, 35 seconds); multiple programmable codes, and 3 LED indicating lights for loop status, system status and shunt status.

Each digital keypad must operate on DC power and contacts must be rated one ampere at minimum 12-volt DC. Each digital keypad must be wired to the control panel to turn on or turn off the entire system from each location. Digital keypad must have 12-key with alarmed and ready lights and audible warning signal.

**Multiple Switch Contact Monitor:** The multiple switch contact monitor must have six (6) contact points: four (4) monitored contacts, one (1) supervised tamper and one (1) relay output contact. Multiple switch contact monitor can be located anywhere on the distributed system.

**Combination Detector:** Combination detectors must be low voltage, wall-mounted, wide angle microwave or passive infrared detectors with a detection pattern appropriate to cover areas shown. Model must be specified on proposed installation layout. The detector must have an LED indicating light.

**Panic Switch:** Panic switch must be low voltage, wall-mounted, SPDT, and latching circuitry and magnetic reed contacts. The actuating lever, housing and cover plate must be ABS fire-retardant plastic. The switch must have an Latching LED indicating light.

**Amplified Speaker:** Amplified speaker must be 120V, 15 Watt, wall-mounted, cast aluminum alloy housing and UL Listed for General Signaling. The output of the speaker must be 15 watt, 108 dBA at 10 feet. The speaker must be compatible to use with intrusion alarm system.

### **99-16724C Construction**

#### **99-16724C(1) Installation**

The intrusion alarm system must be installed to comply with the manufacturer's instructions.

The switch section without wires must be recessed flush into the top edge of the door at the approximate center of the door, and the switch section with wires must be recessed flush in the top section of the door frame. The two sections of the switch must be mounted directly opposite each other to provide maximum sensitivity. The wiring from each magnetic switch must be run to the control panel in the zone dedicated for the intrusion alarm circuit.

The switch section mounted on the bottom edge of the overhead door must be without wires. The switch section with wire must be mounted on the floor directly below the switch part without wires. Magnetic contact switches for overhead doors must be mounted.

The glass break discriminator must be mounted on the ceiling at locations shown.

Combination detector must be mounted at not less than 7½ feet above finished floor at locations shown.

Panic switch and amplified speaker must be mounted at locations shown.

#### **Conduit and Conductors:**

All intrusion alarm system wiring must be installed in conduit system complying with the requirements under "Basic Materials and Methods." Conduit size must be as recommended by the intrusion alarm manufacturer, except that conduits must be not less than ½-inch diameter. Within the office areas and rooms with finished ceiling and furred wall areas, conduits must be concealed in ceiling or walls. All other conduit must be exposed.

All conductors and cables for the intrusion alarm system wiring must be as recommended by the intrusion alarm system manufacturer.

#### **99-16724C(2) Field Quality Control**

**Testing:** Perform operational test for the intrusion alarm system in the presence of the Engineer. The operational tests must demonstrate that all functions of the system operate in the manner described in the manufacturer's literature and demonstrate system stability under normal vibration and shocks to components. Notify the Engineer not less than 10 days in advance of performing the operational tests.

#### **Monitoring:**

Provide monitoring services for the facility for one year after the acceptance of the contract. The services must include a toll-free telephone line connecting to the 24-hour on call monitoring station. Monitoring station must contact designated site representative in the event of alarm and dispatch an

immediate on-site response to the alarm location if the site representative cannot be reached or verification of the cause of the alarm cannot be determined.

Monitoring services after the first year will be handled by the State.

**99-16724C(3) Training**

Training: Provide one hour of on-site training on the use, operation, and maintenance of the system for not more than 8 designated State employees. Notify the Engineer not less than 10 days in advance of proposed training class.

**99-16724D Payment**

Not Used

**99-16911 BOILER CONTROL PANEL**

**99-16911A General**

**99-16911A(1) Summary**

Scope: This work consists of furnishing and installing boiler control panel.

**99-16911A(2) Definitions**

Not Used

**99-16911A(3) Submittals**

Product Data:

Submit a list of materials and equipment to be installed and the manufacturer's descriptive data.

Manufacturer's descriptive data must include complete description, performance data and installation instructions for the materials and equipment specified herein. Control and wiring diagrams, rough-in dimensions, and component layout must be included where applicable. All control and power conductors on the shop drawings must be identified with wire numbers.

**99-16911A(4) Quality Control and Assurance**

Not Used

**99-16911B Materials**

**99-16911B(1) General**

Boiler Control Panel:

Boiler control panel enclosure must be single exterior hinged door, dust tight NEMA Type 3R enclosure containing an electrical mounting panel and hinged interior dead front door. The enclosure must be made of 14-gage steel minimum with all seams continuously welded. A rolled up lip must be provided around three sides of the hinged door and around all sides of the enclosure opening. The door must be provided with a neoprene gasket that is attached with an oil-resistant adhesive. The door must be maintained closed with door clamps. Security must be provided by a hasp and staple for padlocking.

The enclosure must be factory prewired to comply with NEMA Class IIC wiring. All wires entering the enclosure must terminate on terminal blocks. All interior control wires must be 19 strand No. 14 MTW. Wires must be neatly trained and bundled, and wiring troughs must be provided in the enclosure as necessary. Wiring must be arranged so that any piece of apparatus may be removed without disconnecting any wires except the leads to that piece of apparatus.

A wiring diagram encased between two heat-fused laminated plastic sheets must be provided with brass mounting eyelets and attached to the inside of the enclosure.

Main Breaker, MB: Well pump main breaker must be 2-pole, 240-volt, AC, molded case circuit breaker with 100-ampere frame, 100-ampere trip, and interrupting capacity of 10,000 amperes (symmetrical) at 240 volts. Breaker must be Square D Company, Westinghouse, I.T.E., or equal.

Boiler Control Breakers, CBB1, CBB2: Boiler control breakers must be single-pole, 120-volt, AC, molded case circuit breaker with 100-ampere frame, ampere trip as shown, and interrupting capacity of 10,000 amperes (symmetrical) at 120 volts.

Circulating Pumps, East Bays Pumps, West Bays Pumps, and Unit Heater Pumps Breakers, CBCP1 thru CBCP4, CBP1 thru CBP6: breakers must be single-pole, thermal-magnetic type, 120-volt, AC, molded case circuit breaker with 100-ampere frame, ampere trip as shown, and interrupting capacity of 10,000 amperes (symmetrical) at 120 volts.

Starters, STCP1 thru STCP4 and STP1 thru STP6: Starter must be NEMA Size 1, NEMA rated, 2-pole, 240-volt, contactor with 120-volt coil, and non-adjustable overload relay. Overload relay must be resettable by an externally operable pushbutton on the hinged interior deadfront panel. Overload relay must have two thermal overload elements and must trip between 115 and 125 percent of full load motor current, as quoted on the nameplate by the motor manufacturer. Starter must be NEMA rated.

Time Delay Relay, TDR1: Time Delay Relay must be solenoid-operated, pneumatically-timed delay relay with 120-volt, AC, coil, sealed gas chamber, and double-pole, double-throw, double-break contacts having a capacity of 10 amperes at 120 volts, AC. TDR1 must have time delay on deenergizing adjustable from 1.5 to 15 minutes initially set at 7 minutes.

Control Relay, CR1: Control relay must be 120-volt, AC, general purpose relay with 3-pole, double-throw, 10-ampere, 120-volt, AC, contacts. Relay must be enclosed in clear plastic with 11-pin tube type plug base. Sockets for relay must be barrier type, 11-contact relay socket with 10-ampere contacts and screw terminals. Ground bar and Neutral Bar: Ground bar and Neutral bar must be 100-ampere copper neutral bar with circuit taps.

Terminal Block, TB: Terminal block must be 40-ampere, 120/240-volt, molded plastic with two or more mounting holes and two or more terminals in each cast block. The molded plastic must have a high resistance to heat, moisture, mechanical shock, and electric potential and must have a smooth even finish. Each block must have a molded marking strip attached with screws. Terminal blocks must have tubular, high pressure clamp connectors.

Selector Switches, SSB1, SSB2, SSEB, SSWB, SSUH, SSCP1 thru SSCP2, SSP1 thru SSP6: Selector switch must be rotary action, single-pole, 3-position, 10-ampere, 120-volt switch. Switch contacts must have an inductive pilot duty rating of 60 amperes (make), 6 amperes (break) and 10 amperes (continuous) at 120 volts and 35 percent power factor. Selector switch must have legend ring plate marked HAND-OFF-AUTO.

Pilot Lights, PL1 thru PL21: Pilot lights must be 1.2 inch diameter, NEMA Type 4, push-to-test type, panel mounted, heavy duty, oil tight indicating light with 120-volt, AC, LED lamp with colored plastic lens, and screw cap. The color of the lens must be as shown.

Flow Switch (FS). Flow switch must be a fluid flow switch activated by fluid flow in the pipe. The unit must operate independently of pressure and respond to flow only and must consist of a threaded brass mounting base, stainless steel actuator and a 10-ampere, 120-volt, AC, single pole double throw switch enclosed in a watertight housing. Flow switch must be rated for 125 psi.

Temperature Process Controller No.1, TPC1. Temperature process controller must be one temperature input, four relay output stages, microprocessor based controller and sensor system. The controller must have integral with the controller a liquid crystal display for interactive prompting during programming and display of assigned setpoints, differential values, and to view system status and operating information. The controller must be suitable to operate on 120-volt, AC, and output relays must be rated at 10-ampere at 120-volt. The controller must be able to be programmed for both heating and cooling mode and must have accuracy of  $\pm \frac{1}{2}$  degree or better  $^{\circ}\text{F}$ , at  $-30^{\circ}\text{F}$  to  $125^{\circ}\text{F}$  operating temperature. Set point temperature range of temperature process controller must be from  $-40^{\circ}\text{F}$  to  $220^{\circ}\text{F}$ . An appropriate outdoor air temperature monitoring type, weatherproof sensor elements complete with pigtailed, sensor cables, sensor enclosure must be supplied as part of a complete package.

Temperature Process Controller No. 2, 3 and 4, (TPC2, TPC3 and TPC4). Temperature process controller must be two temperature input, one relay for one stage heating output, microprocessor based thermostat and sensor system. The thermostat must have a liquid crystal display integral with the unit for interactive prompting during programming and display of assigned setpoints, set-up values, and to view

system status and operating information. The thermostat must be suitable to operate on 120-volt, AC, and output relays must be rated at 5-amperes at 240-volt, AC. The thermostat must be able to be programmed for heating mode and must have accuracy of  $\pm \frac{1}{2}$  degree or better °F, at 32 °F to 122 °F ambient operating temperature. Setpoint temperature range of thermostat must be from 40 °F to 122 °F. Thermostat. Thermostat must be the pulse width modulation type and have a two-way communication feature with other thermostats. An appropriate outdoor air temperature and slab temperature monitoring type, weatherproof sensor elements complete with pigtails, sensor cables, sensor enclosure must be supplied as part of a complete package.

Pump Alternator. Pump alternator must be microprocessor based (proportional, integral, derivative) PID pump sequencer specifically designed to provide pump control in stand-by mode. In stand-by mode, pump alternator must automatically switches over from lead pump to stand-by pump during pump failure. The pump alternator must be suitable to operate on 120-volt, AC. Unit must have pump relays that are rated at 10-amperes at 240-volt AC and alarm relays rated at 2-amperes at 240-volt AC. The pump alternator must have indicating lights, rotating dials, and DIP switches integral with the unit for interactive prompting during programming, display of alarms, set-up values, to view system status and operating information. The pump alternator must have the following features:

- Adjustable flow proof delay
- Exercising
- Equal run time rotation
- Alarm per pump or Alarm levels
- Test sequence to ensure proper component operation

#### **99-16911B(2) Fabrication**

Component Mounting:

The following electrical components must be mounted on the back panel of Boiler Control Panel Enclosure: Main breaker, MB; Starter, ST; Flow timer, TDR; Control relay, CR; Ground bar and Neutral bar; and Terminal block, TB. Spacers must be installed with all breakers so that they are externally operable with the hinged door closed.

The following electrical components must be mounted on the interior door of Enclosure: Overload reset, Selector switch, SS; and Pilot lights.

#### **99-16911C Construction**

##### **99-16911C(1) Installation**

The Boiler Control Panel must be installed as shown.

All bolts and fasteners must be galvanized.

All concrete around conduit penetrations must be finished smooth and sloped in a way to avoid standing water around the conduit. Wires must be neatly trained and bundled, and wiring troughs must be provided in the enclosure as necessary. Wiring must be arranged so that any piece of apparatus may be removed without disconnecting any wires except the leads to that piece of apparatus. No equipment or device must be mounted on the side or at the bottom of the panel. A minimum of 6 inches of empty space must be provided at the bottom of the panel for bundling field conductors and terminating field conduits.

Use of dark gray control conductors for the wiring of control is prohibited.

Conduction type thermocouple installations must be done as per the direction of the engineer.

##### **99-16911C(2) Operation**

Boiler. Boiler must be factory equipped with control equipment that will maintain the desired temperature of the water stored or flowing through it. Boiler will start and continue heating water while there is an enable signal coming from Temperature Process Controller No. 1 (TPC1) through Control Relays CR1 and CR2.

Boiler's Main Circulating Pumps Control. There are two main circulating pumps for each boiler pumping water through the main line. One of the pump is always on standby in case the lead pump fails. The Pump Alternator must activate and continue running the lead pump when pump demand signal exist from TPC1 through Time Delay Relay. Once pump contact is turned on, there must be time delay (initially set at 10 seconds) for detecting a water flow signal from Flow Switches. If a flow signal is not present within the selected time, the control turns off the lead pump contact and turns on the lag pump contact then an alarm contact is activated to indicate failure. There must be no time that both pumps run together at the same time. Pump alternator must automatically changes the operating sequence of the pumps to allow equal usage of both pumps. During summer, if a pump has not been operated at least once every three days, the control turns on the output for 10 seconds to minimize the possibility of a pump seizing during inactivity.

#### **99-16911C(3) Field Testing**

After complete installation work in the field of all various systems, the heating system must be tested in the presence of the Engineer to demonstrate that all functions operate properly. The contractor must provide all materials and equipment required for testing the system. The contractor must be responsible for the necessary repairs, replacements, adjustments and retests at his own expense.

#### **99-16911C(4) Training**

After complete installation work, training shall be provided for State personnel in operation, troubleshooting, and maintenance of the heating system. The training period must be minimum of 4 hours and shall be conducted for not more than 6 State personnel. The trainer for the control system must be authorized representative of the panel fabricator or integrator, and must have complete knowledge of all devices installed inside the control panel and its peripherals including but not limited to temperature process controllers, temperature sensors, boiler controller, alarm lights, indicating lights, and pump motors.

#### **99-16911D Payment**

Not Used

### **99-16915 SNOW MELTING SYSTEM**

#### **99-16915A General**

##### **99-16915A(1) Summary**

Scope: This work consists of furnishing and installing electric heating mats and cables under finished roof materials and control system.

##### **99-16915A(2) Definitions**

Not Used

##### **99-16915A(3) Submittals**

Submit manufacturer's descriptive information, catalog cuts and installation instructions. Submit scaled design and layout plans, diagrams for power and control wiring.

Design must follow maximum cold lead length to prevent excessive voltage drop and must use heat retention pad to prevent excessive heat loss on the roof.

##### **99-16915A(4) Samples**

Submit a sample of a electric heating mat for authorization before use.

##### **99-16915A(5) Quality Control and Assurance**

###### **99-16915A(5)(a) General**

The manufacturer of the snow melting system must have been in the business of manufacturing snow melting system for a minimum of 5 years.

#### **99-16915B Materials**

The following equipment must compose the snow melting system:

Electric Heating Mat: 12 inch wide, 3/64 inch thick heating element made from a homogenous semi-conductor self regulating polymer, utilizing Positive Temperature Coefficient Nano technology

allowing elements to heat at maximum power in cold environments, Bus braid dielectric liner thermally bonded to heating element, UL listed. The heating element must have maximum heat output 13 W/ft at 32 degree Fahrenheit. Also input voltage of the heating element must be 24 V (AC), single phase.

Power Supply: Power supply must have regulator type 1500 W, 240/24 V, 60 Hz, isolated primary and secondary winding, toroidal type, soft start transformer, NEMA I rated enclosure, line and load terminal blocks with line and load circuit breakers.

Temperature sensor: Temperature sensor must be outdoor, wall mounted, air sensing NEMA 4X thermostat, corrosion resistant stainless steel hydraulic capillary coil, Single pole double throw (SPDT) contact, adjustable set point between 40 to 90 degree Fahrenheit, UL listed.

Terminal Block, TB: Terminal block must be 30-ampere, 600-volt, molded plastic with two or more mounting holes and two or more terminals in each cast block. Each block must have a molded marking strip attached with screws. Terminal blocks must have high pressure clamp connectors.

### **99-16915C Construction**

#### **99-16915C(1) General**

Not Used.

#### **99-16915C(2) Installation**

The snow melting system must be installed with components supplied/recommended by the manufacturer. Identify the locations of the electrical bus braid wires for each heating element, to avoid fastening (nail) through bus braids. Installation must conform to the complete manufacturer's installation instructions, NEC Code, and any appropriate local electric codes.

#### **99-16915C(3) Field Quality Control**

Testing: Perform tests for the snow melting system in the presence of the Engineer and provide resistance readings are taken before, during, and after installation. Notify the Engineer in writing not less than 10 days in advance of performing the tests.

Functional Testing:

Functional tests must demonstrate that each and every part of the system functions as required.

#### **99-16915D Payment**

Not Used

**REVISED STANDARD SPECIFICATIONS  
APPLICABLE TO THE 2010 EDITION  
OF THE STANDARD SPECIFICATIONS**



**Add to the 1st table in section 1-1.06:**

10-17-14

LCS	Department's lane closure system
POC	pedestrian overcrossing
QSD	qualified SWPPP developer
QSP	qualified SWPPP practitioner
SDS	safety data sheet
TRO	time-related overhead
WPC	water pollution control

**Add to the notes of the 1st table in section 1-1.06:**

10-17-14

<sup>b</sup>Interpret a reference to MSDS as a reference to SDS under 29 CFR 1910.1200.

**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:

04-20-12

703 B ST

Replace the Web site for the Department of General Services, Office of Small Business and DVBE Services in the table in section 1-1.11 with:

11-15-13

<http://www.dgs.ca.gov/dgs/ProgramsServices/BusServices.aspx>

Replace "--" for the telephone number for the Office Engineer in the table in section 1-1.11 with:

02-27-15

(916) 227-6299

AA

## 2 BIDDING

04-10-15

Replace the headings and paragraphs in section 2 with:

02-21-14

### 2-1.01 GENERAL

Section 2 includes specifications related to bid eligibility and the bidding process.

The electronic bid specifications in section 2 apply if *Electronic Bidding Contract* is shown on the cover of the *Notice to Bidders and Special Provisions*.

### 2-1.02 BID INELIGIBILITY

A firm that has provided architectural or engineering services to the Department for this contract before bid submittal for this contract is prohibited from any of the following:

1. Submitting a bid
2. Subcontracting for a part of the work
3. Supplying materials

### 2-1.03 RESERVED

02-27-15

### 2-1.04 CONTRACTOR REGISTRATION

No contractor or subcontractor may be listed on a bid proposal for a public works project (submitted on or after March 1, 2015) unless registered with the Department of Industrial Relations pursuant to LaborCode section 1725.5 [with limited exceptions from this requirement for bid purposes only under LaborCode section 1771.1(a)].

02-21-14

### 2-1.05 RESERVED

10-17-14

### 2-1.06 BID DOCUMENTS

01-23-15

#### 2-1.06A General

The *Bid* book includes bid forms and certifications. For an electronic bid, the *Bid* book includes forms not available through the electronic bidding service.

The *Notice to Bidders and Special Provisions* includes the *Notice to Bidders*, revised standard specifications, and special provisions.

The *Bid* book, including *Bid* book forms not available through the electronic bidding service, *Notice to Bidders and Special Provisions*, project plans, and any addenda to these documents may be accessed at the Bidders' Exchange website.

The *Standard Specifications* and *Standard Plans* may be viewed at the Bidders' Exchange website and may be purchased at the Publication Distribution Unit.

10-17-14

### **2-1.06B Supplemental Project Information**

The Department makes supplemental information available as specified in the special provisions.

Logs of test borings are supplemental project information.

If an *Information Handout* or cross sections are available, you may view them at the Contract Plans and Special Provisions link at the Bidders' Exchange website.

If rock cores are available, you may view them by sending a request to [Coreroom@dot.ca.gov](mailto:Coreroom@dot.ca.gov).

If other supplemental project information is available for inspection, you may view it by phoning in a request.

Make your request at least 7 days before viewing. Include in your request:

1. District-County-Route
2. Contract number
3. Viewing date
4. Contact information, including telephone number

For rock cores, also include the bridge number in your request.

If bridge as-built drawings are available:

1. For a project in District 1 through 6 or 10, you may request them from the Office of Structure Maintenance and Investigations, fax (916) 227-8357
2. For a project in District 7, 8, 9, 11, or 12, you may request them from the Office of Structure Maintenance and Investigations, fax (916) 227-8357, and they are available at the Office of Structure Maintenance and Investigations, Los Angeles, CA, telephone (213) 897-0877

As-built drawings may not show existing dimensions and conditions. Where new construction dimensions are dependent on existing bridge dimensions, verify the field dimensions and adjust dimensions of the work to fit existing conditions.

### **2-1.06C–2-1.06D Reserved**

### **2-1.07 JOB SITE AND DOCUMENT EXAMINATION**

Examine the job site and bid documents. Notify the Department of apparent errors and patent ambiguities in the plans, specifications, and Bid Item List. Failure to do so may result in rejection of a bid or rescission of an award.

Bid submission is your acknowledgment that you have examined the job site and bid documents and are satisfied with:

1. General and local conditions to be encountered
2. Character, quality, and scope of work to be performed
3. Quantities of materials to be furnished
4. Character, quality, and quantity of surface and subsurface materials or obstacles
5. Requirements of the contract

02-21-14

### **2-1.08 RESERVED**

### **2-1.09 BID ITEM LIST**

Submit a bid based on the bid item quantities the Department shows on the Bid Item List.

**2-1.10 SUBCONTRACTOR LIST**

On the Subcontractor List form, list each subcontractor to perform work in an amount in excess of 1/2 of 1 percent of the total bid or \$10,000, whichever is greater (Pub Cont Code § 4100 et seq.).

For each subcontractor listed, the Subcontractor Listform must show:

1. Business name and the location of its place of business.
2. California contractor license number for a non-federal-aid contract.
3. Public works contractor registration number
4. Portion of work it will perform. Show the portion of the work by:
  - 4.1. Bid item numbers for the subcontracted work
  - 4.2. Percentage of the subcontracted work for each bid item listed
  - 4.3. Description of the subcontracted work if the percentage of the bid item listed is less than 100 percent

02-21-14

**2-1.11 RESERVED**

01-23-15

**2-1.12 DISADVANTAGED BUSINESS ENTERPRISES****2-1.12A General**

Section 2-1.12 applies to a federal-aid contract.

Under 49 CFR 26.13(b):

The contractor, sub recipient or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR part 26 in the award and administration of DOT-assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the recipient deems appropriate, which may include, but is not limited to:

- (1) Withholding monthly progress payments;
- (2) Assessing sanctions;
- (3) Liquidated damages; and/or
- (4) Disqualifying the contractor from future bidding as non-responsible.

Include this assurance in each subcontract you sign with a subcontractor.

**2-1.12B Disadvantaged Business Enterprise Goal****2-1.12B(1) General**

Section 2-1.12B applies if a DBE goal is shown on the *Notice to Bidders*.

The Department shows a goal for DBE to comply with the DBE program objectives provided in 49 CFR 26.1.

Make work available to DBEs and select work parts consistent with available DBEs, including subcontractors, suppliers, service providers, and truckers.

Meet the DBE goal shown on the *Notice to Bidders* or demonstrate that you made adequate good faith efforts to meet this goal.

You are responsible to verify at bid opening the DBE firm is certified as a DBE by the California Unified Certification Program and possess the work codes applicable to the type of work the firm will perform on the Contract.

Determine that selected DBEs perform a commercially useful function for the type of work the DBE will perform on the Contract as provided in 49 CFR 26.55(c)(1)–(4). Under 49 CFR 26.55(c)(1)–(4), the DBE must be responsible for the execution of a distinct element of work and must carry out its responsibility by actually performing, managing, and supervising the work.

All DBE participation will count toward the Department's federally-mandated statewide overall DBE goal.

Credit for materials or supplies you purchase from DBEs will be evaluated on a contract-by-contract basis and counts toward the goal in the following manner:

1. 100 percent if the materials or supplies are obtained from a DBE manufacturer.
2. 60 percent if the materials or supplies are obtained from a DBE regular dealer.
3. Only fees, commissions, and charges for assistance in the procurement and delivery of materials or supplies, if they are obtained from a DBE that is neither a manufacturer nor regular dealer. 49 CFR 26.55 defines "manufacturer" and "regular dealer."

You receive credit toward the goal if you employ a DBE trucking company that is performing a commercially useful function. The Department uses the following factors in determining whether a DBE trucking company is performing a commercially useful function:

- The DBE must be responsible for the management and supervision of the entire trucking operation for which it is responsible on a particular contract, and there cannot be a contrived arrangement for the purpose of meeting DBE goals.
- The DBE must itself own and operate at least one fully licensed, insured, and operational truck used on the contract.
- The DBE receives credit for the total value of the transportation services it provides on the Contract using trucks it owns, insures, and operates using drivers it employs.
- The DBE may lease trucks from another DBE firm, including an owner-operator who is certified as a DBE. The DBE who leases trucks from another DBE receives credit for the total value of the transportation services the lessee DBE provides on the Contract.
- The DBE may lease trucks without drivers from a non-DBE truck leasing company. If the DBE leases trucks from a non-DBE truck leasing company and uses its own employees as drivers, it is entitled to credit for the total value of these hauling services.
- A lease must indicate that the DBE has exclusive use and control over the truck. This does not preclude the leased truck from working for others during the term of the lease with the consent of the DBE, so long as the lease gives the DBE absolute priority for use of the leased truck. Leased trucks must display the name and identification number of the DBE.

[49 Fed Reg 59595 (10/2/14) (to be codified at 49 CFR 26.55(d))]

04-10-15

### **2-1.12B(2) DBE Commitment Submittal**

Submit DBE information under section 2-1.33.

Submit a copy of the quote from each DBE shown on the DBE Commitment form that describes the type and dollar amount of work shown on the form. Submit a DBE Confirmation form for each DBE shown on the DBE Commitment form to establish that it will be participating in the Contract in the type and dollar amount of work shown on the form. If a DBE is participating as a joint venture partner, submit a copy of the joint venture agreement.

01-23-15

### **2-1.12B(3) DBE Good Faith Efforts Submittal**

You can meet the DBE requirements by either documenting commitments to DBEs to meet the Contract goal or by documenting adequate good faith efforts to meet the Contract goal. An adequate good faith effort means that the bidder must show that it took all necessary and reasonable steps to achieve a DBE goal that, by their scope, intensity, and appropriateness to the objective, could reasonably be expected to meet the DBE goal.

If you have not met the DBE goal, complete and submit the DBE Good Faith Efforts Documentation form under section 2-1.33 showing that you made adequate good faith efforts to meet the goal. Only good faith efforts directed toward obtaining participation by DBEs are considered.

Submit good faith efforts documentation within the specified time to protect your eligibility for award of the contract in the event the Department finds that the DBE goal has not been met.

Refer to 49 CFR 26 app A for guidance regarding evaluation of good faith efforts to meet the DBE goal.

The Department considers DBE commitments of other bidders in determining whether the low bidder made good faith efforts to meet the DBE goal.

02-21-14

## **2-1.13–2-1.14 RESERVED**

## **2-1.15 DISABLED VETERAN BUSINESS ENTERPRISES**

### **2-1.15A General**

Section 2-1.15 applies to a non-federal-aid contract.

Take necessary and reasonable steps to ensure that DVBEs have the opportunity to participate in the Contract.

Comply with Mil & Vet Code § 999 et seq.

### **2-1.15B Projects \$5 Million or Less**

Section 2-1.15B applies to a project with an estimated cost of \$5 million or less.

Make work available to DVBEs and select work parts consistent with available DVBE subcontractors and suppliers.

Meet the goal shown on the *Notice to Bidders*.

Complete and submit the Certified DVBE Summary form under section 2-1.33. List all DVBE participation on this form.

If a DVBE joint venture is used, submit the joint venture agreement with the Certified DVBE Summary form.

List each 1st-tier DVBE subcontractor on the Subcontractor List form regardless of percentage of the total bid.

### **2-1.15C Projects More Than \$5 Million**

#### **2-1.15C(1) General**

Section 2-1.15C applies to a project with an estimated cost of more than \$5 million.

The Department encourages bidders to obtain DVBE participation to ensure the Department achieves its State-mandated overall DVBE goal.

If you obtain DVBE participation:

1. Complete and submit the Certified DVBE Summary form under section 2-1.33. List all DVBE participation on this form.
2. List each 1st tier DVBE subcontractor in the Subcontractor List form regardless of percentage of the total bid.

If a DVBE joint venture is used, submit the joint venture agreement with the Certified DVBE Summary form.

#### **2-1.15C(2) DVBE Incentive**

The Department grants a DVBE incentive to each bidder who achieves a DVBE participation of 1 percent or greater (Mil & Vet Code 999.5 and Code of Regs § 1896.98 et seq.).

To receive this incentive, submit the Certified DVBE Summary form under section 2-1.33.

Bidders other than the apparent low bidder, the 2nd low bidder, and the 3rd low bidder may be required to submit the Certified DVBE Summary form if the bid ranking changes. If the Department requests a Certified DVBE Summary form from you, submit the completed form within 4 business days of the request.

#### **2-1.15C(3) Incentive Evaluation**

The Department applies the small business and non-small business preference during bid verification and proceeds with the evaluation specified below for DVBE incentive.

The DVBE incentive is a reduction, for bid comparison only, in the total bid submitted by the lesser of the following amounts:

1. Percentage of DVBE achievement rounded to 2 decimal places of the verified total bid of the low bidder
2. 5 percent of the verified total bid of the low bidder
3. \$250,000

The Department applies DVBE incentive and determines whether bid ranking changes.

A non-small business bidder cannot displace a small business bidder. However, a small business bidder with higher DVBE achievement can displace another small business bidder.

The Department proceeds with awarding the contract to the new low bidder and posts the new verified bid results at the Department's Web site.

## **2-1.16–2-1.17 RESERVED**

## **2-1.18 SMALL BUSINESS AND NON-SMALL BUSINESS SUBCONTRACTOR PREFERENCES**

### **2-1.18A General**

Section 2-1.18 applies to a non-federal-aid contract.

The Department applies small business preferences and non-small business preferences under Govt Code § 14835 et seq. and 2 CA Code of Regs § 1896 et seq.

Any contractor, subcontractor, supplier, or service provider who qualifies as a small business is encouraged to apply for certification as a small business by submitting its application to the Department of General Services, Office of Small Business and DVBE Services.

Contract award is based on the total bid, not the reduced bid.

### **2-1.18B Small Business Preference**

The Department allows a bidder certified as a small business by the Department of General Services, Office of Small Business and DVBE Services, a preference if:

1. Bidder submitted a completed Request for Small Business Preference or Non-Small Business Preference form with its bid
2. Low bidder did not request the preference or is not certified as a small business

The bidder's signature on the Request for Small Business Preference or Non-Small Business Preference form certifies that the bidder is certified as a small business at the date and time of bid or has submitted a complete application to the Department of General Services. The complete application and any required substantiating documentation must be received by the Department of General Services by 5:00 p.m. on the bid opening date.

The Department of General Services determines whether a bidder was certified on the bid opening date. The Department of Transportation confirms the bidder's status as a small business before applying the small business preference.

The small business preference is a reduction for bid comparison in the total bid submitted by the small business contractor by the lesser of the following amounts:

1. 5 percent of the verified total bid of the low bidder
2. \$50,000

If the Department determines that a certified small business bidder is the low bidder after the application of the small business preference, the Department does not consider a request for non-small business preference.

### **2-1.18C Non-Small Business Subcontractor Preference**

The Department allows a bidder not certified as a small business by the Department of General Services, Office of Small Business and DVBE Services, a preference if:

1. Bidder submitted a completed Request for Small Business Preference or Non–Small Business Preference form with its bid
2. Certified Small Business Listing for the Non–Small Business Preference form shows that you are subcontracting at least 25 percent to certified small businesses

Each listed subcontractor and supplier must be certified as a small business at the date and time of bid or must have submitted a complete application to the Department of General Services. The complete application and any required substantiating documentation must be received by the Department of General Services by 5:00 p.m. on the bid opening date.

The non–small business subcontractor preference is a reduction for bid comparison in the total bid submitted by the non–small business contractor requesting the preference by the lesser of the following amounts:

1. 5 percent of the verified total bid of the low bidder
2. \$50,000

### **2-1.19–2-1.26 RESERVED**

### **2-1.27 CALIFORNIA COMPANIES**

Section 2-1.27 applies to a non-federal-aid contract.

Under Pub Cont Code § 6107, the Department gives preference to a "California company," as defined, for bid comparison purposes over a nonresident contractor from any state that gives or requires a preference to be given to contractors from that state on its public entity construction contracts.

Complete a California Company Preference form.

The California company reciprocal preference amount is equal to the preference amount applied by the state of the nonresident contractor with the lowest responsive bid unless the California company is eligible for a small business preference or a non–small business subcontractor preference, in which case the preference amount is the greater of the two, but not both.

If the low bidder is not a California company and a California company's bid with reciprocal preference is equal to or less than the lowest bid, the Department awards the contract to the California company on the basis of its total bid.

### **2-1.28 RESERVED**

### **2-1.29 OPT OUT OF PAYMENT ADJUSTMENTS FOR PRICE INDEX FLUCTUATIONS**

You may opt out of the payment adjustments for price index fluctuations specified in section 9-1.07. To opt out, submit a completed Opt Out of Payment Adjustments for Price Index Fluctuations form under section 2-1.33.

### **2-1.30–2-1.32 RESERVED**

### **2-1.33 BID DOCUMENT COMPLETION AND SUBMITTAL**

#### **2-1.33A General**

Complete the forms in the *Bid* book.

Use the forms provided by the Department except as otherwise specified for a bidder's bond.

Do not fax forms except for the copies of forms with the public works contractor registration number submitted after the time of bid. Fax these copies to (916) 227-6282.

Submit the forms and copies of the forms to the Office Engineer.

Failure to submit the forms and information as specified may result in a nonresponsive bid.

If an agent other than the authorized corporate officer or a partnership member signs the bid, file a Power of Attorney with the Department either before opening bids or with the bid. Otherwise, the bid may be nonresponsive.

02-27-15

### **2-1.33B Electronic Bids**

Section 2-1.33B applies to electronic bids.

For an electronic bid, complete and submit the electronic portion of the *Bid* book under the *Electronic Bidding Guide* at the Bidders' Exchange website and submit the paper forms as specified for a paper bid.

Your authorized digital signature is your confirmation of and agreement to all certifications and statements contained in the *Bid* book.

On forms and certifications that you submit through the electronic bidding service, you agree that each form and certification where a signature is required is deemed as having your signature.

### **2-1.33C Paper Bids**

Section 2-1.33C applies to paper bids.

Submit your bid and any *Bid* book forms after you submit your bid:

1. Under sealed cover
2. Marked as a bid
3. Identifying the contract number and the bid opening date

### **2-1.33D Bid Form Submittal Schedules**

#### **2-1.33D(1) General**

The *Bid* book includes forms specific to the contract. The deadlines for the submittal of the forms vary depending on the requirements of each contract. Determine the requirements of the contract and submit the forms based on the applicable schedule specified in section 2-1.33D.

Bid forms and information on the form that are due after the time of bid may be submitted at the time of bid.

#### **2-1.33D(2) Federal-Aid Contracts**

##### **2-1.33D(2)(a) General**

Section 2-1.33D(2) applies to a federal-aid contract.

##### **2-1.33D(2)(b) Contracts with a DBE Goal**

Section 2-1.33D(2)(b) applies if a DBE goal is shown on the *Notice to Bidders*.

Submit the bid forms according to the schedule shown in the following table:

04-10-15

**Bid Form Submittal Schedule for a  
Federal-Aid Contract with a DBE Goal**

Form	Submittal deadline
Bid to the Department of Transportation	Time of bid except for the public works contractor registration number
Copy of the Bid to the Department of Transportation as submitted at the time of bid with the public works contractor registration number	10 days after bid opening
Subcontractor List	Time of bid except for the public works contractor registration number
Copy of the Subcontractor List as submitted at the time of bid with the public works contractor registration number	10 days after bid opening
Small Business Status	Time of bid
Opt Out of Payment Adjustments for Price Index Fluctuations <sup>a</sup>	Time of bid
DBE Commitment	No later than 4 p.m. on the 4th business day after bid opening
DBE Confirmation	No later than 4 p.m. on the 4th business day after bid opening
DBE Good Faith Efforts Documentation	No later than 4 p.m. on the 4th business day after bid opening

<sup>a</sup>Submit only if you choose the option.

02-27-15

**2-1.33D(2)(c) Contracts without a DBE Goal**

Reserved

**2-1.33D(2)(d)–2-1.33D(2)(h) Reserved**

**2-1.33D(3) Non-Federal-Aid Contracts**

**2-1.33D(3)(a) General**

Section 2-1.33D(3) applies to non-federal-aid contracts.

**2-1.33D(3)(b) Contractswith a DVBE Goal**

Section 2-1.33D(3)(b) applies if a DVBE goal is shown on the *Notice to Bidders*.

Submit the bid forms according to the schedule shown in the following table:

**Bid Form Submittal Schedule for a  
Non-Federal-Aid Contract with a DVBE Goal**

Form	Submittal deadline
Bid to the Department of Transportation	Time of bid except for the public works contractor registration number for a joint-venture contract
For a joint-venture contract, copy of the Bid to the Department of Transportation as submitted at the time of bid with the public works contractor registration number	10 days after bid opening
Subcontractor List	Time of bid
Opt Out of Payment Adjustments for Price Index Fluctuations <sup>a</sup>	Time of bid
Certified DVBE Summary	No later than 4 p.m. on the 4th business day after bid opening
California Company Preference	Time of bid
Request for Small Business Preference or Non-Small Business Preference <sup>a</sup>	Time of bid
Certified Small Business Listing for the Non-Small Business Preference <sup>a</sup>	No later than 4 p.m. on the 2nd business day after bid opening

<sup>a</sup>Submit only if you choose the option or preference.

**2-1.33D(3)(c) Contracts without a DVBE Goal**

Reserved

**2-1.33D(3)(d)–2-1.33D(3)(h) Reserved**

**2-1.33D(4)–2-1.33D(9) Reserved**

02-21-14

**2-1.34 BIDDER'S SECURITY**

Submit one of the following forms of bidder's security equal to at least 10 percent of the bid:

1. Cash
2. Cashier's check
3. Certified check
4. Signed bidder's bond by an admitted surety insurer
5. For an electronic bid, electronic bidder's bond by an admitted surety insurer submitted using an electronic registry service approved by the Department.

Submit cash, cashier's check, certified check, or bidder's bond to the Department at the Bidders Exchange before the bid opening time.

Submit electronic bidder's bond with the electronic bid.

If using a bidder's bond, you may use the form in the *Bid* book. If you do not use the form in the *Bid* book, use a form containing the same information.

**2-1.35–2-1.39 RESERVED**

**2-1.40 BID WITHDRAWAL**

For a paper bid:

1. An authorized agent may withdraw a bid before the bid opening date and time by submitting a written bid withdrawal request at the location where the bid was submitted. Withdrawing a bid does not prevent you from submitting a new bid.
2. After the bid opening time, you cannot withdraw a bid.

For an electronic bid:

1. Bids are not filed with the Department until the date and time of bid opening.

2. A bidder may withdraw or revise a bid after it has been submitted to the electronic bidding service if this is done before the bid opening date and time.

**2-1.41–2-1.42 RESERVED**

**2-1.43 BID OPENING**

The Department publicly opens and reads bids at the time and place shown on the *Notice to Bidders*.

**2-1.44–2-1.45 RESERVED**

**2-1.46 DEPARTMENT'S DECISION ON BID**

The Department's decision on the bid amount is final.

The Department may reject:

1. All bids
2. A nonresponsive bid

**2-1.47 BID RELIEF**

The Department may grant bid relief under Pub Cont Code § 5100 et seq. Submit any request for bid relief to the Office Engineer. The Relief of Bid Request form is available at the Department's website.

**2-1.48 RESERVED**

**2-1.49 SUBMITTAL FAILURE HISTORY**

The Department considers a bidder's past failure to submit documents required after bid opening in determining a bidder's responsibility.

**2-1.50 BID RIGGING**

Section 2-1.50 applies to a federal-aid contract.

The U.S. Department of Transportation (DOT) provides a toll-free hotline to report bid rigging activities. Use the hotline to report bid rigging, bidder collusion, and other fraudulent activities. The hotline number is (800) 424-9071. The service is available 24 hours 7 days a week and is confidential and anonymous.. The hotline is part of the DOT's effort to identify and investigate highway construction contract fraud and abuse and is operated under the direction of the DOT Inspector General.

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**3 CONTRACT AWARD AND EXECUTION**

02-27-15

**Replace section 3-1.02 with:**

02-21-14

**3-1.02 CONSIDERATION OF BIDS**

**3-1.02A General**

For a lump sum based bid, the Department compares bids based on the total price.

For a unit price based bid, the Department compares bids based on the sum of the item totals.

For a cost plus time based bid, the Department compares bids based on the sum of the item totals and the total bid for time.

**3-1.02B Tied Bids**

The Department breaks a tied bid with a coin toss except:

1. If a small business bidder and a non–small business bidder request preferences and the reductions result in a tied bid, the Department awards the contract to the small business bidder.

2. If a DVBE small business bidder and a non-DVBE small business bidder request preferences and the reduction results in a tied bid, the Department awards the contract to the DVBE small business bidder.

**Replace section 3-1.03 with:**

02-27-15

**3-1.03 CONTRACTOR REGISTRATION**

No contractor or subcontractor may be awarded a contract for public work on a public works project (awarded on or after April 1, 2015) unless registered with the Department of Industrial Relations pursuant to Labor Code section 1725.5.

**Add to the end of section 3-1.04:**

10-19-12

You may request to extend the award period by faxing a request to (916) 227-6282 before 4:00 p.m. on the last day of the award period. If you do not make this request, after the specified award period:

1. Your bid becomes invalid
2. You are not eligible for the award of the contract

**Replace the paragraph in section 3-1.11 with:**

10-19-12

Complete and deliver to the Office Engineer a *Payee Data Record* when requested by the Department.

**Replace section 3-1.12 with:**

01-23-15

**3-1.12 RESERVED**

**Replace section 3-1.13 with:**

07-27-12

**3-1.13 FORM FHWA-1273**

For a federal-aid contract, form FHWA-1273 is included with the Contract form in the documents sent to the successful bidder for execution. Comply with its provisions. Interpret the training and promotion section as specified in section 7-1.11A.

**Delete items 4 and 6 of the 2nd paragraph of section 3-1.18.**

01-23-15

**Delete the 3rd paragraph of section 3-1.18.**

02-27-15

**Replace "For all other contracts, the" in the 4th paragraph of section 3-1.18 with:**

02-27-15

The

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**5 CONTROL OF WORK**

04-24-15

**Add between "million" and ", professionally" in the 3rd paragraph of section 5-1.09A:**

10-19-12

and 100 or more working days

**Add to the list in the 4th paragraph of section 5-1.09A:**

10-19-12

9. Considering discussing with and involving all stakeholders in evaluating potential VECPs

**Add to the end of item 1.1 in the list in the 7th paragraph of section 5-1.09A:**

10-19-12

, including VECPs

**Replace the 1st paragraph of section 5-1.09C with:**

10-19-12

For a contract with a total bid over \$10 million and 100 or more working days, training in partnering skills development is required.

**Delete the 2nd paragraph of section 5-1.09C.**

10-19-12

**Replace "at least 2 representatives" in the 5th paragraph of section 5-1.09C with:**

10-19-12

field supervisory personnel

**Replace the 8th paragraph of section 5-1.13A with:**

04-24-15

Each subcontractor must have an active and valid:

1. State contractor license with a classification appropriate for the work to be performed (Bus & Prof Code § 7000 et seq.)
2. Public works contractor registration number with the Department of Industrial Relations

**Replace section 5-1.13B with:**

01-23-15

**5-1.13B Disadvantaged Business Enterprises**

**5-1.13B(1) General**

Section 5-1.13B applies to a federal-aid contract.

Use each DBE as listed on the DBE Commitment form unless you receive authorization for a substitution. Ensure that all subcontracts and agreements with DBEs to supply labor or materials are performed under 49 CFR 26.

Maintain records, including:

1. Name and business address of each 1st-tier subcontractor
2. Name and business address of each DBE subcontractor, DBE vendor, and DBE trucking company, regardless of tier
3. Date of payment and total amount paid to each business

If you are a DBE contractor, include the date of work performed by your own forces and the corresponding value of the work.

Before the 15th day of each month for the previous month's work, submit:

1. Monthly DBE Trucking Verification form
2. Monthly DBE Payment form

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. Submit the notifications. Upon work completion, complete a Disadvantaged Business Enterprises (DBE) Certification Status Change form. Submit the form within 30 days of Contract acceptance.

Upon work completion, complete a Final Report – Utilization of Disadvantaged Business Enterprises (DBE), First-Tier Subcontractors form. Submit it within 30 days of Contract acceptance. The Department withholds \$10,000 until the form is submitted. The Department releases the withhold upon submission of the completed form.

04-10-15

#### **5-1.13B(2) Performance of Disadvantaged Business Enterprises**

Section 5-1.13(B)(2) applies if a DBE goal is shown on the *Notice to Bidders*.

DBEs must perform work or supply materials as listed on the DBE Commitment form.

Do not terminate or substitute a listed DBE for convenience and perform the work with your own forces or those of an affiliate, a non-DBE firm, or another DBE firm or obtain materials from other sources without authorization from the Department.

The Department authorizes a request to use other forces or sources of materials if it shows any of the following justifications:

1. Listed DBE fails or refuses to execute a written contract based on the plans and specifications for the project.
2. You stipulated that a bond is a condition of executing the subcontract and the listed DBE fails to meet your bond requirements.
3. Work requires a contractor license and the listed DBE does not have a valid license under the Contractors License Law.
4. Listed DBE fails or refuses to perform the work or furnish the listed materials.
5. Listed DBE's work is unsatisfactory and not in compliance with the Contract.
6. Listed DBE is ineligible to work on the project because of suspension or debarment.
7. Listed DBE becomes bankrupt or insolvent.
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 under 49 CFR 26.53.

Notify the original DBE of your intent to use other forces or material sources and provide the reasons. Provide the DBE with 5 business 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

If the Department authorizes the termination or substitution of a listed DBE, make good faith efforts to find another DBE. The substitute DBE must (1) perform at least the same dollar amount of work as the original DBE under the Contract to the extent needed to meet the DBE goal and (2) be certified as a DBE with the work code applicable to the type of work the DBE will perform on the Contract at the time of your request for substitution. Submit your documentation of good faith efforts within 7 days of your request for authorization of the substitution. The Department may authorize a 7-day extension of this submittal period at your request. Refer to 49 CFR 26 app A for guidance regarding evaluation of good faith efforts to meet the DBE goal.

Unless the Department authorizes a request to terminate or substitute a listed DBE, the Department does not pay for work unless it is performed or supplied by the DBE listed on the DBE Commitment form. You may be subject to other sanctions under 49 CFR 26.

**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.

**Replace section 5-1.20E with:**

05-30-14

**5-1.20E Water Meter Charges**

Section 5-1.20E applies if a bid item for water meter charges is shown on the Bid Item List. The charges are specified in a special provision for section 5-1.20E.

The local water authority will install the water meters.

The charges by the local water authority include:

1. Furnishing and installing each water meter
2. Connecting to the local water authority's main water line, including any required hot tap or tee
3. Furnishing and installing an extension pipe from the main water line to the water meter
4. Sterilizing the extension pipe

Make arrangements and pay the charges for the installation of the water meters.

If a charge is changed at the time of installation, the Department adjusts the lump sum price based on the difference between the specified charges and the changed charges.

**Replace section 5-1.20F with:**

05-30-14

**5-1.20F Irrigation Water Service Charges**

Reserved

**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:**

10. Survey monuments

07-19-13

**Add to section 5-1.36C:**

If the Contract does not include an agreement with a railroad company, do not allow personnel or equipment on railroad property.

07-20-12

Prevent material, equipment, and debris from falling onto railroad property.

**Add to section 5-1.36:**

**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.

07-19-13

**Add between the 1st and 2nd paragraphs of section 5-1.37A:**

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.

10-19-12

**Replace the 1st sentence of the 1st paragraph of section 5-1.39C(2) with:**

Section 5-1.39C(2) applies if a plant establishment period of 3 years or more is shown on the *Notice to Bidders*.

10-19-12

**Replace "working days" in the 1st paragraph of section 5-1.43E(1)(a) with:**

original working days

10-19-12

**Replace "settled" in the last paragraph of section 5-1.43E(1)(d) with:**

resolved

04-10-15

**Replace items 3.1 and 3.2 in the list in the paragraph of section 5-1.43E(3)(b) with:**

- 3.1. One-time objection to the other's candidate without stating a reason
- 3.2. Objection to any of the other's subsequent candidates based on a specific breach of the candidate's responsibilities or qualifications under items 1 and 2 above

04-24-15

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## 6 CONTROL OF MATERIALS

07-19-13

Replace section 6-2.05C with:

04-19-13

### 6-2.05C Steel and Iron Materials

Steel and iron materials must be melted and manufactured in the United States except:

1. Foreign pig iron and processed, pelletized, and reduced iron ore may be used in the domestic production of the steel and iron materials
2. If the total combined cost of the materials does not exceed the greater of 0.1 percent of the total bid or \$2,500, materials produced outside the United States may be used if authorized

Furnish steel and iron materials to be incorporated into the work with certificates of compliance and certified mill test reports. Mill test reports must indicate where the steel and iron were melted and manufactured.

All melting and manufacturing processes for these materials, including an application of a coating, must occur in the United States. Coating includes all processes that protect or enhance the value of the material to which the coating is applied.

Replace "Precast concrete members specified section 11-2" in the table in section 6-3.05B with:

07-19-13

Precast concrete members specified as tier1 or tier 2 in section 90-4.01D(1)

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## 7 LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC

02-27-15

Replace "§§ 1727 and 1770–1815" in the 1st sentence of the 1st paragraph of section 7-1.02K(1) with:

02-27-15

§ 1720 et seq.

Replace "\$50" in the 1st sentence in the 6th paragraph of section 7-1.02K(2) with:

07-19-13

\$200

Replace "\$25" in the 2nd sentence in the 13th paragraph of section 7-1.02K(3) with:

07-19-13

\$100

Delete "water or" in the 9th paragraph of section 7-1.03.

05-30-14

**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.

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## **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 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.

AA

**8 PROSECUTION AND PROGRESS**

10-19-12

**Replace "working days" in the 1st paragraph of section 8-1.02B(1) with:**

10-19-12

original working days

**Replace "working days" at each occurrence in the 1st paragraph of section 8-1.02C(1) with:**

10-19-12

original working days

**Delete the 4th paragraph of section 8-1.02C(1).**

04-20-12

**Replace "Contract" in the 9th paragraph of section 8-1.02C(1) with:**

10-19-12

work

**Replace the 1st paragraph of section 8-1.02C(3)(a) with:**

04-20-12

Submit a description of your proposed schedule software for authorization.

**Delete the last paragraph of section 8-1.02C(3)(a).**

04-20-12

**Replace section 8-1.02C(3)(b) with:**

10-19-12

**8-1.02C(3)(b) Reserved**

**Delete the 3rd paragraph of section 8-1.02C(5).**

04-20-12

**Replace "Contract" in the last paragraph of section 8-1.02C(5) with:**

10-19-12

original

**Replace "working days" in the 1st paragraph of section 8-1.02D(1) with:**

10-19-12

original working days

**Replace "8-1.02D(1)" in the 2nd paragraph of section 8-1.02D(1) with:**

01-20-12

8-1.02C(1)

**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



**Replace "in" in the 3rd paragraph of section 9-1.04A with:**

10-19-12

for

**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

**Replace the heading and the 1st paragraph of section 9-1.04D(3) with:**

01-23-15

**9-1.04D(3) Equipment Not On the Job Site and Not Required for Original Contract Work**

For equipment not on the job site at the time required to perform work paid by force account and not required for original Contract work, the time paid is the time the equipment is operated to perform work paid by force account and the time to return the equipment to its source when the work paid by force account is completed.

**Replace item 2 in the 3rd paragraph of section 9-1.04D(3) with:**

01-23-15

2. Operated less than 4 hours is paid as 1/2 day

**Replace section 9-1.04D(4) with:**

01-23-15

**9-1.04D(4) Equipment Not On the Job Site and Required for Original Contract Work**

For equipment not on the job site at the time required to perform work paid by force account and required for original Contract work, the time paid is the time:

1. To move the equipment to the location of work paid by force account plus an equal amount of time to move the equipment to a location on the job site or its source when the work paid by force account is completed
2. Equipment is operated to perform work paid by force account

04-20-12

**Delete ", Huntington Beach," in the 3rd paragraph of section 9-1.07A.**

**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  $X_a$  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

$$Q_{rh} = RHMATT \times 0.80 \times X_{arb}$$

**Replace "weight of dry aggregate" in the definition of the variable  $X_{arb}$  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

$$Q_{mh} = MHMATT \times [(100 - X_{am}) / 100] \times X_{mab}$$

**Replace "weight of dry aggregate" in the definition of the variable  $X_{mab}$  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

$$Q_{rap} = HMATT \times X_{aa}$$

**Replace "weight of dry aggregate" in the definitions of the variables  $X_{aa}$  and  $X_{ta}$  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.



### **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 RESERVED**

**Replace section 10-4 with:**

05-30-14

### **10-4 WATER USAGE**

Section 10-4 includes general specifications for your use of water for construction activities.

The Department encourages you to conserve water in all construction activities.

The Engineer notifies you of any (1) water shortage or (2) mandate from a local water authority to ration water. Within 10 days of the notification, submit a water conservation plan. The plan must include:

1. List of construction activities that require water
2. Measures you will implement for each activity to conserve water
3. Method for curing concrete other than the water method if included in the work
4. Dust palliative you will use for dust control

Any unavailability of water that delays a controlling activity is a material shortage.

**Replace section 10-5 with:**

05-30-14

### **10-5 DUST CONTROL**

Section 10-5 includes general specifications for controlling dust resulting from the work.

Prevent and alleviate dust by:

1. Applying a dust palliative under section 18
2. Applying temporary soil stabilization under section 13-5
3. Managing material stockpiles under section 13-4.03C(3)

**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

07-19-13

**Delete the 3rd sentence in the 5th paragraph of section 11-3.02C(3).**

**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.

07-19-13

**Delete the 3rd paragraph of section 11-3.02D.**

**Replace the 1st sentence in the 4th paragraph of section 11-3.02D with:**

07-19-13

Except for the exempt facilities identified above, an authorized independent third party must witness the qualification tests for welders or welding operators.

**Replace the paragraph in section 11-3.02F with:**

07-19-13

Welding procedures qualification for work welded under AWS D1.5 must comply with clause 5.12 or 5.12.4 of AWS D1.5 and the following:

1. Unless considered prequalified, qualify fillet welds in each position. Conduct the fillet weld soundness test using the essential variables of the WPS as established by the PQR.
2. For qualifying joints that do not comply with figures 2.4 and 2.5 of AWS D1.5, conduct the test complying with figure 5.3 using the welding parameters that were established for the test conducted complying with figure 5.1.
3. Macroetch tests are required for WPS qualification tests, and acceptance must comply with clause 5.19.3 of AWS D1.5.
4. If a nonstandard weld joint is to be made using a combination of WPSs, you may conduct a test under figure 5.3, combining the qualified or prequalified WPSs to be used in production, if the essential variables, including weld bead placement, of each process are limited to those established in table 5.3 of AWS D1.5.
5. Before preparing mechanical test specimens, inspect the PQR welds by visual and radiographic tests. The backing bar must be 3 inches in width and must remain in place during NDT. Results of the visual and radiographic tests must comply with clause 6.26.2 of AWS D1.5 excluding clause 6.26.2.2. All other requirements for clause 5.17 are applicable.

**Add to the list in the 3rd paragraph of section 11-3.02G:**

07-19-13

3. Repairs not included in the welding QC plan



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.

Submit revisions to a contingency plan at least 3 business days before starting the activity requiring a contingency plan. Allow 2 business days for review of the revised contingency plan.

## **Replace section 12-7 with:**

07-19-13

### **12-7 TEMPORARY PEDESTRIAN FACILITIES**

#### **12-7.01 GENERAL**

Section 12-7 includes specifications for constructing temporary pedestrian facilities.

Temporary pedestrian facilities must comply with the *California MUTCD*, Part 6, Chapter 6D, "Pedestrian and Worker Safety."

Design temporary pedestrian facilities with protective overhead covering to support all imposed loads.

The design load and maximum allowable stresses for temporary pedestrian facilities with protective overhead covering must comply with section 48-2.01D(3). The minimum design live load for the temporary pedestrian facilities with protective overhead covering must be 150 psf for the entire structure.

The minimum width of the temporary pedestrian facilities with protective overhead covering between the inside face of handrails must be 60 inches. The clear height of the temporary pedestrian facilities with protective overhead covering measured from the floor surface to the canopy overhead must be at least 8 feet. Provide adequate lighting at all times. Lighting must comply with section 86-6.13.

Submit shop drawings with supporting calculations for temporary pedestrian facilities with protective overhead covering. Shop drawings and calculations must be signed by an engineer who is registered as a civil engineer in the State.

#### **12-7.02 MATERIALS**

Walkways must be surfaced with HMA, portland cement concrete, or wood. The surface must be skid resistant and free of irregularities.

Hand railings must be S4S lumber and painted white.



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 the 3rd paragraph of section 13-3.01B(2)(c) with:**

05-15-15

The SAP must identify the sample containers, preservation requirements, holding times, analytical method, and the laboratory certified under the Environmental Laboratory Accreditation Program of the State Water Resources Control Board. For a list of certified laboratories, go to the board's website.

**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.

**Delete "and NELs are violated" in the 3rd paragraph of section 13-3.03C.**

04-19-13

**Replace "working days" at each occurrence in section 13-3.04 with.**

original working days

10-19-12

**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):**

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

04-19-13

**Delete the 7th paragraph of section 13-4.03C(3).**

05-30-14

**Replace the heading of section 13-4.03E(1) with:**

**General**

05-30-14

**Delete the 1st through 5th sentences in the 2nd paragraph of section 13-4.03E(1).**

05-30-14

**Replace the 1st sentence of the 1st paragraph of section 13-4.03E(3) with:**

Limit vehicle and equipment cleaning or washing at the job site to that needed for safety and protection of the equipment and compliance with PLACs.

05-30-14

	<b>Replace the paragraph in section 13-4.04 with:</b>	04-20-12
Not Used		
	<b>Replace "20-7.02D(6)" in section 13-5.02C with:</b>	07-19-13
20-5.03E		
	<b>Delete "or stockpile" in the 3rd paragraph of section 13-5.02F.</b>	10-19-12
	<b>Replace "20-7.03I(10)" in section 13-5.03C with:</b>	07-19-13
20-5.03E(3)		
	<b>Replace section 13-5.03F with:</b>	04-20-12
<b>13-5.03F Reserved</b>		
	<b>Delete "or stockpile" in item 1 in the list in the 1st paragraph of section 13-5.03K.</b>	10-19-12
	<b>Delete the 3rd paragraph of section 13-5.03K.</b>	10-19-12
	<b>Replace the 2nd sentence in the 1st paragraph of section 13-9.01A with:</b>	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		
	<b>Replace the 2nd paragraph of section 13-9.01B with:</b>	10-19-12
Retain and submit an informational submittal for records of disposed concrete waste.		
	<b>Delete the 4th paragraph of section 13-9.01B.</b>	10-19-12
	<b>Delete "if authorized" in the 1st sentence in the 1st paragraph of section 13-9.02A.</b>	10-19-12



**Add to section 15-2.02B:**

07-19-13

**15-2.02B(5) Remove Concrete Pavement**

**15-2.02B(5)(a) General**

Remove only the portion of pavement to be replaced or repaired during the same lane closure. If there is overlying material on the concrete pavement, remove it with the pavement.

Do not impact the surface within 18 inches of the pavement to remain in place. Use removal methods that do not damage the remaining pavement and base. Slab-lifting equipment must attach to the pavement.

Instead of disposing of removed concrete pavement by removing it from the job site, you may dispose of it under section 15-3.01.

**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:**

Not Used

07-19-13

**Delete the 5th paragraph of section 15-3.03.**

07-19-13

**Add to the end of section 15-4.01A(2):**

Allow 20 days for review of the bridge removal work plan.

04-19-13

**Replace the 2nd sentence of the 3rd paragraph of section 15-4.02C(1) with:**

Paint exposed ends of the remaining reinforcement with 2 applications of organic zinc-rich primer as specified for painting exposed ends of prestressing steel in section 50-1.03B(3).

10-17-14

**Replace the 1st paragraph of section 15-5.01C(1) with:**

Before starting deck rehabilitation activities, complete the removal of any traffic stripes, pavement markings, and pavement markers.

10-19-12

**Replace the 2nd and 3rd paragraphs of section 15-5.01C(2) with:**

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.

10-19-12

**Replace the 2nd paragraph of section 15-5.01C(4) with:**

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.

10-19-12

**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:**

For a contract with less than 60 original working days, submit certificates of compliance for the filler material and bonding agents.

10-19-12

**Replace "51-1.02C" in the 1st paragraph of section 15-5.03B with:**

51-1.02F

04-19-13

**Replace the 4th paragraph of section 15-5.03B with:**

For a contract with less than 60 original working days, alternative materials must be authorized before use.

10-19-12

**Add between the 5th and 6th paragraphs of section 15-5.03C:**

The final surface finish of the patched concrete surface must comply with section 51-1.03F.

10-19-12

**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:**

**15-5.09 POLYESTER CONCRETE EXPANSION DAMS**

04-19-13

**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):**

Within 5 days of completing annular space grouting at a culvert, submit the grouting records.

07-19-13

**Replace "41-1.01" in item 10.3 in the list in the 2nd paragraph of section 15-6.01A(3)(d) with:**

41-2

07-19-13



2. Dust suppressant
3. Dust control binder

Water must comply with section 17.

#### **18-1.01B Definitions**

Reserved

#### **18-1.01C Submittals**

If a dust suppressant or dust control binder is to be used, submit a dust treatment plan at least 15 days before starting job site activities. The dust treatment plan must include:

1. Product name and type
2. Manufacturer's name
3. Polymer emulsion type if synthetic polymer emulsion is used, including identification of:
  - 3.1. Individual components greater than 5 percent by volume in blends of polymers of different compositions
  - 3.2. Additives greater than 2 by volume
4. MSDS
5. Proposed methods for applying products
6. Application rates and number of passes
7. Required weather conditions for application, including ambient and surface temperatures, wind conditions, and allowable period before expected precipitation
8. Drying time or curing time required before traffic is allowed on the treated surface

Submit the manufacturer's instructions for the material to be used as an informational submittal.

Submit a certificate of compliance for the dust suppressant, dust control binders, and fibers.

For dust suppressants, include with the certificate of compliance:

1. Test results verifying compliance with the quality characteristic requirements in section 18-1.01D. The results must be from a test conducted within 6 months before the date of the certificate of compliance.
2. Test results from a test conducted within 2 years before the date of the certificate of compliance verifying compliance with the following environmental requirements:
  - 2.1. Maximum constituent concentration levels
  - 2.2. US EPA regulatory requirements for:
    - 2.2.1. Volatile organic compounds
    - 2.2.2. Semivolatile organic compounds
    - 2.2.3. Toxicity characteristic leaching
    - 2.2.3. Modified synthetic leaching procedure
  - 2.3. Aquatic toxicity

#### **18-1.01D Quality Control and Assurance**

Dust palliatives must comply with US EPA requirements and RWQCB requirements for soil stabilizers.

Dust suppressants must be tested by an EPA-accredited laboratory. Liquid chemical treatments must be tested before dilution. Solid products must be mixed with water to a 25 percent concentration before testing. The chemical constituent concentration for each dust suppressant must not exceed the maximum levels shown in the following table:

**Maximum Constituent Concentration Levels**

Constituent	Test method	Requirement maximum level (ppm)
Arsenic	EPA Method 200.7	5.0
Barium		100.0
Cadmium		0.2
Chromium		1.0
Copper		1.0
Lead		1.0
Mercury	EPA Method 245.1	0.05
Selenium	EPA Method 200.7	5.0
Zinc		10.0
Phosphorus	EPA Method 365.4	2500.0
Cyanide	EPA Method 335.4	0.2

Dust suppressants must comply with the US EPA requirements for the quality characteristics when tested under the test methods shown in the following table:

Quality characteristic	Test method
Volatile organic compounds (VOC)	EPA Method 8260
Semivolatile organic compounds (SVOC)	EPA Method 8270
Toxicity characteristic leaching procedure	EPA Method 1311
Modified synthetic leaching procedure	EPA Method 1312

The aquatic toxicity for dust suppressant must comply with the requirements shown in the following table:

**Aquatic Toxicity Requirements**

Quality characteristic	Test method	Requirement
Aquatic toxicity <sup>a</sup> (LC50 min, ppm)	ASTM E729 or EPA Method 600/4-90/027F and EPA Method 600/4-91/002	10
Aquatic toxicity <sup>a</sup> (rating)	ASTM E729 or EPA Method 600/4-90/027F and EPA Method 600/4-91/002	slightly toxic or better
Renewal toxicity <sup>b</sup> (LC50 min, ppm)	ASTM E1295	10
Renewal toxicity <sup>b</sup> (rating)	ASTM E1295	slightly toxic or better

<sup>a</sup>Using *Ceriodaphnia dubia* (water flea), *Oncorhynchus mykiss* (rainbow trout), *Pimephales promelas* (fathead minnow), and *Americamysis bahia* (mysid shrimp)

<sup>b</sup>Using *Ceriodaphnia dubia* (water flea)

**18-1.02 MATERIALS**

**18-1.02A General**

Dust suppressants and control binders must be either (1) miscible in water or (2) a material that is directly applied to the surface without mixing with water.

**18-1.02B Dust Suppressants**

**18-1.02B(1) General**

Dust suppressants must be one of the following:

1. Petroleum-based organic product
2. Nonpetroleum-based organic product

3. Hygroscopic product
4. Synthetic polymer emulsions

**18-1.02B(2) Petroleum-Based Organic Products**

Petroleum-based organic dust suppressants must be asphalt emulsion, petroleum resin, base oil, mineral oil, or synthetic fluid.

Asphalt emulsion must be Grade SS1h.

Petroleum resin must comply with the requirements shown in the following table:

<b>Petroleum Resin Requirements</b>		
Quality characteristic	Test method	Requirement
Residue (min, %)	ASTM D6934	60
pH	ASTM D1429	4.0–7.0
Specific gravity at 16 °C (min)	ASTM D1298	1.00
Kinematic viscosity at 25 °C (min, Saybolt Furol seconds <sup>a</sup> )	ASTM D2170	188
Flash point (min °C)	ASTM D92	205
Particle charge test	ASTM D7402	Positive

<sup>a</sup> Use ASTM D2161 to convert the mm<sup>2</sup>/s value to Saybolt Furol seconds

Base and mineral oils must comply with the requirements shown in the following table:

<b>Base and Mineral Oils Requirements</b>		
Quality characteristic	Test method	Requirement
Base and mineral oil content (min, %)	-	75
Specific gravity at 16 °C (min)	ASTM D1298	0.85–0.90
Brookfield absolute viscosity at 68 °C (max, cP)	ASTM D2196	250
Flash point (min, °C)	ASTM D93	150

Synthetic fluids must comply with 40 CFR 35 and the requirements shown in the following table:

<b>Synthetic Fluids Requirements</b>		
Quality characteristic	Test method	Requirement
Base and mineral oil content (min, %)	--	75
Specific gravity at 16 °C (min)	ASTM D1298	0.85–0.90
Brookfield absolute viscosity at 68 °C (max, cP)	ASTM D2196	250
Flash point (min, °C)	ASTM D93	150

**18-1.02B(3) Nonpetroleum-Based Organic Products**

Nonpetroleum-based organic dust suppressants must be lignosulfonate, plant oil, or tall oil pitch rosin.

Lignosulfonate must comply with the requirements shown in the following table:

**Lignosulfonate Requirements**

Quality characteristic	Test method	Requirement
Lignin sulfonate content ready to use (min, %)	ASTM D4900	25
Residue total solids content (min %)	ASTM D4903 or D2834	52
Lignin sulfonate content of residue (min, %)	--	50
Reducing sugars content of residue (min, %)	ASTM D5896 or D6406	25
pH	ASTM D1293	6.0–9.0
Specific gravity (min)	ASTM D1429	1.20
Brookfield absolute viscosity at 25° C (max, cP)	ASTM D2196	1,000

Plant oil must comply with the requirements shown in the following table:

**Plant Oil Requirements**

Quality characteristic	Test method	Requirement
Residue active solids content (min, %)	ASTM D4903	50
Specific gravity (min)	ASTM D1429	0.93
Brookfield viscosity (cP)	ASTM D2196	48

Tall oil pitch rosin must comply with the requirements shown in the following table:

**Tall Oil Pitch Rosin Requirements**

Quality characteristic	Test method	Requirement
Rosin acid content (min, %)	ASTM D1240	10
Residue active solids content (min, %)	ASTM D2834	45
pH	ASTM D1293	3.0–9.0
Specific gravity (min)	ASTM D1429	1.00
Brookfield absolute viscosity at 25 °C (cP)	ASTM D2196	50–200

**18-1.02B(4) Hygroscopic Products**

Hygroscopic dust suppressants must be calcium chloride, calcium chloride flake, or magnesium chloride.

Calcium chloride must comply with the requirements shown in the following table:

**Calcium Chloride<sup>a</sup> Requirements**

Quality characteristic	Test method	Requirement
Calcium chloride content (%)	ASTM E449	28–42
Total magnesium as MgCl <sub>2</sub> (max, %)	ASTM E449	6.0
Total alkali chlorides as NaCl (max, %)	ASTM E449	6.0
Calcium hydroxide content (max, %)	ASTM E449	0.2
pH with 5 percent solution	ASTM D1293	7.0–9.0
Specific gravity	ASTM D1429	1.28–1.44

<sup>a</sup>ASTM D98 or AASHTO M144

Calcium chloride flake must comply with the requirements shown in the following table:

### Calcium Chloride Flake<sup>a</sup> Requirements

Quality characteristic	Test method	Requirement
Calcium chloride content (%)	ASTM E449	28–42
Total magnesium as MgCl <sub>2</sub> (max, %)	ASTM E449	6.0
Total alkali chlorides as NaCl (max, %)	ASTM E449	6.0
Calcium hydroxide content (max, %)	ASTM E449	0.2
pH with 5 percent solution	ASTM D1293	7.0–9.0
Gradation percent passing	ASTM C136	
3/8-inch sieve		100
#4 sieve		80–100
#30 sieve		0–5

<sup>a</sup>ASTM D98 or AASHTO M144

Magnesium chloride must comply with the requirements shown in the following table:

### Magnesium Chloride Requirements

Quality characteristic	Test method	Requirement
Magnesium chloride content (%)	ASTM D4691 or ASTM D511 <sup>a</sup>	28–33
Sulfate content as magnesium sulfate (max, %)	ASTM D4691 <sup>a</sup>	4.0
Potassium content as potassium chloride (max, %)	ASTM E449	0.5
Sodium chloride content (max, %)	ASTM E449	1.0
pH with 5% solution	ASTM D1293	7.0–9.0
Specific gravity	ASTM D1429	1.31 ± 0.02

<sup>a</sup>You may use another appropriate atomic absorption spectrophotometry method such as that in *Standard Methods for the Examination of Water and Waste Water* by APHA-AWWA-WPCF.

### 18-1.02B(5) Synthetic Polymer Emulsions

Synthetic polymer emulsions must comply with the requirements shown in the following table:

### Synthetic Polymer Emulsion Requirements

Quality characteristic	Test method	Requirement
Residue active solids content (min, %)	ASTM D2834	40
pH	ASTM D1429	4.0–9.5
Specific gravity at 16 °C	ASTM D1298	1.00–1.15
Brookfield absolute viscosity (max, cP)	ASTM D2196	1,000
Polymer film tensile strength – dry (psi)	ASTM D412	500
Retained coagulum on #100 sieve (max, %)	ASTM D1417	0.1
Ash content (max, %)	ASTM D5040	2

### 18-1.02C Dust Control Binders

Dust control binders must comply with the specifications for a general purpose tackifier in section 21-1.02F(1).

Fibers must comply with section 21-1.02E.

### 18-1.03 CONSTRUCTION

#### 18-1.03A General

Monitor dust conditions and apply dust palliative for dust control as described and as ordered. Reapply dust palliative at any time to control dust.

Apply a dust suppressant to:

1. Temporary haul roads
2. Construction staging, material storage, and layout areas
3. Compacted soil or aggregate base roads or driveways
4. Paved surfaces

Apply a dust control binder to:

1. Rough-graded soils
2. Completed slopes
3. Soil stockpiles unless another practice is already used

Do not use a dust suppressant or dust control binder within 100 feet of a wetland or body of water.

#### 18-1.03B Equipment

Apply dust suppressants that are miscible in water with either (1) a pressure-type water distributor truck equipped with a spray system or (2) a pressure-type asphalt distributor truck as specified in section 93-1.03C.

Apply dust suppressant flakes to the surface using a spreader or spinner disk.

Apply dust control binders with either (1) a pressure-type water distributor truck equipped with a spray system or (2) hydraulic spray equipment as specified for applying hydromulch in section 21-1.03E.

#### 18-1.03C Mixing and Application Rates

Use the mix proportions and application rate for the corresponding dust suppressant as shown in the following table:

Dust suppressant	Mix proportions	Application rate
Asphaltic emulsion, Grade SS1H	5 parts water to 1 part emulsion	0.20–1.0 gal/sq yd
Petroleum resin emulsion	5 parts water to 1 part emulsion	0.20–1.0 gal/sq yd
Base and mineral oil	Apply undiluted	0.30–0.35 gal/sy yd
Lignosulfonate	1 part water to 1 part concentrate	1.0 gal/sq yd
Plant oil	Apply undiluted	0.25–0.50 gal/sq yd
Tall oil pitch rosin	5 parts water to 1 part emulsion for clayey soil and 10 parts water to 1 part emulsion for sandy soil.	0.30–1.0 gal/sq yd
Calcium chloride solution (Hygroscopic)	Apply undiluted	0.20–0.35 gal/sq yd
Calcium chloride flakes (Hygroscopic)	--	1.0–1.5 lb/sq yd
Magnesium chloride (Hygroscopic)	Apply undiluted	0.30–0.50 gal/sq yd
Synthetic polymer emulsion	9 parts water to 1 part concentrate	0.50 gal/sq yd

Apply hygroscopic materials under the manufacturer's instructions.

Apply calcium chloride flakes to a moist surface.



07-19-13

**Delete the 2nd paragraph in section 19-2.03A.**

**Add to the 2nd paragraph of section 19-2.03D:**

10-17-14

Topsoil must comply with section 21.

**Replace the 2nd paragraph of section 19-3.01A(2)(b) with:**

07-01-11

For cofferdams on or affecting railroad property, allow 85 days for review.

**Add to the list in the 1st paragraph of section 19-3.01A(2)(d):**

01-20-12

9. Provisions for discontinuous rows of soil nails

**Replace "sets" in the 3rd and 4th paragraphs of section 19-3.01A(2)(d) with:**

04-19-13

copies

**Add to section 19-3.01A(3)(b):**

01-20-12

For soil nail walls, wall zones are specified in the special provisions.

For ground anchor walls, a wall zone is the entire wall unless otherwise specified in the special provisions.

01-20-12

**Delete the 2nd sentence in the 4th paragraph of section 19-3.01A(3)(b).**

**Replace "90" in the paragraph of section 19-3.02G with:**

01-18-13

90-1

**Add to section 19-3.02:**

07-19-13

**19-3.02I Filter Fabric**

Filter fabric must be Class A.

**Replace the heading of section 19-3.03C with:**

04-19-13

**19-3.03B(4) Cofferdams**

**Replace the heading of section 19-3.03D with:**

04-19-13

**19-3.03B(5) Water Control and Foundation Treatment**

**Replace the 1st paragraph of section 19-3.03E(3) with:**

01-20-12

Compact structure backfill behind lagging of soldier pile walls by hand tamping, mechanical compaction, or other authorized means.

**Add to the end of section 19-3.03E(3):**

07-19-13

If filter fabric is shown behind the lagging:

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:**

01-20-12

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.

**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**

05-30-14

**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
3. Causing excess runoff

05-30-14

Water plants under the Model Water Efficient Landscape Ordinance, 23 CA Code of Regs § 490 et seq., and local water agency requirements.

Water plants at night unless otherwise authorized.

07-19-13

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**

05-30-14

Immediately shut off water to broken supply lines, valves, or sprinkler assemblies. Repair irrigation systems within 24 hours after a malfunction or damage occurs.

07-19-13

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 controllers 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 D 2241, 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.

05-30-14

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. Reuse water from waterline flushing for landscape irrigation if practicable.

07-19-13

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

05-30-14

## **20-2.12–20-2.13 RESERVED**

07-19-13

## **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 <sup>a</sup>	--
O	Acorn	--
P	Plugs <sup>a, b</sup>	--
S	Seedling <sup>c</sup>	--
U	No. 15 container	2768–3696

<sup>a</sup>Do not use containers made of biodegradable material.

<sup>b</sup>Grown in individual container cells.

<sup>c</sup>Bare 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 ± 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 ± 1grams 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:

<b>Grading Requirements</b>	
Sieve size	Percent passing
3/8inch	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



**Replace section 21-1.02J with:**

04-20-12

**21-1.02J Reserved**

**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
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**Replace the paragraph in section 21-1.02P with:**

10-19-12

Fiber roll must be a premanufactured roll filled with rice or wheat straw, wood excelsior, or coconut fiber. Fiber roll must be covered with biodegradable jute, sisal, or coir fiber netting secured tightly at each end and must be one of the following:

1. 8 to 10 inches in diameter and at least 1.1 lb/ft
2. 10 to 12 inches in diameter and at least 3 lb/ft

Fiber roll must have a minimum functional longevity of 1 year.

**Add between the 1st and 2nd paragraphs of section 21-1.03A:**

01-18-13

Remove and dispose of trash, debris, and weeds in areas to receive erosion control materials.

Remove and dispose of loose rocks larger than 2-1/2 inches in maximum dimension unless otherwise authorized.

Protect the traveled way, sidewalks, lined drainage channels, and existing vegetation from overspray of hydraulically-applied material.

**Replace section 21-1.03B with:**

01-18-13

**21-1.03B Reserved**

**Replace "3 passes" in item 2 in the list in the 2nd paragraph of section 21-1.03G with:**

04-19-13

2 passes

**Replace section 21-1.03I with:**

04-20-12

**21-1.03I Reserved**

**Add between the 4th and 5th paragraphs of section 21-1.03P:**

10-19-12

If soil conditions do not permit driving the stakes into the soil, drill pilot holes to facilitate driving of the



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) <sup>b</sup>	ASTM C 231		4
Penetration (inches)	ASTM C 360		0 to 1-1/2 nominal <sup>c, d</sup>
Slump (inches)	ASTM C 143		0-3 nominal <sup>c, d</sup>
Compressive strength (min, psi at 7 days)	ASTM C 39 <sup>e</sup>		530
Compressive strength (max, psi at 3 days) <sup>f</sup>	ASTM C 39 <sup>e</sup>		500

<sup>a</sup> Comply with the table titled "Aggregate Grading" in section 28-2.02C.

<sup>b</sup> If no single test in the first 5 air content tests exceeds 1-1/2 percent, no further air content tests are required.

<sup>c</sup> Maximum penetration must not exceed 2 inches and maximum slump must not exceed 4 inches

<sup>d</sup> Test for either penetration or slump

<sup>e</sup> Prepare cylinders under ASTM C 31

<sup>f</sup> 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 <sup>a</sup>	530 <sup>b</sup>

<sup>a</sup> Cylinders prepared under ASTM C 31

<sup>b</sup> 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
3. At a rate of 1 gal/150 sq ft for the first application
4. At a rate of 1 gal/200 sq ft for the second application. Within 4 days after the first application, clean the surface and apply the second application.

Immediately repair damage to the curing compound or LCB.

**28-2.03G Surfaces Not Within Tolerance**

Where LCB will be paved with concrete pavement, remove the base wherever the surface is higher than the grade established by the Engineer and replace it with LCB. Where LCB will not be paved with concrete pavement, remove the base wherever the surface is higher than 0.05 foot above the grade established by the Engineer and replace it with LCB. If authorized, grind the surface with either a diamond or carborundum blade to within tolerance. After grinding LCB to be paved with concrete pavement and after all free water has left the surface, clean foreign material and grinding residue from the surface. Apply curing compound to the ground area at a rate of approximately 1 gal/150 sq ft.

Where the surface of LCB is lower than 0.05 foot from the grade established by the Engineer, remove the base and replace it with LCB or, if authorized, fill low areas according to the pavement material as follows:

1. For HMA pavement, fill low areas with HMA that complies with the specifications for the lowest layer of pavement. Do not fill low areas concurrently with the paving operation.
2. For concrete pavement, fill low areas with pavement concrete concurrent with the paving operation.

**28-2.04 PAYMENT**

LCB is measured from the dimensions shown.

**Replace section 28-3 with:**

**28-3 RAPID STRENGTH CONCRETE BASE**

07-19-13

Reserved

**Replace section 28-4 with:**

**28-4 LEAN CONCRETE BASE RAPID SETTING**

07-19-13

Reserved

**Replace section 28-5 with:**

**28-5 CONCRETE BASE**

07-19-13

Reserved





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:

<b>Seal Coat Screenings</b>		
Properties	Test method	Specification
Los Angeles Rattler, %, max Loss at 100 revolutions. Loss at 500 revolutions.	California Test 211	10 40
Film stripping, %, max	California Test 302	25

### **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, followed by sand.

03-21-14

07-19-13

### **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**

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.

03-21-14

Submit a sample of asphaltic emulsion in a 1/2-gallon plastic container to the Engineer and to the authorized laboratory. Each sample must be submitted in an insulated shipping container within 24 hours of sampling.

07-19-13

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.

03-21-14

Within 3 business days of sampling, the authorized laboratory must test the 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
5. Elastic recovery under AASHTO T 301 for polymer asphaltic emulsion

Circulate 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. In the presence of the Engineer take two 1/2-gallon samples every 55 tons or at least 1 day's production.

07-19-13

### **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

03-21-14

The cleanness value determined under California Test 227 must be 80 or greater.

07-19-13

**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:

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:

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:

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:

03-21-14

**Polymer Asphaltic Emulsion Pay Factor Table**

Test method and property	Increment	Pay factor
<b>Test on polymer asphaltic emulsion</b>		
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
<b>Test on residue from evaporation test</b>		
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 <sup>a</sup> )	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
ASTM T 301 (elastic recovery <sup>a</sup> )	For each 1 increment below the min value of 60	1
	For each 2 increment below the min value of 60	3
	For each 3 increment below the min value of 60	10

<sup>a</sup> The highest pay factor applies

07-19-13

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.

03-21-14

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. Elastic recovery determined under AASHTO T 301 must be at least 60 percent.

3. Polymer content in percent by weight does not apply.
4. The ring and ball softening point temperature determined under AASHTO T 53 for Test on Residue from Evaporation Test must comply with the following minimum temperature requirement:
  - 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

07-19-13

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

03-21-14

The cleanness value determined under California Test 227 must be 86 or greater.

07-19-13

**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

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.

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:

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:

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:

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 <sup>2</sup> /s (x 10 <sup>-6</sup> ) at 100 °C	ASTM D 445	X ± 3 <sup>a</sup>
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

<sup>a</sup> "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  $100 \pm 5$  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  $8.5 \pm 0.5$  g, measure  $24.5 \pm 0.5$  mm in diameter, and have a Shore Durometer "A" hardness of  $50 \pm 5$  determined under ASTM D 2240. After sieving the combined material for  $10 \pm 1$  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  $79 \pm 1$  percent by weight asphalt binder and  $21 \pm 1$  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  $76 \pm 2$  percent by weight scrap tire crumb rubber and  $24 \pm 2$  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:

<b>Asphalt Rubber Binder</b>			
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:



3. OGFC
4. BWC
5. Minor HMA

If a warm mix asphalt technology is specified, the warm mix asphalt technology to be used must be authorized. For Department-authorized warm mix asphalt technologies, go to the METS website.

### **39-1.01B Definitions**

**binder replacement:** Binder from RAP expressed as a percent of the total binder in the mix.

**coarse aggregate:** Aggregate retained on a no. 4 sieve.

**fine aggregate:** Aggregate passing the no. 4 sieve.

**leveling course:** Thin layer of HMA used to correct minor variations in the longitudinal and transverse profile of the pavement before placement of other pavement layers.

**lower course:** Layer of HMA below 0.2 feet from finished grade exclusive of OGFC.

**miscellaneous areas:** Areas outside the traveled way such as:

1. Median areas not including inside shoulders
2. Island areas
3. Sidewalks
4. Gutters
5. Ditches
6. Overside drains
7. Aprons at ends of drainage structures

**processed RAP:** RAP that has been fractionated.

**supplemental fine aggregate:** Aggregate passing the no. 30 sieve, including hydrated lime, portland cement, and fines from dust collectors.

**surface course:** Upper 0.2 feet of HMA exclusive of OGFC.

**top layer:** Final riding surface.

### **39-1.01C Submittals**

#### **39-1.01C(1) General**

Reserved

#### **39-1.01C(2) Job Mix Formula**

##### **39-1.01C(2)(a) General**

Except for the HMA to be used in miscellaneous areas and dikes, submit your proposed JMF for each type of HMA to be used. The JMF must be submitted on the Contractor Job Mix Formula Proposal form along with:

1. Mix design documentation on Contractor Hot Mix Asphalt Design Data form dated within 12 months of submittal
2. JMF verification on a Caltrans Hot Mix Asphalt Verification form, if applicable
3. JMF renewal on a Caltrans Job Mix Formula Renewal form, if applicable
4. MSDS for:
  - 4.1. Asphalt binder
  - 4.2. Supplemental fine aggregate except fines from dust collectors
  - 4.3. Antistrip additives

The Contractor Hot Mix Asphalt Design Data form must show documentation on aggregate quality.

If you cannot submit a Department-verified JMF on a Caltrans Hot Mix Asphalt Verification form dated within 12 months before HMA production, the Engineer verifies the JMF.

Submit a new JMF if you change any of the following:

1. Target asphalt binder percentage greater than  $\pm 0.2$  percent
2. Asphalt binder supplier
3. Combined aggregate gradation
4. Aggregate sources
5. Liquid antistrip producer or dosage
6. Average binder content in a new fractionated RAP stockpile by more than  $\pm 2.0$  percent from the average RAP binder content reported on page 4 of your Contractor Hot Mix Asphalt Design Data form
7. Average maximum specific gravity in a new fractionated RAP stockpile by more than  $\pm 0.060$  from the average maximum specific gravity value reported on page 4 of your Contractor Hot Mix Asphalt Design Data form
8. Any material in the JMF

Allow the Engineer 5 business days from a complete JMF submittal for document review of the aggregate qualities, mix design, and JMF. The Engineer notifies you if the proposed JMF submittal is accepted.

If your JMF fails verification testing, submit an adjusted JMF based on your testing. An adjusted JMF requires a new Contractor Job Mix Formula Proposal form and Contractor Hot Mix Asphalt Design Data form and verification of a plant-produced sample.

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.

#### **39-1.01C(2)(b) Job Mix Formula Renewal**

You may request a JMF renewal by submitting:

1. Proposed JMF on a Contractor Job Mix Formula Proposal form
2. Previously verified JMF documented on a Caltrans Hot Mix Asphalt Verification form dated within 12 months
3. Mix design documentation on a Contractor Hot Mix Asphalt Design Data form used for the previously verified JMF

#### **39-1.01C(2)(c) Job Mix Formula Modification**

For an authorized JMF, submit a modified JMF if you change any of the following:

1. Asphalt binder supplier
2. Liquid antistrip producer
3. Liquid antistrip dosage

You may change any of the above items only once during the Contract.

Submit your modified JMF request a minimum of 15 days before production. Each modified JMF submittal must consist of:

1. Proposed modified JMF on Contractor Job Mix Formula Proposal form, marked *Modified*.
2. Mix design records on Contractor Hot Mix Asphalt Design Data form for the authorized JMF to be modified.
3. JMF verification on Hot Mix Asphalt Verification form for the authorized JMF to be modified.
4. Test results for the modified JMF in compliance with the mix design specifications. Perform tests at the mix design OBC as shown on the Contractor Asphalt Mix Design Data form.

With an accepted modified JMF submittal, the Engineer verifies each modified JMF within 10 days of receiving all verification samples.

#### **39-1.01C(3) Quality Control Plan**

With your proposed JMF submittal, submit a QC plan for HMA.

The QC plan must describe the organization and procedures for:

1. Controlling HMA quality characteristics
2. Taking samples, including sampling locations

3. Establishing, implementing, and maintaining QC
4. Determining when corrective actions are needed
5. Implementing corrective actions
6. Methods and materials for backfilling core locations

The QC plan must address the elements affecting HMA quality including:

1. Aggregate
2. Asphalt binder
3. Additives
4. Production
5. Paving

The QC plan must include aggregate QC sampling and testing during lime treatment.

The Engineer reviews the QC plan within 5 business days from the submittal. Do not start HMA production until the Engineer authorizes the plan.

If QC procedures, personnel, tester qualifications, sample testing locations, or lab accreditation status change, submit a QC plan supplement at least 3 business days before implementing the proposed change. Do not implement the change without authorization.

#### **39-1.01C(4) Test Results**

For mix design, JMF verification, production start-up, and each 10,000 tons, submit AASHTO T 283 and AASHTO T 324 (Modified) test results to the Engineer and electronically to:

Moisture\_Tests@dot.ca.gov

Submit all QC test results, except AASHTO T 283 and AASHTO T 324 (Modified), within 3 business days of a request. Submit AASHTO T 283 QC tests within 15 days of sampling.

For tests performed under AASHTO T324 (Modified), submit test data and 1 tested sample set within 5 business days of sampling.

If coarse and fine durability index tests are required, submit test results within 2 business days of testing.

If tapered notched wedge is used, submit test result values within 24 hours of testing.

#### **39-1.01C(5) Reserved**

#### **39-1.01C(6) Liquid Antistrip Treatment**

If liquid antistrip treatment is used, submit the following with your proposed JMF submittal:

1. One 1-pint sample
2. Infrared analysis including copy of absorption spectra
3. Certified copy of test results
4. Certificate of compliance for each liquid antistrip shipment. On each certificate of compliance, include:
  - 4.1. Your signature and printed name
  - 4.2. Shipment number
  - 4.3. Material type
  - 4.4. Material specific gravity
  - 4.5. Refinery
  - 4.6. Consignee
  - 4.7. Destination
  - 4.8. Quantity
  - 4.9. Contact or purchase order number
  - 4.10. Shipment date
6. Proposed proportions for liquid antistrip

For each delivery of liquid antistrip to the HMA production plant, submit a 1-pint sample to METS. Submit shipping documents. Label each liquid antistrip sampling container with:

1. Liquid antistrip 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 HMA mixing plant type, submit the following information in the order specified:

1. For batch plant 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 total weight of mix
  - 1.6. Liquid antistriper content as a percentage of the asphalt binder weight
2. For continuous mixing plant:
  - 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 liquid antistriper collected from the liquid antistriper meter
  - 2.8. Asphalt binder content as percentage of the 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. Liquid antistriper content as percentage of the asphalt binder weight calculated from:
    - 2.9.1. Asphalt binder meter output
    - 2.9.2. Liquid antistriper meter output

### **39-1.01C(7) Lime Treatment**

If aggregate lime treatment is used, submit the following with your proposed JMF submittal and each time you produce lime-treated aggregate:

1. Exact lime proportions for fine and coarse virgin aggregate
2. If marination is required, the averaged aggregate quality test results within 24 hours of sampling
3. For dry lime aggregate treatment, a treatment data log from the dry lime and aggregate proportioning device in the following order:
  - 3.1. Treatment date
  - 3.2. Time of day the data is captured
  - 3.3. Aggregate size being treated
  - 3.4. HMA type and mix aggregate size
  - 3.5. Wet aggregate flow rate collected directly from the aggregate weigh belt
  - 3.6. Aggregate moisture content, expressed as a percent of the dry aggregate weight
  - 3.7. Flow rate of dry aggregate calculated from the flow rate of wet aggregate
  - 3.8. Dry lime flow rate
  - 3.9. Lime ratio from the authorized JMF for each aggregate size being treated
  - 3.10. Lime ratio from the authorized JMF for the combined aggregate
  - 3.11. 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
  - 3.12. Calculated difference between the authorized lime ratio and the actual lime ratio
4. For lime slurry aggregate treatment, a treatment data log from the slurry proportioning device in the following order:
  - 4.1. Treatment date
  - 4.2. Time of day the data is captured
  - 4.3. Aggregate size being treated
  - 4.4. Wet aggregate flow rate collected directly from the aggregate weigh belt

- 4.5. Moisture content of the aggregate just before treatment, expressed as a percent of the dry aggregate weight
- 4.6. Dry aggregate flow rate calculated from the wet aggregate flow rate
- 4.7. Lime slurry flow rate measured by the slurry meter
- 4.8. Dry lime flow rate calculated from the slurry meter output
- 4.9. Authorized lime ratio for each aggregate size being treated
- 4.10. Actual lime ratio calculated from the aggregate weigh belt and the slurry meter output, expressed as a percent of the dry aggregate weight
- 4.11. Calculated difference between the authorized lime ratio and the actual lime ratio
- 4.12. Dry lime and water proportions at the slurry treatment time

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.

### **39-1.01C(8) Warm Mix Asphalt Technology**

If warm mix asphalt technology is used, submit the following with your proposed JMF submittal:

1. MSDS for warm mix asphalt technology 10-17-14
2. For warm mix asphalt water injection foam technology:
  - 2.1. Name of technology
  - 2.2. Proposed foaming water content
  - 2.3. Proposed HMA production temperature range
  - 2.4. Certification from binder supplier stating no antifoaming agent is used. 04-18-14
3. For warm mix asphalt additive technology:
  - 3.1. Name of technology
  - 3.2. Percent admixture by weight of binder and percent admixture by total weight of HMA as recommended by the manufacturer
  - 3.3. Methodology for inclusion of admixture in laboratory-produced HMA
  - 3.4. Proposed HMA production temperature range

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 mixing plant, 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 mixing plant, the rate of flow of the asphalt meter
9. For a continuous mixing plant, the rate of flow of HMA additive meter
10. For batch plant mixing, 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

At the end of each day's production shift, submit electronic and printed media from the HMA plant process controller. Present data on electronic media in comma-separated values or tab-separated values format. The 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.

### **39-1.01C(9) Samples**

For the samples taken for JMF verification, submit 3 parts to the Engineer and use 1 part for your testing.

At production start-up and within 1000 tons of the halfway point of production of HMA, submit samples split from your HMA production sample for AASHTO T 283 and AASHTO T 324 (Modified) tests to the Engineer.

For production samples taken, submit 3 parts to the Engineer and use 1 part for your testing.

**39-1.01C(10)–39-1.01C(11) Reserved**

**39-1.01C(12) Data Cores**

Section 39-1.01C(12) applies if a bid item for data core is shown on the Bid Item List.

Submit a summary of data cores taken and a photograph of each data core to the Engineer and to:

Coring@dot.ca.gov

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. For recovered material, 1/2 inch
  - 7.2. For unstabilized material, 1.0 inch
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

**39-1.01C(13) Pavement Smoothness**

**39-1.01C(13)(a) General**

Reserved

**39-1.01C(13)(b) Straightedge Measurements**

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

**39-1.01C(13)(c) Inertial Profiler Certification**

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

- 1. Inertial profiler certification issued by the Department.
- 2. Operator certification for the inertial profiler issued by the Department.
- 3. List of manufacturer's recommended test procedures for the inertial profiler 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 to the Engineer and to the electronic mailbox address:

smoothness@dot.ca.gov

**39-1.01C(13)(d) Inertial Profiler Data**

10-17-18

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

smoothness@dot.ca.gov

The profile information must include:

- 1. Raw profile data for each lane.
- 2. ProVAL ride quality analysis report for the International Roughness Index of left and right wheel paths of each lane. Submit this report in pdf file format.
- 3. ProVAL ride quality analysis report for the Mean Roughness Index of each lane. Submit this report in pdf file format.
- 4. ProVAL smoothness assurance analysis report for the International Roughness Index of left wheel path. Submit this report in pdf file format.
- 5. ProVAL smoothness assurance analysis report for the International Roughness Index of right wheel path. Submit this report in pdf file format.
- 6. ProVAL smoothness assurance analysis report for grinding locations of left wheel path. Submit this report in pdf file format.
- 7. ProVAL smoothness assurance analysis report for grinding locations of right wheel path. Submit this report in pdf file format.
- 8. GPS data file for each lane in GPS eXchange. Submit data file in GPS eXchange file format.
- 9. Manufacturer's recommended inertial profiler calibration and verification test results.
- 10. Inertial profiler calibration and verification test results including bounce, block, and distance measurement instrument.

04-18-14

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\_B\_E\_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  
B = 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  
E = Ending station to the nearest foot (i.e., 14+20) or ending post mile to the nearest hundredth (i.e., 28.06) no leading zero  
X = Profile description as "EXIST" for existing pavement, "INTER" for after prepaving smoothness correction, "PAVE" for after paving, and "CORR" for after final surface pavement correction  
PT = HMA pavement type

**39-1.01C(13)(e) Reserved**

**39-1.01C(14)–39-1.01C(15) Reserved**

**39-1.01D Quality Control and Assurance**

**39-1.01D(1) General**

When testing under AASHTO T 324 (Modified), test under AASHTO T 324 with the following parameters:

1. Target air voids must equal  $7 \pm 1$  percent
2. Specimen height must be  $60 \pm 1$  mm
3. Number of test specimens must be 4 (2 test sets)
4. Do not average test sets
5. Test specimen must be a 150 mm gyratory compacted specimen
6. Test temperature must be set at:
  - 6.1.  $113 \pm 2$  degrees F for PG 58
  - 6.2.  $122 \pm 2$  degrees F for PG 64
  - 6.3.  $131 \pm 2$  degrees F for PG 70 and above
7. Measurements for impression must be taken at every 100 passes along the total length of sample
8. Inflection point defined as the number of wheel passes at the intersection of the creep slope and the stripping slope at maximum rut depth
9. Testing shut off must be set at 25,000 passes
10. Submersion time for samples must not exceed 4 hours

10-17-14

Take samples under California Test 125.

04-18-14

HMA samples may be heated a maximum of 2 times for up to 4 hours each.

**39-1.01D(2) Job Mix Formula Verification**

10-17-14

The Engineer verifies the JMF from samples taken from HMA produced by the plant to be used. The production set point at the plant must be within  $\pm 0.2$  from the asphalt binder percentage target value shown in your Contractor Job Mix Formula Proposal form. Notify the Engineer at least 2 business days before sampling materials. Samples may be taken from a different project including a non-Department project if you make arrangements for the Engineer to be present during sampling.

04-18-14

In the Engineer's presence and from the same production run, take samples of:

1. Aggregate. Coarse, fine, and supplemental fine aggregate must be taken from the combined cold feed belt, or hot bins. If lime treatment is required, samples must be taken from individual stockpiles before lime treatment. Samples must be at least 120 lb for each coarse aggregate, 80 lb for each fine aggregate, and 10 lb for each type of supplemental fines. For hot bin samples, the Department combines these aggregate samples to comply with the TV submitted on a Contractor Job Mix Formula Proposal form.
2. Asphalt binder. Take 2 samples minimum. Each sample must be in a 1-quart cylindrical-shaped can with an open top and friction lid. If the asphalt binder is modified or rubberized, the asphalt binder must be sampled with the components blended in the proportions to be used.

3. RAP. RAP samples must be at least 50 lb from each fractionated stockpile used or 100 lb from the belt.
4. Plant-produced HMA. The HMA samples must be at least 250 lb.

For aggregate, RAP, and HMA, split the samples into at least 4 parts and label their containers. Three parts are for the Department's verification testing and 1 part is for your testing.

After acceptance of the JMF submittal, the Engineer verifies each proposed JMF within 20 days of receiving all verification samples.

For JMF verification, the Engineer tests the following for compliance with the specifications:

1. Aggregate quality
2. Aggregate gradation
3. Voids in mineral aggregate on laboratory-produced HMA must comply with the mix design specifications for voids in mineral aggregate
4. HMA quality characteristics for Department acceptance

To verify the HMA for air voids, voids in mineral aggregate, and dust proportion, the Engineer uses an average of 3 briquettes. The Engineer tests plant-produced material.

If the Engineer verifies the JMF, the Engineer furnishes you a Hot Mix Asphalt Verification form.

If the Engineer's test results on plant-produced samples do not show compliance with the specifications, the Engineer notifies you. Adjust your JMF based on your testing unless the Engineer authorizes reverification without adjustments. JMF adjustments may include a change in:

1. Asphalt binder content target value up to  $\pm 0.2$  percent from the OBC value submitted on Contractor Hot Mix Asphalt Design Dataform
2. Aggregate gradation target values within the target value limits specified in the aggregate gradation table

You may adjust the JMF only once due to a failed verification test.

For each HMA type and aggregate size specified, the Engineer verifies up to 2 proposed JMF submittals including a JMF adjusted after verification failure. If you submit more than 2 JMFs for each type of HMA and aggregate size, the Engineer deducts \$3,000 from payments for each verification exceeding this limit. This deduction does not apply to verifications initiated by the Engineer or if a JMF expires while HMA production is stopped longer than 30 days.

A verified JMF is valid for 12 months.

### **39-1.01D(3) Job Mix Formula Authorization**

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 authorizes the verified JMF

### **39-1.01D(4) Job Mix Formula Renewal**

For a JMF renewal and upon request, in the Engineer's presence and from the same production run, take samples of:

1. Aggregate. Coarse, fine, and supplemental fine aggregate must be taken from combined cold-feed belt, or hot bins. If lime treatment is required, samples must be taken from individual stockpiles before lime treatment. Samples must be at least 120 lb for each coarse aggregate, 80 lb for each fine aggregate, and 10 lb for each type of supplemental fines. For hot bins, the Department combines these aggregate samples to comply with the TV submitted on a Contractor Job Mix Formula Proposal form.
2. Asphalt binder. Take 2 samples minimum. Each sample must be in a 1-quart cylindrical-shaped can with an open top and friction lid. If the asphalt binder is modified or rubberized, the asphalt binder must be sampled with the components blended in the proportions to be used.

3. RAP. RAP samples must be at least 50 lb from each fractionated stockpile.
4. Plant-produced HMA. The HMA samples must be at least 250 lb.

Notify the Engineer at least 2 business days before sampling materials. For aggregate, RAP, and HMA, split samples into at least 4 parts. Submit 3 parts to the Engineer and use 1 part for your testing.

Allow the Engineer 5 business days from a complete JMF reverification submittal for document review of the aggregate qualities, mix design, and JMF.

The most recent aggregate quality test results within the past 12 months may be used for verification of JMF renewal or upon request, the Engineer may perform aggregate quality tests for verification of JMF renewal.

The Engineer verifies the JMF for renewal under section 39-1.01D(2) except:

1. The Engineer keeps the samples until you provide test results for your part on a Contractor Job Mix Formula Renewal form.
2. The Department tests samples of materials obtained from the HMA production unit after you submit test results that comply with the mix design specifications.
3. After completion of the JMF verification renewal document review, the Engineer verifies each proposed JMF within 20 days of receiving the verification renewal samples and the complete Contractor Job Mix Formula Renewal form.
4. You may not adjust the JMF due to a failed verification.
5. For each HMA type and aggregate gradation specified, the Engineer verifies at no cost to you 1 proposed JMF renewal within a 12-month period.

If the Engineer verifies the JMF renewal, the Engineer furnishes you a Hot Mix Asphalt Verification form. The Hot Mix Asphalt Verification form is valid for 12 months.

#### **39-1.01D(5) Job Mix Formula Modification**

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. The Engineer tests verification samples for compliance with:

1. Hamburg wheel track mix design specifications
2. Air void content
3. Voids in mineral aggregate on plant-produced HMA mix design specifications
4. Dust proportion mix design specifications

The Engineer may test for moisture susceptibility for compliance with the mix design specifications.

If the modified JMF is verified, the Engineer revises your Hot Mix Asphalt Verification form to include the new asphalt binder source, new liquid antistriper producer, or new liquid antistriper dosage. 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 JMF modification.

#### **39-1.01D(6) Certifications**

##### **39-1.01D(6)(a) General**

Laboratories testing aggregate and HMA qualities used to prepare the mix design and JMF must be qualified under AASHTO Materials Reference Laboratory program and the Department's Independent Assurance Program.

##### **39-1.01D(6)(b) Hot Mix Asphalt Plants**

Before production, the HMA plant must have a current qualification under the Department's Material Plant Quality Program.

##### **39-1.01D(6)(c) Inertial Profiler Certifications**

The inertial profiler equipment must display a current certification decal with expiration date.

The inertial profiler operator and device certifications must be not more than 12 months old.

The operator must be certified for each different model of inertial profiler device operated.

**39-1.01D(6)(d)–39-1.01D(6)(e) Reserved**

**39-1.01D(7) Prepaving Meeting**

Meet with the Engineer at a prepaving meeting at a mutually agreed time and place. Discuss the QC plan and the methods of performing HMA production and paving work.

The following personnel must attend the prepaving meeting:

1. Project manager
2. Superintendent
3. HMA plant manager
4. HMA paving foreman

If a warm mix asphalt technology is used, a technical representative for warm mix asphalt technology must attend the prepaving meeting.

**39-1.01D(8) Quality Control**

**39-1.01D(8)(a) General**

QC test results must comply with the specifications for Department acceptance.

Prepare 3 briquettes for air voids content and voids in mineral aggregate determination. Report the average of 3 tests.

Except for smoothness, if 2 consecutive QC test results or any 3 QC test results for 1 day's production do not comply with the materials specifications:

1. Stop HMA production
2. Notify the Engineer
3. Take corrective action
4. Demonstrate compliance with the specifications before resuming production and placement

For QC tests performed under AASHTO T 27, results are considered 1 QC test regardless of number of sieves out of compliance.

Do not resume production and placement until the Engineer authorizes your corrective action proposal.

**39-1.01D(8)(b) Reserved**

**39-1.01D(8)(c) Aggregate**

**39-1.01D(8)(c)(i) General**

Reserved

**39-1.01D(8)(c)(ii) Aggregate Lime Treatments**

If lime treatment is required, sample coarse and fine aggregate from individual stockpiles before lime treatment. Combine aggregate in the JMF proportions. Test the aggregate under the test methods and frequencies shown in the following table:

### Aggregate Quality Control During Lime Treatment

Quality characteristic	Test method	Minimum sampling and testing frequency
Sand equivalent <sup>a, b</sup>	AASHTO T 176	1 per 750 tons of untreated aggregate
Percent of crushed particles	AASHTO T 335	1 per 10,000 tons or 2 per project whichever is greater
Los Angeles Rattler	AASHTO T 96	
Fine aggregate angularity	AASHTO T 304 Method A	
Flat and elongated particles	ASTM D4791	

<sup>a</sup>Report test results as the average of 3 tests from a single sample.

<sup>b</sup>Use of a sand reading indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, 4.8, 7.1.2, and 8.4.3 do not apply.

For lime slurry aggregate treatment, determine the aggregate moisture content at least once every 2 hours of treatment. Calculate moisture content under AASHTO T 329 and report it as a percent of dry aggregate weight. Use the moisture content calculations as a set point for the proportioning process controller.

The device controlling 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 a deviation of more than 0.2 percent above or below the lime ratio in the accepted JMF, stop treatment and take corrective action.

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 a deviation of more than 0.2 percent above or below the lime ratio in the accepted JMF, stop treatment and do not use that day's treated aggregate in HMA.

The Engineer may order you to stop aggregate treatment activities for any of the following:

1. You fail to submit treatment data log
2. You fail to submit aggregate QC data for marinated aggregate
3. You submit incomplete, untimely, or incorrectly formatted data
4. You do not take corrective actions
5. You take late or unsuccessful corrective actions
6. You do not stop treatment when proportioning tolerances are exceeded
7. You use malfunctioning or failed proportioning devices

If you stop treatment for noncompliance, notify the Engineer of any corrective actions taken and conduct a successful 20-minute test run before resuming treatment.

#### **39-1.01D(8)(d) Liquid Antistrip Treatment**

For continuous mixing or batch-plant mixing, sample asphalt binder before adding liquid antistrip. For continuous mixing, sample the combined asphalt binder and liquid antistrip after the static mixer.

#### **39-1.01D(8)(e) Production Start-up Evaluation**

You and the Engineer evaluate HMA production and placement at production start-up.

Within the first 750 tons produced on the 1st day of HMA production, in the Engineer's presence, and from the same production run, take samples of:

1. Aggregate
2. Asphalt binder
3. RAP
4. HMA

Sample aggregate from the combined cold-feed belt or hot bin. Take RAP samples from the RAP system.

For aggregate, RAP, and HMA, split the samples into at least 4 parts and label their containers. Submit 3 parts to the Engineer and keep 1 part.

You and the Engineer must test the samples and report test results, except for AASHTO T 324 (Modified) and AASHTO T 283 test results, within 5 business days of sampling. For AASHTO T 324 (Modified) and AASHTO T 283 test results, report test results within 15 days of sampling. If you proceed before receipt of the test results, the Engineer may consider the HMA placed to be represented by these test results.

Take one 4- or 6-inch diameter density core for each 250 tons or portion thereof of HMA placed. For each density core, the Engineer reports the bulk specific gravity determined under AASHTO T 275, Method A, in addition to the percent of theoretical maximum density.

#### **39-1.01D(8)(f) Hot Mix Asphalt Density**

During HMA placement determine HMA density using a nuclear gauge. On the 1st day of production, develop a correlation factor between cores and nuclear gauge under California Test 375.

Test for in-place density using cores and a nuclear gauge. Test at random locations you select and include the test results in your QC production tests reports.

#### **39-1.01D(8)(g) Tapered Notched Wedge**

Perform QC testing on the completed tapered notched 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 theoretical maximum density.
4. Determine percent compaction of the longitudinal joint as the ratio of the daily average of the field compaction values and the maximum density test results.

Determine percent compaction values each day the tapered notched wedge joint is completed. 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 comply with the specifications.

#### **39-1.01D(8)(h) Density Cores**

To determine density, take 4- or 6-inch diameter density cores at least once every 5 business days. Take 1 density core for every 250 tons of HMA from random locations the Engineer designates. Take density cores in the Engineer's presence and backfill and compact holes with authorized material. Before submitting a density core, mark it with the density core's location and place it in a protective container.

If a density core is damaged, replace it with a density core taken within 1 foot longitudinally from the original density core. Relocate any density core located within 1 foot of a rumble strip to 1 foot transversely away from the rumble strip.

For a tapered notched wedge joint, take 4- or 6-inch diameter density 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 backfill and compact holes with authorized material. Before submitting a density core, mark it with the core's location and place it in a protective container.

**39-1.01D(8)(i) Reserved****39-1.01D(8)(j) Pavement Smoothness****39-1.01D(8)(j)(i) General**

Test pavement smoothness using an inertial profiler except use a 12-foot straightedge for the HMA pavement 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 inertial profiler testing is required, pavement smoothness for each lane must be determined by the International Roughness Index for the left and right wheel paths in an individual lane and then averaging the results. The average of the International Roughness Index values from the left and right wheel paths for the same lane is the Mean Roughness Index 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 inertial profiler testing is required, identify areas of localized roughness. Areas of localized roughness must be identified using the FHWA's engineering software ProVAL smoothness assurance analysis by calculating continuous International Roughness Index values for each wheel path with a 25-foot interval using a 250 mm filter.

Collect profiling data under AASHTO R 56 and analyze data using 250 mm and International Roughness Index filters.

**39-1.01D(8)(j)(ii) Inertial Profiler Calibration and Verification Tests**

Operate the inertial profiler according to the manufacturer's instructions and AASHTO R 57 at 1-inch recording intervals.

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

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

1. Block test. Verify the height sensor accuracy under California Test 387.
2. Bounce test. Verify the combined height sensor and accelerometer accuracy under California Test 387.
3. Distance measurement instrument test. Calibrate the accuracy of the testing procedure under California Test 387.
4. Manufacturer's recommended tests.

Conduct cross-correlation inertial profiler verification test in the Engineer's presence before performing initial profiling. Verify cross-correlation inertial profiler verification test at least annually. Conduct 5 repeat runs of the inertial profiler 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 California Test 387 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 International Roughness Index values must be within 10 percent of the Department's International Roughness Index values. The Engineer may order you to recalibrate your inertial profiler equipment and reprofile. If your results are inaccurate due to operator error, the Engineer may disqualify your inertial profiler operator.

**39-1.01D(8)(j)(iii) Smoothness Testing**

Notify the Engineer of start location by station and start time at least 2 business days before profiling.

Remove foreign objects on the pavement surface before profiling.

Mark the beginning and ending station on the pavement shoulder before profiling. Stationing must be the same when profiling more than one surface.

While collecting the profile data to determine the International Roughness Index values, 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
4. Begin and end of all at-grade intersections

10-17-14

04-18-14

Determine the Mean Roughness Index for 0.1-mile fixed sections using the ProVAL ride quality analysis with a 250 mm filter. Profile the left and right wheel paths of each lane. Calculate the Mean Roughness Index 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 Mean Roughness Index specifications for a full section. Adjust the Mean Roughness Index 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 International Roughness Index for each wheel path with a 25-foot interval using a 250 mm filter.

Pavement smoothness must comply with the specifications in section 39-1.01D(9)(c).

### **39-1.01D(9) Department Acceptance**

#### **39-1.01D(9)(a) General**

The Department tests treated aggregate for acceptance before lime treatment except for gradation.

The Engineer takes HMA samples for AASHTO T 283 and AASHTO T 324 (Modified) from one of the following:

1. At the plant
2. At the truck
3. Windrow

10-17-14

The Engineer takes HMA samples for all other tests from one of the following:

1. At the plant
2. At the truck
3. Windrow
4. Mat behind the paver

04-18-14

The Engineer's sampling and testing is independent of your QC sampling and testing.

If you request, the Engineer splits samples and provides you with a part.

No single test result may represent more than 750 tons or one day's production, whichever is less, excluding AASHTO T 283 and AASHTO T 324 (Modified).

Except for smoothness, if 2 consecutive Department acceptance test results or any 3 Department acceptance test results for 1 day's production do not comply with the specifications:

1. Stop HMA production
2. Take corrective action
3. Demonstrate compliance with the specifications before resuming production and placement

10-17-14

For Department acceptance tests performed under AASHTO T 27, results are considered 1 Department acceptance test regardless of the number of sieves out of compliance.

The Engineer accepts HMA based on:

1. Authorized JMF
2. Authorized QC plan
3. Asphalt binder compliance
4. Asphalt emulsion compliance
5. Visual inspection
6. Pavement smoothness

### 39-1.01D(9)(b) In-Place Density

10-17-14

Except for HMA pavement placed using method compaction, the Engineer tests the density core you take from each 250 tons of HMA. The Engineer determines the percent of theoretical maximum density for each density core by determining the density core's density and dividing by the theoretical maximum density.

04-18-14

Density cores must be taken from the final layer, cored to the specified total paved thickness.

If the percent of theoretical maximum density does not comply with the specifications, the Engineer may accept the HMA and take a payment deduction.

For acceptance of a completed tapered notched wedge joint, the Engineer determines density from cores based on:

1. Field compaction by measuring the bulk specific gravity of the cores under AASHTO T 275, 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

### 39-1.01D(9)(c) Pavement Smoothness

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

1. Have no areas of localized roughness with an International Roughness Index greater than 160 in/mi
2. Comply with the Mean Roughness Index requirements shown in the following table for a 0.1 mile section:

**HMA<sup>a</sup> Pavement Smoothness Acceptance Criteria**

HMA thickness	Mean Roughness Index requirement
> 0.20 foot	60 in/mi or less
≤0.20 foot	75 in/mi or less

<sup>a</sup> Except OGFC

The final surface of HMA must comply with the Mean Roughness Index requirements before placing OGFC. Correct pavement to the Mean Roughness Index specifications. Localized roughness greater than 160 in/mi must be corrected regardless of the International Roughness Index values of a 0.1-mile section.

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.

### **39-1.01D(9)(d) Dispute Resolution**

You and the Engineer must work together to avoid potential conflicts and to resolve disputes regarding test result discrepancies. Notify the Engineer within 5 business days of receiving a test result if you dispute the test result.

If you or the Engineer dispute each other's test results, submit QC test results and copies of paperwork including worksheets used to determine the disputed test results. An independent third party performs referee testing. Before the third party participates in a dispute resolution, it must be qualified under AASHTO Materials Reference Laboratory program, and the Department's Independent Assurance Program. The independent third party must have no prior direct involvement on this Contract. By mutual agreement, the independent third party is chosen from:

1. Department laboratory in a district or region not in the district or region the project is located
2. Transportation Laboratory
3. Laboratory not currently employed by you or your HMA producer

If split QC or acceptance samples are not available, the independent third party uses any available material representing the disputed HMA for evaluation.

If the independent third party determines the Department's test results are valid, the Engineer deducts the independent third party's testing costs from payments. If the independent third party determines your test results are valid, the Department pays the independent third party's testing costs.

### **39-1.02 MATERIALS**

#### **39-1.02A General**

Reserved

#### **39-1.02B Mix Design**

##### **39-1.02B(1) General**

The HMA mix design must comply with AASHTO R 35 except:

1. Notes 3, 6, and 10 do not apply
2. AASHTO M 323 does not apply on combinations of aggregate gradation and asphalt binder contents to determine the OBC and HMA mixture qualities

The Contractor Hot Mix Asphalt Design Data form must show documentation on aggregate quality.

##### **39-1.02B(2) Hot Mix Asphalt Treatments**

If the test results for AASHTO T 283 or AASHTO T 324 (Modified) for untreated plant-produced HMA are less than the minimum requirements for HMA mix design, determine the plasticity index of the aggregate blend under California Test 204.

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

If the plasticity index is from 4 to 10, treat the aggregate with dry lime with marination or lime slurry with marination.

If the plasticity index is less than 4, treat the aggregate with dry lime or lime slurry with marination, or treat the HMA with liquid antistripping.

##### **39-1.02B(3) Warm Mix Asphalt Technology**

For HMA with warm mix asphalt additive technology, produce HMA mix samples for your mix design using your methodology for inclusion of warm mix asphalt admixture in laboratory-produced HMA. For warm mix asphalt water injection foam technology, the use of foamed asphalt for mix design is not required.

#### **39-1.02C Asphalt Binder**

Asphalt binder must comply with section 92.

For replace asphalt concrete surfacing or hot mix asphalt (leveling) the grade of asphalt binder for the HMA must be PG 64-10 or PG 64-16.

**39-1.02D Aggregate**

**39-1.02D(1) General**

Aggregate must be clean and free from deleterious substances.

The aggregate for replace asphalt concrete surfacing and hot mix asphalt (leveling) must comply with the gradation specifications for Type A HMA in section 39-2.02.

**39-1.02D(2) Aggregate Gradations**

10-17-14

Aggregate gradation must be determined before the addition of asphalt binder and must include supplemental fines. Test for aggregate gradation under AASHTO T 27. Do not wash the coarse aggregate. Use a mechanical sieve shaker. Aggregate shaking time must not exceed 10 minutes for each coarse and fine aggregate portion.

04-18-14

Choose a target value within the target value limits shown in the tables titled "Aggregate Gradations."

Gradations are based on nominal maximum aggregate size.

**39-1.02D(3) Aggregate Lime Treatments**

**39-1.02D(3)(a) General**

If aggregate lime treatment is required, virgin aggregate must comply with the aggregate quality specifications.

Lime for treating aggregate must comply with section 24-2.02B.

Water for lime treatment of aggregate with lime slurry must comply with section 24-2.02C.

Notify the Engineer at least 24 hours before the start of aggregate treatment.

Do not treat RAP.

The lime ratio is the pounds of dry 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.

Coarse and fine aggregate fractions must have the lime ratio ranges shown in the following table:

Aggregate fractions	Lime ratio percent
Coarse	0.4–1.0
Fine	1.5–2.0
Combined	0.8–1.5

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 marination is required, marinate treated aggregate in stockpiles from 24 hours to 60 days before using in HMA. Do not use aggregate marinated longer than 60 days.

Treated aggregate must not have lime balls or clods.

**39-1.02D(3)(b) Dry Lime**

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

Proportion dry lime by weight with an automatic continuous proportioning system.

If you use a batch-type proportioning system for HMA production, control proportioning in compliance with the specifications for continuous mixing plants. Use a separate dry lime aggregate treatment system for HMA batch mixing including:

1. Pugmill mixer
2. Controller
3. Weigh belt for the lime
4. Weigh belt for the aggregate

If using a continuous mixing plant for HMA production 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 lime treatment 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 Department's Material Plant Quality Program manual.

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 to the aggregate for mixing and coating before dry lime addition. Immediately before mixing lime with aggregate, water must not visibly separate from the 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 process. 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.

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 process 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.

### **39-1.02D(3)(c) Lime Slurry**

For lime slurry aggregate treatment, treat aggregate separate from HMA production. Stockpile and marinate the aggregate.

Proportion lime and water with a continuous or batch mixing system.

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.

Immediately before mixing lime slurry with the aggregate, water must not visibly separate from the aggregate.

Proportion lime slurry and aggregate by weight in a continuous process.

### **39-1.02E Liquid Antistrip Treatment**

Liquid antistrip must be from 0.25 to 1.0 percent by weight of asphalt binder. Do not use liquid antistrip as a substitute for asphalt binder.

Liquid antistrip total amine value must be 325 minimum when tested under ASTM D2074.

Use only 1 liquid antistrip type or brand at a time. Do not mix liquid antistrip types or brands.

Store and mix liquid antistrip under the manufacturer's instructions.

**39-1.02F–39-1.02G Reserved**

**39-1.02H Hot Mix Asphalt Production**

**39-1.02H(1) General**

Do not start HMA production before verification and authorization of JMF.

HMA plants must be Department-qualified. Before production, the HMA plant must have a current qualification under the Department's Materials Plant Quality Program.

For lime treated 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.

Weighing and metering devices used for the production of HMA modified with additives must comply with the requirements of the Department's Material Plant Quality Program. If a loss-in-weight meter is used for dry HMA additive, the meter must 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 per hour.
6. Complying with the limits of Table B, "Conveyor Scale Testing Extremes," in the Department's Material Plant Quality Program

10-17-14

Proportion aggregate by hot or cold-feed control.

Aggregate temperature must not be more than 375 degrees F when mixed with the asphalt binder.

04-18-14

Asphalt binder temperature must be from 275 to 375 degrees F when mixed with aggregate.

Mix HMA ingredients into a homogeneous mixture of coated aggregates.

HMA with or without RAP must not be more than 325 degrees F.

For HMA produced using warm mix asphalt technology, HMA must be at a temperature between 240 and 325 degrees F.

If method compaction is used, HMA must be produced at a temperature between 305 and 325 degrees F.

If you stop production for longer than 30 days, a production start-up evaluation is required.

**39-1.02H(2) Liquid Antistrip**

If 3 consecutive sets of recorded production data show actual delivered liquid antistrip weight is more than  $\pm 1$  percent of the authorized mix design liquid antistrip weight, stop production and take corrective action.

If a set of recorded production data shows actual delivered liquid antistrip weight is more than  $\pm 2$  percent of the authorized mix design liquid antistrip weight, stop production. If the liquid antistrip 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.

The Engineer orders proportioning activities stopped for any of the following:

1. You do not submit data
2. You submit incomplete, untimely, or incorrectly formatted data
3. You do not take corrective actions
4. You take late or unsuccessful corrective actions
5. You do not stop production when proportioning tolerances are exceeded
6. You use malfunctioning or failed proportioning devices

If you stop production, notify the Engineer of any corrective actions taken before resuming.

### **39-1.02H(3) Warm Mix Asphalt Technology**

Proportion all ingredients by weight. The HMA plant process controller 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 plant process controller.

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 plant process controller 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  $\pm 0.3$  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  $\pm 0.5$  percent of the target additive weight. The indicated HMA additive batch scale weight may vary from the preselected weight setting by up to  $\pm 1.0$  percent of the target additive weight.

### **39-1.02I Geosynthetic Pavement Interlayer**

Geosynthetic pavement interlayer must comply with the specifications for pavement fabric, paving mat, paving grid, paving geocomposite grid, or geocomposite strip membrane as shown.

The asphalt binder for geosynthetic pavement interlayer must be PG 64-10, PG 64-16, or PG 70-10.

### **39-1.02J Tack Coat**

Tack coat must comply with the specifications for asphaltic emulsion or asphalt binder. Choose the type and grade.

### **39-1.02K Miscellaneous Areas and Dikes**

For miscellaneous areas and dikes:

1. Choose either the 3/8-inch or 1/2-inch aggregate gradation for Type A HMA.
2. Minimum asphalt binder content must be 6.8 percent for 3/8-inch aggregate and 6.0 percent for 1/2-inch aggregate. If you request and the Engineer authorizes, you may reduce the minimum asphalt binder content.
3. Choose asphalt binder Grade PG 64-10, PG 64-16 or PG 70-10.

For HMA used in miscellaneous areas and dikes, sections 39-1.01C, 39-1.01D, 39-1.02B, 39-1.02D(3), and 39-1.02E–J do not apply.

### **39-1.03 CONSTRUCTION**

#### **39-1.03A General**

Do not place HMA on wet pavement or 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

10-17-14

HMA placed in a windrow on the roadway surface must not extend more than 250 feet in front of the loading equipment or material transfer vehicle.

04-18-14

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

Where density or data core samples are taken, backfill and compact holes with authorized material.

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 130 degrees F for HMA with warm mix asphalt technology

#### **39-1.03B Spreading and Compacting Equipment**

##### **39-1.03B(1) General**

Paving equipment for spreading must be:

1. Self-propelled
2. Mechanical
3. Equipped with a screed or strike-off assembly that can distribute HMA the full width of a traffic lane
4. Equipped with a full-width compacting device
5. Equipped with automatic screed slope controls and sensing devices that control the thickness, longitudinal grade, and transverse screed slope

Install and maintain grade and slope references.

The screed must be heated and produce a uniform HMA surface texture without tearing, shoving, or gouging.

The paver must not leave marks such as ridges and indentations unless you can eliminate them by rolling.

Rollers must be equipped with a system that prevents HMA from sticking to the wheels. You may use a parting agent that does not damage the HMA or impede the bonding of layers.

In areas inaccessible to spreading and compacting equipment:

1. Spread the HMA by any means to obtain the specified lines, grades, and cross sections
2. Use a pneumatic tamper, plate compactor, or equivalent to achieve thorough compaction

### **39-1.03B(2) Material Transfer Vehicle**

If a material transfer vehicle is specified, the material transfer vehicle must have sufficient capacity to prevent stopping the paver and must be capable of:

1. Either receiving HMA directly from trucks or using a windrow pickup head to load it from a windrow deposited on the roadway surface
2. Remixing the HMA with augers before transferring into the paver's receiving hopper or feed system
3. Transferring HMA directly into the paver's receiving hopper or feed system

### **39-1.03B(3) Method Compaction Equipment**

For method compaction, each paver spreading HMA must be followed by 3 rollers:

1. One vibratory roller specifically designed to compact HMA. The roller must be capable of at least 2,500 vibrations per minute and must be equipped with amplitude and frequency controls. The roller's gross static weight must be at least 7.5 tons.
2. One oscillating type pneumatic-tired roller at least 4 feet wide. Pneumatic tires must be of equal size, diameter, type, and ply. The tires must be inflated to 60 psi minimum and maintained so that the air pressure does not vary more than 5 psi.
3. One steel-tired, 2-axle tandem roller. The roller's gross static weight must be at least 7.5 tons.

Each roller must have a separate operator. Rollers must be self-propelled and reversible.

### **39-1.03B(4)–39-1.03B(6) Reserved**

### **39-1.03C Surface Preparation**

#### **39-1.03C(1) General**

Before placing HMA, remove loose paving particles, dirt, and other extraneous material by any means including flushing and sweeping.

#### **39-1.03C(2) Subgrade**

Prepare subgrade to receive HMA under the sections for the material involved. Subgrade must be free of loose and extraneous material.

#### **39-1.03C(3) Reserved**

#### **39-1.03C(4) Prepaving Inertial Profiler**

Section 39-1.03C(4) applies to existing asphalt concrete surfaces receiving an HMA overlay if a bid item for prepaving inertial profiler is shown in the Bid Item List.

Before starting paving activities, perform prepaving inertial profiler measurements. Prepaving inertial profiler includes taking profiles of the existing pavement, analyzing the data with ProVAL to determine existing pavement International Roughness Index, Mean Roughness Index, and areas of localized roughness.

If the Contract includes cold planing, perform prepaving inertial profiler measurements before cold planning.

If the Contract includes replace asphalt concrete surfacing, perform prepaving inertial profiler measurements after replacing the asphalt concrete surfacing.

### **39-1.03C(5)Prepaving Grinding**

Section 39-1.03C(5) applies to all existing asphalt concrete surfaces that will not be cold planned or milled and that will receive an HMA overlay less than or equal to 0.20 foot exclusive of OGFC if a bid item for prepaving grinding day is shown in the Bid Item List.

After performing prepaving inertial profiling, correct areas of localized roughness greater than 180 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 39-1.01C(13)(d).

10-17-14

Notify the Engineer of those areas of localized roughness that cannot be corrected by prepaving grinding according to the ProVAL smoothness assurance analysis grinding report. The Engineer responds to your notification within 5 business days.

04-18-14

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 inertial profiler. Corrective work performed by a different method, including taking profiles of the corrected areas and associated traffic control, is change order work.

If ordered not to correct areas of localized roughness, the smoothness specifications do not apply to the final pavement surface placed in those areas.

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 39-1.01C(13)(d).

Dispose of grinding residue.

Pave within 7 days of correcting areas.

The final pavement surface must comply with section 39-1.01D(9)(c).

If the Engineer determines more time is required for prepaving grinding than the Contract allows for and if prepaving grinding is a controlling activity, the Engineer makes a time adjustment.

### **39-1.03C(6) Tack Coat**

Apply tack coat:

1. To existing pavement including planed surfaces
2. Between HMA layers
3. To vertical surfaces of:
  - 3.1. Curbs
  - 3.2. Gutters
  - 3.3. Construction joints

Before placing HMA, apply tack coat in 1 application at the minimum residual rate shown in the following table for the condition of the underlying surface:

**Tack Coat Application Rates for HMA**

HMA over:	Minimum Residual Rates (gal/sq yd)		
	CSS1/CSS1h, SS1/SS1h and QS1h/CQS1h Asphaltic Emulsion	CRS1/CRS2, RS1/RS2 and QS1/CQS1 Asphaltic Emulsion	Asphalt Binder and PMRS2/PMCRS2 and PMRS2h/PMCRS2h Asphaltic Emulsion
New HMA (between layers)	0.02	0.03	0.02
PCC and existing AC surfacing	0.03	0.04	0.03
Planned pavement	0.05	0.06	0.04

Notify the Engineer if you dilute asphaltic emulsion with water. The weight ratio of added water to asphaltic emulsion must not exceed 1 to 1.

Measure added water either by weight or volume under section 9-1.02 or you may use water meters from water districts, cities, or counties. If you measure water by volume, apply a conversion factor to determine the correct weight.

With each dilution, submit:

1. Weight ratio of water to bituminous material in the original asphaltic emulsion
2. Weight of asphaltic emulsion before diluting
3. Weight of added water
4. Final dilution weight ratio of water to asphaltic emulsion

Apply to vertical surfaces with a residual tack coat rate that will thoroughly coat the vertical face without running off.

If you request and the Engineer authorizes, you may:

1. Change tack coat rates
2. Omit tack coat between layers of new HMA during the same work shift if:
  - 2.1. No dust, dirt, or extraneous material is present
  - 2.2. Surface is at least 140 degrees F

Immediately in advance of placing HMA, apply additional tack coat to damaged areas or where loose or extraneous material is removed.

Close areas receiving tack coat to traffic. Do not track tack coat onto pavement surfaces beyond the job site.

Asphalt binder tack coat temperature must be from 285 to 350 degrees F when applied.

**39-1.03C(7) Geosynthetic Pavement Interlayer**

If specified, place geosynthetic pavement interlayer over a coat of asphalt binder. Place geosynthetic pavement interlayer in compliance with the manufacturer's instructions.

Before placing the geosynthetic pavement interlayer and asphalt binder:

1. Repair cracks 1/4 inch and wider, spalls, and holes in the pavement. Repairing cracks is change order work.
2. Clean the pavement of loose and extraneous material.

Immediately before placing the interlayer, apply 0.25 ± 0.03 gallon of asphalt binder per square yard of interlayer or until the fabric is saturated. Apply asphalt binder the width of the geosynthetic pavement interlayer plus 3 inches on each side. At an interlayer overlap, apply asphalt binder on the lower interlayer the same overlap distance as the upper interlayer.

Align and place the interlayer with no overlapping wrinkles, except a wrinkle that overlaps may remain if it is less than 1/2 inch thick. If the overlapping wrinkle is more than 1/2 inch thick, cut the wrinkle out and overlap the interlayer no more than 2 inches.

The minimum HMA thickness over the interlayer must be 0.12 foot thick including conform tapers. Do not place the interlayer on a wet or frozen surface.

Overlap the interlayer borders between 2 to 4 inches. In the direction of paving, overlap the following roll with the preceding roll at any break.

You may use rolling equipment to correct distortions or wrinkles in the interlayer.

If asphalt binder tracked onto the interlayer or brought to the surface by construction equipment causes interlayer displacement, cover it with a small quantity of HMA.

Before placing HMA on the interlayer, do not expose the interlayer to:

1. Traffic except for crossings under traffic control and only after you place a small HMA quantity
2. Sharp turns from construction equipment
3. Damaging elements

Pave HMA on the interlayer during the same work shift.

### **39-1.03D Longitudinal Joints**

#### **39-1.03D(1) General**

Longitudinal joints in the top layer must match lane lines. Alternate the longitudinal joint offsets in the lower layers at least 0.5 foot from each side of the lane line. You may request other longitudinal joint placement patterns.

A vertical longitudinal joint of more than 0.15 foot is not allowed at any time between adjacent lanes open to traffic.

For HMA thickness of 0.15 foot 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 foot, you must place HMA on adjacent traveled way lanes or shoulder 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 other authorized release agent under the conform tapers to facilitate the taper removal when paving activities resume.

If placing HMA against the edge of existing pavement, sawcut or grind the pavement straight and vertical along the joint and remove extraneous material.

#### **39-1.03D(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.

### **39-1.03E Edge Treatments**

Construct edge treatment on the HMA pavement as shown.

Where a safety edge is required, use the same type of HMA used for the adjacent lane or shoulder.

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  $\pm 5$  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.

### **39-1.03F 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.

### **39-1.03G 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.

If shoulders or median borders are shown, pave shoulders and median borders adjacent to the lane before opening a lane to traffic.

If shoulder conform tapers are shown, place conform tapers concurrently with the adjacent lane's paving.

If a driveway or a road connection is shown, 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.

### **39-1.03H Leveling**

Section 39-1.03H applies if a bid item for hot mix asphalt (leveling) is shown on the Bid Item List.

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 hot mix asphalt (leveling).

### **39-1.03I Miscellaneous Areas and Dikes**

Prepare the area to receive HMA for miscellaneous areas and dikes, including excavation and backfill as needed.

Spread miscellaneous areas in 1 layer and compact to the specified lines and grades.

In median areas adjacent to slotted median drains, each layer of HMA must not exceed 0.20 foot maximum compacted thickness.

The finished surface must be:

1. Textured uniformly
2. Compacted firmly
3. Without depressions, humps, and irregularities

### **39-1.03J Replace Asphalt Concrete Surfacing**

Where replace asphalt concrete surfacing is shown, remove existing asphalt concrete surfacing and replace with HMA. The Engineer determines the exact limits of asphalt concrete surfacing to be replaced.

Replace asphalt concrete in a lane before the lane is specified to be opened to traffic.

Before removing asphalt concrete, outline the replacement area and cut neat lines with a saw or grind to full depth of the existing asphalt concrete. Do not damage asphalt concrete and base remaining in place.

If the base is excavated beyond the specified plane, replace it with HMA. The Department does not pay for this HMA.

Do not use a material transfer vehicle if replace asphalt concrete surfacing is specified.

### **39-1.03K–39-1.03N Reserved**

#### **39-1.03O Compaction**

##### **39-1.03O(1) General**

Rolling must leave the completed surface compacted and smooth without tearing, cracking, or shoving.

If a vibratory roller is used as a finish roller, turn the vibrator off.

Do not open new HMA pavement to traffic until the surface temperature is below 130 degrees F.

If the surface to be paved is both in sunlight and shade, pavement surface temperatures are taken in the shade.

##### **39-1.03O(2) Method Compaction**

Use method compaction for any of the following conditions:

1. HMA pavement thickness shown is less than 0.15 foot
2. Replace asphalt concrete surfacing
3. Leveling courses
4. Areas the Engineer determines conventional compaction and compaction measurement methods are impeded

10-17-14

HMA compaction coverage is the number of passes needed to cover the paving width. A pass is 1 roller's movement parallel to the paving in either direction. Overlapping passes are part of the coverage being made and are not a subsequent coverage. Do not start a coverage until completing the prior coverage.

04-18-14

Method compaction must consist of performing:

1. Breakdown compaction of each layer with 3 coverages using a vibratory roller. The speed of the vibratory roller in miles per hour must not exceed the vibrations per minute divided by 1,000. If the HMA layer thickness is less than 0.08 foot, turn the vibrator off.
2. Intermediate compaction of each layer of HMA with 3 coverages using a pneumatic-tired roller at a speed not to exceed 5 mph.
3. Finish compaction of HMA with 1 coverage using a steel-tired roller.

Start rolling at the lower edge and progress toward the highest part.

The Engineer may order fewer coverages if the layer thickness of HMA is less than 0.15 foot.

### **39-1.03O(3)–39-1.03O(5) Reserved**

#### **39-1.03P Smoothness Corrections**

If the final surface of the pavement does not comply with the smoothness specifications, 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.

Do not use equipment with carbide cutting teeth to grind the pavement unless 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.

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 inertial profiler, reprofile the entire lane length with the inertial profiler device.

Where corrections are made within areas requiring testing with a 12-foot straightedge, retest the corrected area with the straightedge.

#### **39-1.03Q Data Cores**

Section 39-1.03Q applies if a bid item for data core is shown on the Bid Item List.

Take data cores of the completed HMA pavement, underlying base, and subbase material. Notify the Engineer 3 business days before coring.

Protect data cores and surrounding pavement from damage.

Take 4-inch 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 data core summary and photograph submittal, dispose of cores.

#### **39-1.04 PAYMENT**

Geosynthetic pavement interlayer is measured by the square yard for the actual pavement area covered.

If tack coat, asphalt binder, and asphaltic emulsion are paid as separate bid items, their bid items are measured under section 92 or section 94.

The Department does not adjust the unit price for an increase or decrease in the tack coat quantity.

HMA of the type shown in the Bid Item List is measured based on the combined mixture weight. If recorded batch weights are printed automatically, the bid item for HMA is measured by using the printed batch weights, provided:

1. Total aggregate and supplemental fine aggregate weight per batch is printed. If supplemental fine aggregate is weighed cumulatively with the aggregate, the total aggregate batch weight must include the supplemental fine aggregate weight.
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 is correlated with a load slip.
5. Copy of the recorded batch weights is certified by a licensed weigh master and submitted.

Place hot mix asphalt dike of the type shown in the Bid Item List is measured along the completed length. Payment for the HMA used to construct the dike is not included in the payment for place hot mix asphalt dike.

Place hot mix asphalt (miscellaneous areas) is measured as the in-place compacted area. Payment for the HMA used for miscellaneous areas is not included in the payment for place hot mix asphalt (miscellaneous areas).

If replace asphalt concrete surfacing is shown, the bid item for replace asphalt concrete is measured based on the specified dimensions and any adjustments ordered.

The Department does not adjust the unit price for an increase or decrease in the prepaving grinding day quantity.

The Department reduces payment for noncompliance of HMA density based on the factors shown in the following table:

<b>Reduced Payment Factors for Percent of Maximum Theoretical Density</b>			
HMA percent of maximum theoretical density	Reduced payment factor	HMA percent of maximum theoretical density	Reduced payment factor
91.0	0.0000	97.0	0.0000
90.9	0.0125	97.1	0.0125
90.8	0.0250	97.2	0.0250
90.7	0.0375	97.3	0.0375
90.6	0.0500	97.4	0.0500
90.5	0.0625	97.5	0.0625
90.4	0.0750	97.6	0.0750
90.3	0.0875	97.7	0.0875
90.2	0.1000	97.8	0.1000
90.1	0.1125	97.9	0.1125
90.0	0.1250	98.0	0.1250
89.9	0.1375	98.1	0.1375
89.8	0.1500	98.2	0.1500
89.7	0.1625	98.3	0.1625
89.6	0.1750	98.4	0.1750
89.5	0.1875	98.5	0.1875
89.4	0.2000	98.6	0.2000
89.3	0.2125	98.7	0.2125
89.2	0.2250	98.8	0.2250
89.1	0.2375	98.9	0.2375
89.0	0.2500	99.0	0.2500
< 89.0	Remove and replace	> 99.0	Remove and replace

## 39-2 TYPE A HOT MIX ASPHALT

### 39-2.01 GENERAL

#### 39-2.01A Summary

Section 39-2 includes specifications for producing and placing Type A hot mix asphalt.

You may produce Type A HMA using an authorized warm mix asphalt technology.

#### 39-2.01B Definitions

Reserved

#### 39-2.01C Submittals

##### 39-2.01C(1) General

Reserved

##### 39-2.01C(2) Job Mix Formula

The JMF must be based on an HMA mix design determined as described in the Superpave Mix Design SP-2 Manual by the Asphalt Institute.

##### 39-2.01C(3) Reclaimed Asphalt Pavement

Submit QC test results for RAP gradation with the combined aggregate gradation within 2 business days of taking RAP samples during HMA production.

##### 39-2.01C(4)–39-2.01C(6) Reserved

#### 39-2.01D Quality Control and Assurance

##### 39-2.01D(1) General

Reserved

##### 39-2.01D(2) Quality Control

##### 39-2.01D(2)(a) General

Reserved

##### 39-2.01D(2)(b) Aggregate

Test the quality characteristics of aggregate under the test methods and frequencies shown in the following table:

**Aggregate Testing Frequencies**

Quality characteristic	Test method	Minimum testing frequency
Gradation <sup>a</sup>	AASHTOT 27	1 per 750 tons and any remaining part
Sand equivalent <sup>b, c</sup>	AASHTOT 176	
Moisture content <sup>d</sup>	AASHTOT 329	
Crushed particles	AASHTOT 335	1 per 10,000 tons or 2 per project whichever is greater
Los Angeles rattler	AASHTOT 96	
Flat and elongated particles	ASTM D4791	
Fine aggregate angularity	AASHTO T 304 Method A	

<sup>a</sup>If RAP is used, test the combined aggregate gradation under California Test 384.

<sup>b</sup>Reported value must be the average of 3 tests from a single sample.

<sup>c</sup>Use of a sand reading indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, 4.8, 7.1.2, 8.4.2 and 8.4.3 do not apply.

<sup>d</sup>Test at continuous mixing plants only. If RAP is used, test the RAP moisture content at continuous mixing plant and batch mixing plant.

For lime treated aggregate, test aggregate before treatment and test for gradation and moisture content during HMA production.

**39-2.01D(2)(c) Reclaimed Asphalt Pavement**

10-17-14

Sample and test processed RAP at a minimum frequency of 1 sample per 1000 tons with a minimum of 6 samples per fractionated stockpile. If the fractionated stockpile has not been augmented, the 3 RAP samples taken and tested for mix design may be part of this minimum sample requirement. If a fractionated RAP stockpile is augmented, sample and test processed RAP quality characteristics at a minimum frequency of 1 sample per 500 tons of augmented RAP.

04-18-14

The combined RAP sample when tested under AASHTO T 164 must be within  $\pm 2.0$  percent of the average asphalt binder content reported on page 4 of your Contractor Hot Mix Asphalt Design Data form. If new fractionated RAP stockpiles are required, the average binder content of the new fractionated RAP stockpile must be within  $\pm 2.0$  percent of the average binder reported on page 4 of your Contractor Hot Mix Asphalt Design Data form.

The combined RAP sample when tested under AASHTO T209 must be within  $\pm 0.06$  of the average maximum specific gravity reported on page 4 of your Contractor Hot Mix Asphalt Design Data form.

During HMA production, sample RAP twice daily and perform QC testing for:

1. Aggregate gradation at least once a day under California Test 384
2. Moisture content at least twice a day

**39-2.01D(2)(d) Hot Mix Asphalt Production**

Test the quality characteristics of HMA under the test methods and frequencies shown in the following table:

**Hot Mix Asphalt Testing Frequencies**

Quality characteristic	Test method	Minimum testing frequency
Asphalt binder content	AASHTOT 308 Method A	1 per 750 tons and any remaining part
HMA moisture content	AASHTOT 329	1 per 2,500 tons but not less than 1 per paving day
Air voids content	AASHTOT 269	1 per 4,000 tons or 2 every 5 paving days, whichever is greater
Voids in mineral aggregate	SP-2 Asphalt Mixture Volumetrics	1 per 10,000 tons or 2 per project whichever is greater
Dust proportion	SP-2 Asphalt Mixture Volumetrics	
Density of core	California Test 375	2 per paving day
Nuclear gauge density	California Test 375	3 per 250 tons or 3 per paving day, whichever is greater
Hamburg wheel track	AASHTO T 324 (Modified)	1 per 10,000 tons or 1 per project, whichever is greater
Moisture susceptibility	AASHTOT 283	

**39-2.01D(3)–39-2.01D(4) Reserved**

**39-2.01D(5) Department Acceptance**

The Department accepts Type A HMA based on compliance with:

1. Aggregate quality requirements shown in the following table:

### Aggregate Quality

Quality characteristic	Test method	Requirement
Aggregate gradation <sup>a</sup>	AASHTO T 27	JMF ± Tolerance
Percent of crushed particles	AASHTOT 335	95
Coarse aggregate (min, %)		
One-fractured face		90
Two-fractured faces		
Fine aggregate (min, %)		70
(Passing No. 4 sieve		
and retained on No. 8 sieve.)		
One fractured face		
Los Angeles Rattler (max, %)	AASHTOT 96	12
Loss at 100 Rev.		40
Loss at 500 Rev.		
Sand equivalent (min.) <sup>b, c</sup>	AASHTOT 176	47
Flat and elongated particles (max, % by weight at 5:1)	ASTM D4791	10
Fine aggregate angularity (min, %) <sup>d</sup>	AASHTO T 304 Method A	45

<sup>a</sup>The Engineer determines combined aggregate gradations containing RAP under California Test 384.

<sup>b</sup>Reported value must be the average of 3 tests from a single sample.

<sup>c</sup>Use of a sand reading indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, 4.8, 7.1.2, 8.4.2 and 8.4.3 do not apply.

<sup>d</sup>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.

2. If RAP is used, RAP quality requirements shown in the following table:

### Reclaimed Asphalt Pavement Quality

Quality characteristic	Test method	Requirement
Binder content (% within the average value reported)	AASHTO T 164	±2.0
Specific gravity (within the average value reported)	AASHTOT 209	±0.06

3. In-place HMA quality requirements shown in the following table:

### Type A HMA Acceptance In Place

Quality characteristic	Test method	Requirement
Asphalt binder content (%)	AASHTOT 308 Method A	JMF -0.3, +0.5
HMA moisture content (max, %)	AASHTOT 329	1
Air voids content at N <sub>design</sub> (%) <sup>a, b</sup>	AASHTOT 269	4 ± 1.5
Voids in mineral aggregate on plant-produced HMA (min, %) <sup>a</sup> Gradation: No. 4 3/8-inch 1/2-inch 3/4-inch 1-inch with NMAS <sup>g</sup> = 1-inch with NMAS <sup>g</sup> = 3/4-inch	SP-2 Asphalt Mixture Volumetrics <sup>c</sup>	15.5–18.5 14.5–17.5 13.5–16.5 12.5–15.5  12.5–15.5 13.5–16.5
Dust proportion	SP-2 Asphalt Mixture Volumetrics	0.6–1.3
Density of core (% of max theoretical density) <sup>e, f</sup>	California Test 375	91–97
Hamburg wheel track (min number of passes at 0.5-inch rut depth) Binder grade: PG 58 PG 64 PG 70 PG 76 or higher	AASHTO T 324 (Modified)	10,000 15,000 20,000 25,000
Hamburg wheel track (min number of passes at inflection point) Binder grade: PG 58 PG 64 PG 70 PG 76 or higher	AASHTO T 324 (Modified)	10,000 10,000 12,500 15,000
Moisture susceptibility (min, psi, dry strength)	AASHTOT 283	100
Moisture susceptibility (min, psi, wet strength)	AASHTOT 283	70

<sup>a</sup>Prepare 3 briquettes. Report the average of 3 tests.

<sup>b</sup>The Engineer determines the bulk specific gravity of each lab-compacted briquette under AASHTO T 275, Method A, and theoretical maximum specific gravity under AASHTO T 209, Method A.

<sup>c</sup>Determine bulk specific gravity under AASHTO T 275, Method A.

<sup>d</sup>The Engineer determines the laboratory-prepared HMA value for mix design verification only.

<sup>e</sup>The Engineer determines percent of theoretical maximum density under California Test 375 except the Engineer uses:

1. AASHTO T 275 to determine in-place density of each density core
2. AASHTO T 209, Method A to determine theoretical maximum density instead of calculating test maximum density

<sup>f</sup>The Engineer determines theoretical maximum density under AASHTO T 209, Method A, at the frequency specified in California Test 375, Part 5. D.

<sup>g</sup>NMAS means nominal maximum aggregate size.

## 39-2.02 MATERIALS

### 39-2.02A General

Reserved

### 39-2.02B Mix Design

The mix design must comply with the requirements shown in the following table:

**Type A HMA Mix Design Requirements**

Quality characteristic	Test method	Requirement
Air voids content (%)	AASHTO T 269 <sup>a</sup>	$N_{\text{initial}} > 8.0$ $N_{\text{design}} = 4.0$ ( $N_{\text{design}} = 5.0$ for 1-inch aggregate) $N_{\text{max}} > 2.0$
Gyrations compaction (no. of gyrations)	AASHTO T 312	$N_{\text{initial}} = 8$ $N_{\text{design}} = 85.0$ $N_{\text{max}} = 130$
Voids in mineral aggregate (min, %) <sup>b</sup> Gradation: No. 4 3/8-inch 1/2-inch 3/4-inch 1-inch with NMAS <sup>e</sup> = 1-inch with NMAS <sup>e</sup> = 3/4-inch	SP-2 Asphalt Mixture Volumetrics	16.5–19.5 15.5–18.5 14.5–17.5 13.5–16.5  13.5–16.5 14.5–17.5
Dust proportion	SP-2 Asphalt Mixture Volumetrics	0.6–1.3
Hamburg wheel track (min number of passes at 0.5-inch rut depth) Binder grade: PG 58 PG 64 PG 70 PG 76 or higher	AASHTO T 324 (Modified) <sup>c</sup>	10,000 15,000 20,000 25,000
Hamburg wheel track (min number of passes at the inflection point) Binder grade: PG 58 PG 64 PG 70 PG 76 or higher	AASHTO T 324 (Modified) <sup>c</sup>	10,000 10,000 12,500 15,000
Moisture susceptibility, dry strength (min, psi)	AASHTO T 283 <sup>c</sup>	100
Moisture susceptibility, wet strength (min, psi)	AASHTO T 283 <sup>c, d</sup>	70

<sup>a</sup>Calculate the air voids content of each specimen using AASHTO T 275, Method A, to determine bulk specific gravity. Use AASHTO T 209, Method A, to determine theoretical maximum specific gravity. Use a digital manometer and pycnometer when performing AASHTO T 209.

<sup>b</sup>Measure bulk specific gravity using AASHTO T 275, Method A.

<sup>c</sup>Test plant produced HMA.

<sup>d</sup>Freeze thaw required.

<sup>e</sup>NMAS means nominal maximum aggregate size.

For HMA mixtures using RAP, the maximum binder replacement is 25.0 percent for surface course and 40.0 percent for lower courses.

For HMA with a binder replacement percent less than or equal to 25 percent of your specified OBC, you may request that the performance graded 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 of your specified OBC and less than or equal to 40 percent of OBC, you must use a performance graded asphalt binder grade with upper and lower temperature classifications reduced by 6 degrees C from the specified grade.

**39-2.02C Asphalt Binder**

Reserved

**39-2.02D Aggregates**

**39-2.02D(1) General**

Before the addition of asphalt binder and lime treatment, the aggregate must comply with the requirements shown in the following table:

<b>Aggregate Quality</b>			
Quality characteristic	Test method	Requirement	
Percent of crushed particles	AASHTOT 335		
Coarse aggregate (min, %)			
One-fractured face			95
Two-fractured faces			90
Fine aggregate (min, %)	AASHTOT 335		
(Passing No. 4 sieve and retained on No. 8 sieve.)			
One fractured face		70	
Los Angeles Rattler (max, %)	AASHTOT 96		
Loss at 100 Rev.			12
Loss at 500 Rev.			40
Sand equivalent (min) <sup>a, b</sup>	AASHTOT 176	47	
Flat and elongated particles (max, % by weight at 5:1)	ASTM D4791	10	
Fine aggregate angularity (min, %) <sup>c</sup>	AASHTO T 304 Method A	45	

<sup>a</sup>Reported value must be the average of 3 tests from a single sample.

<sup>b</sup>Use of a Sand Reader Indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, 4.8, 7.1.2, 8.4.2 and 8.4.3 do not apply.

<sup>c</sup>The Engineer waives this specification if HMA contains 10 percent or less of nonmanufactured sand by weight of total aggregate, except if your JMF fails verification. Manufactured sand is fine aggregate produced by crushing rock or gravel.

**39-2.02D(2) Aggregate Gradations**

The aggregate gradations for Type A HMA must comply with the requirements shown in the following table:

10-17-14

<b>Aggregate Gradation Requirements</b>	
Type A HMA pavement thickness shown	Gradation
0.10 foot	3/8 inch
Greater than 0.10 to less than 0.20 foot	1/2 inch
0.20 foot to less than 0.25 foot	3/4 inch
0.25 foot or greater	3/4 inch or 1 inch

Aggregate gradation must be within the target value limits for the specified sieve size shown in the following tables:

**Aggregate Gradations  
(Percentage Passing)**

1-inch

Sieve size	Target value limit	Allowable tolerance
1"	100	--
3/4"	88–93	TV $\pm$ 5
1/2"	72–85	TV $\pm$ 6
3/8"	55–70	TV $\pm$ 6
No. 4	35–52	TV $\pm$ 7
No. 8	22–40	TV $\pm$ 5
No. 30	8–24	TV $\pm$ 4
No. 50	5–18	TV $\pm$ 4
No. 200	3–7	TV $\pm$ 2

3/4-inch

Sieve size	Target value limit	Allowable tolerance
1"	100	--
3/4"	90–98	TV $\pm$ 5
1/2"	70–90	TV $\pm$ 6
No. 4	42–58	TV $\pm$ 5
No. 8	29–43	TV $\pm$ 5
No. 30	10–23	TV $\pm$ 4
No. 200	2–7	TV $\pm$ 2

1/2-inch

Sieve sizes	Target value limit	Allowable tolerance
3/4"	100	--
1/2"	95–98	TV $\pm$ 5
3/8"	72–95	TV $\pm$ 5
No. 4	52–69	TV $\pm$ 5
No. 8	35–55	TV $\pm$ 5
No. 30	15–30	TV $\pm$ 4
No. 200	2–8	TV $\pm$ 2

3/8-inch

Sieve sizes	Target value limits	Allowable tolerance
1/2"	100	--
3/8"	95–98	TV $\pm$ 5
No. 4	55–75	TV $\pm$ 5
No. 8	30–50	TV $\pm$ 5
No. 30	15–35	TV $\pm$ 5
No. 200	2–9	TV $\pm$ 2

No. 4

Sieve sizes	Target value limits	Allowable tolerance
3/8"	100	--
No. 4	95–98	TV $\pm$ 5
No. 8	70–80	TV $\pm$ 6
No. 30	34–45	TV $\pm$ 5
No. 200	2–12	TV $\pm$ 4

**39-2.02E Reclaimed Asphalt Pavement**

You may substitute RAP for part of the virgin aggregate in a quantity up to a maximum of 25 percent of the aggregate blend.

Provide enough space for meeting all RAP handling requirements at your facility. Provide a clean, graded base, well drained area for stockpiles.

If RAP is from multiple sources, blend the RAP thoroughly and completely before fractionating.

For RAP substitution of 15 percent or less, fractionation is not required.

For RAP substitution greater than 15 percent, fractionate RAP stockpiles into 2 sizes, a coarse fraction RAP retained on 3/8-inch sieve, and a fine fraction RAP passing 3/8-inch sieve.

The RAP fractionation must comply with the requirements shown in the following table:

**RAP Stockpile Fractionation Gradation Requirements**

Quality characteristic	Test method	Requirement
Coarse (% passing the 1-inch sieve)	California Test 202 <sup>a</sup>	100
Fine (% passing the 3/8-inch sieve)	California Test 202 <sup>a</sup>	98–100

<sup>a</sup>Maximum mechanical shaking time is 10 minutes

You may use the coarse fractionated stockpile, the fine fractionated stockpile, or a combination of the coarse and fine fractionated stockpiles.

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.

**39-2.02F Hot Mix Asphalt Production**

10-17-14

If RAP is used, the asphalt plant must automatically adjust the virgin asphalt binder to account for RAP percentage and RAP binder.

During production, you may adjust hot or cold-feed proportion controls for virgin aggregate and RAP. RAP must be within ±3 of RAP percentage shown in your Contractor Job Mix Formula Proposal form without exceeding 25 percent.

The aggregate temperature requirements do not apply to RAP.

**39-2.03 CONSTRUCTION**

Spread Type A HMA at the atmospheric and surface temperatures shown in the following table:

**Minimum Atmospheric and Surface Temperatures for Type A HMA**

Compacted layer thickness, feet	Atmospheric, °F		Surface, °F	
	Unmodified asphalt binder	Modified asphalt binder	Unmodified asphalt binder	Modified asphalt binder
< 0.15	55	50	60	55
≥ 0.15	45	45	50	50

For method compaction, the maximum compacted layer thickness must be 0.25 foot.

04-18-14

For Type A HMA placed under method compaction, if the asphalt binder is:

1. Unmodified, complete:
  - 1.1. 1st coverage of breakdown compaction before the surface temperature drops below 250 degrees F
  - 1.2. Breakdown and intermediate compaction before the surface temperature drops below 190 degrees F

- 1.3. Finish compaction before the surface temperature drops below 150 degrees F
2. Modified, complete:
  - 2.1. 1st coverage of breakdown compaction before the surface temperature drops below 240 degrees F
  - 2.2. Breakdown and intermediate compaction before the surface temperature drops below 180 degrees F
  - 2.3. Finish compaction before the surface temperature drops below 140 degrees F

If you request and the Engineer authorizes, you may cool Type A HMA with water when rolling activities are complete. Apply water under section 17.

#### **39-2.04 PAYMENT**

Not Used

### **39-3 RUBBERIZED HOT MIX ASPHALT–GAP GRADED**

#### **39-3.01 GENERAL**

##### **39-3.01A Summary**

Section 39-3 includes specifications for producing and placing rubberized hot mix asphalt–gap graded.

You may produce RHMA-G using a warm mix asphalt technology.

##### **39-3.01B Definitions**

Reserved

##### **39-3.01C Submittals**

##### **39-3.01C(1) General**

At least 5 business days before use, submit the permit issued by the local air district for asphalt rubber binder blending equipment. If an air quality permit is not required by the local air district for producing asphalt rubber binder, submit verification from the local air district that an air quality permit is not required. 10-17-14

At least 10 days before RHMA-G production, submit the name of an authorized laboratory to perform QC testing for asphalt rubber binder. The authorized laboratory must comply with the Caltrans Independent Assurance Program.

##### **39-3.01C(2) Job Mix Formula**

With your proposed JMF include MSDS for:

1. Base asphalt binder
2. CRM and asphalt modifier
3. Blended asphalt rubber binder components

The JMF must be based on an HMA mix design determined as described in the Superpave Mix Design SP-2 Manual by the Asphalt Institute. 04-18-14

##### **39-3.01C(3) Asphalt Rubber Binder**

Submit a proposal for asphalt rubber binder design and profile. In the design, include the asphalt binder, asphalt modifier, and CRM and their proportions.

If you change asphalt rubber binder supplier or any component material used in asphalt rubber binder or its percentage, submit a new JMF.

For the asphalt rubber binder used, submit:

1. Log of production daily.
2. Certificate of compliance with test results for CRM and asphalt modifier with each truckload delivered to the HMA plant. The certificate of compliance for asphalt modifier must represent no more than 5,000 lb.
3. Certified weight slips for the CRM and asphalt modifier furnished.

4. QC test results on viscosity within 2 business days after sampling.
5. QC test results on cone penetration, resilience, and softening point within 3 business days after sampling.

Submit a certificate of compliance for the CRM and asphalt modifier. With the certificate of compliance, submit test results for CRM and asphalt modifier with each truckload delivered to the HMA plant.

04-18-14

### **39-3.01D Quality Control and Assurance**

#### **39-3.01D(1) General**

Reserved

#### **39-3.01D(2) Job Mix Formula Verification**

If you request, the Engineer verifies RHMA-G quality requirements within 7 days of receiving all verification samples and after the JMF document submittal has been accepted.

#### **39-3.01D(3) Quality Control**

##### **39-3.01D(3)(a) General**

Reserved

##### **39-3.01D(3)(b) Asphalt Rubber Binder**

###### **39-3.01D(3)(b)(i) General**

The asphalt rubber binder blending plant must be authorized under the Department's Material Plant Quality Program.

10-17-14

Take asphalt rubber binder samples from the feed line connecting the asphalt rubber binder tank to the HMA plant.

04-18-14

###### **39-3.01D(3)(b)(ii) Asphalt Modifier**

Test asphalt modifier under the test methods and frequencies shown in the following table:

**Asphalt Modifier for Asphalt Rubber Binder**

Quality characteristic	Test method	Frequency
Viscosity	ASTM D445	1 per shipment
Flash point	ASTM D92	
Molecular Analysis		
Asphaltenes	ASTM D2007	1 per shipment
Aromatics	ASTM D2007	

###### **39-3.01D(3)(b)(iii) Crumb Rubber Modifier**

Sample and test scrap tire CRM and high natural CRM separately. Test CRM under the test methods and frequencies shown in the following table:

**Crumb Rubber Modifier for Asphalt Rubber Binder**

Quality characteristic	Test method	Frequency
Scrap tire CRM gradation	California Test 385	1 per 10,000 lb
High natural CRM gradation	California Test 385	1 per 3,400 lb
Wire in CRM	California Test 385	1 per 10,000 lb
Fabric in CRM	California Test 385	
CRM particle length	--	
CRM specific gravity	California Test 208	
Natural rubber content in high natural CRM	ASTM D297	1 per 3,400 lb

Sample and test scrap tire CRM and high natural CRM separately.

**39-3.01D(3)(b)(iv) Asphalt Rubber Binder**

10-17-14

Test asphalt rubber binder under the test methods and frequencies shown in the following table:

Quality characteristic	Test method	Frequency
Cone penetration	ASTM D217	1 per lot
Resilience	ASTM D5329	
Softening point	ASTM D36	
Viscosity	ASTM D7741	15 minutes before use per lot

Retain the sample from each lot. Test for cone penetration, resilience, and softening point for the first 3 lots and, if all 3 lots pass, the testing frequency may be reduced to once for every 3 lots.

If QC test results indicate that the asphalt rubber binder does not meet the specifications, take corrective action and notify the Engineer.

04-18-14

**39-3.01D(3)(c) Aggregate**

Test the quality characteristics of aggregate under the test methods and frequencies shown in the following table:

**Aggregate Testing Frequencies**

Quality characteristic	Test method	Minimum testing frequency
Gradation	AASHTOT 27	1 per 750 tons and any remaining part
Sand equivalent <sup>a, b</sup>	AASHTOT 176	
Moisture content <sup>c</sup>	AASHTOT 329	
Crushed particles	AASHTOT 335	1 per 10,000 tons or 2 per project, whichever is greater
Los Angeles rattler	AASHTOT 96	
Flat and elongated particles	ASTM D4791	
Fine aggregate angularity	AASHTO T 304 Method A	

<sup>a</sup>Reported value must be the average of 3 tests from a single sample.

<sup>b</sup>Use of a sand reading indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, 4.8, 7.1.2, 8.4.2 and 8.4.3 do not apply.

<sup>c</sup>Test at continuous mixing plants only

For lime treated aggregate, test aggregate before treatment and test for gradation and moisture content during RHMA-G production.

**39-3.01D(3)(d) Hot Mix Asphalt Production**

Test the quality characteristics of RHMA-G under the test methods and frequencies shown in the following table:

**RHMA-G Mix Asphalt Testing Frequencies**

Quality characteristic	Test method	Minimum testing frequency
Asphalt binder content	AASHTOT 308 Method A	1 per 750 tons and any remaining part
HMA moisture content	AASHTOT 329	1 per 2,500 tons but not less than 1 per paving day
Air voids content	AASHTOT 269	1 per 4,000 tons or 2 every 5 paving days, whichever is greater
Voids in mineral aggregate	SP-2 Asphalt Mixture Volumetrics	1 per 10,000 tons or 2 per project whichever is greater
Dust proportion	SP-2 Asphalt Mixture Volumetrics	
Density of core	California Test 375	2 per paving day
Nuclear gauge density	California Test 375	3 per 250 tons or 3 per paving day, whichever is greater
Hamburg wheel track	AASHTO T 324 (Modified)	1 per 10,000 tons or 1 per project, whichever is greater
Moisture susceptibility	AASHTOT 283	

**39-3.01D(4) Reserved****39-3.01D(5) Department Acceptance****39-3.01D(5)(a) General**

The Department accepts RHMA-G based on compliance with:

1. Aggregate quality requirements shown in the following table:

### Aggregate Quality

Quality characteristic	Test method	Requirement
Aggregate gradation	AASHTO T 27	JMF ± Tolerance
Percent of crushed particles	AASHTOT 335	-- 90
Coarse aggregate (min, %)		
One-fractured face		
Two-fractured faces		
Fine aggregate (min, %)	AASHTOT 335	70
(Passing No. 4 sieve		
and retained on No. 8 sieve.)		
One fractured face		
Los Angeles Rattler (max, %)	AASHTOT 96	12 40
Loss at 100 Rev.		
Loss at 500 Rev.		
Sand equivalent (min) <sup>a, b</sup>	AASHTOT 176	47
Flat and elongated particles (max, % by weight at 5:1)	ASTM D4791	Report only
Fine aggregate angularity (min, %) <sup>c</sup>	AASHTO T 304 Method A	45

<sup>a</sup>Reported value must be the average of 3 tests from a single sample.

<sup>b</sup>Use of a sand reading Indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, 4.8, 7.1.2, 8.4.2 and 8.4.3 do not apply.

<sup>c</sup>The Engineer waives this specification if RHMA-G contains 10 percent or less of nonmanufactured sand by weight of total aggregate. Manufactured sand is fine aggregate produced by crushing rock or gravel.

2. In-place RHMA-G quality requirements shown in the following table:

**RHMA-G In-Place Acceptance**

Quality characteristic	Test method	Requirement
Asphalt binder content (%)	AASHTOT 308 Method A	JMF -0.4, +0.5
HMA moisture content (max, %)	AASHTOT 329	1
Air voids content @ N <sub>design</sub> (%) <sup>a, b</sup>	AASHTOT 269	4.0 ± 1.5
Voids in mineral aggregate on laboratory-produced HMA <sup>d</sup> (min, %) Gradation: 1/2-inch and 3/4-inch	SP-2 Asphalt Mixture Volumetrics <sup>c</sup>	18.0–23.0
Voids in mineral aggregate on plant-produced HMA (min, %) <sup>a</sup> Gradation: 1/2-inch and 3/4-inch	SP-2 Asphalt Mixture Volumetrics <sup>c</sup>	18.0–23.0
Dust proportion <sup>a</sup>	SP-2 Asphalt Mixture Volumetrics	Report only
Density of core (% of max theoretical density) <sup>e, f</sup>	California Test 375	91–97
Hamburg wheel track (min number of passes at 0.5-inch rut depth) Binder grade: PG 58 PG 64 PG 70	AASHTO T 324 (Modified)	15,000 20,000 25,000
Hamburg wheel track (min number of passes at inflection point) Binder grade: PG 58 PG 64 PG 70	AASHTO T 324 (Modified)	10,000 12,500 15,000
Moisture susceptibility (min, psi, dry strength)	AASHTOT 283	100
Moisture susceptibility (min, psi, wet strength)	AASHTOT 283	70

<sup>a</sup>Prepare 3 briquettes. Report the average of 3 tests.

<sup>b</sup>The Engineer determines the bulk specific gravity of each lab-compacted briquette under AASHTO T 275, Method A, and theoretical maximum specific gravity under AASHTO T 209, Method A.

<sup>c</sup>Determine bulk specific gravity under AASHTO T 275, Method A.

<sup>d</sup>The Engineer determines the laboratory-prepared RHMA-G value for mix design verification only.

<sup>e</sup>The Engineer determines percent of theoretical maximum density under California Test 375 except the Engineer uses:

1. AASHTO T 275, Method A, to determine in-place density of each density core instead of using the nuclear gauge
2. AASHTO T 209, Method A to determine theoretical maximum density instead of calculating test maximum density.

<sup>f</sup>The Engineer determines theoretical maximum density under AASHTO T 209, Method A, at the frequency specified in California Test 375, Part 5. D.

**39-3.01D(5)(b) Asphalt Rubber Binder**

**39-3.01D(5)(b)(i) General**

The Department does not use asphalt rubber binder design profile for production acceptance.

**39-3.01D(5)(b)(ii) Asphalt Modifier**

The Department accepts asphalt modifier based on compliance with the requirements shown in the following table:

**Asphalt Modifier for Asphalt Rubber Binder**

Quality characteristic	Test method	Requirement
Viscosity at 100 °C (m <sup>2</sup> /s x 10 <sup>-6</sup> )	ASTM D445	X ± 3 <sup>a</sup>
Flash point (min, °C)	ASTM D92	207
Molecular Analysis		
Asphaltenes (max, % by mass (max))	ASTM D2007	0.1
Aromatics (min % by mass)	ASTM D2007	55

<sup>a</sup>The symbol "X" is the asphalt modifier viscosity.

**39-3.01D(5)(b)(iii)Crumb Rubber Modifier**

The Department accepts scrap tire CRM and high natural CRM based on compliance with the requirements shown in the following table:

**Crumb Rubber Modifier for Asphalt Rubber Binder**

Quality characteristic	Test method	Requirement
Scrap tire CRM gradation (% passing No. 8 sieve)	California Test 385	100
High natural CRM gradation (% passing No. 10 sieve)	California Test 385	100
Wire in CRM (max, %)	California Test 385	0.01
Fabric in CRM (max, %)	California Test 385	0.05
CRM particle length (max, in)	--	3/16
CRM specific gravity	California Test 208	1.1–1.2

Scrap tire CRM and high natural CRM are sampled and tested separately.

**39-3.01D(5)(b)(iv)Asphalt Rubber Binder**

10-17-14

For Department acceptance testing, take samples in the Engineer's presence of asphalt rubber binder in 6 qt cans with open tops and friction lids. Take samples once per day or every 5 lots, whichever is greater.

The Department accepts asphalt rubber binder based on compliance with the requirements shown in the following table:

Quality characteristic	Test method	Requirement
Cone penetration at 25 °C (0.10 mm)	ASTM D217	25–70
Resilience at 25 °C (min, % rebound)	ASTM D5329	18
Softening point (°C)	ASTM D36	52–74
Viscosity at 190 °C (centipoises) <sup>a</sup>	ASTM D7741	1,500–4,000

<sup>a</sup>Prepare sample for viscosity test under California Test 388.

04-18-14

**39-3.01D(5)(c)–39-3.01D(5)(f) Reserved**

**39-3.02 MATERIALS**

**39-3.02A General**

Reserved

### 39-3.02B Mix Design

For RHMA-G, the mix design must comply with the requirements shown in the following table:

**RHMA-G Mix Design Requirements**

Quality characteristic	Test method	Requirement
Air voids content (%)	AASHTO T 269 <sup>a</sup>	$N_{\text{design}} = 4.0$
Gyratory compaction (no. of gyrations)	AASHTO T 312	$N_{\text{design}} = 50-150^b$
Voids in mineral aggregate (min, %)	SP-2 Asphalt Mixture Volumetrics <sup>c</sup>	18.0–23.0
Dust proportion	SP-2 Asphalt Mixture Volumetrics	Report only
Hamburg wheel track (min number of passes at 0.5-inch rut depth) Binder grade: PG 58 PG 64 PG 70	AASHTO T 324 (Modified) <sup>d</sup>	15,000 20,000 25,000
Hamburg wheel track (min number of passes at the inflection point) Binder grade: PG 58 PG 64 PG 70	AASHTO T 324 (Modified) <sup>d</sup>	10,000 10,000 12,500
Moisture susceptibility, dry strength (min, psi)	AASHTO T 283 <sup>d</sup>	100
Moisture susceptibility, wet strength (min, psi)	AASHTO T 283 <sup>d, e</sup>	70

<sup>a</sup>Calculate the air voids content of each specimen using AASHTO T 275, Method A, to determine bulk specific gravity and AASHTO T 209, Method A, to determine theoretical maximum specific gravity. Under AASHTO T 209 use a digital manometer and pycnometer when performing AASHTO T 209.

<sup>b</sup>Superpave gyratory compactor ram pressure may be increased to a maximum of 825kPa, and specimens may be held at a constant height for a maximum of 90 minutes.

<sup>c</sup>Measure bulk specific gravity using AASHTO T 275, Method A.

<sup>d</sup>Test plant produced RHMA.

<sup>e</sup>Freeze thaw required.

Determine the amount of asphalt rubber binder to be mixed with the aggregate for RHMA-G as follows:

1. Base the calculations on the average of 3 briquettes produced at each asphalt rubber binder content.
2. Plot asphalt rubber binder content versus average air voids content for each set of 3 specimens and connect adjacent points with a best-fit curve.
3. Calculate voids in mineral aggregate for each specimen, average each set, and plot the average versus asphalt rubber binder content.
4. Calculate the dust proportion and plot versus asphalt rubber binder content.
5. From the curve plotted, select the theoretical asphalt rubber binder content at 4 percent air voids.
6. At the selected asphalt rubber binder content, calculate dust proportion.
7. Record the asphalt rubber binder content in the Contractor Hot Mix Asphalt Design Data Form as the OBC.

The OBC must not fall below 7.5 percent by total weight of the mix.

Laboratory mixing and compaction must comply with AASHTO R 35, except the mixing temperature of the aggregate must be between 300 and 325 degrees F. The mixing temperature of the asphalt rubber binder must be between 375 and 425 degrees F. The compaction temperature of the combined mixture must be between 290 and 320 degrees F.

### 39-3.02C Asphalt Rubber Binder

#### 39-3.02C(1) General

Asphalt rubber binder must be a combination of:

1. Asphalt binder
2. Asphalt modifier
3. CRM

The combined asphalt binder and asphalt modifier must be  $80.0 \pm 2.0$  percent by weight of the asphalt rubber binder.

#### 39-3.02C(2) Asphalt Modifier

Asphalt modifier must be a resinous, high flash point, and aromatic hydrocarbon, and must comply with the requirements shown in the following table:

**Asphalt Modifier for Asphalt Rubber Binder**

Quality characteristic	Test method	Requirement
Viscosity at 100 °C ( $m^2/s \times 10^{-6}$ )	ASTM D445	$X \pm 3^a$
Flash point (min, °C)	ASTM D92	207
Molecular Analysis		
Asphaltenes(max, % by mass)	ASTM D2007	0.1
Aromatics (min, % by mass)	ASTM D2007	55

<sup>a</sup>The symbol "X" is the proposed asphalt modifier viscosity. "X" must be between 19 and 36. A change in "X" requires a new asphalt rubber binder design.

Asphalt modifier must be from 2.0 to 6.0 percent by weight of the asphalt binder in the asphalt rubber binder.

#### 39-3.02C(3) Crumb Rubber Modifier

CRM must be a ground or granulated combination of scrap tire CRM and high natural CRM. CRM must be  $75.0 \pm 2.0$  percent scrap tire CRM and  $25.0 \pm 2.0$  percent high natural CRM by total weight of CRM. Scrap tire CRM must be from any combination of automobile tires, truck tires, or tire buffings.

The CRM must comply with the requirements shown in the following table:

**Crumb Rubber Modifier for Asphalt Rubber Binder**

Quality characteristic	Test method	Requirement
Scrap tire CRM gradation (% passing No. 8 sieve)	California Test 385	100
High natural CRM gradation (% passing No. 10 sieve)	California Test 385	100
Wire in CRM (max, %)	California Test 385	0.01
Fabric in CRM (max, %)	California Test 385	0.05
CRM particle length (max, in) <sup>a</sup>	--	3/16
CRM specific gravity	California Test 208	1.1–1.2
Natural rubber content in high natural CRM (%)	ASTM D297	40.0–48.0

<sup>a</sup>Test at mix design and for certificate of compliance.

CRM must be ground or granulated at ambient temperature. If steel and fiber are cryogenically separated, separation must occur before grinding or granulating. Cryogenically produced CRM particles must be ground or granulated and not pass through the grinder or granulator.

CRM must be dry, free-flowing particles that do not stick together. CRM must not cause foaming when combined with the asphalt binder and asphalt modifier. You may add calcium carbonate or talc up to 3 percent by weight of CRM.

**39-3.02C(4) Design and Profile**

Design the asphalt rubber binder from testing you perform for each quality characteristic and for the reaction temperatures expected during production. The profile must include the same component sources for the asphalt rubber binder used. The 24-hour (1,440-minute) interaction period determines the design profile. At a minimum, mix asphalt rubber binder components, take samples, and perform and record the tests shown in the following table:

**Asphalt Rubber Binder Reaction Design Profile**

Quality characteristic	Test Method	Minutes of reaction <sup>a</sup>							Limits
		45	60	90	120	240	360	1440	
Cone penetration at 25 °C(0.10 mm)	ASTM D217	X <sup>b</sup>				X		X	25–70
Resilience at 25 °C (min,% rebound)	ASTM D5329	X				X		X	18
Field softening point(°C)	ASTM D36	X				X		X	52–74
Viscosity (centipoises)	ASTM D7741	X	X	X	X	X	X	X	1,500–4,000

<sup>a</sup>Six hours (360 minutes) after CRM addition, reduce the oven temperature to 275 °F for 16 hours. After the 16-hour (960 minutes) cooldown after CRM addition, reheat the binder to the reaction temperature expected during production for sampling and testing at 24 hours (1,440 minutes).

<sup>b</sup>"X" denotes required testing

**39-3.02C(5) Asphalt Rubber Binder Production**

**39-3.02C(5)(a) General**

Deliver scrap tire CRM and high natural CRM in separate bags.

**39-3.02C(5)(b) Mixing**

Proportion and mix asphalt binder, asphalt modifier, and CRM simultaneously or premix the asphalt binder and asphalt modifier before adding CRM. If you premix asphalt binder and asphalt modifier, mix them for at least 20 minutes. When you add CRM, the asphalt binder and asphalt modifier must be from 375 to 440 degrees F.

After interacting for at least 45 minutes, the quality characteristics of asphalt rubber binder must comply with the requirements shown in the following table:

Quality characteristic	Test method	Requirement
Cone penetration at 25 °C (0.10 mm)	ASTM D217	25–70
Resilience at 25 °C (min, % rebound)	ASTM D5329	18
Softening point(°C)	ASTM D36	52–74
Viscosity at 190 °C(centipoises) <sup>a</sup>	ASTM D7741	1,500–4,000

<sup>a</sup>Prepare sample for viscosity test under California Test 388.

10-17-14

Do not use asphalt rubber binder during the first 45 minutes of the reaction period. During this period, the asphalt rubber binder mixture must be between 375 degrees F and the lower of 425 or 25 degrees F below the asphalt binder's flash point indicated in the MSDS.

04-18-14

If any asphalt rubber binder is not used within 4 hours after the reaction period, discontinue heating. If the asphalt rubber binder drops below 375 degrees F, reheat before use. If you add more scrap tire CRM to the reheated asphalt rubber binder, the binder must undergo a 45-minute reaction period. The added scrap tire CRM must not exceed 10 percent of the total asphalt rubber binder weight. Reheated and

reacted asphalt rubber binder must comply with the viscosity specifications. Do not reheat asphalt rubber binder more than twice.

**39-3.02D Aggregates**

**39-3.02D(1) General**

For RHMA-G, before the addition of asphalt binder and lime treatment, the aggregate must comply with the requirements shown in the following table:

<b>Aggregate Quality</b>		
Quality characteristic	Test method	Requirement
Percent of crushed particles	AASHTOT 335	--
Coarse aggregate (min, %)		
One-fractured face		
Two-fractured faces		
Fine aggregate (min, %)	AASHTOT 96	90
(Passing No. 4 sieve		
and retained on No. 8 sieve.)		
One fractured face	70	
Los Angeles Rattler (max, %)	AASHTOT 176	47
Loss at 100 Rev.		
Loss at 500 Rev.		
Sand equivalent (min) <sup>a, b</sup>	47	
Flat and elongated particles (max, % by weight at 5:1)	ASTM D4791	Report only
Fine aggregate angularity (min, %) <sup>c</sup>	AASHTO T 304 Method A	45

<sup>a</sup>Reported value must be the average of 3 tests from a single sample.

<sup>b</sup>Use of a sand reading indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, 4.8, 7.1.2, 8.4.2 and 8.4.3 do not apply.

<sup>c</sup>The Engineer waives this specification if HMA contains 10 percent or less of nonmanufactured sand by weight of total aggregate, except if your JMF fails verification. Manufactured sand is fine aggregate produced by crushing rock or gravel.

**39-3.02D(2) Aggregate Gradations**

The aggregate gradations for RHMA-G must comply with the requirements shown in the following table:

10-17-14

<b>Aggregate Gradation Requirements</b>	
Type A HMA pavement thickness shown	Gradation
0.10 to less than 0.20 foot	1/2 inch
0.20 foot or greater	3/4 inch

04-18-14

For RHMA-G, the aggregate gradations must be within the target value limits for the specified sieve size shown in the following tables:

**Aggregate Gradation  
(Percentage Passing)  
Rubberized Hot Mix Asphalt - Gap Graded (RHMA-G)**

3/4-inch RHMA-G

Sieve Sizes	Target Value Limits	Allowable Tolerance
1"	100	--
3/4"	95-98	TV ±5
1/2"	83-87	TV ± 6
3/8"	65-70	TV ±5
No. 4	28-42	TV ±6
No. 8	14-22	TV ±5
No. 200	0-6	TV ±2

1/2-inch RHMA-G

Sieve Sizes	Target Value Limits	Allowable Tolerance
3/4"	100	--
1/2"	90-98	TV ± 6
3/8"	83-87	TV ±5
No. 4	28-42	TV ±6
No. 8	14-22	TV ±5
No. 200	0-6	TV ±2

**39-3.02E Rubberized Hot Mix Asphalt Production**

Asphalt rubber binder must be from 375 to 425 degrees F when mixed with aggregate.

If the dry and wetmoisture susceptibility test result for treated plant-produced RHMA-G is less than the RHMA-G mix design requirement for dry and wetmoisture susceptibility strength, the minimum dry and wet strength requirement is waived, but you must use one of the following treatments:

1. Aggregate lime treatment using the slurry method
2. Aggregate lime treatment using the dry lime method
3. Liquid antistrip treatment of HMA

**39-3.03 CONSTRUCTION**

Use a material transfer vehicle when placing RHMA-G.

Do not use a pneumatic tired roller to compact RHMA-G.

10-17-14

Spread and compact RHMA-G at an atmospheric temperature of at least 55 degrees F and a surface temperature of at least 60 degrees F.

If the atmospheric temperature is below 70 degrees F, cover loads in trucks with tarps. The tarps must completely cover the exposed load until you transfer the mixture to the paver's hopper or to the pavement surface. Tarps are not required if the time from discharge to truck until transfer to the paver's hopper or the pavement surface is less than 30 minutes.

For RHMA-G placed under method compaction:

1. Complete the 1st coverage of breakdown compaction before the surface temperature drops below 285 degrees F.
2. Complete breakdown and intermediate compaction before the surface temperature drops below 250 degrees F. Use a static steel-tired roller instead of the pneumatic-tired roller for intermediate compaction.
3. Complete finish compaction before the surface temperature drops below 200 degrees F.

Spread sand at a rate between 1 and 2 lb/sq yd on new RHMA-G pavement when finish rolling is complete. Sand must be free of clay or organic matter. Sand must comply with section 90-1.02C(3). Keep traffic off the pavement until spreading sand is complete.

### 39-3.04 PAYMENT

Not Used

## 39-4 OPEN GRADED FRICTION COURSES

### 39-4.01 GENERAL

#### 39-4.01A Summary

Section 39-4 includes specifications for producing and placing open graded friction courses. Open graded friction courses include HMA-O, RHMA-O, and RHMA-O-HB.

You may produce OGFC using a warm mix asphalt technology.

#### 39-4.01B Definitions

Reserved

#### 39-4.01C Submittals

Submit a complete JMF, except do not specify an asphalt binder content.

#### 39-4.01D Quality Control and Assurance

##### 39-4.01D(1) General

Reserved

##### 39-4.01D(2) Quality Control

##### 39-4.01D(2)(a) General

Reserved

##### 39-4.01D(2)(b) Asphalt Rubber Binder

For RHMA-O and RHMA-O-HB, the asphalt rubber binder must comply with the specifications in 39-3.01D(2)(b).

##### 39-4.01D(2)(c) Aggregate

Test the quality characteristics of aggregate under the test methods and frequencies shown in the following table:

**Aggregate Testing Frequencies**

Quality characteristic	Test method	Minimum testing frequency
Gradation	AASHTOT 27	1 per 750 tons and any remaining part
Moisture content <sup>a</sup>	AASHTOT 329	1 per 1500 tons and any remaining part
Crushed particles	AASHTOT 335	1 per 10,000 tons or 2 per project, whichever is greater
Los Angeles rattler	AASHTOT 96	
Flat and elongated particles	ASTM D4791	

<sup>a</sup>Test at continuous mixing plants only

For lime treated aggregate, test aggregate before treatment and test for gradation and moisture content during OGFC production.

##### 39-4.01D(2)(d) Hot Mix Asphalt Production

Test the quality characteristics of OGFC under the test methods and frequencies shown in the following table:

**OGFC Testing Frequencies**

Quality characteristic	Test method	Minimum testing frequency
Asphalt binder content	AASHTOT 308 Method A	1 per 750 tons and any remaining part
HMA moisture content	AASHTOT 329	1 per 2,500 tons but not less than 1 per paving day

**39-4.01D(3) Department Acceptance**

**39-4.01D(3)(a) General**

The Department accepts OGFC based on compliance with:

- Aggregate quality requirements shown in the following table:

**Aggregate Quality**

Quality characteristic	Test method	Requirement
Aggregate gradation	AASHTO T 27	JMF ± Tolerance
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	AASHTOT 335	90 90 90
Los Angeles Rattler (max, %) Loss at 100 Rev. Loss at 500 Rev.	AASHTOT 96	12 40
Flat and elongated particles (max, % by weight @ 5:1)	ASTM D4791	Report only

- In-place OGFC quality requirements shown in the following table:

**OGFC Acceptance In Place**

Quality characteristic	Test method	Requirement
Asphalt binder content (%)	AASHTOT 308 Method A	JMF -0.4, +0.5
HMA moisture content (max, %)	AASHTOT 329	1

**39-4.01D(3)(b) Asphalt Rubber Binder**

The Department accepts asphalt rubber binder in RHMA-O and RHMA-O-HB under 39-3.01D(5)(b).

**39-4.01D(3)(c) Pavement Smoothness**

Pavement smoothness of OGFC must comply with the Mean Roughness Index requirements shown in the following table for a 0.1 mile section:

**OGFC Pavement Smoothness Acceptance Criteria**

OGFC placement on	Mean Roughness Index 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

**39-4.01D(3)(d)–39-4.01D(3)(f) Reserved**

**39-4.02 MATERIALS**

**39-4.02A General**

When mixed with asphalt binder, aggregate must not be more than 325 degrees F except aggregate for OGFC with unmodified asphalt binder must be not more than 275 degrees F.

**39-4.02B Mix Design**

The Department determines the asphalt binder content under California Test 368 within 20 days of your complete JMF submittal and provides you a Caltrans Hot Mix Asphalt Verification form.

For OGFC, the 1st paragraph of section 39-1.02B(1) does not apply.

**39-4.02C Asphalt Binder**

Asphalt rubber binder in RHMA-O and RHMA-O-HB must comply with section 39-3.02B.

**39-4.02D Aggregate**

**39-4.02D(1) General**

Aggregate must comply with the requirements shown in the following table:

**Aggregate Quality**

Quality characteristic	Test method	Requirement
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	AASHTOT 335	-- 90   90
Los Angeles Rattler (max, %) Loss at 100 Rev. Loss at 500 Rev.	AASHTOT 96	12 40
Flat and elongated particles (max, % by weight at 5:1)	ASTM D4791	Report only

**39-4.02D(2) Aggregate Gradations**

10-17-14

The aggregate gradations for HMA-O must comply with the requirements shown in the following table:

**Aggregate Gradation Requirements**

HMA-O pavement thickness shown	Gradation
0.10 foot or greater to less than 0.15 foot	1/2 inch
0.15 foot or greater	1 inch

The aggregate gradations for RHMA-O and RHMA-O-HB must comply with the requirements shown in the following table:

**Aggregate Gradation Requirements**

RHMA-O and RHMA-O-HB pavement thickness shown	Gradation
0.10 foot or greater	1/2 inch

04-18-14

For RHMA-O and RHMA-O-HB, the 1-inch aggregate gradation is not allowed.

For OGFC, the aggregate gradations must be within the target value limits for the specified sieve size shown in the following tables:

**Aggregate Gradations  
(Percentage Passing)  
Open Graded Friction Course (OGFC)**

1-inch OGFC

Sieve size	Target value limit	Allowable tolerance
1 1/2"	100	--
1"	99–100	TV ±5
3/4"	85–96	TV ±5
1/2"	55–71	TV ±6
No. 4	10–25	TV ±7
No. 8	6–16	TV ±5
No. 200	0–6	TV ±2

1/2-inch OGFC

Sieve size	Target value limit	Allowable tolerance
3/4"	100	--
1/2"	95–100	TV ±6
3/8"	78–89	TV ±6
No. 4	28–37	TV ±7
No. 8	7–18	TV ±5
No. 30	0–10	TV ±4
No. 200	0–3	TV ±2

If lime treatment is required, you may reduce the lime ratio for the combined aggregate from 1.0 to 0.5 percent for OGFC.

**39-4.03 CONSTRUCTION**

Use a material transfer vehicle when placing OGFC.

If the atmospheric temperature is below 70 degrees F, cover loads in trucks with tarps. The tarps must completely cover the exposed load until you transfer the mixture to the paver's hopper or to the pavement surface. Tarps are not required if the time from discharge to truck until transfer to the paver's hopper or the pavement surface is less than 30 minutes.

Apply a tack coat before placing OGFC. The tack coat application rate must comply with the requirements of the following table:

### Tack Coat Application Rates for OGFC

OGFC over:	Minimum Residual Rates (gal/sq yd)		
	CSS1/CSS1h, SS1/SS1h and QS1h/CQS1h Asphaltic Emulsion	CRS1/CRS2, RS1/RS2 and QS1/CQS1 Asphaltic Emulsion	Asphalt Binder and PMRS2/PMCRS2 and PMRS2h/PMCRS2h Asphaltic Emulsion
New HMA	0.03	0.04	0.03
PCC and existing AC surfacing	0.05	0.06	0.04
Planned pavement	0.06	0.07	0.05

Compact OGFC with steel-tired, 2-axle tandem rollers. If placing over 300 tons of OGFC per hour, use at least 3 rollers for each paver. If placing less than 300 tons of OGFC per hour, use at least 2 rollers for each paver. Each roller must weigh between 126 to 172 lb per linear inch of drum width. Turn the vibrator off.

Compact OGFC with 2 coverages. The Engineer may order fewer coverages if the layer thickness of OGFC is less than 0.20 foot.

For HMA-O with unmodified asphalt binder:

1. Spread and compact only if the atmospheric temperature is at least 55 degrees F and the surface temperature is at least 60 degrees F.
2. Complete the 1st coverage using 2 rollers before the surface temperature drops below 240 degrees F.
3. Complete all compaction before the surface temperature drops below 200 degrees F.

For HMA-O with modified asphalt binder except asphalt rubber binder:

1. Spread and compact only if the atmospheric temperature is at least 50 degrees F and the surface temperature is at least 50 degrees F.
2. Complete the 1st coverage using 2 rollers before the surface temperature drops below 240 degrees F.
3. Complete all compaction before the surface temperature drops below 180 degrees F.

For RHMA-O and RHMA-O-HB:

1. Spread and compact only if the atmospheric temperature is at least 55 degrees F and surface temperature is at least 60 degrees F.
2. Complete the 1st coverage using 2 rollers before the surface temperature drops below 280 degrees F.
3. Complete compaction before the surface temperature drops below 250 degrees F.

Spread sand at a rate between 1 and 2 lb/sq yd on new 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(3). Keep traffic off the pavement until spreading sand is complete.

If you choose to correct OGFC for smoothness, the Engineer determines if the corrective method causes raveling. OGFC that is raveling must be removed and replaced.

#### **39-4.04 PAYMENT**

Not Used

### **39-5 BONDED WEARING COURSES**

#### **39-5.01 GENERAL**

##### **39-5.01A General**

##### **39-5.01A(1) Summary**

Section 39-5 includes specifications for producing and placing bonded wearing courses.

BWC includes placing a polymer modified asphaltic emulsion and the specified HMA in a single pass with an integrated paving machine.

BWC using RHMA-G, RHMA-O, or HMA-O must comply with the specifications for RHMA-G, RHMA-O, or HMA-O.

**39-5.01A(2) Definitions**

Reserved

**39-5.01A(3) Submittals**

With your JMF submittal, include:

1. Asphaltic emulsion membrane target residual rate
2. Weight ratio of water to bituminous material in the original asphaltic emulsion

Within 3 business days following the 1st job site delivery, submit test results for asphaltic emulsion properties performed on a sample taken from the asphaltic emulsion delivered.

Within 1 business day of each job site delivery of asphaltic emulsion, submit to METS a 2-quart sample and a certificate of compliance. Ship each sample so that it is received at METS within 48 hours of sampling.

Each day BWC is placed, submit the residual and application rate for the asphaltic emulsion membrane.

During production, submit certified volume or weight slips for the materials supplied.

**39-5.01A(4) Quality Control and Assurance**

**39-5.01A(4)(a) General**

For each job site delivery of asphaltic emulsion, take a 2-quart sample in the presence of the Engineer. Take samples from the delivery truck at mid-load from a sampling tap or thief. If the sample is taken from the tap, draw and discard 4 quarts before sampling.

If you unload asphalt binder or asphaltic emulsion into a bulk storage tank, do not use material from the tank until you submit test results for a sample taken from the bulk storage tank. Testing must be performed by an AASHTO-accredited laboratory.

**39-5.01A(4)(b) Quality Control**

Sample BWC in two 1-gallon metal containers.

The asphaltic emulsion membrane must be tested under ASTM D2995 at least once per paving day at the job site.

**39-5.01A(4)(c) Department Acceptance**

The Department accepts asphaltic emulsion membrane based on compliance with the requirements shown in the following table:

10-17-14

**Asphaltic Emulsion Membrane**

Quality characteristic	Test method	Requirement
Saybolt Furol Viscosity at 25 °C (SFS) <sup>a</sup>	AASHTO T59	20–100
Sieve test on original emulsion at time of delivery (max, %)	AASHTO T59	0.05
24-hour storage stability(max, %)	AASHTO T59	1
Residue by evaporation(min, %)	California Test 331	63
Tests on residue from evaporation test:		
Torsional recovery, measure entire arc of recovery at 25 °C(min, %)	California Test 332	40
Penetration at 25 °C(0.01 mm)	AASHTO T49	70–150

<sup>a</sup>SFS means Saybolt Furol seconds

The Department accepts the BWC based on the submitted asphaltic emulsion membranetarget residual rate±0.02 gal/sqyd when tested under ASTM D2995.

### 39-5.01B Materials

#### 39-5.01B(1) General

Reserved

#### 39-5.01B(2) Asphaltic Emulsion Membrane

The asphaltic emulsion membrane must comply with the requirements shown in the following table:

10-17-14

**Asphaltic Emulsion Membrane**

Quality characteristic	Test method	Requirement
Saybolt Furol Viscosity at 25 °C(SFS) <sup>a</sup>	AASHTO T59	20–100
Sieve test on original emulsion at time of delivery (max, %)	AASHTO T59	0.05
24-hour storage stability(max, %)	AASHTO T59	1
Residue by evaporation(min, %)	California Test 331	63
Tests on residue from evaporation test:		
Torsional recovery, measure entire arc of recovery at 25 °C(min, %)	California Test 332	40
Penetration at 25 °C (0.01 mm)	AASHTO T49	70–150

<sup>a</sup> SFS means Saybolt Furol seconds

04-18-14

#### 39-5.01B(3) Reserved

#### 39-5.01C Construction

##### 39-5.01C(1) General

Use method compaction for BWC.

Do not dilute the asphaltic emulsion.

Do not place BWC if rain is forecast for the project area within 24 hours by the National Weather Service.

##### 39-5.01C(2) Spreading and Compacting Equipment

Use amaterial transfer vehicle when placing BWC.

Use an integrated distributor paver capable of spraying the asphaltic emulsion membrane, spreading the HMA, and leveling the mat surface in 1 pass.

Apply asphaltic emulsion membrane at a uniform rate for the full paving width. The asphaltic emulsion membrane must not be touched by any part of the paver including wheels or tracks.

If the spray bar is adjusted for changing pavement widths, the paver must prevent excess spraying of asphaltic emulsion beyond 2 inches of the HMA edge.

##### 39-5.01C(3) Applying Asphaltic Emulsion

10-17-14

Before spreading HMA, apply asphaltic emulsion membrane on dry or damp pavement with no free water.

04-18-14

Apply emulsion at a temperature from 120 to 180 degrees F and in a single application at the residual rate specified for the condition of the underlying surface. Asphaltic emulsion membrane must have a target residual rate for the surfaces to receive the emulsion as shown in the following table:

### Asphaltic Emulsion Membrane Target Residual Rate

Surface to receive asphaltic emulsion membrane	Target residual rates (gal/sqyd)
PCC pavement	0.09–0.11
Dense, compacted, new HMA pavement	0.11–0.14
Open textured, dry, aged or oxidized existing AC pavement	0.13–0.17

If requested and authorized, you may change the asphaltic emulsion membrane application rates.

#### 39-5.01C(4) Placing and Compacting Hot Mix Asphalt

Construct a transverse joint if the HMA remains in the paver for more than 30 minutes.

Do not reintroduce HMA spread over asphaltic emulsion membrane into the paving process.

Do not overlap or hot lap HMA. Pave through lanes after paving adjacent:

1. Shoulders
2. Tapers
3. Transitions
4. Road connections
5. Driveways
6. Curve widenings
7. Chain control lanes
8. Turnouts
9. Turn pockets
10. Ramps

For BWC placed on areas adjacent to through lanes that extend into the through lanes, cut the BWC to a neat, straight vertical line at the lane line.

If you spill asphaltic emulsion into the paver hopper, stop paving and remove the contaminated material.

#### 39-5.01D Payment

Not Used

### 39-5.02 BONDED WEARING COURSES-GAP GRADED

#### 39-5.02A General

##### 39-5.02A(1) Summary

Section 39-5.02 includes specifications for producing bonded wearing course-gap graded.

##### 39-5.02A(2) Definitions

Reserved

##### 39-5.02A(3) Submittals

Include film thickness and calculations and AASHTO T 305 results with your JMF submittal.

##### 39-5.02A(4) Quality Control and Assurance

###### 39-5.02A(4)(a) General

Reserved

###### 39-5.02A(4)(b) Quality Control

###### 39-5.02A(4)(b)(i) General

Reserved

###### 39-5.02A(4)(b)(ii) Aggregate

Test the quality characteristics of aggregate under the test methods and frequencies shown in the following table:

### Aggregate Testing Frequencies

Quality characteristic	Test method	Minimum testing frequency
Gradation	AASHTOT 27	1 per 750 tons and any remaining part
Sand equivalent <sup>a, b</sup>	AASHTOT 176	
Moisture content <sup>c</sup>	AASHTOT 329	1 per 1500 tons and any remaining part
Crushed particles	AASHTOT 335	1 per 10,000 tons or 2 per project, whichever is greater
Los Angeles rattler	AASHTOT 96	
Flat and elongated particles	ASTM D4791	
Fine aggregate angularity	AASHTO T 304 Method A	

<sup>a</sup>Reported value must be the average of 3 tests from a single sample.

<sup>b</sup>Use of a sand reading indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, 4.8, 7.1.2, 8.4.2, and 8.4.3 do not apply.

<sup>c</sup>Test at continuous mixing plants only.

For lime treated aggregate, test aggregate before treatment and test for gradation and moisture content during BWC-G production.

#### **39-5.02A(4)(b)(iii) Hot Mix Asphalt Production**

Sample BWC in two 1-gallon metal containers.

Test the quality characteristics of BWC-G under the test methods and frequencies shown in the following table:

#### BWC-G Testing Frequencies

Quality characteristic	Test method	Minimum testing frequency
Asphalt binder content	AASHTOT 308 Method A	1 per 750 tons and any remaining part
HMA moisture content	AASHTOT 329	1 per 2,500 tons but not less than 1 per paving day

#### **39-5.02A(4)(b)(iv)–39-5.02A(4)(b)(vii) Reserved**

#### **39-5.02A(4)(c) Department Acceptance**

The Department accepts BWC-G based on compliance with:

1. Asphalt binder content at JMF -0.4, +0.5 percent when tested under AASHTO T 308, Method A.
2. Aggregate quality requirements shown in the following table:

### Aggregate Quality

Quality characteristic	Test method	Requirement
Aggregate gradation	AASHTO T 27	JMF ± Tolerance
Percent of crushed particles	AASHTOT 335	-- 90
Coarse aggregate (min, %)		
One-fractured face		
Two-fractured faces		
Fine aggregate (min, %)	AASHTOT 96	12 35
(Passing No. 4 sieve and retained on No. 8 sieve.)		
One fractured face		
Los Angeles Rattler (max, %)	AASHTO T 176	47
Loss at 100 Rev.	ASTM D4791	25
Loss at 500 Rev.		
Sand equivalent (min)	AASHTO T 304 Method A	45
Flat and elongated particles (max, % by weight at 5:1)		
Fine aggregate angularity (min, %)		

<sup>a</sup>Reported value must be the average of 3 tests from a single sample.

<sup>b</sup>Use of a sand reading indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, 4.8, 7.1.2, 8.4.2 and 8.4.3 do not apply.

#### 39-5.02B Materials

##### 39-5.02B(1) General

Reserved

##### 39-5.02B(2) Mix Design

For BWC-G, the 1st paragraph of section 39-1.02B(1) does not apply.

Determine the proposed OBC from a mix design that complies with the requirements shown in the following table:

#### Hot Mix Asphalt Mix Design Requirements

Quality characteristic	Test method	Requirement
Film thickness (min, μm)	Asphalt Institute MS-2 Table 6.1 <sup>a</sup>	12
Drain down (max, %)	AASHTO T 305 <sup>b</sup>	0.1

<sup>a</sup>Film thickness is calculated based on the effective asphalt content and determined as follows:

$$FT = \left( \frac{P_{be}}{SA \times G_b \times 1000} \right) 10^6$$

Where:

- FT = Film thickness in  $\mu\text{m}$
- $P_{be}$  = Effective asphalt content by total weight of mix using SP-2 Asphalt Mixture
- SA = Estimated surface area of the aggregate blend in  $\text{m}^2/\text{kg}$  from Table 6.1 in the Asphalt Institute Manual Series No. 2 (MS-2).
- $G_b$  = Specific gravity of asphalt binder

<sup>b</sup> Combine aggregate and asphalt at the asphalt binder supplier's instructed mixing temperature. Coated aggregates that fall through the wire basket during loading must be returned to the basket before conditioning at 350 °F for 1 hour.

The OBC must be greater than 4.9 percent by total weight of mix.

**39-5.02B(3) Asphalt Binder**

Reserved

**39-5.02B(4) Aggregate**

The aggregate must comply with the requirements shown in the following table:

<b>Aggregate Quality</b>		
Quality characteristic	Test method	Requirement
Percent of crushed particles	AASHTOT 335	90
Coarse aggregate (min, %)		
One-fractured face		
Two-fractured faces		
Fine aggregate (min, %)	AASHTO 96	85
(Passing No. 4 sieve and retained on No. 8 sieve.)		
One fractured face		
Los Angeles Rattler (max, %)	AASHTO T 176	47
Loss at 100 Rev.		
Loss at 500 Rev.	ASTM D4791	25
Sand equivalent (min)		
Flat and elongated particles (max, % by weight @ 5:1)	AASHTO T 304 Method A	45
Fine aggregate angularity (min, %)		

<sup>a</sup>Reported value must be the average of 3 tests from a single sample.

<sup>b</sup>Use of a sand reading indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, 4.8, 7.1.2, 8.4.2 and 8.4.3 do not apply.

The aggregate gradations for BWC-G must comply with the requirements shown in the following table:

10-17-14

**Aggregate Gradation Requirements**

BWC-G pavement thickness shown	Gradation
less than 0.08 foot	No. 4 or 3/8 inch
0.08 foot or greater	1/2 inch

04-18-14

The proposed aggregate gradation must be within the TV limits for the specified sieve sizes shown in the following tables:

**Aggregate Gradation  
(Percentage Passing)  
Bonded Wearing Course—Gap Graded**

1/2-inch BWC-G

Sieve sizes	Target value limits	Allowable tolerance
3/4"	100	--
1/2"	80–100	TV ± 6
3/8"	55–80	TV ± 6
No. 4	25–40	TV ± 7
No. 8	19–32	TV ± 5
No. 16	16–22	TV ± 5
No. 30	10–18	TV ± 4
No. 50	8–13	TV ± 4
No. 100	6–10	TV ± 2
No. 200	4.0–7.0	TV ± 2

3/8-inch BWC-G

Sieve sizes	Target value limits	Allowable tolerance
1/2"	100	--
3/8"	80–100	TV ± 6
No. 4	25–40	TV ± 7
No. 8	19–32	TV ± 5
No. 16	16–22	TV ± 5
No. 30	10–18	TV ± 4
No. 50	8–13	TV ± 4
No. 100	7–11	TV ± 2
No. 200	6.0–10.0	TV ± 2

No. 4 BWC-G

Sieve sizes	Target value limits	Allowable tolerance
1/2"	100	--
3/8"	95–100	TV ± 2
No. 4	42–55	TV ± 7
No. 8	19–32	TV ± 5
No. 16	16–22	TV ± 5
No. 30	10–18	TV ± 4
No. 50	8–13	TV ± 4
No. 100	7–11	TV ± 2
No. 200	6.0–10.0	TV ± 2

**39-5.02C Construction**

10-17-14

Apply asphaltic emulsion when the atmospheric and pavement temperatures are above:

1. 50 degrees F if PG 76-22 M is specified
2. 45 degrees F if PG 64-28 M is specified

04-18-14

**39-5.02D Payment**

Not Used

**39-6 HOT MIX ASPHALT ON BRIDGE DECKS**

**39-6.01 GENERAL**

Section 39-6 includes specifications for producing and placing hot mix asphalt on bridge decks.

HMA used for bridge decks must comply with the specifications for Type A HMA in section 39-2.

### **39-6.02 MATERIALS**

Do not use the 1-inch or 3/4-inch aggregate gradation for HMA on bridge decks.

The grade of asphalt binder for HMA must be PG 64-10 or PG 64-16.

### **39-6.03 CONSTRUCTION**

Spread and compact HMA on bridge decks using method compaction.

If a concrete expansion dam is to be placed at a bridge deck expansion joint, tape oil-resistant construction paper to the deck over the area to be covered by the dam before placing the tack coat and HMA across the joint.

Apply tack coat at the minimum residual rate specified in section 39-1.03C(5). For HMA placed on a deck seal, use the minimum residual rate specified for PCC.

For HMA placed on a deck seal:

1. Place the HMA within 7 days after installing the deck seal.
2. If a paper mask is placed on the deck under section 54-5.03, place the HMA continuously across the paper mask.
3. Place HMA in at least 2 approximately equal layers.
4. For placement of the 1st HMA layer:
  - 4.1. Comply with the HMA application temperature recommended by the deck seal manufacturer.
  - 4.2. Deliver and place HMA using equipment with pneumatic tires or rubber-faced wheels. Do not operate other vehicles or equipment on the bare deck seal.
  - 4.3. Deposit HMA on the deck seal in such a way that the deck seal is not damaged. Do not use a windrow.
  - 4.4. Place HMA in a downhill direction on bridge decks with grades over 2 percent.
  - 4.5. Self-propelled spreading equipment is not required.

### **39-6.04 PAYMENT**

Not Used

## **39-7 MINOR HOT MIX ASPHALT**

### **39-7.01 GENERAL**

#### **39-7.01A Summary**

Section 39-7 includes specifications for producing and placing minor hot mix asphalt.

Minor HMA must comply with section 39-2 except as specified in this section 39-7.

#### **39-7.01B Definitions**

Reserved

#### **39-7.01C Submittals**

The QC plan, test results, and inertial profiler specifications in sections 39-1.01C(3), 39-1.01C(4), 39-1.01C(13)(c)–(d) do not apply.

#### **39-7.01D Quality Control and Assurance**

##### **39-7.01D(1) General**

For minor HMA, the JMF renewal, inertial profiler certifications and testing, and prepping meeting specifications in sections 39-1.01D(4), 39-1.01D(6)(c), and 39-1.01D(7) do not apply.

Test pavement smoothness with a 12 foot straightedge.

##### **39-7.01D(2) Quality Control**

For minor HMA, section 39-2.01D(2) applies except testing for compliance with the following quality characteristics is not required:

1. Flat and elongated particles

- 2. Fine aggregate angularity
- 3. Hamburg wheel track
- 4. Moisture susceptibility

**39-7.01D(3) Department Acceptance**

The Department accepts minor HMA under section 39-2.01D(5) except compliance with the following quality characteristics is not required:

- 1. Flat and elongated particles
- 2. Fine aggregate angularity
- 3. Hamburg wheel track
- 4. Moisture susceptibility

**39-7.02 MATERIALS**

**39-7.02A General**

Reserved

**39-7.02B Mix Design**

The mix design for minor HMA must comply with section 39-2.02B except the Hamburg wheel track and moisture susceptibility requirements do not apply.

**39-7.02C Asphalt Binder**

The grade of asphalt binder for minor HMA must be PG-64-10 or PG-64-16.

**39-7.02D Liquid Antistrip Treatment**

Treat minor HMA with liquid antistrip. Liquid antistrip treatment is not required if you submit AASHTO T 283 and AASHTO T 324 (Modified) test results showing compliance with section 39-2.02B. The tests must be dated within 12 months of submittal.

10-17-14

04-18-14

**39-7.03 CONSTRUCTION**

Not Used

**39-7.04 PAYMENT**

Not Used

**39-8–39-10 RESERVED**

AA

**40 CONCRETE PAVEMENT**

07-19-13

**Replace the headings and paragraphs in section 40 with:**

07-19-13

**40-1 GENERAL**

**40-1.01 GENERAL**

**40-1.01A Summary**

Section 40-1 includes general specifications for constructing concrete pavement.

**40-1.01B Definitions**

**concrete raveling:** Progressive disintegration of the pavement surface resulting from dislodged aggregate.

**full depth crack:** Crack that runs from one edge of the slab to the opposite or adjacent side of the slab, except a crack parallel to and within 0.5 foot of either side of a planned contraction joint

**working crack:** Crack that extends through the full depth of the slab and is parallel to and within 0.5 foot of either side of a planned contraction joint.

**action limit:** Value at which corrective actions must be made while production may continue.

**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:

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 <sup>a</sup>	California Test 223 or California Test 226	1 per day

<sup>a</sup> 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  $\pm 1.0$  percent of the specified value. If no value is specified, the action limit is  $\pm 1.0$  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	Test Method		Frequency <sup>a</sup>
	CRCP	JPCP	
Modulus of rupture (28 day)	California Test 523		1,000 cu yd
Air content <sup>b</sup>	California Test 504		1 day's paving
Dowel bar placement	--	Measurement <sup>a</sup>	700 sq yd
Tie bar placement	--	Measurement <sup>a</sup>	4,000 sq yd
Thickness	California Test 531		1,200 sq yd
Coefficient of friction	California Test 342		1 day's paving

<sup>a</sup>A single test represents no more than the frequency specified.

<sup>b</sup>Tested 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:

where:

- $n_c$  = Number of your quality control tests (minimum of 6 required)
- $n_v$  = Number of Department's tests (minimum of 2 required)
- $\bar{X}_c$  = Mean of your quality control tests
- $\bar{X}_v$  = 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  $\pm 1.5$  percent of the specified value. If no value is specified, the air content must be within  $\pm 1.5$  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:

<b>Tie Bar Tolerance</b>	
Dimension	Tolerance
Horizontal and vertical skew	5 1/4 inch, max
Longitudinal translation	$\pm 2$ inch
Horizontal offset (embedment)	$\pm 2$ inch
Vertical depth	<ol style="list-style-type: none"> <li>1. At least 1/2 inch below the bottom of the saw cut</li> <li>2. When measured at any point along the bar, not less than 2 inches clear of the pavement's surface and bottom</li> </ol>

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:

**Aggregate Filler Grading**

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  $\pm 5$  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  $20 \pm 5$  feet from the transverse construction joint formed at each day's start of paving and  $1 \pm 0.25$  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:

<b>Deduction for Thickness Deficiency</b>	
Average thickness deficiency (foot) <sup>a</sup>	Deduction(\$/sq yd)
0.01	0.90
0.02	2.30
0.03	4.10
0.04	6.40
0.05	9.11

<sup>a</sup>Values 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:

<b>Fast-Setting Concrete</b>		
Property	Test method	Value
Compressive strength <sup>a</sup> (psi, min)		
at 3 hours	California Test 551	3,000
at 24 hours	California Test 551	5,000
Flexural strength <sup>a</sup> (psi, min, at 24 hours)	California Test 551	500
Bond strength <sup>a</sup> (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 <sup>a</sup> (g, max, at 24 hours)	California Test 550	25
Drying shrinkage (% max, at 4 days)	ASTM C596	0.13
Water soluble chlorides <sup>b</sup> (% max, by weight)	California Test 422	0.05
Water soluble sulfates <sup>b</sup> (% max, by weight)	California Test 417	0.25
Thermal stability (% min)	California Test 553	90

<sup>a</sup>Perform test with aggregate filler if used.

<sup>b</sup>Test 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:

<b>Aggregate Filler Grading</b>	
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 <sup>a</sup> (Pa·s) RVT, No. 1 spindle, 20 RPM at 77 °F	ASTM D2196	0.075– 0.200
Specific gravity <sup>a</sup> (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 D618	2,500
Styrene content <sup>a</sup> (%), 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 <sup>a</sup> (g/sq m, max)	South Coast Air Quality Management District, Method 309-91 <sup>b</sup>	60

<sup>a</sup>Perform the test before adding initiator.

<sup>b</sup>For 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.

04-18-14

HMA must comply with the specifications for minor HMA in section 39.

07-19-13

#### **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 <sup>a</sup> (cP, max, Brookfield RVT with UL adapter, 50 RPM at 77 °F)	ASTM D2196	25
Specific gravity <sup>a</sup> (min, at 77 °F)	ASTM D1475	0.90
Flash point <sup>a</sup> (°F, min)	ASTM D3278	180
Vapor pressure <sup>a</sup> (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 <sup>a</sup> (% , max)	ASTM D2369	30
PCC saturated surface-dry bond strength (psi, min, at 24 hours and 77 ± 2 °F)	California Test 551	500

<sup>a</sup>Perform 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 type pneumatic-tired roller at least 4 feet wide. Pneumatic tires must be of equal size, diameter, type, and ply. The tires must be inflated to 60 psi minimum and maintained so that the air pressure does not vary more than 5 psi. The roller's gross static weight must be at least 15 tons. 04-18-14
2. Vibratory pad-foot roller exerting a dynamic centrifugal force of at least 10 tons 07-19-13

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 minor HMA under section 39. Use the no. 4 gradation. 04-18-14
2. Remove all loose debris and sweep the pavement. 07-19-13

#### **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.

04-18-14

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 minor HMA that complies with section 39. Remove the temporary HMA taper before constructing the transition taper.

07-19-13

#### **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 <sup>a</sup>
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 <sup>b</sup>	California Test 223 or California Test 226	1 per shift
Modulus of rupture	California Test 524	Comply with section 41-9.01D(6)(a)

<sup>a</sup>Test at the most frequent interval.

<sup>b</sup>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 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  $\pm 1.0$  percent and the suspension limit is  $\pm 1.5$  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.



## **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

**Delete the 3rd paragraph of section 46-2.01A.**

07-19-13

**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:**

07-18-14

Steel wire must comply with the specifications for plain wire reinforcement in ASTM A1064/A1064M. Welded wire reinforcement must comply with the specifications for plain wire welded wire reinforcement in ASTM A1064/A1064M.

Hooks and bends must comply with the *Building Code Requirements for Structural Concrete* published by ACI.

**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).



**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 between the 3rd and 4th paragraphs of section 49-3.02C(2):**

07-18-14

If drilling slurry is used during excavation, maintain the slurry level at least 10 feet above the piezometric head.

**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



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 C1107
- 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.**

**Replace section 50-1.02F with:**

**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:**

**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:**

After installation, cover the duct ends and vents to prevent water or debris from entering.

**Add to section 50-1.03A(3):**

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).**

**Add to section 50-1.03B(1):**

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).**

**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.

Vacuum grouting equipment must consist of:

- 1. Volumeter for the measurement of void volume
- 2. Vacuum pump with capacity of at least 10 cfm and equipped with a flow meter capable of measuring the amount of grout being injected

**50-1.03B(2)(d)(x) Vertical Tendon Grouting**

Provide a standpipe at the upper end of the tendon to collect bleed water and allow it to be removed from the grout. The standpipe must be large enough to prevent the grout elevation from dropping below the highest point of the upper anchorage device. If the grout level drops to the highest point of the upper anchorage device, immediately add grout to the standpipe.

Remove the standpipe after the grout has hardened.

For vertical tendons in excess of 100 feet high or if grouting pressure exceeds 145 psi, inject grout at a higher vent from which grout has already flowed to maintain one-way flow.

**50-1.03B(2)(d)(xi) Vents**

Place vents at the following locations:

- 1. Anchorage areas at both ends of the tendon
- 2. Each high point
- 3. 4 feet upstream and downstream of each crest of a high point
- 4. Each change in the cross section of duct

**Add to section 50-1.03B(2):**

09-16-11

**50-1.03B(2)(e) Debonding Prestressing Strands**

Where shown, debond prestressing strands by encasing the strands in plastic sheathing along the entire length shown and sealing the ends of the sheathing with waterproof tape.

Distribute the debonded strands symmetrically about the vertical centerline of the girder. The debonded lengths of pairs of strands must be equal.

Do not terminate debonding at any one cross section of the member for more than 40 percent of the debonded strands or 4 strands, whichever is greater.

Thoroughly seal the ends with waterproof tape to prevent the intrusion of water or cement paste before placing the concrete.

AA

## 51 CONCRETE STRUCTURES

07-18-14

**Replace the paragraphs of section 51-1.01A with:**

10-19-12

Section 51-1 includes general specifications for constructing concrete structures.

Earthwork for the following concrete structures must comply with section 19-3:

1. Sound wall footings
2. Sound wall pile caps
3. Culverts
4. Barrier slabs
5. Junction structures
6. Minor structures
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:**

07-19-13

copies

**Replace the heading of section 51-1.01D(4) with:**

04-19-13

**Testing Concrete Surfaces**

**Add to section 51-1.01D(4)(a):**

04-19-13

The Engineer tests POC deck surfaces for smoothness and crack intensity.

**Add to the list in the 1st paragraph of section 51-1.01D(4)(b):**

04-19-13

3. Completed deck surfaces, including ramps and landings of POCs

**Replace the 4th paragraph in section 51-1.01D(4)(b) with:**

04-19-13

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.

**Add between the 5th and 6th paragraphs of section 51-1.01D(4)(b):**

04-19-13

POC deck surfaces must comply with the following smoothness requirements:

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:**

07-18-14

**51-1.03F(5)(b)(i) General**

Except for bridge widenings, texture roadway surfaces of bridge decks, approach slabs, and sleeper slabs, and other roadway surfaces of concrete structures longitudinally by grinding and grooving or by longitudinal tining.

For bridge widenings, texture the roadway surfaces 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:**

04-19-13

copies

**Replace "set" in the 7th paragraph of section 51-2.02D(1)(c)(ii) with:**

04-19-13

copy

**Add to the 1st paragraph of section 51-2.02D(3):**

04-19-13

POC deck surfaces must comply with section 51-1.03F(6) before placing and anchoring joint seal assemblies.

**Replace "sets" in the 2nd paragraph of section 51-2.02E(1)(c) with:**

04-19-13

copies

**Replace "set" in the 6th paragraph of section 51-2.02E(1)(c) with:**

04-19-13

copy

**Replace the 2nd paragraph of section 51-2.02E(1)(e) with:**

08-05-11

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.

**Replace "sets" in the 1st and 2nd paragraphs of section 51-2.02F(1)(c) with:**

04-19-13

copies

**Add between the 1st and 2nd paragraphs of section 51-4.01A:**

10-19-12

Prestressing concrete members must comply with section 50.

**Delete the 2nd paragraph of section 51-4.01A.**

04-20-12

**Replace the 3rd paragraph of section 51-4.01C(2) with:**

04-20-12

For segmental or spliced-girder construction, shop drawings must include the following additional information:

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:**

04-19-13

copies

**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.

**Replace the paragraph in section 51-5.02G with:**

04-18-14

HMA for a temporary roadway structural section must comply with the specifications for minor HMA in section 39.

**Delete the 1st paragraph of section 51-5.03B(3).**

07-19-13

**Delete the 2nd paragraph of section 51-5.03D(1).**

07-19-13

**Add between the 1st and 2nd paragraphs of section 51-7.01A:**

10-19-12

Minor structures include:

1. Pipe culvert headwalls and endwalls for a pipe with a diameter less than 5 feet
2. Drainage inlets
3. Other structures described as minor structures

**Delete the 4th paragraph of section 51-7.01A.**

10-19-12

**Replace the 1st and 2nd paragraphs of section 51-7.01B with:**

10-19-12

Concrete must comply with the specifications for minor concrete.

**Add to section 51:**

10-19-12

**51-8-51-15 RESERVED**

AA

## 52 REINFORCEMENT

07-18-14

### Add to section 52-1.01A:

07-20-12

Splicing of bar reinforcement must comply with section 52-6.

### Replace the 1st and 2nd paragraphs of section 52-1.02B with:

10-19-12

Reinforcing bars must be deformed bars complying with ASTM A 706/A 706M, Grade 60, except you may use:

1. Deformed bars complying with ASTM A 615/A 615M, Grade 60, in:
  - 1.1. Junction structures
  - 1.2. Sign and signal foundations
  - 1.3. Minor structures
  - 1.4. Concrete crib members
  - 1.5. Mechanically-stabilized-embankment concrete panels
  - 1.6. Masonry block sound walls
2. Deformed or plain bars complying with ASTM A 615/A 615M, Grade 40 or 60, in:
  - 2.1. Slope and channel paving
  - 2.2. Concrete barriers Type 50 and 60
3. Plain bars for spiral or hoop reinforcement in structures and concrete piles

### Add to the list in the 3rd paragraph of section 52-1.02B:

04-20-12

9. Shear reinforcement stirrups in PC girders

### Replace the 9th paragraph of section 52-1.03D with:

07-18-14

Terminate each unit of spiral reinforcement at both ends by lapping the spiral reinforcement on itself for at least 80 diameters followed by (1) a 135-degree hook with a 6-inch tail hooked around an intersecting longitudinal bar or (2) a mechanical lap splice coupler. Discontinuities in spiral reinforcement may be made only where shown or authorized. The spiral on each side of a discontinuity or a lap splice is a separate unit. Where discontinuities in spiral reinforcement are not allowed, splice the spiral reinforcement. Lap splices in spiral reinforcement must be lapped at least 80 diameters followed by (1) a 135-degree hook with a 6-inch tail hooked around an intersecting longitudinal bar or (2) a mechanical lap splice coupler.

### Add to section 52-5.01D:

07-18-14

#### 52-5.01D(4) Quality Assurance Testing

Secure, identify, and transport QA headed bar reinforcement test samples to METS as specified for splice test samples in section 52-5.01D(3)(b).

The Department tests headed bar reinforcement as specified for QC testing in section 52-5.01D(3)(b).

The Department will notify you of the QA test results for each bundle of 4 test samples of splices within 3 business days after METS receives the bundle unless more than 1 bundle is received on the same day, in which case allow 2 additional business days for each additional bundle received.





8. Details of allowed options incorporated in the work.
9. Direction of rolling of plates where orientation is specified.
10. Distortion control plan.
11. Dimensional tolerances. Include measures for controlling accumulated error to meet overall tolerances.
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} <sup>a</sup>
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} <sup>a</sup>
HS low alloy structural steel	ASTM A 709/A 709M, Grade 50W or Grade HPS 50W, or {ASTM A 588/A 588M} <sup>a</sup>
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} <sup>a</sup>

<sup>a</sup>Grades 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 <sup>a</sup>
HS bolts and studs	ASTM A 449, Type 1 <sup>a</sup>
HS threaded rods	ASTM A 449, Type 1 <sup>a</sup>
HS nonheaded anchor bolts	ASTM F 1554, Grade 105, Class 2A <sup>a</sup>
Nuts	ASTM A 563, including appendix X1 <sup>b</sup>
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 <sup>b</sup>
Hardened washers	ASTM F 436, Type 1, Circular, including S1 supplementary requirements
Direct tension indicators	ASTM F 959, Type 325, zinc-coated

<sup>a</sup>Use hardened washers.

<sup>b</sup>Zinc-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 ASTM A 563, including appendix X1 <sup>a</sup>
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 <sup>b</sup>	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

<sup>a</sup>Zinc-coated nuts tightened beyond snug or wrench tight must be furnished with a dry lubricant complying with supplementary requirement S2 in ASTM A 563.

<sup>b</sup>Hydrostatic 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 <sup>a</sup> (Thickness up to 2 inches)	15 at 40 °F
Grade 50W <sup>a</sup> (Thickness up to 2 inches)	15 at 40 °F
Grade 50 <sup>a</sup> (Thickness over 2 inches up to 4 inches )	20 at 40 °F
Grade 50W <sup>a</sup> (Thickness over 2 inches up to 4 inches)	20 at 40 °F
Grade HPS 50W <sup>a</sup> (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

<sup>a</sup>If 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:**

Section 55-1.02B(1) applies to work performed at the source and at the job site.

07-19-13

**Replace the 4th paragraph in section 55-1.02B(1) with:**

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.

07-19-13

**Replace the 1st sentence of the 5th paragraph in section 55-1.02B(1) with:**

Fabricate floor beams, stringers, and girders having end connection angles to exact length back to back of connection angles.

07-19-13

**Add to the 7th paragraph in section 55-1.02B(1):**

Use low-stress stamps for fracture critical members and tension members.

07-19-13

**Replace the 2nd sentence of the 9th paragraph in section 55-1.02B(1) with:**

Slightly round edges and sharp corners, including edges marred, cut, or roughened during handling or erection.

07-19-13

**Replace the 3rd paragraph in section 55-1.02B(2) with:**

Instead of machining, you may heat straighten steel not in contact with other metal bearing surfaces if the above tolerances are met.

07-19-13

**Replace item 2 in the list in the 1st paragraph of section 55-1.02B(3) with:**

2. Radius of bend measured to the concave face must comply with *Manual of Steel Construction* of the AISC

07-19-13

**Replace the 1st sentence of the 2nd paragraph in section 55-1.02B(3) with:**

Plates to be bent to a smaller radius than specified in *Manual of Steel Construction* of the AISC must be bent hot.

07-19-13

**Replace the introductory clause of the 2nd paragraph of section 55-1.02B(4) with:**

Threads for pin ends and pin nuts 1-1/2 inches or more in diameter must comply with the following:

07-19-13

**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.

**Delete the 3rd paragraph in section 55-1.02B(7)(a).**

07-19-13

**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.





**58 SOUND WALLS**

04-19-13

10-19-12

**Delete the 3rd paragraph of section 58-1.01.**

**Replace the 1st paragraph of section 58-2.01D(5)(a) with:**

08-05-11

You must employ a special inspector and an authorized laboratory to perform Level 1 inspections and structural tests of masonry to verify the masonry construction complies with section 1704, "Special Inspections," and section 2105, "Quality Assurance," of the 2007 CBC.

10-19-12

**Delete the 1st paragraph of section 58-2.02F.**

**Replace "sets" at each occurrence in the 1st paragraph of section 58-4.01C with:**

04-19-13

copies

AA

**59 PAINTING**

11-15-13

**Replace "SSPC-SP 10" at each occurrence in section 59 with:**

10-19-12

SSPC-SP 10/NACE no. 2

**Replace "SSPC-SP 6" at each occurrence in section 59 with:**

10-19-12

SSPC-SP 6/NACE no. 3

**Replace "SSPC-CS 23.00" at each occurrence in section 59 with:**

10-19-12

SSPC-CS 23.00/AWS C 2.23M/NACE no. 12

**Replace "*Specification for Structural Joints Using ASTM A325 or A 490 Bolts*" in the 1st paragraph of section 59-2.01C(1) with:**

07-19-13

*Specification for Structural Joints Using High-Strength Bolts*

**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:**

10-19-12

AISC-420-10/SSPC-QP 3 (Enclosed Shop)

**Replace "Specification for Structural Joints Using ASTM A325 or A 490 Bolts" in the 1st paragraph of section 59-2.02 with:**

07-19-13

*Specification for Structural Joints Using High-Strength Bolts*

**Replace the paragraphs in section 59-2.03A with:**

10-19-12

Clean and paint all exposed structural steel and other metal surfaces.

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 <sup>a</sup>	Exterior grade latex <sup>b</sup> , 2 coats	2 minimum each coat, 4–8 total
Total thickness, all coats		8–14
Connections to existing structural steel: <sup>c</sup>		
Undercoat	Inorganic zinc primer, AASHTO M 300 Type I or II	4–8
Finish coat <sup>a</sup>	Exterior grade latex <sup>b</sup> , 2 coats	2 minimum each coat, 4–8 total
Total thickness, all coats		8–14

<sup>a</sup>If no finish coats are described, a final coat of inorganic zinc primer is required.

<sup>b</sup>Exterior grade latex must comply with section 91-2.02 unless otherwise specified.

<sup>c</sup>Includes 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:**

*Specification for Structural Joints Using High-Strength Bolts*

07-19-13

**Add to section 59-2.03C:**

**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:

04-19-13

**State Specification PWB Coating System**

Surface	Description	State Specification PWB Coating	Dry film thickness (mils)
Surfaces cleaned to bare metal <sup>a</sup> :	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

<sup>a</sup>Includes 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:**

soldier

04-19-13

**Replace section 59-11 with:**

**59-11 STAINING GALVANIZED SURFACES**

07-19-13

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:

1. Identify and obtain authorization for the areas to be stained
2. Remove oils, dirt, and other contaminants from the surfaces to be stained
3. Dry all surfaces to be stained

**59-12.03C Application**

After the areas to be stained have been identified, prepared, and the test plot authorized, stain the exposed surfaces under the manufacturer's instructions to achieve a color consistent with, or as close as possible to, the authorized test area color.

Control overspray and protect adjacent surfaces.

Keep stained surfaces dry for at least 20 days following the application of the stain.









AA

**74 PUMPING EQUIPMENT AND CONTROLS**

04-19-13

**Replace the 1st paragraph of section 74-1.01C(3) with:**

04-19-13

Submit at least 5 copies of product data to OSD, Documents Unit. Each copy must be bound together and include an index stating equipment names, manufacturers, and model numbers. Two copies will be returned. Notify the Engineer of the submittal. Include in the notification the date and contents of the submittal.

**Replace the 1st sentence of the 1st paragraph in section 74-2.01D(2) with:**

01-20-12

Drainage pumps must be factory certified under ANSI/HI 14.6.

AA

**75 MISCELLANEOUS METAL**

07-19-13

**Add between 2nd and 3rd paragraphs of section 75-1.03A:**

07-19-13

Fabricate expansion joint armor from steel plates, angles, or other structural shapes. Shape the armor to the section of the concrete deck and match-mark it in the shop. Straighten warped sections of expansion joint armor before placing. Secure the expansion joint armor in the correct position during concrete placement.

**Replace "SSPC-QP 3" in the 3rd paragraph of section 75-1.03E(4) with:**

10-19-12

AISC-420-10/SSPC-QP3

**Replace "metal beam guard railing" in the table in the 1st paragraph of section 75-1.05 with:**

07-19-13

guardrail

AA

**Replace section 78 with:**

07-20-12

**78 INCIDENTAL CONSTRUCTION**

07-20-12

**78-1 GENERAL**

Section 78 includes specifications for incidental bid items that are not closely associated with other sections.

**78-2-78-50 RESERVED**

AA

**80 FENCES**

07-18-14

**Add to section 80-2.02D:**

10-19-12

Vertical stays must:

- 1. Comply with ASTM A641
- 2. Be 12-1/2 gage
- 3. Have a Class 3 zinc coating

**Replace item 1 in the list in section 80-2.02E with:**

10-19-12

Comply with ASTM A 116, Type Z, Grade 60, Class 1

**Add after "galvanized wire" in the 1st paragraph of section 80-2.02F:**

10-19-12

complying with ASTM A 641

**Replace the 3rd and 4th paragraphs of section 80-2.02F with:**

10-19-12

Each staple used to fasten barbed wire and wire mesh fabric to wood posts must:

- 1. Comply with ASTM F 1667
- 2. Be at least 1-3/4 inches long
- 3. Be manufactured from 9-gage galvanized wire

Wire ties used to fasten barbed wire and wire mesh to metal posts must be at least 11-gage galvanized wire complying with ASTM F 626. Clips and hog rings used for metal posts must be at least 9-gage galvanized wire complying with ASTM F 626.

**Replace the 8th through 14th paragraphs of section 80-2.03 with:**

10-19-12

Attach the wire mesh and barbed wire to each post.

Securely fasten tension wires to wood posts. Make a single or double loop around each post at each attachment point and staple the wire to the post. Use wire ties, hog rings, or wire clips to fasten the wires to the metal posts.

Connect each wood brace to its adjacent post with a 3/8 by 4-inch steel dowel. Twist the tension wires until the installation is rigid.

Stretch barbed wire and wire mesh fabric and fasten to each wood or steel end, corner, or gate post. Apply tension according to the manufacturer's instructions using a mechanical stretcher or other device designed for such use. If no tension is specified by the manufacturer, use 250 pounds for the required tension. Evenly distribute the pull over the longitudinal wires in the wire mesh such that no more than 50 percent of the original depth of the tension curves is removed. Do not use a motorized vehicle, truck, or tractor to stretch the wire.

Attach barbed wire and wire mesh fabric to the private-property side of posts. On curved alignments, place the wire mesh and barbed wire on the face of the post against which the normal pull of the wire

mesh and wire will be exerted. Terminate the wire mesh and barbed wire at each end, corner, pull, and gate post in the new fence line. Attach wire mesh and barbed wire to each wood or steel end, corner, pull, or gate post by wrapping each horizontal strand around the post and tying it back on itself with at least 4 tightly-wound wraps.

At line posts, fasten the wire mesh to the post at the top and bottom and at intermediate points not exceeding 10 inches apart. Fasten each line of barbed wire to each line post. Use wire ties or clips to fasten the wires to metal posts under the post manufacturer's instructions. Drive staples crosswise with the grain of the wood and pointed slightly downward. Drive staples just short of actual contact with the wires to allow free longitudinal movement of those wires and to prevent damage to the wire's protective coating. Secure all wires to posts to maintain horizontal alignment.

Splices in barbed wire and wire mesh are allowed provided there are no more than 2 splices per 50 feet of fence. Use commercially-available galvanized mechanical wire splices or a wire splice created by tying off wire. Install mechanical wire splices with a tool designed for that purpose under the manufacturer's instructions. Tie off the wire as follows:

1. Carry the ends of each wire 3 inches past the tied-off knot location and wrap around the wire for at least 6 turns in opposite directions.
2. Remove the splice tool and close the space by pulling the end of the wires together.
3. Cut the unused ends of the wire close and neat.

07-18-14

**Delete "resisting moment" and its definition in section 80-3.01B.**

**Add to section 80-3.01B:**

07-18-14

**posts and braces:** Framework that supports the metal fabric for chain link fence. Posts and braces include round and roll-formed cross sections used as line, end, latch, or corner posts and braces.

**Add to section 80-3.01C:**

07-18-14

Submit a certificate of compliance for posts and braces that includes the information specified in ASTM F1043, section 9.

07-18-14

**Delete section 80-3.01D.**

**Replace the 1st paragraph of section 80-3.02B with:**

07-18-14

The base metal for posts and braces must be commercial-quality, weldable steel complying with AASHTO M 181, Type 1, except for the protective coating requirements.

Posts and braces must comply with the strength requirements in ASTM F1043:

1. Group IA, regular grade, for round posts
2. Group II-L for roll-formed posts and braces

07-18-14

**Delete the 4th through 8th paragraphs of section 80-3.02B.**





## 84 TRAFFIC STRIPES AND PAVEMENT MARKINGS

05-30-14

Replace section 84-1.01C with:

05-30-14

### 84-1.01C Submittals

For glass beads used in drop-on applications and in thermoplastic formulations, submit a certificate of compliance and test results for each lot of beads specifying the EPA test methods used and tracing the lot to the specific test sample. The testing for lead and arsenic content must be performed by an independent testing laboratory.

Submit retroreflectivity readings for traffic stripes and pavement markings at locations with deficient retroreflectivity determined by the Engineer.

### 84-1.01D Quality Control and Assurance

Test each lot of glass beads for arsenic and lead under EPA Test Method 3052 and 6010B or 6010C.

Applied traffic stripes and pavement markings must be retroreflective. Within 30 days of applying traffic stripes and pavement markings, the retroreflectivity of the stripes and markings must be a minimum of  $250 \text{ mcd}\cdot\text{m}^{-2}\cdot\text{lx}^{-1}$  for white and  $125 \text{ mcd}\cdot\text{m}^{-2}\cdot\text{lx}^{-1}$  for yellow when measured under ASTM E1710.

The Engineer will perform a nighttime, drive-through, visual inspection of the retroreflectivity of the traffic stripes and pavement markings and notify you of any locations with deficient retroreflectivity. Measure the retroreflectivity of the deficient areas using a retroreflectometer under ASTM E1710 and the sampling protocol specified in ASTM D7585.

Replace the paragraph in section 84-1.02 with:

05-30-14

Glass beads applied to paint must comply with State Specification 8010-004.

Glass beads applied to molten thermoplastic material must be Type 2 beads complying with AASHTO M 247. The glass beads must have a coating that promotes adhesion of the beads to thermoplastic.

At least 75 percent of the beads by count must be true spheres that are colorless and do not exhibit dark spots, air inclusions, or surface scratches when viewed under 20X magnification.

Each lot of glass beads used in pavement markings must contain less than 200 ppm each of arsenic and lead when tested under EPA Test Method 3052 and 6010B or 6010C.

Replace the 1st paragraph in section 84-2.04 with:

01-20-12

A double extruded thermoplastic traffic stripe consisting of two 4-inch wide yellow stripes is measured as 2 traffic stripes.

A double sprayable thermoplastic traffic stripe consisting of two 4-inch wide yellow stripes is measured as 1 traffic stripe.

Add to section 84:

01-20-12

### 84-6 THERMOPLASTIC TRAFFIC STRIPES AND PAVEMENT MARKINGS WITH ENHANCED WET NIGHT VISIBILITY

Reserved

84-7-84-10 RESERVED

AA

## 86 ELECTRICAL SYSTEMS

10-17-14

### Replace the paragraphs in section 86-1.01 with:

07-19-13

Section 86 includes general specifications for constructing and rehabilitating electrical systems.

Electrical systems must comply with the material and installation specifications in section 86-2.

Section 86-3 includes specifications for constructing controller assemblies.

Section 86-4 includes specifications for constructing traffic signal faces, programmed visibility signal faces, pedestrian signal faces, flashing beacons, ramp metering signs, and signal mounting assemblies.

Section 86-5 includes specifications for constructing vehicle detectors and pedestrian push button assemblies.

Section 86-6 includes specifications for constructing lighting systems.

Section 86-7 includes specifications for constructing rehabilitating electrical equipment.

Comply with Part 4 of the *California MUTCD*. Nothing in section 86 is to be construed as to reduce the minimum standards in this manual.

The locations shown for electrical systems are approximate; the Engineer determines the final locations.

### Replace the paragraphs in section 86-1.015 with:

07-19-13

**actuation:** Actuation as defined in the *California MUTCD*.

**channel:** Discrete information path.

**controller assembly:** Assembly for controlling a system's operations, consisting of a controller unit and auxiliary equipment housed in a rainproof cabinet.

**controller unit:** Part of the controller assembly performing the basic timing and logic functions.

**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.

**Delete item 15.3 in the list in the 1st paragraph of section 86-2.04B(3).**

07-19-13

**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 crimpstyle terminal lugs.

Terminate field conductors no. 12 and smaller with spadetype terminals. Terminate field conductors no. 10 and larger with spadetype or ringtype terminals.

**Replace the value for resistivity in the table in the 6th paragraph of section 86-2.09E with:**

07-19-13

$25 \times 10^{13} \Omega$  per inch, minimum

**Add between "the" and "head" in the 3rd sentence of the 2nd paragraph of 86-2.09F:**

07-19-13

connector

**Replace "project" in the 3rd paragraph of section 86-2.11A with:**

10-19-12

work

**Replace "Contract" in item 2 in the list in the 11th paragraph of section 86-2.11A with:**

10-19-12

work

**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:**

07-19-13

The Department furnishes the BBS components under section 6-2.03.

**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:**

07-19-13

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.

**Replace the heading of section 86-4.02 with:**

07-19-13

**PROGRAMMED VISIBILITY VEHICLE SIGNAL SECTION**

**Replace "face" in the 1st paragraph of section 86-4.02 with:**

07-19-13

section

**Add before the 1st sentence in section 86-4.03A:**

07-19-13

The pedestrian signal face must be Type A.

**Replace the 1st sentence of the 2nd paragraph of section 86-4.03B with:**

07-19-13

The Department tests the pedestrian signal's front screen in a horizontal position with its edges supported.

**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:**

07-19-13

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.

**Replace item 1 in the list in the 1st paragraph of section 86-4.03I(2) with:**

07-19-13

- 1. Not include reflectors.

**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)

**Replace the paragraphs in section 86-4.03J with:**

Reserved

10-17-14

**Add between "beacon" and "must" in the 1st sentence of section 86-4.05:**

signal face

07-19-13

**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:**

Viscosity, Brookfield Thermosel, no. 27 Spindle, 20 rpm, 190 °C	D 4402	2.5–3.5 Pa·s
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07-19-13

**Replace the paragraph in section 86-5.01A(3)(d) with:**

Use epoxy sealant for repair work in and around sawcuts housing inductive loops.

07-19-13

**Replace "all loop conductors" in the 3rd paragraph of section 86-5.01A(4) with:**

the detector lead-in cable

07-19-13

**Replace "Encase the loop wires" in the 1st sentence of the 3rd paragraph of section 86-5.01A(5) with:**

The loop wires must be encased

07-19-13

**Replace section 86-5.02 with:**

07-19-13

**86-5.02PUSH BUTTON ASSEMBLIES**

The housing for a push button assembly must be die-cast or permanent mold-cast aluminum. The assembly must be rainproof and shockproof in any weather condition.

The push button's switch must be a single-pole, double-throw switching unit with screw-type terminals rated 15 A at 125 V(ac). The switch must have:

1. Plunger actuator and a U frame to allow recessed mounting in the push button housing
2. Operating force of 3.5 lb
3. Maximum pretravel of 5/64 inch
4. Minimum overtravel of 1/32 inch
5. Differential travel from 0.002 to 0.04 inch
6. 2-inch minimum diameter actuator

Where a push button is attached to a pole, the housing must be shaped to fit the pole's curvature. Use saddles if needed to make a neat and secure fit.



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 <sup>-1</sup> 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 <sup>-1</sup> 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 <sup>a</sup> 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 <sup>a</sup> min	ASTM D 6637	410 x 620
Tensile strength at ultimate, lb/ft <sup>a</sup> 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 <sup>a</sup> 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 <sup>b</sup> min	GRI:GG9	0.65

<sup>a</sup>Machine direction x cross direction

<sup>b</sup>Geosynthetic Research Institute, Test Method GG9, *Torsional Behavior of Bidirectional Geogrids When Subjected to In-Plane Rotation*

**Replace section 88-1.02Q with:**

07-19-13

**88-1.02Q Geosynthetic Bond Breaker**

Geosynthetic bond breaker must be nonwoven; needle punched; not heat treated; polypropylene, polyethylene material.

When tested under the referenced test methods, properties of geosynthetic bond breaker material must have the values shown in the following table:

**Geosynthetic Bond Breaker**

Property	Test	Value
Mass per unit area, oz/sq yd min	ASTM D 5261	14.7
Thickness at 29 psi, mm min	ASTM D 5199	1.0
Tensile strength at ultimate, lbs/ft min	ASTM D 4595	685
Elongation, percent max	ASTM D 4595	130
Permittivity at 2.9 psi, m/s min	ASTM D 5493	0.0001
Hydraulic transmissivity at 29 psi, m/s min	ASTM D 6574	0.0002
Ultraviolet resistance, percent min retained grab breaking load, 500 hours	ASTM D 4355	60

AA

**90 CONCRETE**

07-19-13

**Replace the 3rd paragraph of section 90-1.01C(7) with:**

08-05-11

Submit weighmaster certificates in printed form or, if authorized, in electronic media. Present electronic media in a tab-delimited format on a CD or DVD. Captured data for the ingredients represented by each batch must be line feed carriage return and one line separate record with sufficient fields for the specified data.

**Replace the 3rd paragraph of section 90-3.01C(5) with:**

08-05-11

Production data must be input by hand into a pre-printed form or captured and printed by the proportioning device. Present electronic media containing recorded production data in a tab-delimited format on a CD or DVD. Each capture of production data must be followed by a line feed carriage return with sufficient fields for the specified data.

**Replace the 1st paragraph of section 90-4.01A with:**

07-19-13

Section 90-4 includes specifications for fabricating PC concrete members.

**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 <sup>a</sup>	ASTM C117	
Moisture content of fine aggregate	ASTM C566, or electronically actuated moisture meter <sup>b</sup>	1–2 times per each day of pour, depending on conditions

<sup>a</sup>Percent 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.

<sup>b</sup>Electronically actuated moisture meter must be calibrated once per week per ASTM C566.

### Concrete QC Tests

Property	Test method	Minimum testing frequency
Compressive strength <sup>b</sup>	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 <sup>a</sup>	If concrete is air entrained, once for each set of cylinders, and when conditions warrant

<sup>a</sup>ASTM C173/C173M must be used for lightweight concrete.

<sup>b</sup>Cylinders 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 <sup>a</sup>	97.5	97.5	97.5 <sup>b</sup>
Viscosity at 135 °C <sup>c</sup> , 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 <sup>d</sup> , 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 <sup>e</sup>	80 <sup>e</sup>	80 <sup>e</sup>
Elastic recovery <sup>f</sup> , Test temperature °C min recovery, %	T 301	25 75	25 75	25 65
PAV <sup>g</sup> , 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

