04

STATE OF CALIFORNIA

DEPARTMENT OF TRANSPORTATION

# NOTICE TO BIDDERS

## AND

# SPECIAL PROVISIONS

**FOR CONSTRUCTION ON STATE HIGHWAY IN SAN MATEO COUNTY IN SAN MATEO ON ROUTE 92 FROM ALAMEDA DE LAS PULGAS OVERCROSSING TO THE HAYWARD PARK OVERHEAD AND ON ROUTE 82 FROM WEST 20TH AVENUE TO 17TH AVENUE**

**In District 04 On Route 92, 82**

**Under**

| | |
|---|---|
| ***Bid* book dated October 3, 2016** | ***Standard Specifications* dated 2010** |
| **Project plans approved June 28, 2016** | ***Standard Plans* dated 2010** |

**Identified by**

**Contract No. 04-235524**

**04-SM-92, 82-R11.0/R11.4, 10.4/10.7**

**Project ID 0412000496**

**Federal-Aid Project**
**ACNH-X081(030)E**

## Electronic Bidding Contract

**AADD**

**Bids open Tuesday, November 29, 2016** **OSD**

**Dated October 3, 2016** **IH**

**********

# SPECIAL NOTICES

**********

- See sections 2 and 3 for contractors' registration requirements.

# CONTRACT NO. 04-235524

**The special provisions contained herein have been prepared by or under the direction of the following registered persons.**

**ENVIRONMENTAL (AIR & NOISE)**

2-29-16

REGISTERED CIVIL ENGINEER DATE

REGISTERED PROFESSIONAL ENGINEER
Shiang Yang
No. C44483
Exp. 03/31/16
CIVIL
STATE OF CALIFORNIA

## Design

8/26/2016

REGISTERED CIVIL ENGINEER DATE
(Signature)

REGISTERED PROFESSIONAL ENGINEER
Maxim Hovhanessian
No. C42284
Exp. 3/31/2018
CIVIL
STATE OF CALIFORNIA

**ELECTRICAL**

K. Y. Xu 3/1/16

REGISTERED ELECTRICAL ENGINEER

REGISTERED PROFESSIONAL ENGINEER
K. Y. Xu
No. E15219
Exp. 6/30/16
ELECT.
STATE OF CALIFORNIA

WATER POLLUTION CONTROL

Ganga D. Tripathi 02/26/2016

REGISTERED CIVIL ENGINEER

REGISTERED PROFESSIONAL ENGINEER
Ganga Tripathi
No. 78447
Exp. 09/30/2017
CIVIL
STATE OF CALIFORNIA

**EROSION CONTROL**

LICENSED LANDSCAPE ARCHITECT

LICENSED LANDSCAPE ARCHITECT
DAVID WARREN YAU No. 1949
Signature
11-30-17
Renewal Date
12.29.15
Date
STATE OF CALIFORNIA

# GEOTECHNICAL

8/26/2016

REGISTERED CIVIL ENGINEER (Signature) DATE

REGISTERED PROFESSIONAL ENGINEER
John C. Moore
No. C 61792
Exp. 06/30/2017
CIVIL
STATE OF CALIFORNIA

**ENVIRONMENTAL (HAZARDOUS WASTE)**

February 29, 2016

REGISTERED CIVIL ENGINEER DATE

REGISTERED PROFESSIONAL ENGINEER
Christopher R. Wilson
No. C 49882
Exp. 9/30/2016
CIVIL
STATE OF CALIFORNIA

**LANDSCAPE**

LICENSED LANDSCAPE ARCHITECT

LICENSED LANDSCAPE ARCHITECT
Scott J. Bottari
No. 4513
Signature
04-30-17
Renewal Date
02-29-16
Date
STATE OF CALIFORNIA

**MATERIALS**

8/26/16

REGISTERED CIVIL ENGINEER (Signature) — DATE

REGISTERED PROFESSIONAL ENGINEER
KAN WAI WONG
No. C 78089
Exp. 9/30/17
CIVIL
STATE OF CALIFORNIA

**STRUCTURES**

02/29/2016

Registered Civil Engineer — Date

REGISTERED PROFESSIONAL ENGINEER
KEVIN L ELLINGSON
No. C58528
Exp. 06/30/2017
CIVIL
STATE OF CALIFORNIA

# Traffic

7/7/2016

REGISTERED CIVIL ENGINEER (Signature) — DATE

REGISTERED PROFESSIONAL ENGINEER
ROBIN B. PON
No. C 057558
Exp. 12/31/2017
CIVIL
STATE OF CALIFORNIA

# Traffic - Signs

08/26/16

REGISTERED CIVIL ENGINEER (RAJESH OBEROI) — DATE

REGISTERED PROFESSIONAL ENGINEER
RAJESH OBEROI
No. C 46046
Exp. 12/31/16
CIVIL
STATE OF CALIFORNIA

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# STANDARD PLANS LIST

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

| | |
|---|---|
| A10A | Abbreviations (Sheet 1 of 2) |
| RSP A10B | Abbreviations (Sheet 2 of 2) |
| A10C | Lines and Symbols (Sheet 1 of 3) |
| A10D | Lines and Symbols (Sheet 2 of 3) |
| A10E | Lines and Symbols (Sheet 3 of 3) |
| RSP A10F | Legend - Soil (Sheet 1 of 2) |
| RSP A10G | Legend - Soil (Sheet 2 of 2) |
| A20A | Pavement Markers and Traffic Lines, Typical Details |
| A20B | Pavement Markers and Traffic Lines, Typical Details |
| RSP A20C | Pavement Markers and Traffic Lines, Typical Details |
| A20D | Pavement Markers and Traffic Lines, Typical Details |
| RSP A24A | Pavement Markings - Arrows |
| A24B | Pavement Markings - Arrows and Symbols |
| RSP A24C | Pavement Markings - Symbols and Numerals |
| A24D | Pavement Markings - Words |
| RSP A24E | Pavement Markings - Words, Limit and Yield Lines |
| RSP A24F | Pavement Markings - Crosswalks |
| A62A | Excavation and Backfill - Miscellaneous Details |
| A62B | Limits of Payment for Excavation and Backfill - Bridge Surcharge and Wall |
| A62D | Excavation and Backfill - Concrete Pipe Culverts |
| RSP A62DA | Excavation and Backfill - Concrete Pipe Culverts - Indirect Design Method |
| A73B | Markers |
| A73C | Delineators, Channelizers and Barricades |
| RSP A76A | Concrete Barrier Type 60 |
| RSP A77L1 | Midwest Guardrail System Standard Railing Section (Wood Post with Wood Block) |
| RSP A77M1 | Midwest Guardrail System Standard Hardware |
| RSP A77N1 | Midwest Guardrail System Wood Post and Wood Block Details |
| RSP A77N4 | Midwest Guardrail System Typical Railing Delineation and Dike Positioning Details |
| RSP A77P1 | Midwest Guardrail System Typical Layouts for Embankments |
| RSP A77Q1 | Midwest Guardrail System Typical Layouts for Structure Approach |
| RSP A77Q5 | Midwest Guardrail System Typical Layouts for Structure Departure |

| | |
|---|---|
| RSP A77S1 | Midwest Guardrail System End Anchor Assembly (Type SFT) |
| RSP A77U3 | Midwest Guardrail System Connections to Abutments and Walls |
| RSP A77U4 | Midwest Guardrail System Transition Railing (Type WB-31) |
| RSP A78A | Thrie Beam Barrier - Standard Barrier Railing Section (Wood Post with Wood Block) |
| A78C1 | Thrie Beam Barrier - Standard Hardware Details |
| RSP A78C2 | Thrie Beam Barrier - Post and Block Details |
| RSP A78E1 | Single Thrie Beam Barrier - End Anchor Assembly and Terminal System End Treatment |
| A78J | Single Thrie Beam Barrier - Transition Railing (Type STB) |
| RSP A85 | Chain Link Fence |
| RSP A85B | Chain Link Fence Details |
| RSP A87A | Curbs and Driveways |
| RSP A87B | Hot Mix Asphalt Dikes |
| RSP A88A | Curb Ramp Details |
| RSP P1 | Jointed Plain Concrete Pavement New Construction |
| RSP P8 | Individual Slab Replacement with Rapid Strength Concrete |
| RSP P10 | Concrete Pavement Dowel Bar Details |
| RSP P12 | Concrete Pavement Dowel Bar Basket Details |
| RSP P75 | Pavement Edge Treatments - Overlays |
| RSP P76 | Pavement Edge Treatments - New Construction |
| D71 | Drainage Inlet Markers |
| RSP D73 | Drainage Inlets |
| D73A | Drainage Inlets (Precast) |
| D74A | Drainage Inlets |
| RSP D74B | Drainage Inlets |
| D74C | Drainage Inlet Details |
| RSP D77A | Grate Details No. 1 |
| RSP D77B | Grate Details No. 2 |
| D78A | Gutter Depressions |
| D78B | Inlet Depressions - Concrete Shoulders |
| D78C | Inlet Depressions - Hot Mix Asphalt Shoulders |
| D79 | Precast Reinforced Concrete Pipe - Direct Design Method |
| D79A | Precast Reinforced Concrete Pipe - Direct Design Method |
| RSP D87D | Overside Drains |
| D88 | Construction Loads on Culverts |

| | |
|---|---|
| D97H | Reinforced Concrete Pipe or Non-Reinforced Concrete Pipe - Standard and Positive Joints |
| RSP H1 | Landscape and Erosion Control Abbreviations |
| RSP H2 | Landscape and Erosion Control Symbols |
| RSP H7 | Landscape Details |
| RSP H8 | Landscape Details |
| RSP H9 | Landscape Details |
| RSP H9A | Landscape Details |
| H10 | Irrigation Controller Enclosure Cabinet |
| H51 | Erosion Control Details - Fiber Roll and Compost Sock |
| H52 | Rolled Erosion Control Product |
| T1A | Temporary Crash Cushion, Sand Filled (Unidirectional) |
| 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 T10A | Traffic Control System for Lane Closures on Freeways and Expressways |
| RSP T11 | Traffic Control System for Lane Closure on Multilane Conventional Highways |
| RSP T14 | Traffic Control System for Ramp Closure |
| T51 | Temporary Water Pollution Control Details (Temporary Silt Fence) |
| T53 | Temporary Water Pollution Control Details (Temporary Cover) |
| T55 | Temporary Water Pollution Control Details (Temporary Erosion Control Blanket) |
| T56 | Temporary Water Pollution Control Details (Temporary Fiber Roll) |
| T57 | Temporary Water Pollution Control Details (Temporary Check Dam) |
| T58 | Temporary Water Pollution Control Details (Temporary Construction Entrance) |
| T61 | Temporary Water Pollution Control Details (Temporary Drainage Inlet Protection) |
| T62 | Temporary Water Pollution Control Details (Temporary Drainage Inlet Protection) |
| T63 | Temporary Water Pollution Control Details (Temporary Drainage Inlet Protection) |
| T64 | Temporary Water Pollution Control Details (Temporary Drainage Inlet Protection) |
| T65 | Temporary Water Pollution Control Details [Temporary Fence (Type ESA)] |
| B0-3 | Bridge Details |
| RSP B3-1A | Retaining Wall Type 1 (Case 1) |
| RSP B3-5 | Retaining Wall Details No. 1 |
| B7-11 | Utility Details |
| RSP B11-56 | Concrete Barrier Type 736 |

| | |
|---|---|
| RSP B15-6 | Sound Wall Masonry Block on Type 736S/SV Barrier Details (1) |
| RSP B15-7 | Sound Wall Masonry Block on Type 736S/SV Barrier Details (2) |
| B15-8 | Sound Wall Masonry Block on Type 736S/SV Barrier Details (3) |
| B15-12 | Sound Wall Masonry Block on Barrier 5'-0" Access Gate Details (1) |
| RS1 | Roadside Signs, Typical Installation Details No. 1 |
| RS2 | Roadside Signs - Wood Post, Typical Installation Details No. 2 |
| RSP RS3 | Roadside Signs - Laminated Wood Box Post Typical Installation Details No. 3 |
| RS4 | Roadside Signs, Typical Installation Details No. 4 |
| RSP S1 | Overhead Signs - Truss, Instructions and Examples |
| RSP S2 | Overhead Signs - Truss, Single Post Type - Post Types II thru IX |
| S3 | Overhead Signs - Truss, Single Post Type - Base Plate and Anchorage Details |
| S4 | Overhead Signs - Truss, Single Post Type - Structural Frame Members Details No. 1 |
| S5 | Overhead Signs - Truss, Single Post Type - Structural Frame Members Details No. 2 |
| S6 | Overhead Signs - Truss, Gusset Plate Details |
| S8 | Overhead Signs - Truss, Single Post Type - Round Pedestal Pile Foundation |
| S20 | Overhead Signs - Steel Frames - Removable Sign Panel Frames |
| S21 | Overhead Signs - Removable Sign Panel Frames Mounting Details |
| S48 | Overhead Signs - Lightweight Post Details |
| S49 | Overhead Signs - Lightweight Foundation Details |
| S81 | Overhead Laminated Sign - Single or Multiple Panel, Type A (1" Thick) |
| S87 | Type A-1 Mounting Hardware - Overhead Laminated Type A Panel, Truss and Lightweight Sign Structures |
| S88 | Type A-2 Mounting Hardware - Overhead Laminated Type A Panel, Bridge Mounted and Tubular Sign Structures |
| S90 | Channel and Bolt Hole Location, Overhead Formed Sign Panel |
| S91 | Overhead Sign - Formed Sign Panel, Type A-3 Mounting Hardware |
| S92 | Overhead Sign - Formed Sign Panel |
| S93 | Framing Details for Framed Single Sheet Aluminum Signs, Rectangular Shape |
| S94 | Roadside Framed Single Sheet Aluminum Signs, Rectangular Shape |
| S95 | Roadside Single Sheet Aluminum Signs, Diamond Shape |
| RSP ES-1A | Electrical Systems (Legend and Abbreviations) |
| RSP ES-1B | Electrical Systems (Legend and Abbreviations) |
| RSP ES-1C | Electrical Systems (Legend and Abbreviations) |
| RSP ES-2C | Electrical Systems (Service Equipment Enclosure Notes, Type III Series) |
| RSP ES-2D | Electrical Systems (Service Equipment Enclosure and Typical Wiring Diagram, Type III - A Series) |
| RSP ES-3C | Electrical Systems (Controller Cabinet Foundation and Pad Details) |

| | |
|---|---|
| RSP ES-3H | Electrical Systems (Irrigation Controller Enclosure Cabinet) |
| RSP ES-3J | Electrical Systems (BBS Power Connection Diagram, with Bypass Control Line) |
| RSP ES-4A | Electrical Systems (Signal Heads and Mountings) |
| RSP ES-4B | Electrical Systems (Pedestrian Signal Heads) |
| RSP ES-4C | Electrical Systems (Signal Heads and Mountings) |
| RSP ES-4D | Electrical Systems (Signal Head Mounting) |
| RSP ES-4E | Electrical Systems (Signal Heads and Optical Detector Mounting) |
| RSP ES-5A | Electrical Systems (Loop Detectors) |
| RSP ES-5B | Electrical Systems (Detectors) |
| RSP ES-5C | Electrical Systems (Accessible Pedestrian Signal and Push Button Assemblies) |
| RSP ES-5D | Electrical Systems (Curb and Shoulder Termination, Trench, and Handhole Details) |
| RSP ES-6A | Electrical Systems (Lighting Standard, Types 15 and 21) |
| ES-6B | Electrical Systems (Electrolier Anchorage and Grouting for Types 15 and 21, Barrier Rail Mounted) |
| RSP ES-6E | Electrical Systems (Lighting Standard, Types 30 and 31) |
| RSP ES-7A | Electrical Systems (Signal and Lighting Standard, Type TS, and Push Button Assembly Post) |
| RSP ES-7B | Electrical Systems (Signal and Lighting Standard, Type 1 and Equipment Identification Characters) |
| RSP ES-7G | Electrical Systems (Signal And Lighting Standard, Case 5 Signal Mast Arm Loading, Wind Velocity = 100 mph and Signal Mast Arm Lengths 50' to 55') |
| RSP ES-7J | Electrical Systems (Flashing Beacon on a Type 1, Type 15-FBS, and Type 40 Standard) |
| RSP ES-7M | Electrical Systems (Signal and Lighting Standard, Detail No. 1) |
| RSP ES-7N | Electrical Systems (Signal and Lighting Standard, Detail No. 2) |
| ES-7O | Electrical Systems (Signal and Lighting Standard, Detail No. 3) |
| RSP ES-7Q | Electrical Systems (Pedestrian Barricades) |
| RSP ES-7R | Electrical Systems (Signal and Lighting, Miscellaneous Attachment) |
| RSP ES-8A | Electrical Systems (Non-Traffic Pull Box) |
| RSP ES-8B | Electrical Systems (Traffic Pull Box) |
| RSP ES-9C | Electrical Systems (Structure Pull Box) |
| RSP ES-9D | Electrical Systems (Structure Pull Box Installations) |
| RSP ES-10A | Electrical Systems (Isofootcandle Curves) |
| RSP ES-10B | Electrical Systems (Isofootcandle Curves) |
| RSP ES-11 | Electrical Systems (Foundation Installations) |
| RSP ES-13A | Electrical Systems (Splicing Details) |
| ES-13B | Electrical Systems (Fuse Rating, Kinking and Banding Detail) |
| RSP ES-16B | Electrical Systems (Closed Circuit Television, 25' to 45' Pole) |

# CANCELED STANDARD PLANS LIST

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

**RUMBLE STRIP**

Canceled on January 15, 2016

METAL BEAM GUARD RAILING - STANDARD RAILING SECTIONS

Canceled on July 19, 2013

Canceled on July 19, 2013

Canceled on July 19, 2013

Canceled on July 19, 2013

Canceled on July 19, 2013

Canceled on July 19, 2013

Canceled on July 19, 2013

METAL BEAM GUARD RAILING – TYPICAL VEGETATION CONTROL

Canceled on July 19, 2013

Canceled on July 19, 2013

Canceled on July 19, 2013

Canceled on July 19, 2013

Canceled on July 19, 2013

Canceled on July 19, 2013

METAL BEAM GUARD RAILING - TYPICAL LAYOUTS FOR EMBANKMENTS

Canceled on July 19, 2013

Canceled on July 19, 2013

Canceled on July 19, 2013

Canceled on July 19, 2013

Canceled on July 19, 2013

Canceled on July 19, 2013

METAL BEAM GUARD RAILING - TYPICAL LAYOUTS FOR STRUCTURES

Canceled on July 19, 2013

Canceled on July 19, 2013

Canceled on July 19, 2013

Canceled on July 19, 2013

Canceled on July 19, 2013

METAL BEAM GUARD RAILING - TYPICAL LAYOUTS FOR FIXED OBJECTS

Canceled on July 19, 2013

Canceled on July 19, 2013

Canceled on July 19, 2013

Canceled on July 19, 2013

Canceled on July 19, 2013

Canceled on July 19, 2013

Canceled on July 19, 2013

Canceled on July 19, 2013

METAL BEAM GUARD RAILING - END ANCHORAGE AND RAIL TENSIONING ASSEMBLY

Canceled on July 19, 2013

Canceled on July 19, 2013

Canceled on July 19, 2013

Canceled on July 19, 2013

Canceled on July 19, 2013

METAL BEAM GUARD RAILING - CONNECTIONS DETAILS AND TRANSITION RAILING TO BRIDGE RAILINGS, ABUTMENTS AND WALLS

Canceled on July 19, 2013
Canceled on July 19, 2013
Canceled on July 19, 2013
Canceled on July 19, 2013
Canceled on July 19, 2013
Canceled on July 19, 2013

PAVEMENTS

Canceled on July 19, 2013

CRIB WALLS

Canceled on July 19, 2013
Canceled on July 19, 2013
Canceled on July 19, 2013

SLOTTED AND GRATED LINE DRAINS

Canceled on October 30, 2015
Canceled on October 30, 2015

RETAINING WALLS

Canceled on April 20, 2012
Canceled on April 20, 2012
Canceled on April 20, 2012
Canceled on April 20, 2012
Canceled on April 20, 2012
Canceled on April 20, 2012

OVERHEAD SIGNS (TRUSS)

Canceled on July 19, 2013
Canceled on July 19, 2013

OVERHEAD SIGNS (LIGHTWEIGHT)

Canceled on July 19, 2013
Canceled on July 19, 2013
Canceled on July 19, 2013
Canceled on July 19, 2013
Canceled on July 19, 2013
Canceled on July 19, 2013
Canceled on July 19, 2013

OVERHEAD SIGN - CHANGEABLE MESSAGE SIGN (MODEL 510)

Canceled on July 19, 2013
Canceled on July 19, 2013
Canceled on July 19, 2013
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Canceled on July 19, 2013

Canceled on July 19, 2013

ELECTRICAL SYSTEMS - LIGHTING STANDARDS

Canceled on July 19, 2013

Canceled on July 19, 2013

Canceled on July 19, 2013

ELECTRICAL SYSTEMS - SIGNAL AND LIGHTING STANDARDS

Canceled on July 19, 2013

ELECTRICAL SYSTEMS - PULL BOX

Canceled on January 20, 2012

ELECTRICAL SYSTEMS - ISOFOOTCANDLE DIAGRAMS AND FOUNDATION DETAILS

Canceled on July 20, 2012

ELECTRICAL SYSTEMS - PEDESTRIAN OVERHEAD LIGHTING

Canceled on October 30, 2015

Canceled on October 30, 2015

# NOTICE TO BIDDERS

Bids open Tuesday, November 29, 2016

Dated October 3, 2016

General work description: Interchange Improvements, retaining and sound walls

The Department will receive sealed bids for CONSTRUCTION ON STATE HIGHWAY IN SAN MATEO COUNTY IN SAN MATEO ON ROUTE 92 FROM ALAMEDA DE LAS PULGAS OVERCROSSING TO THE HAYWARD PARK OVERHEAD AND ON ROUTE 82 FROM WEST 20TH AVENUE TO 17TH AVENUE.

District-County-Route-Post Mile: 04-SM-92, 82-R11.0/R11.4, 10.4/10.7

Contract No. 04-235524

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

The DBE Contract goal is 11 percent.

Federal-aid project no.:

ACNH-X081(030)E

Bids must be on a cost+time basis.

Complete the work within the number of working days bid.

Do not bid more than 250 working days.

The estimated cost of the project is $16,100,000.

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

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

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

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

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

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

If the minimum wage rates as determined by the United States Secretary of Labor differs from the general prevailing wage rates determined by the Director of the California Department of Industrial Relations for similar classifications of labor, the Contractor and subcontractors must not pay less than the higher wage rate. The Department does not accept lower State wage rates not specifically included in the federal minimum wage determinations. This includes helper, or other classifications based on hours of experience, or any other classification not appearing in the federal wage determinations. Where federal wage determinations do not contain the State wage rate determination otherwise available for use by the Contractor and subcontractors, the Contractor and subcontractors must not pay less than the federal minimum wage rate that most closely approximates the duties of the employees in question.

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

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

D04

## BID ITEM LIST

| Item No. | Item Code | Item Description | Unit of Measure | Estimated Quantity |
|---|---|---|---|---|
| 1 | 070030 | LEAD COMPLIANCE PLAN | LS | LUMP SUM |
| 2 | 080050 | PROGRESS SCHEDULE (CRITICAL PATH METHOD) | LS | LUMP SUM |
| 3 | 090105 | TIME-RELATED OVERHEAD (LS) | LS | LUMP SUM |
| 4 | 120090 | CONSTRUCTION AREA SIGNS | LS | LUMP SUM |
| 5 | 120100 | TRAFFIC CONTROL SYSTEM | LS | LUMP SUM |
| 6 | 120120 | TYPE III BARRICADE | EA | 6 |
| 7 | 120149 | TEMPORARY PAVEMENT MARKING (PAINT) | SQFT | 610 |
| 8 | 120159 | TEMPORARY TRAFFIC STRIPE (PAINT) | LF | 36,000 |
| 9 | 120165 | CHANNELIZER (SURFACE MOUNTED) | EA | 30 |
| 10 | 120300 | TEMPORARY PAVEMENT MARKER | EA | 810 |
| 11 | 128652 | PORTABLE CHANGEABLE MESSAGE SIGN (LS) | LS | LUMP SUM |
| 12 | 129000 | TEMPORARY RAILING (TYPE K) | LF | 18,100 |
| 13 | 129100 | TEMPORARY CRASH CUSHION MODULE | EA | 230 |
| 14 | 032403 | TEMPORARY ALTERNATIVE CRASH CUSHION | EA | 25 |
| 15 | 130100 | JOB SITE MANAGEMENT | LS | LUMP SUM |
| 16 | 130300 | PREPARE STORM WATER POLLUTION PREVENTION PLAN | LS | LUMP SUM |
| 17 | 130310 | RAIN EVENT ACTION PLAN | EA | 71 |
| 18 | 130320 | STORM WATER SAMPLING AND ANALYSIS DAY | EA | 46 |
| 19 | 130330 | STORM WATER ANNUAL REPORT | EA | 2 |
| 20 | 032404 | TEMPORARY DEWATERING AND NON-STORMWATER DISCHARGE CONTROL SYSTEM | LS | LUMP SUM |

| Item No. | Item Code | Item Description | Unit of Measure | Estimated Quantity |
|---|---|---|---|---|
| 21 | 130530 | TEMPORARY HYDRAULIC MULCH (BONDED FIBER MATRIX) | SQYD | 38,000 |
| 22 | 130570 | TEMPORARY COVER | SQYD | 2,000 |
| 23 | 130620 | TEMPORARY DRAINAGE INLET PROTECTION | EA | 36 |
| 24 | 130640 | TEMPORARY FIBER ROLL | LF | 11,000 |
| 25 | 130680 | TEMPORARY SILT FENCE | LF | 2,000 |
| 26 | 130710 | TEMPORARY CONSTRUCTION ENTRANCE | EA | 4 |
| 27 | 130730 | STREET SWEEPING | LS | LUMP SUM |
| 28 | 130900 | TEMPORARY CONCRETE WASHOUT | LS | LUMP SUM |
| 29 | 141000 | TEMPORARY FENCE (TYPE ESA) | LF | 3,060 |
| 30 | 141103 | REMOVE YELLOW THERMOPLASTIC TRAFFIC STRIPE (HAZARDOUS WASTE) | LF | 13,800 |
| 31 | 150685 | REMOVE IRRIGATION FACILITY | LS | LUMP SUM |
| 32 | 150711 | REMOVE PAINTED TRAFFIC STRIPE | LF | 36,000 |
| 33 | 150712 | REMOVE PAINTED PAVEMENT MARKING | SQFT | 610 |
| 34 | 150714 | REMOVE THERMOPLASTIC TRAFFIC STRIPE | LF | 18,900 |
| 35 | 150715 | REMOVE THERMOPLASTIC PAVEMENT MARKING | SQFT | 1,000 |
| 36 | 150722 | REMOVE PAVEMENT MARKER | EA | 2,100 |
| 37 | 150742 | REMOVE ROADSIDE SIGN | EA | 66 |
| 38 | 150755 | REMOVE SIGN STRUCTURE WALKWAY (EA) | EA | 3 |
| 39 | 150757 | REMOVE SIGN STRUCTURE (EA) | EA | 1 |
| 40 | 150761 | REMOVE SIGN PANEL AND REMOVABLE SIGN PANEL FRAME | EA | 3 |

| Item No. | Item Code | Item Description | Unit of Measure | Estimated Quantity |
|---|---|---|---|---|
| 41 | 150809 | REMOVE CULVERT (LF) | LF | 670 |
| 42 | 150820 | REMOVE INLET | EA | 13 |
| 43 | 150853 | REMOVE CONCRETE PAVEMENT (SQYD) | SQYD | 630 |
| 44 | 152391 | RELOCATE ROADSIDE SIGN (METAL POST) | EA | 1 |
| 45 | 152609 | MODIFY INLET TO MANHOLE | EA | 3 |
| 46 | 153103 | COLD PLANE ASPHALT CONCRETE PAVEMENT | SQYD | 13,700 |
| 47 | 153123 | REMOVE CONCRETE (SQYD) | SQYD | 920 |
| 48 | 153140 | REMOVE CONCRETE SIDEWALK (SQYD) | SQYD | 890 |
| 49 | 153141 | REMOVE CONCRETE ISLAND (PORTIONS) (SQYD) | SQYD | 650 |
| 50 | 153215 | REMOVE CONCRETE (CURB AND GUTTER) | LF | 11,500 |
| 51 | 160102 | CLEARING AND GRUBBING (LS) | LS | LUMP SUM |
| 52 | 190101 | ROADWAY EXCAVATION | CY | 10,300 |
| 53 | 190105 | ROADWAY EXCAVATION (TYPE Z-2) (AERIALLY DEPOSITED LEAD) | CY | 2,630 |
| 54(F) | 192037 | STRUCTURE EXCAVATION (RETAINING WALL) | CY | 3,880 |
| 55 | 192502 | SAND BEDDING | CY | 4 |
| 56(F) | 193013 | STRUCTURE BACKFILL (RETAINING WALL) | CY | 4,506 |
| 57(F) | 193031 | PERVIOUS BACKFILL MATERIAL (RETAINING WALL) | CY | 340 |
| 58 | 194001 | DITCH EXCAVATION | CY | 140 |
| 59 | 198010 | IMPORTED BORROW (CY) | CY | 8,240 |
| 60 | 200002 | ROADSIDE CLEARING | LS | LUMP SUM |

| Item No. | Item Code | Item Description | Unit of Measure | Estimated Quantity |
|---|---|---|---|---|
| 61 | 202027 | RELOCATE WATER METER | EA | 3 |
| 62 | 204096 | MAINTAIN EXISTING PLANTED AREAS | LS | LUMP SUM |
| 63 | 205034 | DECOMPOSED GRANITE | SQFT | 310 |
| 64 | 206005 | EDGING | LF | 160 |
| 65 | 206761 | 24-32 STATION IRRIGATION CONTROLLER (PEDESTAL MOUNTED) | EA | 2 |
| 66 | 208426 | 2" BACKFLOW PREVENTER ASSEMBLY | EA | 4 |
| 67 | 208440 | BACKFLOW PREVENTER ENCLOSURE | EA | 4 |
| 68 | 208598 | 2" PLASTIC PIPE (SCHEDULE 40) (SUPPLY LINE) | LF | 40 |
| 69 | 208601 | 4" PLASTIC PIPE (SCHEDULE 40) (SUPPLY LINE) | LF | 520 |
| 70 | 208738 | 8" CORRUGATED HIGH DENSITY POLYETHYLENE PIPE CONDUIT | LF | 390 |
| 71 | 210270 | ROLLED EROSION CONTROL PRODUCT (NETTING) | SQFT | 88,700 |
| 72 | 210300 | HYDROMULCH | SQFT | 339,000 |
| 73 | 210350 | FIBER ROLLS | LF | 6,370 |
| 74 | 210360 | COMPOST SOCK | LF | 530 |
| 75 | 210430 | HYDROSEED | SQFT | 339,000 |
| 76 | 210600 | COMPOST | SQFT | 339,000 |
| 77 | 210630 | INCORPORATE MATERIALS | SQFT | 84,600 |
| 78 | 260203 | CLASS 2 AGGREGATE BASE (CY) | CY | 360 |
| 79 | 390132 | HOT MIX ASPHALT (TYPE A) | TON | 15,600 |
| 80 | 390137 | RUBBERIZED HOT MIX ASPHALT (GAP GRADED) | TON | 3,730 |

| Item No. | Item Code | Item Description | Unit of Measure | Estimated Quantity |
|---|---|---|---|---|
| 81 | 394073 | PLACE HOT MIX ASPHALT DIKE (TYPE A) | LF | 4,830 |
| 82 | 394074 | PLACE HOT MIX ASPHALT DIKE (TYPE C) | LF | 510 |
| 83 | 394077 | PLACE HOT MIX ASPHALT DIKE (TYPE F) | LF | 1,490 |
| 84 | 394090 | PLACE HOT MIX ASPHALT (MISCELLANEOUS AREA) | SQYD | 9 |
| 85 | 397005 | TACK COAT | TON | 70 |
| 86 | 401055 | JOINTED PLAIN CONCRETE PAVEMENT (RSC) | CY | 130 |
| 87 | 490601 | 16" CAST-IN-DRILLED-HOLE CONCRETE PILING | LF | 2,220 |
| 88 | 490603 | 24" CAST-IN-DRILLED-HOLE CONCRETE PILING | LF | 12,135 |
| 89 | 498044 | 36" CAST-IN-DRILLED-HOLE CONCRETE PILE (SIGN FOUNDATION) | LF | 26 |
| 90 | 498052 | 60" CAST-IN-DRILLED-HOLE CONCRETE PILE (SIGN FOUNDATION) | LF | 25 |
| 91(F) | 510060 | STRUCTURAL CONCRETE, RETAINING WALL | CY | 1,430 |
| 92(F) | 510502 | MINOR CONCRETE (MINOR STRUCTURE) | CY | 50 |
| 93(F) | 511064 | FRACTURED RIB TEXTURE | SQFT | 13,635 |
| 94(F) | 520101 | BAR REINFORCING STEEL | LB | 14,400 |
| 95(F) | 520103 | BAR REINFORCING STEEL (RETAINING WALL) | LB | 565,200 |
| 96(F) | 520120 | HEADED BAR REINFORCEMENT | EA | 1,950 |
| 97(F) | 560213 | FURNISH SIGN STRUCTURE (LIGHTWEIGHT) | LB | 13,300 |
| 98(F) | 560214 | INSTALL SIGN STRUCTURE (LIGHTWEIGHT) | LB | 13,300 |
| 99 | 560218 | FURNISH SIGN STRUCTURE (TRUSS) | LB | 19,600 |
| 100(F) | 560219 | INSTALL SIGN STRUCTURE (TRUSS) | LB | 19,600 |

| Item No. | Item Code | Item Description | Unit of Measure | Estimated Quantity |
|---|---|---|---|---|
| 101(F) | 560223 | FURNISH SIGN STRUCTURE (BRIDGE MOUNTED WITHOUT WALKWAY) | LB | 1,770 |
| 102(F) | 560224 | INSTALL SIGN STRUCTURE (BRIDGE MOUNTED WITHOUT WALKWAY) | LB | 1,770 |
| 103(F) | 560233 | FURNISH FORMED PANEL SIGN (OVERHEAD) | SQFT | 840 |
| 104(F) | 560244 | FURNISH LAMINATED PANEL SIGN (1"-TYPE A) | SQFT | 330 |
| 105 | 560248 | FURNISH SINGLE SHEET ALUMINUM SIGN (0.063"-UNFRAMED) | SQFT | 340 |
| 106 | 560249 | FURNISH SINGLE SHEET ALUMINUM SIGN (0.080"-UNFRAMED) | SQFT | 500 |
| 107 | 560251 | FURNISH SINGLE SHEET ALUMINUM SIGN (0.063"-FRAMED) | SQFT | 45 |
| 108 | 560252 | FURNISH SINGLE SHEET ALUMINUM SIGN (0.080"-FRAMED) | SQFT | 310 |
| 109 | 566011 | ROADSIDE SIGN - ONE POST | EA | 46 |
| 110 | 566012 | ROADSIDE SIGN - TWO POST | EA | 6 |
| 111 | 568001 | INSTALL SIGN (STRAP AND SADDLE BRACKET METHOD) | EA | 3 |
| 112 | 568007 | INSTALL SIGN OVERLAY | SQFT | 36 |
| 113 | 568016 | INSTALL SIGN PANEL ON EXISTING FRAME | SQFT | 570 |
| 114 | 568023 | INSTALL ROADSIDE SIGN (LAMINATED WOOD BOX POST) | EA | 2 |
| 115(F) | 582001 | SOUND WALL (MASONRY BLOCK) | SQFT | 5,972 |
| 116(F) | 598001 | ANTI-GRAFFITI COATING | SQFT | 19,607 |
| 117 | 623001 | 12" TEMPORARY CULVERT | LF | 52 |
| 118 | 650012 | 15" REINFORCED CONCRETE PIPE | LF | 600 |
| 119 | 650014 | 18" REINFORCED CONCRETE PIPE | LF | 810 |
| 120 | 650018 | 24" REINFORCED CONCRETE PIPE | LF | 36 |

| Item No. | Item Code | Item Description | Unit of Measure | Estimated Quantity |
|---|---|---|---|---|
| 121 | 650022 | 30" REINFORCED CONCRETE PIPE | LF | 110 |
| 122(F) | 721019 | ROCK SLOPE PROTECTION (NO. 3, METHOD B) (CY) | CY | 2 |
| 123 | 721420 | CONCRETE (DITCH LINING) | CY | 8 |
| 124 | 729011 | ROCK SLOPE PROTECTION FABRIC (CLASS 8) | SQYD | 6 |
| 125 | 730070 | DETECTABLE WARNING SURFACE | SQFT | 160 |
| 126 | 731502 | MINOR CONCRETE (MISCELLANEOUS CONSTRUCTION) | CY | 8 |
| 127 | 731504 | MINOR CONCRETE (CURB AND GUTTER) | CY | 120 |
| 128 | 731511 | MINOR CONCRETE (ISLAND PAVING) | CY | 20 |
| 129 | 731518 | MINOR CONCRETE (BRUSHED CONCRETE) | SQFT | 7,330 |
| 130 | 731521 | MINOR CONCRETE (SIDEWALK) | CY | 240 |
| 131 | 731623 | MINOR CONCRETE (CURB RAMP) | CY | 8 |
| 132 | 032405 | INTERLOCKING CONCRETE PAVERS | SQFT | 610 |
| 133(F) | 750001 | MISCELLANEOUS IRON AND STEEL | LB | 9,730 |
| 134 | 750010 | MANHOLE FRAME AND COVER | EA | 5 |
| 135 | 032406 | LIGHTING (CITY STREET - EL CAMINO) | LS | LUMP SUM |
| 136 | 800103 | TEMPORARY FENCE (TYPE CL-6) | LF | 1,450 |
| 137 | 832005 | MIDWEST GUARDRAIL SYSTEM | LF | 1,550 |
| 138 | 839543 | TRANSITION RAILING (TYPE WB-31) | EA | 4 |
| 139 | 839581 | END ANCHOR ASSEMBLY (TYPE SFT) | EA | 5 |
| 140 | 839584 | ALTERNATIVE IN-LINE TERMINAL SYSTEM | EA | 2 |

| Item No. | Item Code | Item Description | Unit of Measure | Estimated Quantity |
|---|---|---|---|---|
| 141 | 839585 | ALTERNATIVE FLARED TERMINAL SYSTEM | EA | 5 |
| 142 | 032407 | SMART CRASH CUSHION (SCI 70-GM) | EA | 2 |
| 143 | 839701 | CONCRETE BARRIER (TYPE 60) | LF | 170 |
| 144 | 839703 | CONCRETE BARRIER (TYPE 60C) | LF | 500 |
| 145 | 032408 | CONCRETE BARRIER (TYPE 60R) | LF | 190 |
| 146(F) | 839726 | CONCRETE BARRIER (TYPE 736A) | LF | 763 |
| 147(F) | 032409 | CONCRETE BARRIER (TYPE 736S MODIFIED) | LF | 360 |
| 148(F) | 045615 | CONCRETE BARRIER (TYPE 736SV MODIFIED) | LF | 477 |
| 149 | 840504 | 4" THERMOPLASTIC TRAFFIC STRIPE | LF | 34,800 |
| 150 | 840505 | 6" THERMOPLASTIC TRAFFIC STRIPE | LF | 1,270 |
| 151 | 840506 | 8" THERMOPLASTIC TRAFFIC STRIPE | LF | 3,610 |
| 152 | 840507 | 6" THERMOPLASTIC TRAFFIC STRIPE (BROKEN 8-4) | LF | 1,400 |
| 153 | 840508 | 8" THERMOPLASTIC TRAFFIC STRIPE (BROKEN 12-3) | LF | 960 |
| 154 | 840515 | THERMOPLASTIC PAVEMENT MARKING | SQFT | 2,900 |
| 155 | 032410 | GREEN COLOR SURFACE MARKING | SQFT | 2,390 |
| 156 | 840526 | 4" THERMOPLASTIC TRAFFIC STRIPE (BROKEN 17-7) | LF | 1,000 |
| 157 | 850101 | PAVEMENT MARKER (NON-REFLECTIVE) | EA | 400 |
| 158 | 850111 | PAVEMENT MARKER (RETROREFLECTIVE) | EA | 980 |
| 159 | 860090 | MAINTAINING EXISTING TRAFFIC MANAGEMENT SYSTEM ELEMENTS DURING CONSTRUCTION | LS | LUMP SUM |
| 160 | 032412 | SIGNAL AND LIGHTING (LOCATION 1) | LS | LUMP SUM |

| Item No. | Item Code | Item Description | Unit of Measure | Estimated Quantity |
|---|---|---|---|---|
| 161 | 032413 | SIGNAL AND LIGHTING (LOCATION 2) | LS | LUMP SUM |
| 162 | 032411 | SIGNAL AND LIGHTING (STAGE CONSTRUCTION) | LS | LUMP SUM |
| 163 | 032414 | LIGHTING | LS | LUMP SUM |
| 164 | 860402 | LIGHTING (CITY STREET) | LS | LUMP SUM |
| 165 | 032415 | LIGHTING (STAGE CONSTRUCTION) | LS | LUMP SUM |
| 166 | 861100 | RAMP METERING SYSTEM | LS | LUMP SUM |
| 167 | 999990 | MOBILIZATION | LS | LUMP SUM |

# SPECIAL PROVISIONS

## ORGANIZATION

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

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

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

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## DIVISION I GENERAL PROVISIONS

### 1 GENERAL

**Add to section 1-1.01:**

| Item code | Item description | Applicable section |
|---|---|---|
| 032403 | TEMPORARY CRASH CUSHION (ABSORB 350 TL2) | 12 |
| 032404 | TEMPORARY DEWATERING AND NON-STORMWATER DISCHARGE CONTROL SYSTEM | 13 |
| 032405 | INTERLOCKING CONCRETE PAVERS | 73 |
| 032406 | LIGHTING (CITY STREET - EL CAMINO) | 77 |
| 032407 | SMART CRASH CUSHION (SCI 70GM) | 83 |
| 032408 | CONCRETE BARRIER (TYPE 60R) | 83 |
| 032409 | CONCRETE BARRIER (TYPE 736S MODIFIED) | 83 |
| 045615 | CONCRETE BARRIER (TYPE 736SV MODIFIED) | 83 |
| 032410 | GREEN COLOR SURFACE MARKING | 84 |
| 032412 | SIGNAL AND LIGHTING (LOCATION 1) | 86 |
| 032413 | SIGNAL AND LIGHTING (LOCATION 2) | 86 |
| 032411 | SIGNAL AND LIGHTING (STAGE CONSTRUCTION) | 86 |
| 032414 | LIGHTING | 86 |
| 032415 | LIGHTING (STAGE CONSTRUCTION) | 86 |

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### 2 BIDDING

**Add between the 1st and 2nd paragraphs of section 2-1.06B:**

The Department makes the following supplemental project information available:

**Supplemental Project Information**

| Means | Description |
|---|---|
| Included in the *Information Handout* | Foundation Recommendations, Calif. Dept. of Transportation, July 14, 2015<br><br>Material Recommendation for Temporary Pavement, May 13, 2015<br><br>Water Source: CalWater<br>Water Quality Information Handout<br><br>Preliminary Site Investigation Report, SR-82/SR-92 Interchange Modifications, San Mateo, California |
| | |
| Included with the project plans | Logs of Test Borings |

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# 5 CONTROL OF WORK

**Add before the 1st paragraph of section 5-1.20B(4):**

Arsenic is present in earth material on the job site. The material on the job site:

1. Is not a hazardous waste
2. Does not require disposal at a permitted landfill or solid waste disposal facility

The following concentrations of the naturally occurring arsenic are detected on the job site:

**Arsenic Concentrations**

| Minimum (mg/kg) | Maximum (mg/kg) | Average (mg/kg) |
|---|---|---|
| 2.4 | 5.5 | 4.2 |

The arsenic concentrations exceed the San Francisco Bay RWQCB's environmental screening levels for residential and commercial land uses, but are consistent with the background concentrations reported for the San Francisco Bay Area.

Disclose the arsenic concentration of the material to the receiving property owner. You are responsible for any additional sampling and analysis required by the receiving property owner.

**Add to the list in the 1st paragraph of section 5-1.20B(4):**

1.3. Containing acknowledgment of arsenic concentration disclosure

**Add to section 5-1.20C:**

This project does not include work on the railroad property, but a railroad is shown on the general plan sheet within the project limits. Do not trespass on the railroad property located within the project limits.

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# 6 CONTROL OF MATERIALS

**Add to section 6-2.03:**

The Department furnishes you with:

- Model 2070 controller assemblies, including controller unit, completely wired controller cabinet, and detector sensor units
- Components of battery backup system as follows:
  - Inverter/charger unit
  - Power transfer relay
  - Manually-operated bypass switch
  - Battery harness
  - Utility interconnect wires
  - Battery temperature probe
  - Relay contact wires
- CCTV wireless communication equipment

The Department furnishes you with completely wired controller cabinets with auxiliary equipment but without controller unit at Caltrans Maintenance Station, 30 Rickard Street, San Francisco, CA 94134, Tel (415) 330-6500. At least 48 hours before you pick up the materials, inform the Engineer of what you will pick up and when you will pick it up.

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# 7 LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC

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# 8 PROSECUTION AND PROGRESS

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

Section 8-1.04B does not apply.

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

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

1. CPM baseline schedule
2. SWPPP
3. Notification of DRA or DRB nominee and disclosure statement

If the submittals for Contractor-supplied biologist and biological resource information program are authorized, you may enter the job site only to measure controlling field dimensions and locate utilities.

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

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

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

3. Written statement from the vendor that the order for electrical material has been received and accepted by the vendor. The statement must show the dates that the materials will be shipped.
4. Written statement from the vendor that the order for structural steel has been received and accepted by the vendor. The statement must show the dates that the materials will be shipped.

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

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

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

**Add to section 8-1.10A:**

Damages additional to those specified in section 8-1.10 are $ 3000 per day starting on the 1st day after expiration of the number of working days bid until work requiring lane or shoulder closures on Route 92 is complete.

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Before starting the traffic signal functional test at any location, all items of work related to signal control must be completed and all roadside signs, pavement delineation, and pavement markings must be in place at that location.

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# 12 TEMPORARY TRAFFIC CONTROL

**Replace section 12-2 with:**

## 12-2 CONSTRUCTION PROJECT FUNDING SIGNS

### 12-2.01 GENERAL

Section 12-2 includes specifications for installing construction project funding signs.

Construction project funding signs must comply with the details shown on the Department's Traffic Operations Web site.

Keep construction project funding signs clean and in good repair at all times.

### 12-2.02 MATERIALS

Construction project funding signs must be wood post signs complying with section 56-4.

Sign panels for construction project funding signs must be framed, single sheet aluminum panels complying with section 56-2.

The background on construction project funding signs must be Type II retroreflective sheeting on the Authorized Material List for signing and delineation materials.

The legend must be retroreflective, except for nonreflective black letters and numerals. The colors blue and orange must comply with PR Color no. 3 and no. 6, respectively, as specified in the Federal Highway Administration's *Color Tolerance Chart*.

The legend for the type of project on construction project funding signs must read as follows:

HIGHWAY IMPROVEMENT

The legend for the types of funding on construction project funding signs must read as follows and in the following order:

FEDERAL HIGHWAY TRUST FUNDS

STATE HIGHWAY FUNDS

SAN MATEO COUNTY TRANSPORTATION FUNDS

The Engineer will provide the year of completion for the legend on construction project funding signs. Furnish and install a sign overlay for the year of completion within 10 working days of notification.

The legend for the year of completion on construction project funding signs must read as follows:

YEAR OF COMPLETION 2017

The size of the legend on construction project funding signs must be as described. Do not add any additional information unless authorized.

### 12-2.03 CONSTRUCTION

Install 2 Type 1 and 2 construction project funding signs at the locations designated by the Engineer before starting major work activities visible to highway users.

When authorized, remove and dispose of construction project funding signs upon completion of the project.

**12-2.04 PAYMENT**

Not Used

**Add to section 12-3.12C:**

Start displaying the message on the portable changeable message sign 45 minutes before closing the lane.

Place the portable changeable message sign in advance of the 1st warning sign for each:

1. Off-ramp closure
2. Connector closure

**Replace "Reserved" in section 12-3.13 with:**

**12-3.13A General**

**12-3.13A(1) Summary**

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

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

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

The impact attenuator vehicle must comply with the attenuator manufacturer's instructions for:

1. Support truck, except the weight of the support truck must comply with the allowable vehicle weight limits shown on the Authorized Materials List for highway safety features and the manufacturer's instructions
2. Trailer-mounted attenuator
3. Truck-mounted attenuator

Flashing arrow signs must comply with section 12-3.03 except you may use a portable changeable message sign instead of a flashing arrow sign. If a portable changeable message sign is used as a flashing arrow sign, it must comply with section 6F.61 "Arrow Panels" of the *California MUTCD*.

**12-3.13A(2) Definitions**

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

**12-3.13A(3) Submittals**

Submit a certificate of compliance for each attenuator used on the project.

**12-3.13A(4) Quality Control and Assurance**

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

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

**12-3.13B Materials**

Impact attenuator vehicles must be on the Authorized Materials List for highway safety features. Impact attenuator vehicles must comply with Veh Code Div 12.

Each attenuator must be individually identified with the manufacturer's name, address, attenuator model number, and a specific serial number. The name and number must be a minimum 1/2 inch high and located on the left, street side, lower front corner. Do not use an attenuator that is damaged or appears to be in poor condition until it is recertified by the manufacturer. The Engineer determines if a used attenuator supplied under this Contract needs to be recertified. Each unit must be certified by the manufacturer to comply with the requirements for an attenuator under the standards established by the Department's Division of Research, Innovation and System Information.

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

Each impact attenuator vehicle must have:

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

**12-3.13C Construction**

Do not start impact attenuator vehicle activities until authorized.

Except where prohibited, use an impact attenuator vehicle:

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

Monitor placement and use of the attenuator vehicle on a regular basis and adjust the use of the attenuator to match changing field conditions as construction progresses.

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

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

Do not use a damaged attenuator. Replace any attenuator damaged from an impact during work activities.

**12-3.13D Payment**

Not Used

**Replace section 12-3.20 of the RSS with:**

**12-3.20 TEMPORARY ALTERNATIVE CRASH CUSHION**

**12-3.20A General**

**12-3.20A(1) Summary**

Section 12-3.20 includes specifications for installing, maintaining, and removing temporary alternative crash cushion.

**12-3.20A(2) Submittals**

Submit, as informational submittals, a copy of the following for each type of temporary alternative crash cushion installed:

1. Manufacturer's plan and parts list.

2. Manufacturer's certificate of compliance.
3. Manufacturer's Installation Instructions

### 12-3.20B Materials

#### 12-3.20B(1) General

Temporary alternative crash cushion must be 1 or more of the following:

1. N-E-A-T SYSTEM
2. ABSORB 350
3. SENTRY LONGITUDINAL ENERGY DISSIPATER END TREATMENT or SLED

#### 12-3.20B(2) N-E-A-T SYSTEM

N-E-A-T system TL-2 must be as manufactured by Energy Absorption Systems, Inc.

You may obtain the N-E-A-T System from:

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

#### 12-3.20B(3) ABSORB 350

ABSORB 350 must be a non-redirective, gating type, ABSORB 350 TL-2 (5 Element), as manufactured by Barrier Systems, Inc.

You may obtain ABSORB 350 from:

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

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

#### 12-3.20B(4) SENTRY LONGITUDINAL ENERGY DISSIPATER END TREATMENT (SLED)

SLED System TL-2 must be as manufactured by:

TRAFFIX DEVICES, INC.
160 AVENIDA LA PATA
SAN CLEMENTE, CA 92673
TELEPHONE: (949) 361-5663

You may obtain Quadguard CZ System and ACZ350 System from:

MANUFACTURER
TRAFFIX DEVICES, INC.
160 AVENIDA LA PATA
SAN CLEMENTE, CA 92673
TELEPHONE: (949) 361-5663

### 12-3.20C Construction

#### 12-3.20C(1) Installation

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

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

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

Install concrete anchorage devices to attach the alternative system to the asphalt concrete pad under the manufacturer’s installation instructions and limit the anchorage devices to those which have been determined satisfactory for such application by previous testing.

#### 12-3.20C(2) Maintenance

#### 12-3.20C(2)(a) General

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

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

#### 12-3.20C(2)(b) Temporary Alternative Crash Cushions Damaged by Your Operations

Immediately repair damaged temporary alternative crash at your expense. Replace at your expense temporary alternative crash cushions damaged beyond repair.

#### 12-3.20C(2)(c) Temporary Alternative Crash Cushions Damaged by Public Traffic

Immediately repair damaged temporary alternative crash cushions. Replace temporary alternative crash cushions damaged beyond repair.

### 12-3.20D Payment

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

Payment for repairing the temporary alternative crash cushion damaged by public traffic is change order work.

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

**Add to section 12-4.02A:**

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

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

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

The full width of the traveled way must be open to traffic when there are no active construction activities in the traveled way or within 6 feet of the traveled way and on:

1. Fridays after 3:00 p.m.
2. Saturdays
3. Sundays

4. Designated holidays
5. Special days

Designated holidays are shown in the following table:

**Designated Holidays**

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

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

The special days is the third Monday in January.

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

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

**Add to the RSS for section 12-4.03B:**

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

| Type of facility | Route | Direction or Segment | Period | Liquidated damages/interval ($) |
|---|---|---|---|---|
| Mainline | 92 | Partial Closure | 1st half hour<br>2nd half hour<br>2nd hour and beyond | $2,800 / 10 minutes<br>$4,200 / 10 minutes<br>$5,600 / 10 minutes |
| Connector | 92 / 82 | Full Closure | 1st half hour<br>2nd half hour<br>2nd hour and beyond | $1,000 / 10 minutes<br>$1000 / 10 minutes<br>$1000 / 10 minutes |

**Add to the RSS for section 12-4.03C:**

Submit a contingency plan for each of the following activities:

1. Rapid strength concrete
2. Cold planing AC
3. HMA paving

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

**Replace "Reserved" in section 12-4.04 with:**

**Lane Closure Restriction for Designated Holidays and Special Days**

| Thu | Fri | Sat | Sun | Mon | Tues | Wed | Thu | Fri | Sat | Sun |
|---|---|---|---|---|---|---|---|---|---|---|
| x | **H** xx | xx | xx | | | | | | | |
| | **SD** xx | | | | | | | | | |
| x | xx | **H** xx | xx | | | | | | | |
| | | **SD** xx | | | | | | | | |
| | x | xx | **H** xx | xx | | | | | | |
| | | | **SD** xx | | | | | | | |
| | x | xx | xx | **H** xx | xxx | | | | | |
| | x | xx | xx | **SD** xx | xxx | | | | | |
| | | | | x | **H** xx | | | | | |
| | | | | x | **SD** xx | | | | | |
| | | | | | x | **H** xx | | | | |
| | | | | | | **SD** xx | | | | |
| | | | | | | x | **H** xx | xx | xx | xx |
| | | | | | | | **SD** xx | | | |

Legend:

| | |
|---|---|
| | Refer to lane requirement charts |
| x | The full width of the traveled way must be open for use by traffic after 7 AM. |
| xx | The full width of the traveled way must be open for use by traffic. |
| xxx | The full width of the traveled way must be open for use by traffic until 7 PM. |
| **H** | Designated holiday |
| **SD** | Special day |

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

**Chart no. 1**
**Freeway Lane Requirements**

County: SM | Route/Direction: 92/EB | PM: R11.0/R11.5

Closure limits: At the Route 92/82 Interchange.

| Hour | 24 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mon-Thu | 1 | 1 | 1 | 1 | 1 | 1 | 2 | | | | | | | | | | | | | 2 | 2 | 2 | 1 | 1 | |
| Fri | 1 | 1 | 1 | 1 | 1 | 1 | 2 | | | | | | | | | | | | | 2 | 2 | 2 | 1 | 1 | |
| Sat | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | | | | | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | |
| Sun | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | |

Legend:

| | |
|---|---|
| 1 | Provide at least 1 through freeway lane open in direction of travel |
| 2 | Provide at least 2 adjacent through freeway lanes open in direction of travel |
| | Work allowed within the highway where shoulder or lane closure is not required |

REMARKS:

**Chart no. 2**
**Freeway Lane Requirements**

County: SM | Route/Direction: 92/WB | PM: R11.0/R11.5

Closure limits: At the Route 92/82 Interchange.

| Hour | 24 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mon-Thu | 1 | 1 | 1 | 1 | 1 | 1 | 2 | | | | | | | | | | | | | 2 | 2 | 2 | 1 | 1 | |
| Fri | 1 | 1 | 1 | 1 | 1 | 1 | 2 | | | | | | | | | | | | | 2 | 2 | 2 | 1 | 1 | |
| Sat | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | | | | | | | | | 2 | 2 | 2 | 2 | 1 | 1 | |
| Sun | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | |

Legend:

| | |
|---|---|
| 1 | Provide at least 1 through freeway lane open in direction of travel |
| 2 | Provide at least 2 adjacent through freeway lanes open in direction of travel |
| | Work allowed within the highway where shoulder or lane closure is not required |

REMARKS:

**Chart no. 3**
**Expressway Lane Requirements**

County: SM | Route/Direction: 82/NB | PM: 10.3/10.7

Closure limits: At the Route 92/82 Interchange.

| Hour | 24 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mon-Thu | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | | | 2 | 2 | 1 | 1 | 1 | |
| Fri | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | | | 2 | 2 | 1 | 1 | 1 | |
| Sat | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | |
| Sun | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | |

Legend:

| | |
|---|---|
| 1 | Provide at least 1 through freeway lane open in direction of travel |
| 2 | Provide at least 2 adjacent through freeway lanes open in direction of travel |
| | Work allowed within the highway where shoulder or lane closure is not required |

REMARKS:

**Chart no. 4**
**Expressway Lane Requirements**

County: SM | Route/Direction: 82/SB | PM: 10.3/10.7

Closure limits: At the Route 92/82 Interchange.

| Hour | 24 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mon-Thu | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | | | | 2 | 1 | 1 | 1 | 1 | |
| Fri | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | | | | | | 2 | 1 | 1 | 1 | 1 | |
| Sat | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | |
| Sun | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | |

Legend:

| | |
|---|---|
| 1 | Provide at least 1 through freeway lane open in direction of travel |
| 2 | Provide at least 2 adjacent through freeway lanes open in direction of travel |
| | Work allowed within the highway where shoulder or lane closure is not required |

REMARKS:

**Replace "Reserved" in section 12-4.05D with:**

**Chart no. 5**
**Complete Connector Closure Hours**

County: SM | Route/Direction: 92/EB | PM: R11.1

Closure limits: On the Connector Off-ramp to SB Route 82

| Hour | 24 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mon-Thu | C | C | C | C | C | C | | | | | C | C | C | C | C | | | | | C | C | C | C | C | |
| Fri | C | C | C | C | C | C | | | | | C | C | C | C | C | | | | | C | C | C | C | C | |
| Sat | C | C | C | C | C | C | C | C | C | C | | | | | | | | C | C | C | C | C | C | C | |
| Sun | C | C | C | C | C | C | C | C | C | C | C | | | | C | C | C | C | C | C | C | C | C | C | |

Legend:

| | |
|---|---|
| C | Connector may be closed completely |
| | Work allowed within the highway where shoulder or lane closure is not required |

REMARKS: See Detour #1.

**Chart no. 6**
**Complete Connector Closure Hours**

County: SM | Route/Direction: 92/EB | PM: R11.2

Closure limits: On the Connector On-ramp from SB Route 82

| Hour | 24 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mon-Thu | C | C | C | C | C | C | | | | | | | | | | | | | | | | | C | C | |
| Fri | C | C | C | C | C | C | | | | | | | | | | | | | | | | | C | C | |
| Sat | C | C | C | C | C | C | C | C | | | | | | | | | | | | | | | C | C | |
| Sun | C | C | C | C | C | C | C | C | C | | | | | | | | | | | | | C | C | C | |

Legend:

| | |
|---|---|
| C | Connector may be closed completely |
| | Work allowed within the highway where shoulder or lane closure is not required |

REMARKS: See Detour #2.

**Chart no. 7**
**Complete Connector Closure Hours**

County: SM | Route/Direction: 92/EB | PM: R11.3

Closure limits: On the Connector Off-ramp to NB Route 82

| Hour | 24 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mon-Thu | C | C | C | C | C | C | | | | | | | | | | | | | | | C | C | C | C | |
| Fri | C | C | C | C | C | C | | | | | | | | | | | | | | | C | C | C | C | |
| Sat | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | |
| Sun | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | |

Legend:

| | |
|---|---|
| C | Connector may be closed completely |
| | Work allowed within the highway where shoulder or lane closure is not required |

REMARKS: See Detour #3.

**Chart no. 8**
**Complete Connector Closure Hours**

County: SM | Route/Direction: 92/EB | PM: R11.3

Closure limits: On the Connector On-ramp from NB Route 82

| Hour | 24 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mon-Thu | C | C | C | C | C | C | | | | | | | | | | | | | | | C | C | C | C | |
| Fri | C | C | C | C | C | C | | | | | | | | | | | | | | | C | C | C | C | |
| Sat | C | C | C | C | C | C | C | C | C | C | | | | | | | | | C | C | C | C | C | C | |
| Sun | C | C | C | C | C | C | C | C | C | C | C | C | C | | | C | C | C | C | C | C | C | C | C | |

Legend:

| | |
|---|---|
| C | Connector may be closed completely |
| | Work allowed within the highway where shoulder or lane closure is not required |

REMARKS: See Detour #4.

**Chart no. 9**
**Complete Connector Closure Hours**

| County: SM | Route/Direction: 92/WB | PM: R11.1 |
|---|---|---|

Closure limits: On the Connector On-ramp from SB Route 82

| Hour | 24 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mon-Thu | C | C | C | C | C | C | | | | | | | | | | | | | | | C | C | C | C | |
| Fri | C | C | C | C | C | C | | | | | | | | | | | | | | | C | C | C | C | |
| Sat | C | C | C | C | C | C | C | C | C | C | | | | | C | C | C | C | C | C | C | C | C | C | |
| Sun | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | |

Legend:

| | |
|---|---|
| C | Connector may be closed completely |
| | Work allowed within the highway where shoulder or lane closure is not required |

REMARKS: See Detour #5.

**Chart no. 10**
**Complete Connector Closure Hours**

| County: SM | Route/Direction: 92/WB | PM: R11.2 |
|---|---|---|

Closure limits: On the Connector Off-ramp to SB Route 82

| Hour | 24 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mon-Thu | C | C | C | C | C | C | | | | | | | | | | | | | | | C | C | C | C | |
| Fri | C | C | C | C | C | C | | | | | | | | | | | | | | | C | C | C | C | |
| Sat | C | C | C | C | C | C | C | C | | | | | | | | | | | | | C | C | C | C | |
| Sun | C | C | C | C | C | C | C | C | C | | | | | | | | | | | C | C | C | C | C | |

Legend:

| | |
|---|---|
| C | Connector may be closed completely |
| | Work allowed within the highway where shoulder or lane closure is not required |

REMARKS: See Detour #6.

**Chart no. 11**
**Complete Connector Closure Hours**

| County: SM | Route/Direction: 92/WB | PM: R11.3 |
|---|---|---|

Closure limits: On the Connector On-ramp from NB Route 82

| Hour | 24 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mon-Thu | C | C | C | C | C | C | | | | | | | | | | | | | | C | C | C | C | C | |
| Fri | C | C | C | C | C | C | | | | | | | | | | | | | | C | C | C | C | C | |
| Sat | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | |
| Sun | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | |

Legend:

| | |
|---|---|
| C | Connector may be closed completely |
| | Work allowed within the highway where shoulder or lane closure is not required |

REMARKS: See Detour #7.

**Chart no. 12**
**Complete Connector Closure Hours**

| County: SM | Route/Direction: 92/WB | PM: R11.3 |
|---|---|---|

Closure limits: On the Connector Off-ramp to NB Route 82

| Hour | 24 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mon-Thu | C | C | C | C | C | C | | | | | | | | | | | | | | | | C | C | C | |
| Fri | C | C | C | C | C | C | | | | | | | | | | | | | | | | C | C | C | |
| Sat | C | C | C | C | C | C | C | C | C | | | | | | | | | | | C | C | C | C | C | |
| Sun | C | C | C | C | C | C | C | C | C | C | | | | | | | | | | C | C | C | C | C | |

Legend:

| | |
|---|---|
| C | Connector may be closed completely |
| | Work allowed within the highway where shoulder or lane closure is not required |

REMARKS: See Detour #8.

**Replace "Reserved" in section 12-5 with:**

**12-5.01 GENERAL**

Section 12-5 includes specifications for closing traffic lanes, ramps, or a combination with stationary lane closures on multilane highways.

A traffic control system for a closure includes the temporary traffic control devices described as part of the traffic control system. The temporary traffic control devices must comply with section 12-3.

### 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 at the end of each work period except for portable delineators placed along open trenches or excavation adjacent to the traveled way. You may store the components at selected central locations designated by the Engineer within the limits of the highway.

### 12-5.04 PAYMENT

A traffic control system for a lane closure is paid for as traffic control system.

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

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

**Replace section 12-8 with:**

## 12-8 TEMPORARY PAVEMENT DELINEATION

### 12-8.01 GENERAL

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

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

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

### 12-8.02 MATERIALS

#### 12-8.02A General

Not Used

#### 12-8.02B Temporary Lane Line and Centerline Delineation

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

### 12-8.02C Temporary Edge Line Delineation

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

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

### 12-8.02D Temporary Traffic Stripe Tape

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

### 12-8.02E Temporary Traffic Stripe Paint

Not Used

### 12-8.02F Temporary Pavement Marking Tape

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

### 12-8.02G Temporary Pavement Marking Paint

You may use one of the types of temporary removable pavement marking tape or permanent pavement marking tape on the Authorized Material List instead of temporary pavement marking paint.

### 12- 8.02H Temporary Pavement Markers

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

## 12-8.03 CONSTRUCTION

### 12-8.03A General

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

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

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

### 12-8.03B Temporary Lane line and Centerline Delineation

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

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

### 12-8.03C Temporary Edge Line Delineation

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

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

Channelizers used for temporary edge line delineation must be an orange surface-mounted type. Cement channelizer bases to the pavement under section 85 for cementing pavement markers to pavement except do not use epoxy adhesive to place channelizers on the top layer of the pavement. Channelizers must be one of the 36-inch, surface-mounted types on the Authorized Material List.

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

### 12-8.03D Temporary Traffic Stripe Tape

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

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

### 12-8.03E Temporary Traffic Stripe Paint

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

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

### 12-8.03F Temporary Pavement Marking Tape

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

### 12-8.03G Temporary Pavement Marking Paint

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

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

### 12- 8.03H Temporary Pavement Markers

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

You may use retroreflective pavement markers specified in section 85 instead of temporary pavement markers for long term day/night use, 180 days or less, except to simulate patterns of broken traffic stripe. Retroreflective pavement markers used for temporary pavement markers must comply with section 85,

except the waiting period before placing pavement markers on new HMA surfacing as specified in section 85-1.03 does not apply. Do not use epoxy adhesive to place pavement markers in areas where removal of the pavement markers is required.

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

**12-8.04 PAYMENT**

Not Used

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# 13 WATER POLLUTION CONTROL

**Replace section 13-12 with:**

## 13-12 TEMPORARY DEWATERING AND NON-STORM WATER DISCHARGE CONTROL SYSTEM

### 13-12.01 GENERAL

#### 13-12.01A Summary

Section 13-12 includes specifications for designing, installing, operating, monitoring, maintaining, and removing temporary dewatering and non-storm water discharge control system (TDNWCS) for the collection, conveyance, treatment and disposal of contaminated groundwater and accumulated stormwater from excavations or other areas requiring dewatering including impounded construction site water, water resulting from piling work, and stormwater combined with groundwater.

Design, installation, operation, and monitoring of a TDNWCS and monitoring and disposal of the treated effluent must comply with San Francisco Bay Regional Water Quality Control Board NPDES General Permit for Discharge or Reuse of Extracted and Treated Groundwater Resulting from the Cleanup of Groundwater Polluted by Volatile Organic Compounds, Fuel Leaks and Other Related Wastes (Order No. R2-2012-0012, NPDES No. CAG912002). You are responsible for all costs and requirements related to obtaining coverage under the Order No. R2-2012-0012.

Volatile organic compounds and petroleum hydrocarbon products were reported at concentrations exceeding their respective waste discharge requirements (WDRs) in groundwater collected at the job site. The site investigation report is listed in SSP 2-1.06B of the Supplemental Project Information and is included in the Water Quality Information Handout. The reported concentrations for these metals also exceeded the trigger values in Table 3 of the Order No. R2-2012-0012.

You may discharge into a publicly owned treatment works system instead of using a TDNWCS. If contaminated groundwater, stormwater, or both are discharged to a publicly owned treatment works, obtain a municipal batch discharge permit. You are responsible for all costs and requirements related to obtaining the municipal batch discharge permit and discharging the water.

#### 13-12.01B Submittals

##### 13-12.01B(1) Temporary Dewatering and Non-storm Water Discharge Control System Plan

Submit the TDNWCS plan at least 55 days prior to discharge activities:

1. Submit 3 copies of the TDNWCS plan. Allow 10 days for the Engineers' review. The Engineer provides comments and specifies the date when the review stopped if revisions are required.
2. Change and resubmit a revised TDNWCS plan within 5 days of receiving the Engineer's comments. The Engineer's review resumes when a complete TDNWCS plan has been resubmitted.
3. When the Engineer authorizes the TDNWCS plan, submit an electronic copy and 4 printed copies of the authorized TDNWCS plan.
4. Allow 30 days for the Engineer to submit the authorized TDNWCS plan to the RWQCB.
5. If the Engineer requests changes to the TDNWCS plan based on the RWQCB's comments, amend the TDNWCS plan within 5 business days.

The TDNWCS plan must include:

1. Title sheet.
2. Table of contents.
3. Certification and approval sheet described in the Department's *Storm Water Prevention Plan (SWPPP) and Water Pollution Control Plan (WPCP) Preparation Manual.*
4. Amendment log and format described in the Department's *Storm Water Prevention Plan (SWPPP) and Water Pollution Control Plan (WPCP) Preparation Manual.*
5. Description and schedule of the discharge activities.
6. Discharge alternatives, including:
   - 6.1. Dust control
   - 6.2. Percolation
   - 6.3. Storm sewers
   - 6.4. Surface waters
7. Treatment system description and components.
8. Anticipated flow rates.
9. Operation and maintenance manual for equipment.
10. Monitoring, sampling, and reporting plan, including quality assurance and quality control.
11. Health and safety plan.
12. Spill prevention plan.
13. Field-recorded data, visual inspection, calibration procedures, and examples of logs.
14. Measuring equipment descriptions.
15. Shop drawings showing:
    - 15.1. Section and plan views of stormwater effluent treatment systems
    - 15.2. Location of sampling points for water quality measurements
    - 15.3. Flow path and placement of pipes, hoses, pumps, holding tanks, and other equipment used to convey water
    - 15.4. General position of treatment components relative to excavations or other areas requiring dewatering
    - 15.5. Point of stormwater discharge
16. Daily inspection report form. The daily inspection report must include:
    - 16.1. Discharge volumes
    - 16.2. Water quality monitoring records
    - 16.3. Discharge point information that includes:
      - 16.3.1. Date and time
      - 16.3.2. Weather conditions, including wind direction and velocity
      - 16.3.3. Presence or absence of water fowl or aquatic wildlife
      - 16.3.4. Color and clarity of the effluent discharge
      - 16.3.5. Erosion or ponding downstream of the discharge site
      - 16.3.6. Photographs labeled with the time, date, and location
17. Municipal batch discharge permit from a publicly owned treatment works if required.
18. Coagulant pollution prevention plan with the TDNWCS plan if you use chemical coagulants, in-line flocculants, or both, in the treatment system. Chemical coagulants and flocculants proposed for use in TDNWCS must comply with all provisions under "Active Treatment System (TDNWCS) Requirements" within Attachment F Provisions D and E, in the NPDES *General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities (Order No. 2009-0009-DWQ, NPDES No. CAS000002).*The coagulant prevention work plan must include:
    - 18.1. Description of BMPs to prevent accidental spillage, overfeeding into the treatment system, or other mishandling of coagulant agents
    - 18.2. Monitoring plan for all coagulants, flocculants, or both
    - 18.3. Description of the agents, including chemical and trade names
    - 18.4. Determination of acute and chronic toxicity for aquatic organisms conforming to EPA methods for the agents
    - 18.5. Monitoring plan to detect a residual agent at concentrations at or below established acute toxicity levels for freshwater and marine conditions for that agent

**13-12.01B (2) Notice of Discharge Report**

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

1. Submit the notice of discharge within 48 hours after exceeding the limits

2. Document the reasons for exceeding the water quality standard and any corrective work performed to prevent a recurrence in the notice of discharge

### 13-12.01B(3) Other Active Treatment System Submittals

If the TDNWCS discharges treated effluent, submit a daily inspection report within 24 hours.

Submit records of delivery and removal of TDNWCS components.

### 13-12.01C Quality Control and Assurance

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

Discharges from a TDNWCS must comply to Order No. R2-2012-0012 and other applicable permits.

## 13-12.02 MATERIALS

### 13-12.02A General

Design and implement a system for the site conditions and anticipated flow rate.

System must include:

1. Treatment system
2. Collection and conveyance system
3. Temporary holding tanks
4. Sampling methods
5. Discharge methods

### 13-12.02B Treatment System

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

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

### 13-12.02C Collection and Conveyance System

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

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

### 13-12.02D Temporary Holding Tank System

Store water pumped during dewatering activities that is not diverted to other in temporary holding tanks placed at the work area for treatment.

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

1. Anticipated flow rate
2. Pumping rates
3. Capacity inefficiencies due to sediment retention within the holding tanks
4. Sediment settling rates

5. Sediment removal frequency
6. Anticipated water loss or reuse rates

Temporary holding tanks must have holding capacity sufficient to handle the water removed from dewatering activities and to prevent delay of work.

Each temporary holding tank must have an inlet and outlet capable of receiving and discharging flows at a sufficient rate to handle the water removed from dewatering activities.

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

### 13-12.02E Discharge Method

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

Discharge treated water:

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

## 13-12.03 CONSTRUCTION

### 13-12.03A General

Water quality must comply with limits for discharge effluents and the receiving waters. Whenever observations or measurements under section 13-12.03B determine the water quality limits are exceeded:

1. Stop the discharge immediately
2. Notify the Engineer
3. Start corrective measures to change, repair, or replace the equipment and procedures used to treat the water

After the Engineer inspects and authorizes your corrective measures, resume treatment and discharge activities under the startup-phase sampling requirements before resuming regular-phase sampling.

Maintain the TDNWCS to provide required function and prevent leaks. Whenever a component of the system is not functioning properly, discontinue treatment activities and repair or replace the component.

Sediments removed from uncontaminated areas during maintenance of the treatment system must be dried, distributed uniformly, and stabilized at a location within the project limits where authorized.

Relocate the TDNWCS as needed.

### 13-12.03B Monitoring

#### 13-12.03B(1) General

Comply with the manufacturer's instructions for all calibrations of the flow meter. Perform calibrations in the presence of the Engineer.

While the system in operation, monitor in conformance with the Monitoring and Reporting Program included in Attachment E of the Order R2-2012-0012 for discharging treated water.

Monitoring equipment for the TDNWCS must record data at least once every 15 minutes. Cumulative flow data must be recorded daily. The recording system must have the capacity to record a minimum of 7 days of continuous data.

Monitoring equipment must be interfaced with the control system of the TDNWCS to provide shutoff or recirculation whenever effluent readings exceed limits for applicable constituents. The control system must default to recirculation or shutoff during a power failure or other catastrophic event.

The control system must control the dose of the coagulant, flocculent, or both to prevent overdosing.

Comply with the manufacturer's instructions for the use and calibration of meters and devices for taking water quality measurements. Perform calibrations in the presence of the Engineer.

You may discharge into a publicly owned treatment works (POTW) system instead of using a dewatering and non-storm water discharge system. If contaminated groundwater, storm water, or both are discharged to a POTW, obtain a municipal batch discharge permit. You are responsible for all costs and requirements related to obtaining the municipal batch discharge permit and discharging the water.

**13-12.03B(2) Flow Rate Monitoring**

A flow meter that has been approved by the Engineer for exclusive use in dewatering during construction must be used to measure all excavation discharges. All calibrations must be done in conformance with the manufacturer's instructions in the presence of the Engineer.

Record the flow-meter totalize readings and compute average daily volumes for every day that dewatering is performed.

**13-12.03C Inspection**

Perform compliance monitoring in conformance with the Monitoring and Reporting Program (MRP) included in Attachment E of the Order No. R2-2012-0012 for discharging treated water. If a batch discharge permit is obtained from a POTW, comply with the provisions contained in the batch discharge permit including all monitoring and reporting requirements.

While TDNWCS is being operated, document the results in a Daily Inspection Report (DIR). The DIR form must include the discharge volume records and water quality monitoring records. In developing the DIR, refer to the Department's Dewatering Guide. The DIR form must be approved by the Engineer before use. The DIR must be provided weekly or as directed to the Engineer.

All information and recorded data collected or submitted as part of the DIR must be certified as true and accurate and signed by those who gather the information.

**13-12.03C(1) Visual Inspection**

During each day of discharge, perform daily inspection of the effluent at the discharge site and include, in the DIR, observations of:

1. Date and Time
2. Weather conditions
3. Wind direction and velocity
4. The presence or absence of water fowl or aquatic wildlife
5. The color and clarity of the effluent discharge
6. Erosion or ponding downstream of the discharge site

The DIR must include photographs of the discharge point and areas downstream of the discharge location. These photographs must be labeled with the time, date, and location.

**13-12.04 PAYMENT**

Not Used

**Add to section 13-3.01A:**

The project is risk level 2.

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## 14 ENVIRONMENTAL STEWARDSHIP

**Add to section 14-1.02A:**

An ESA exists on this project.

Before start of work, protect the ESA by installing Temporary Fence (Type ESA)

**Replace section 14-6.02 with:**

## 14-6.02 SPECIES PROTECTION

### 14-6.02A General

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

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

| Species Name |
|---|
| Non-game migratory birds (non-raptors) |
| Raptors and owls |

### 14-6.02B Material

Not Used

### 14-6.02C Construction

#### 14-6.02C(1) General

Not Used

#### 14-6.02C(2) Protective Radius

Upon discovery of a regulated species, stop construction activities within a 50-foot radius of the discovery or as defined in the table below. Immediately notify the Engineer. Do not resume activities until receiving notification from the Engineer.

| Regulated species name | Protective radius |
|---|---|
| Raptors and owls | 300 Feet |

#### 14-6.02C(3) Protocols

Not used

#### 14-6.02C(4) Biological Resource Information

Not used

#### 14-6.02C(5) Protection Measures

Within species protection area 1, implement the following protection measures:

1. Bird surveys are required for migratory and nongame birds during nesting period:
   1.1. Notify the Engineer 14 days before starting initial pruning, vegetation removal, or ground-disturbing work. A Department Biologist will perform an initial survey of the job site. Proceed with the work when authorized. This work authorization is valid for 72 hours.
   1.2. Notify the Engineer 5 days before performing subsequent pruning, vegetation removal, or ground-disturbing work. A Department Biologist will perform a survey of the job site. Proceed with the work when authorized. This work authorization is valid for 72 hours.
2. Project related activities, including storage of vehicles and material, will occur on paved or gravel turnouts or unvegetated shoulders. Any staging in vegetated areas will require additional assessments by a Department Biologists.

#### 14-6.02C(6) Monitoring Schedule

Not Used

**14-6.02D Payment**

Not Used

**Replace the 2nd paragraph of section 14-8.02A with:**

Do not exceed 86 dBA LMax at 50 feet from the job site activities from 9:00 p.m. to 6:00 a.m. except you may perform the following activities during the hours and for the days shown in the following table:

**Noise Restriction Exceptions**

| Activity | Hours | | Days | |
|---|---|---|---|---|
| | From | To | From | Through |
| Cold Plane AC, Remove Concrete, and Roadway Excavation | 7:00 PM | 7:00 AM | Monday | Friday |

**Add to section 14-8.02A:**

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

**Replace section 14-11.03 with:**

**14-11.03 MATERIAL CONTAINING HAZARDOUS WASTE CONCENTRATIONS OF AERIALLY DEPOSITED LEAD**

**14-11.03A General**

**14-11.03A(1) Summary**

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

ADL is present within the project limits.

The Department has received from the DTSC a variance regarding the use of material containing ADL. The variance applies if Type Y-1 or Y-2 material are shown.

**14-11.03A(2) Definitions**

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

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

of 5 feet above the maximum historic water table elevation and protected from infiltration by a pavement structure which will be maintained by the Department.

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

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

### 14-11.03A(3) Site Conditions

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

Type Z-2 material exists as shown.

### 14-11.03A(4) Submittals

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

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

Include perimeter air monitoring incorporating upwind and downwind sampling locations relative to active work locations. The plan should also include worker monitoring with personal air samplers. Analyze samples using National Institute of Safety and Health Method 7105. Sampling and analysis must achieve a detection limit of 0.2 µg/ $m^3$ of air, or lower. Conduct daily monitoring while clearing and grubbing and performing earthwork operations. Analyze the samples daily on a 24-hour turnaround time schedule. Provide the results to the Engineer as soon as they are available. Analyses must be performed by a laboratory accredited by the Environmental Lead Laboratory-Accreditation Program of the American Industrial Hygiene Association. The downwind sample results must not exceed 1.0 µg/$m^3$ of air over 24 hours, in compliance with section 11-1-302 of the Bay Area Air Quality Management District's (BAAQMD) Regulation 11, Hazardous Pollutants, Rule 1, Lead. If the downwind sample result alone exceeds 1.0 µg/ $m^3$ of air, modify the work to prevent the release of lead above the regulatory limit. If the upwind sample result exceeds 1.0 µg/ $m^3$ of air and the downwind sample result is greater than that for the upwind sample, modify the work to prevent the release of lead created by the site work. Monitor under the direction of a CIH. The air monitoring data must be reviewed and signed by the CIH.

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

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

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

1. Excavation schedule by location and date
2. Temporary locations of stockpiled material
3. Dust control measures
4. Air monitoring under 14-11.03A(4)(a). Include the following information:

   4.1. Location and type of equipment
   4.2. Sampling frequency
   4.3. Name and address of the accredited laboratory for sample analysis
5. Transportation equipment and routes
6. Method for preventing spills and tracking material onto public roads
7. Truck waiting and staging areas
8. Site for disposal of hazardous waste
9. Spill Contingency Plan for material containing ADL

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

Not Used

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

Copies of the bills of lading must be submitted as an informational submittal upon placement of Type Y-1 or Y-2 material in its final location.

**14-11.03A(5) Quality Control and Assurance**

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

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

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

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

**14-11.03B Materials**

Not Used

**14-11.03C Construction**

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

Not Used

**14-11.03C(2) Material Management**

Transport excavated Type Z-2 material using:

1. Hazardous waste manifest
2. Hazardous waste transporter with a current DTSC registration certificate and CA Highway Patrol (CHP) Biennial Inspection of Terminals (BIT) Program compliance documentation.

**14-11.03C(3) Dust Control**

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

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

Not Used

### 14-11.03C(5) Material Transportation

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

### 14-11.03C(6) Disposal

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

### 14-11.03D Payment

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

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

**Replace section 14-11.07 with:**

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

### 14-11.07A General

### 14-11.07A(1) Summary

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

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

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

### 14-11.07A(2) Submittals

### 14-11.07A(2)(a) General

Reserved

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

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

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

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

1. Objective of the operation
2. Removal equipment

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

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

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

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

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

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

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

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

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

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

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

### 14-11.07B Materials

Not Used

### 14-11.07C Construction

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

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

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

From the first 220 gal of hazardous waste or portion thereof if less than 220 gal of hazardous waste are produced, a minimum of 4 randomly selected samples must be taken and analyzed individually. Samples must not be composited. From each additional 880 gal of hazardous waste or portion thereof if less than

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

After the Engineer accepts the analytical test results, dispose of yellow thermoplastic and yellow paint hazardous waste residue at a Class 1 disposal facility located in California under the requirements of the disposal facility operator within 60 days after accumulating 220 pounds of residue and dust.

If less than 220 pounds of hazardous waste residue and dust is generated in total, dispose of it within 30 days after the start of accumulation of the residue and dust.

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

**14-11.07D Payment**

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

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

**Replace section 14-11.09 with:**

**14-11.09 TREATED WOOD WASTE**

**14-11.09A General**

**14-11.09A(1) Summary**

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

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

**14-11.09A(2) Submittals**

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

**14-11.09B Materials**

Not Used

**14-11.09C Construction**

**14-11.09C(1) General**

Not Used

**14-11.09C(2) Training**

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

1. Applicable requirements of 8 CA Code of Regs
2. Procedures for identifying and segregating TWW

3. Safe handling practices
4. Requirements of 22 CA Code of Regs, Div. 4.5, Chp. 34
5. Proper disposal methods

Maintain records of personnel training for 3 years.

### 14-11.09C(3) Storage

Store TWW before disposal using the following methods:

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

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

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

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

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

### 14-11.09C(4) Transporting and Disposal

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

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

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

Dispose of TWW at an approved California disposal site operating under a RWQCB permit that includes acceptance of TWW.

Dispose of TWW within:

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

**14-11.09D Payment**

Not Used

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# 15 EXISTING FACILITIES

**Replace section 15-2.02B(3) with:**

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

**15-2.02B(3)(a) General**

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

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

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

**15-2.02B(3)(b) Materials**

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

**15-2.02B(3)(c) Construction**

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

Do not use a heating device to soften the pavement.

The cold planing machine must be:

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

Replace broken, missing, or worn machine teeth.

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

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

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

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

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

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

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

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

Completely remove temporary tapers before placing permanent surfacing.

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

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

### 15-2.02B(3)(d) Payment

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

**Replace section 15-2.02C(2) with:**

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

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

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

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

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

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

**Replace section 15-2.02I with:**

### 15-2.02I Remove Sign Structures

Removing overhead sign structures includes removal of:

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

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

Concrete foundations may be abandoned in place except that the top portion, including anchor bolts, reinforcing steel, and conduits, must be removed to a depth of not less than __3__ feet below the adjacent finished grade. The resulting holes must be backfilled and compacted with material that is equivalent to the surrounding material.

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

**Replace section 15-2.02M with:**

**15-2.02M Remove Sign Structure Walkway**

Removing overhead and bridge mounted sign structure walkway includes removal of:

1. Light fixtures, light fixture mounting channels, and mounting hardware for light fixtures
2. Walkway brackets, walkway gratings, safety railings, safety angles, and gutter and ballast boxes, where existing
3. Electrical conduits, wiring, and equipment for sign lighting

Remove sign lighting fixture, conduit, and wiring back to the sign disconnect enclosure and properly terminate. After removing the conduit, properly plug any holes that remain in the mast arm of tubular overhead sign structures or the post of truss overhead sign structures.

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

**15-2.03A(2)(b) Department Salvage Location**

A minimum of 2 business days before hauling salvaged material to the Department salvage storage location, notify: Engineer
For salvage department furnished material, the Department salvage storage location is:

Caltrans Maintenance Station
30 Rickard Street, San Francisco, CA 94134.
Telephone: (415) 330-6500

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# 17 WATERING

**Replace the 1st sentence of the paragraph in section 17-1.02 with:**

Water must be nonpotable.

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# 19 EARTHWORK

**Add to section 19-2.03G:**

Roughen embankment slopes to receive erosion control materials by either track-walking or rolling with a sheepsfoot roller. Track-walk slopes by running track-mounted equipment perpendicular to slope contours.

**Replace section 19-6.03B with:**

**19-6.03B Subsidence**

You may compact the ground surface on which an embankment is to be constructed before placing embankment material.

If the compaction results in an average subsidence exceeding 0.25 foot, the Engineer measures the ground surface after compaction. Allow time for the Engineer to measure the area before placing embankment material.

A quantity of 2006 cubic yards of embankment will be added to the computed imported borrow quantity for the anticipated effect of subsidence.

If you do not agree with this specified quantity, you may submit a plan for measuring subsidence. The plan must include complete details of the measuring devices and their installation.

If the your plan for measuring subsidence is authorized, install and maintain the subsidence-measuring devices.

The Engineer takes readings as needed to determine the progress of subsidence. Provide assistance as needed.

If the Engineer finds that a device has been damaged, that device will not be used for determining subsidence in the area the device represents. The subsidence for that area is considered as zero regardless of the subsidence measured at other areas.

Subsidence is considered as zero at:

1. Intersection of the side slope and end slope at structures with the ground line as established by the original cross-sections
2. Points on the cross-sections 50 feet beyond the start and end of the area with subsidence-measuring devices, unless the Engineer agrees otherwise

The additional quantity of material for embankment work due to subsidence is determined by the average-end-area method from the original measurements and the final measurements, including zero subsidence at specified areas.

After final measurements are made, remove detachable elements of the subsidence-measuring devices.

**Add to section 19-7.02C:**

The portion of imported borrow placed within 4 feet of the finished grade must have a resistance (R-Value) of at least _25_.

**Replace the 2nd and 3rd paragraphs of section 19-7.04 with:**

Imported borrow is measured based on planned or authorized cross section for embankments as shown and the measured ground surface.

Quantities of roadway excavation, structure excavation, and ditch excavation used in constructing the embankment will be adjusted by multiplying by a grading factor. This grading factor is determined by the Engineer. The Department does not adjust payment if the grading factor determined by the Engineer does not equal the actual grading factor.

The quantity of imported borrow is the quantity remaining after deducting the adjusted quantities from excavations from the total embankment quantity and adding the quantity for subsidence as specified in section 19-6.03B.

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# 20 LANDSCAPE

**Replace the 3rd paragraph in section 20-1.02C of the RSS for section 20 with:**

Rodenticides must be diphacinone.

**Add to section 20-1.02C of the RSS for section 20:**

Select herbicides from the following table:

**Herbicides**

| Herbicide name | Herbicide type | | | | | |
|---|---|---|---|---|---|---|
| | Preemergent (granular) | Preemergent (non-granular) | Post-emergent | Selective | Non-selective | Systemic |
| Aminopyralid | | | | X | | |
| Chlorsulfuron | | | | X | | |
| Clopyralid MEA | | | | | X | |
| Diquat dibromide | | | | | X | |
| Dithiopyr | | X | | | | |
| Fluazifop-P-Butyl | | | | X | | |
| Glyphosate | | | X | | | X |
| Imazapyr | | | | | X | |
| Isoxaben | | X | | | | |
| Oryzalin | | X | | | | |
| Oxadiazon | X | X | | | | X |
| Oxyfluorfen (odorless) | | X | X | | | |
| Pendimethalin | X | X | X | | | |
| Rimsulfuron | | | | X | | |
| Sethoxydim | | | X | X | | |
| Sulfentrazone | | | | | X | |
| Sulfometuron-methyl | | | | | X | |
| Sulfosulfuron | | | | | X | |
| Triclopyr | | | | | | X |

**Delete the 5th paragraph of section 20-1.03A of the RSS for section 20.**

**Add to section 20-1.03C(3) of the RSS for section 20:**

Control weeds within the highway including medians and surfaced areas such as new and existing pavement, curbs, and sidewalks.

Where pavement, dikes, curbs, sidewalks, walls, and fences are located 12 feet or more beyond mulched areas, plant basins, and groundcover areas, limit mowing to 6 feet beyond these areas.

**Replace the 2nd paragraph in section 20-1.03C(4) of the RSS for section 20 with:**

Dispose of mowed material from initial and subsequent mowing during roadside clearing.

**Add to section 20-2.02C(6) of the RSS for section 20:**

The local water authority is the California Water Service Company.

The local water authority will relocate the water meters

The charges by the local water authority for relocating existing water meters is $3,000 per meter, and includes

1. Disconnecting each water meter
2. Reconnecting each water meter to the local water authority's water line, including furnishing and installing hot tap or tee
3. Furnishing and installing extension pipe from the main water line to the water meter
4. Sterilizing the extension pipe

Make arrangements and pay the charges for relocating water meters.

**Add to section 20-2.03B(3) of the RSS for section 20:**

The color of the backflow preventer blanket must be black.

**Replace item 1 in the list in the 1st paragraph of section 20-2.03B(4) of the RSS for section 20 with:**

1. Be hot-dipped galvanized steel

**Add to the list in the 1st paragraph of section 20-2.03B(4) of the RSS for section 20:**

7. Be powder coated by the manufacturer to match color no. 17038 of FED-STD-595

**Add to the list in the 1st paragraph of section 20-2.07B(2)(a) of the RSS for section 20:**

17. Be EPA WaterSense® approved.

**Add after the 1st paragraph of section 20-2.07B(2)(a) of the RSS for section 20:**

Furnish 2 remote access devices to the Engineer.

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

The irrigation controllers within Department highway areas must be ET water SmartBox Controller 205W-24 and must have 2-way communication by 3G cellular. The vendor must install any necessary software and conduct any initial software or proprietary website setup configuration for communications between controller and any web-enabled device.

You may obtain specified equipment listed below from:

Company: Imperial Technical Services
Address: 6630-B Patterson Pass Road, Livermore, California 94550
Business phone number: 925) 667-2190, Fax: (925) 667-2197
Email address: QuoteDepartment@imperialsprinkler.com

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

| Equipment description | Quoted price (EA) | Quantity | Extended price | Controller identification |
|---|---|---|---|---|
| ICA3-ETW2-24 ITSASSY IRRIGATION CONTROLLER ASSEMBLY | $5627.50 | 2 | $11,255 | ICC A and B |
| SP ITSOPT SURGE PROTECTION 120V | $112.50 | 2 | $225 | ICC A and B |
| PED-24SS ENCVIT STRONGBOX STLSTL PEDESTAL 24" WIDE 12" | $360.80 | 2 | $721.60 | ICC A and B |

These prices are good until January 14, 2017.

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

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

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

A single irrigation controller enclosure cabinet must be 48 inches high by 24 inches wide by 12 inches deep.

**Replace the 2nd paragraph in section 20-2.08A(4) of the RSS for section 20 with:**

Conduct a pressure test under section 20-2.01A(4)(b):

1. After installing irrigation supply lines in conduit
2. Before and after extending irrigation supply lines in conduit

Repair leaks and retest until satisfactory pressure test results are achieved.

**Add to section 20-2.08B of the RSS for section 20:**

**20-2.08B(7) Irrigation Supply Lines**

Irrigation supply lines installed in irrigation conduit must comply with section 20-2.09.

**20-2.08B(8) Electrical Conduit and Conductors**

Control and neutral conductors installed in irrigation conduit must comply with section 20-2.05.

Electrical conduit must comply with section 86-2.05.

**Replace the 2nd paragraph in section 20-2.08C(1) of the RSS for section 20 with:**

If extending an existing conduit, remove conductors from the conduit and replace with new conductors. New conductors must match the removed conductors in color and size and be spliced to the existing conductors in adjacent pull boxes.

**Add to section 20-2.08C(1) of the RSS for section 20:**

Install top of conduits:

1. 24 to 30 inches below the finished surface in sidewalk areas
2. 40 to 52 inches below the finished grade in other paved areas

Install irrigation conduits before installing other pipe supply lines.

After installing irrigation conduits and placement of base and surfacing is complete, demonstrate that the conduits are free of obstructions and restrictions.

If there are no conductors installed in electrical conduits, install a pull wire or rope ending in a 5-foot loop in each pull box.

Immediately after testing, cap the ends of irrigation supply lines that are not to be connected to other supply lines,

During backfill operation, support the conduit so that no movement or damage to the conduit or joints occurs.

**Delete the 2nd paragraph and list in section 20-2.08C(2)(a) of the RSS for section 20.**

**Add "PVC" after "Schedule 40" in heading and paragraphs 1 and 3 in section 20-2.08C(3) of the RSS for section 20.**

**Delete the 1st paragraph in section 20-2.08D of the RSS for section 20.**

**Add to section 20-2.08D of the RSS for section 20:**

Payment for control and neutral conductors, electrical conduit, irrigation supply lines, and pressure testing irrigation supply lines that are installed in irrigation conduit is included in payment for various types and sizes of irrigation conduit.

**Replace the paragraphs in section 20-5.03D(1)(d) of the RSS for section 20 with:**

Test plots are not required.

**Replace item 1 in the list in the 1st paragraph of section 20-5.03D(2)(a) of the RSS for section 20 with:**

1. Uniform gold fines color.

**Add to section 20-5.03D(2)(a) of the RSS for section 20:**

Do not use the following materials:

1. Soil sterilant
2. Filter fabric

**Add after the 5th paragraph of section 20-5.03D(3) of the RSS for section 20:**

After satisfactory completion of the decomposed granite work, apply a topcoat of solidifying emulsion annually to the surface per the manufacturer's instructions. Continue the annual application until the plant establishment period is completed or until Contract acceptance.

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# 21 EROSION CONTROL

**Replace item 2 in the list in the 5th paragraph of section 21-1.02E with:**

2. Contain 3/8-inch fiber strands for at least 25 percent by total volume.

**Replace section 21-1.02M with:**

**21-1.02M Compost**

Compost must be derived from 1 or a combination of the following types of materials:

1. Green material consisting of chipped, shredded, or ground vegetation or clean, processed, recycled wood products
2. Biosolids
3. Manure
4. Mixed food waste

Compost must not be derived from mixed municipal solid waste and must not contain paint, petroleum products, pesticides, or other chemical residues harmful to plant or animal life. Metal concentrations in compost must not exceed the maximum listed under 14 CA Code of Regs § 17868.2.

Process compost materials under 14 CA Code of Regs § 17868.3.

The quality characteristics of compost must have the values shown in the following table:

**Compost**

| Quality characteristic | Test method[a] | Value |
|---|---|---|
| pH | TMECC 04.11-A | 6–8.5 |
| Soluble salts (dS/m) | TMECC 04.10-A | 0–10 |
| Moisture content (% wet weight) | TMECC 03.09-A | 30–60 |
| Organic matter content (% dry weight) | TMECC 05.07-A | 30–70 |
| Maturity (seed emergence)<br>(% relative to positive control) | TMECC 05.05-A | 80 or above |

| | | |
|---|---|---|
| Maturity (seedling vigor)<br>(% relative to positive control) | TMECC 05.05-A | 80 or above |
| Stability (mg $CO_2$-C/g OM per day) | TMECC 05.08-B | 8 or below |
| Particle size for fine compost[b]<br>dry weight<br>Pass 2-inch sieve (% min)<br>Pass 3/8-inch sieve (% min) | TMECC 02.02-B | <br><br>98<br>95 |
| Particle size for medium compost[b]<br>dry weight<br>Pass 2-inch sieve (% min)<br>Pass 3/8-inch sieve (% min)<br>Pass 3/8-inch sieve (% max) | TMECC 02.02-B | <br><br>90<br>40<br>75 |
| Particle size for coarse compost[b]<br>dry weight<br>Pass 2-inch sieve (% min)<br>Pass 3/8-inch sieve (% max) | TMECC 02.02-B | <br><br>90<br>30 |
| Pathogen<br>Salmonella (most probable number per 4 grams dry weight basis) | TMECC 07.01-B | < 3 |
| Pathogen<br>Fecal coliform (most probable number per gram dry weight basis) | TMECC 07.01-B | < 1,000 |
| Physical contaminants (% dry weight)<br>Plastic, glass, and metal | TMECC 02.02-C | combined total:<br>< 0.5 |
| Physical contaminants (% dry weight)<br>Sharps | TMECC 02.02-C | None detected |

[a] TMECC refers to "Test Methods for the Examination of Composting and Compost," published by the United States Department of Agriculture and the United States Compost Council (USCC).
[b]Maximum particle length must be 6 inches.

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surface. Tarps are not required if the time from discharging to the truck until transfer to the paver's hopper or the pavement surface is less than 30 minutes.

Spread Type A HMA at the atmospheric and surface temperatures shown in the following table:

**Minimum Atmospheric and Surface Temperatures**

| Compacted layer thickness | Atmosphere, °F | | Surface, °F | |
|---|---|---|---|---|
| | Unmodified asphalt binder | Modified asphalt binder | Unmodified asphalt binder | Modified asphalt binder [a] |
| < 0.15 | 45 | 45 | 50 | 45 |
| ≥ 0.15 | 40 | 40 | 40 | 40 |

[a] Except asphalt rubber binder.

For method compaction, the maximum compacted layer thickness must be 0.25 foot.

For Type A HMA placed under method compaction, if the asphalt binder is:

1. Unmodified, complete:
   1.1 First coverage of breakdown compaction before the surface temperature drops below 240 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 140 degrees F
2. Modified, complete:
   2.1. First coverage of breakdown compaction before the surface temperature drops below 230 degrees F
   2.2. Breakdown and intermediate compaction before the surface temperature drops below 170 degrees F
   2.3. Finish compaction before the surface temperature drops below 130 degrees F

If you request and the request is authorized, you may cool Type A HMA with water when rolling activities are complete. Apply water under section 17.

**Replace the 2nd paragraph in section 39-3.01A of the RSS for section 39 with:**

You must produce RHMA-G using an authorized warm mix asphalt technology, except the water injection technology is not allowed.

**Add to section 39-3.02C(1) of the RSS for section 39:**

The grade of asphalt binder for RHMA-G must be PG 64-16.

**Replace the paragraphs of section 39-3.03 of the RSS for section 39 with:**

Use a material transfer vehicle when placing RHMA-G.

Do not use a pneumatic tired roller to compact RHMA-G.

Spread and compact RHMA-G at an atmospheric temperature of at least 50 degrees F and a surface temperature of at least 50 degrees F.

If the atmospheric temperature is below 60 degrees F, cover loads in trucks with tarps. If the time for HMA discharge to truck at the HMA plant until transfer to paver's hopper is 90 minutes or greater and 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 discharging to the 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. Only spread and compact 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 of breakdown compaction before the surface temperature drops below 260 degrees F
3. Complete breakdown and intermediate compaction before the surface temperature drops below 230 degrees F
4. Complete finish compaction before the surface temperature drops below 180 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.

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# 40 CONCRETE PAVEMENT

**Replace "Reserved" in section 40-5 of the RSS for section 40 with:**

## 40-5.01 GENERAL

### 40-5.01A Summary

Section 40-5 includes specifications for constructing JPCP with RSC (JPCP—RSC).

JPCP—RSC must comply with the specifications for JPCP in section 40-4.

### 40-5.01B Definitions

**early age:** Any age less than 10 times the time of final setting.

**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 concrete penetration resistance that is at least 4,000 psi under ASTM C403/C403M.

### 40-5.01C Submittals

#### 40-5.01C(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.

Submit QC test results within 48 hours of paving shift completion except submit modulus of rupture results within:

1. 15 minutes of opening age test completion
2. 24 hours of a 3, 7, or 10-day test completion

#### 40-5.01C(2) Quality Control Plan

At least 20 days before placing trial slabs, submit a QC plan.

#### 40-5.01C(3) Rapid Strength Concrete

At least 45 days before the intended use, submit a sample of cement from each proposed lot and samples of proposed admixtures in the quantities ordered by the Engineer.

During JPCP—RSC 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 C 917 except testing age and water content may be modified to suit the particular material.

#### 40-5.01C(4) Mix Design

Section 40-1.01C(4) does not apply.

At least 10 days before constructing trial slabs, submit mix designs

### 40-5.01D Quality Control and Assurance

#### 40-5.01D(1) General

Section 40-1.01D(1) does not apply.

Core pavement as described for thickness, bar placement, and air content.

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

The Department tests for coefficient of friction within 7 days of receiving notification that the pavement is ready for testing.

#### 40-5.01D(2) Prepaving Conference

The 2nd paragraph of section 40-1.01D(2) does not apply.

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

Do not start paving activities, trial slabs, or test strips until the listed personnel have attended the preconstruction conference.

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

#### 40-5.01D(3) Quality Control Plan

Section 40-1.01D(4) does not apply.

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 and qualifications of the QC manager and assistant QC managers.
2. 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.
3. Contingency plan for correcting problems in production, transportation, and placement.
4. Provisions for determining if JPCP—RSC placement must be suspended.
5. Outline of the procedure for the production, transportation, and placement of JPCP—RSC.
6. Outline of the procedure for sampling and testing to be performed during and after JPCP—RSC construction.
7. Production target values for material properties that impact concrete quality or strength including cleanness value and sand equivalent.
8. Forms to report concrete inspection, sampling, and testing results.
9. Location of your quality control testing laboratory and testing equipment to be used during and after paving operations.
10. List of the testing equipment to be used including the date of last calibration.
11. Names and certifications of quality control personnel including those performing sampling and testing.
12. Outline of the procedure for placing and testing trial slabs, including:
    12.1. Locations and times
    12.2. Production procedures
    12.3. Placement and finishing methods
    12.4. Sampling methods, sample curing, and sample transportation
    12.5. Testing and reposting test results reporting
13. Procedure for identifying transverse contraction joint locations relative to the dowel bars longitudinal center.
14. Procedure for consolidating concrete around the dowel bars.

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. Dowel bar placement, alignment, and anchorage
11. Tie bar placement and alignment
12. Modulus of rupture strength
13. Finishing and curing
14. Protecting pavement before opening to traffic
15. Surface smoothness

**40-5.01D(4) Quality Control Manager**

Designate a QC manager and assistant QC managers to administer the QC plan. The QC manager must be certified as an American Concrete Institute (ACI) Concrete Field Testing Technician-Grade I and Concrete Laboratory Testing Technician-Grade II. The assistant QC managers must have the same certification except Concrete Laboratory Testing Technician-Grade I instead of Grade II is acceptable.

The QC manager must review and sign the sampling, inspection, and test reports before submitting them. The QC manager or his assistant must be present for:

1. Each stage of mix design
2. Trial slab construction
3. Test strip construction
4. Production and construction of JPCP—RSC
5. 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 JPCP—RSC except those specified for QC.

### 40-5.01D(5) Mix Design for RSC

#### 40-5.01D(5)(a) General

Section 40-1.01D(5) does not apply.

#### 40-5.01D(5)(b) 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 JPCP—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 the following ages:
    - 10.1. 80 percent of opening age
    - 10.2. Opening age
    - 10.3. 120 percent of opening age
    - 10.4. 1-day when the opening age is less than or equal to 1 day
    - 10.5. 3-day when the opening age is less than or equal to 3 days
    - 10.6. 7-day when the opening age is less than 7 days
    - 10.7. 10-day
    - 10.8. 28-day
11. Shrinkage test result
12. Any special instructions or conditions such as water temperature requirements

Before placing JPCP—RSC, your mix design must be field qualified. Testing must be performed by a technician certified as an ACI "Concrete Laboratory Technician, Grade I" or Grade II Test for modulus of rupture under California Test 524 at the following ages:

1. Opening age
2. 3-day when the opening age is less than or equal to 3 days
3. 10-day when the opening age is more than 3 days

If a mix design is rejected, submit a new mix design and obtain field qualification.

### 40-5.01D(6) Trial Slabs

Before constructing test strips, construct 1 trial slab for each mix design and obtain authorization. Trial slabs must:

1. Be 10 by 20 feet
2. Have a thickness of 10 inches or the largest thickness shown, whichever is greater
3. Constructed using the same equipment and methods proposed for paving and under similar atmospheric and temperature conditions expected during paving
4. Demonstrate that JPCP—RSC will be cured, sawed, and comply with the requirement for opening to traffic within the specified lane closures

Place trial slabs near the job site at a mutually-agreed location that is not on the roadway nor within the project limits.

During trial slab construction, sample and split the aggregate for grading, cleanness value, and sand equivalent testing.

Within 20 minutes after RSC delivery for trial slabs, fabricate test beams under California Test 524. Use test beams to determine opening age and 10-day 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. 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 10-day testing under California Test 524 except place them into sand at a time that is (1) from 5 to 10 times the final set time or (2) 24 hours, whichever is earlier.

After authorization remove and dispose of trial slabs and testing materials.

### 40-5.01D(7) Quality Control Testing

#### 40-5.01D(7)(a) General

Section 40-1.01D(6)(b) does not apply.

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 JPCP—RSC placement, sample and fabricate beams for modulus of rupture testing within the first 30 cu yd, at least once every 130 cu yd, and within the final truckload. Submit split samples and assist the Department in fabricating 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 and 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.

#### 40-5.01D(7)(b) Rapid Strength Concrete

##### 40-5.01D(7)(b)(i) General

Your quality control must include testing RSC for the properties at the frequencies shown in the following table:

**RSC Minimum Quality Control**

| Property | Test method | Minimum testing frequency[a] |
|---|---|---|
| Cleanness value | California Test 227 | 650 cu yd or 1 per shift |
| Sand equivalent | California Test 217 | 650 cu yd or 1 per shift |
| Aggregate gradation | California Test 202 | 650 cu yd or 1 per shift |
| Air content | California Test 504 | 130 cu yd or 2 per shift |
| Yield | California Test 518 | 2 per shift |
| Slump or penetration | ASTM C143 or California Test 533 | 1 per 2 hours of paving |
| Unit weight | California Test 518 | 650 cu yd or 2 per shift |
| Aggregate moisture meter calibration[b] | California Test 223 or California Test 226 | 1 per shift |
| Modulus of rupture | California Test 524 | Comply with section 40-5.01D(7)(a) |

[a]Test at the most frequent interval.
[b]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. Slump or penetration

Control charts must include:

1. Contract number
2. Mix proportions
3. Test number
4. Each test parameter
5. Action and suspension limits
6. Specification limits
7. Quality control test results

For fine and coarse aggregate gradation control charts, record the running average of the previous 4 consecutive gradation tests for each sieve and superimpose the specification limits.

For air content control charts, the action limit is ±1.0 percent of the specified value. If no value is specified, the action limit is ±1.0 percent of the value used for your approved mix design.

As a minimum, a process is out of control if any of the following occurs:

1. For fine and coarse aggregate gradation, 2 consecutive running averages of 4 tests are outside the specification limits
2. For individual penetration or air content measurements:
   2.1. One point falls outside the suspension limit line
   2.2. Two points in a row fall outside the action limit line

Stop production and take corrective action for out of control processes or the Engineer rejects subsequent material.

Before each day's concrete pavement placement and at intervals not to exceed 4 hours of production, use a tachometer to test and record vibration frequency for concrete consolidation vibrators.

If requested, submit split samples and assist the Department in fabricating test beams for the Department's testing.

### 40-5.01D(7)(b)(ii) Modulus of Rupture

Fabricate and test for modulus of rupture in the Engineer's presence.

Fabricate beams for modulus of rupture testing under California Test 524 except beams may be fabricated using an internal vibrator under ASTM C 31.

Test beams under California Test 524 except place them in sand from (1) 5 to 10 times the final set time or (2) 24 hours, whichever is earlier. For each sample, calculate the test result as the average from testing 3 beams.

Your quality control testing must include modulus of rupture testing for each day's paving. Test within the first 30 cu yd, at least once per every 130 cu yd. and the final truck load.

A single test result represents no more than 1 paving shift or 130 cu yd, whichever is less. If you wish to increase the testing frequency, you must notify the Engineer at least 2 days before paving. No payment is made for your additional testing.

### 40-5.01D(8) Acceptance Criteria

### 40-5.01D(8)(a) General

The requirement for testing the modulus of rupture at 28 days in section 40-1.01D7(a)(i) does not apply.

### 40-5.01D(8)(b) Modulus of Rupture

Section 40-1.01D(7)(b)(ii) does not apply.

JPCP—RSC is accepted based on your testing for modulus of rupture at opening age and the Department's testing for modulus of rupture at 10 days. For each sample, the Department calculates the test result as the average from testing 3 beams. The test result represents 1 paving shift or 130 cu yd, whichever is less.

If the opening age is equal to or less than 3 days, JPCP—RSC must have a modulus of rupture at opening age that is at least 400 psi and a modulus of rupture at 10 days that is at least 650 psi.

If the opening age is between 3 and 9 days, JPCP—RSC must have a modulus of rupture at opening age that is at least 550 psi and a modulus of rupture at 10 days that is at least 650 psi.

If the opening age is equal to or less than 3 days, the modulus of rupture at opening age is at least 400 psi, and the modulus of rupture at 10 days is at least 570 psi but less than 650 psi, you may request authorization to leave the JPCP—RSC in place and accept the specified deduction.

If the opening age is between 3 and 9 days, if the modulus of rupture at opening age is at least 550 psi, and the modulus of rupture at 10 days is at least 570 psi but less than 650 psi, you may request authorization to leave the JPCP—RSC in place and accept the specified deduction.

## 40-5.02 MATERIALS

### 40-5.02A General

Sections 40-1.02B(1) and 40-1.02B(2) do not apply.

RSC must comply with 90-3 except volumetric proportioning is not allowed. The 2nd paragraph of section 90-1.02I(2)(a) does not apply.

### 40-5.02B Aggregate

Comply with section 40-1.02B(3) except aggregate must be either:

1. Innocuous
2. Such that the RSC has an expansion ratio of less than 0.10 percent under ASTM C 1567 with the proposed proportion and mix design. Include test data with the mix design submittal. Test data must be dated within 3 years of the contract award date. The test data must be for the same mix design and based on aggregate from the same proposed source and proportion.

### 40-5.02C Proportioning

For batches with a volume of 1 cu yd or more, proportioning methods must comply with one of the following:

1. Batch at a central batch plant and charge into a mixer truck for transportation to the job site. Proportion under section 90-1.02(F).
2. Except for cement, batch at a central batch plant. Charge into a mixer truck, transport to a cement silo and weigh system, use the silo and system to proportion cement, and charge cement into the mixer truck.
3. Except for cement, batch at a central batch plant. Charge into a mixer truck, transport to a location where pre-weighed containerized cement is added to the mixer truck. The cement pre-weighing operation must utilize a platform scale. The platform scale must have a maximum capacity of 2.75 tons with a maximum graduation size of 1 pound. Pre-weigh cement into a fabric container. The minimum amount of cement to be proportioned into any single container must be 1/2 of the total amount required for the load of RSC being produced. Before reuse, clean fabric containers used for transportation or proportioning of cement.

## 40-5.03 CONSTRUCTION

### 40-5.03A General

If the cement in JPCP—RSC is other than portland cement, section 40-1.03K does not apply, and the pavement must be cured per the cement Manufacturer's written recommendations.

Do not place JPCP—RSC if the opening age is less than or equal to 3 days and the temperature is forecasted to be less than 40 degrees within 72 hours of final finishing. Use the forecast from the National Weather Service.

### 40-5.03B Test Strips

The 9th paragraph of section 40-1.03C for the elimination of test strip does not apply.

Test strips must be 400–1000 feet long.

### 40-5.03C Joints

Section 40-1.03D(2) does not apply.

Before placing JPCP—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. Place the top of the joint filler flush with the top of the pavement and extend it down to the bottom of excavation. Secure joint filler to the joint face of the existing pavement and prevent it from moving during the placement of JPCP—RSC.

Where the existing transverse joint spacing in an adjacent lane exceeds 15 feet, construct an additional transverse contraction joint midway between the existing joints. If transverse joints do not align in a curve, drill a full depth 2-inch diameter hole under ASTM C 42/C 42M where the joint meets the adjacent slab. Fill the hole with joint filler material. Do not allow the filling material to penetrate into unsealed joints.

In addition to the specifications in section 40-1.03D(4), after removing new pavement, clean the faces of joints and remove loose material and contaminants from underlying base. Coat the base surface with curing compound under section 28-2.03F.

### 40-5.03D Placing Concrete

The 3rd paragraph of section 40-1.03H(1) does not apply.

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.

After mixing and placing JPCP—RSC, do not add water to the surface to facilitate final finishing. You may request authorization to use a surface finishing additive; include the manufacture's recommendations with you request.

### 40-5.03E Protecting Concrete Pavement

If the opening age is equal to or less than 3 days, section 40-1.03L does not apply. Protect pavement under section 90-1.03C . Protect JPCP—RSC from activities that cause damage, reduce texture, and reduce the coefficient of friction. Do not allow soil, gravel, petroleum products, concrete, or asphalt mixes on the JPCP—RSC surface.

### 40-5.03F Early Use of Concrete Pavement

Section 40-1.03M does not apply.

### 40-5.04 PAYMENT

If the jointed plain concrete pavement (RSC) has an opening age equal to or less than 3 days, a modulus of rupture at opening age that is at least 400 psi, and a modulus of rupture at 10 days that is greater than or equal to 570 psi but less than 650 psi, the Department deducts 10 percent of the payment for jointed plain concrete pavement (RSC).

If the jointed plain concrete pavement (RSC) has an opening age between 3 and 9 days, a modulus of rupture at opening age that is at least 550 psi, and a modulus of rupture at 10 days that is greater than or equal to 570 psi but less than 650 psi, the Department deducts 10 percent of the payment for jointed plain concrete pavement (RSC).

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5. Timeline and critical path activities
6. Structural, geotechnical, and corrosion design requirements
7. Future meetings, if necessary, for pile mitigation and pile mitigation plan review
8. Safety requirements, including Cal/OSHA and Tunnel Safety Orders

**Add to section 49-3.02B(6)(c):**

The synthetic slurry must be one of the materials shown in the following table:

| Material | Manufacturer |
|---|---|
| SlurryPro CDP | KB INTERNATIONAL LLC<br>735 BOARD ST STE 209<br>CHATTANOOGA TN 37402<br>(423) 266-6964 |
| Super Mud | PDS CO INC<br>105 W SHARP ST<br>EL DORADO AR 71731<br>(870) 863-5707 |
| Shore Pac GCV | CETCO CONSTRUCTION DRILLING PRODUCTS<br>2870 FORBS AVE<br>HOFFMAN ESTATES IL 60192<br>(800) 527-9948 |
| Terragel or Novagel Polymer | GEO-TECH SERVICES LLC<br>220 N. ZAPATA HWY STE 11A-449A<br>LAREDO TX 78043<br>(210) 259-6386 |

Use synthetic slurries in compliance with the manufacturer's instructions. Synthetic slurries shown in the above table may not be appropriate for a given job site.

Synthetic slurries must comply with the Department's requirements for synthetic slurries to be included in the above table. The requirements are available from the Offices of Structure Design, P.O. Box 168041, MS# 9-4/11G, Sacramento, CA 95816-8041.

SlurryPro CDP synthetic slurry must comply with the requirements shown in the following table:

**SLURRYPRO CDP**

| Property | Test | Value |
|---|---|---|
| Density<br>During drilling<br><br>Before final cleaning and immediately before placing concrete | Mud Weight (density), API 13B-1, section 1 | <br>≤ 67.0 pcf[a]<br><br>≤ 64.0 pcf[a] |
| Viscosity<br>During drilling<br><br>Before final cleaning and immediately before placing concrete | Marsh Funnel and Cup. API 13B-1, section 2.2 | <br>50–120 sec/qt<br><br>≤ 70 sec/qt |
| pH | Glass electrode pH meter or pH paper | 6.0–11.5 |
| Sand content, percent by volume<br>Before final cleaning and immediately before placing concrete | Sand, API 13B-1, section 5 | ≤ 0.5 percent |

[a]If authorized, you may use slurry in salt water. The allowable density of slurry in salt water may be increased by 2 pcf.
Slurry temperature must be at least 40 degrees F when tested.

Super Mud synthetic slurry must comply with the requirements shown in the following table:

**SUPER MUD**

| Property | Test | Value |
|---|---|---|
| Density<br>During drilling<br><br>Before final cleaning and immediately before placing concrete | Mud Weight (Density), API 13B-1, section 1 | <br>≤ 64.0 pcf[a]<br><br>≤ 64.0 pcf[a] |
| Viscosity<br>During drilling<br><br>Before final cleaning and immediately before placing concrete | Marsh Funnel and Cup. API 13B-1, section 2.2 | <br>32–60 sec/qt<br><br>≤ 60 sec/qt |
| pH | Glass electrode pH meter or pH paper | 8.0–10.0 |
| Sand content, percent by volume<br>Before final cleaning and immediately before placing concrete | Sand, API 13B-1, section 5 | ≤ 0.5 percent |

[a]If authorized, you may use slurry in salt water. The allowable density of slurry in salt water may be increased by 2 pcf.
Slurry temperature must be at least 40 degrees F when tested.

Shore Pac GCV synthetic slurry must comply with the requirements shown in the following table:

**SHORE PAC GCV**

| Property | Test | Value |
|---|---|---|
| Density<br>During drilling<br><br>Before final cleaning and immediately before placing concrete | Mud Weight (Density), API 13B-1, section 1 | <br>≤ 64.0 pcf[a]<br><br>≤ 64.0 pcf[a] |
| Viscosity<br>During drilling<br><br>Before final cleaning and immediately before placing concrete | Marsh Funnel and Cup. API 13B-1, section 2.2 | <br>33–74 sec/qt<br><br>≤ 57 sec/qt |
| pH | Glass electrode pH meter or pH paper | 8.0–11.0 |
| Sand content, percent by volume<br>Before final cleaning and immediately before placing concrete | Sand, API 13B-1, section 5 | ≤ 0.5 percent |

[a]If authorized, you may use slurry in salt water. The allowable density of slurry in salt water may be increased by 2 pcf.
Slurry temperature must be at least 40 degrees F when tested.

Terragel or Novagel Polymer synthetic slurry must comply with the requirements shown in the following table:

**TERRAGEL OR NOVAGEL POLYMER**

| Property | Test | Value |
|---|---|---|
| Density<br>During drilling<br><br>Before final cleaning and immediately before placing concrete | Mud Weight (Density), API 13B-1, section 1 | <br>≤ 67.0 pcf[a]<br><br>≤ 64.0 pcf[a] |
| Viscosity<br>During drilling<br><br>Before final cleaning and immediately before placing concrete | Marsh Funnel and Cup. API 13B-1, section 2.2 | <br>45–104 sec/qt<br><br>≤ 104 sec/qt |
| pH | Glass electrode pH meter or pH paper | 6.0–11.5 |
| Sand content, percent by volume<br>Before final cleaning and immediately before placing concrete | Sand, API 13B-1, section 5 | ≤ 0.5 percent |

[a]If authorized, you may use slurry in salt water. The allowable density of slurry in salt water may be increased by 2 pcf.
Slurry temperature must be at least 40 degrees F when tested.

**Add to section 49-3.02C(1):**

If the piling center-to-center spacing is less than 3 pile diameters, do not drill holes or drive casing for an adjacent pile until 24 hours have elapsed after concrete placement in the preceding pile and your prequalification test results for the concrete mix design show that the concrete will attain at least 1800 psi compressive strength at the time of drilling or driving.

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### 73-6.01C Submittals

Submit the following:

1. A full size sample of each interlocking concrete paver color
2. Manufacturer's drawings and installation details.
3. Certificate of compliance for concrete pavers and filter fabric
4. Test results from an independent testing laboratory for compliance of paving unit requirements to ASTM C 936 or other applicable requirements.
5. Sieve analysis for bedding and joint sand
6. Copy of current certificate from Interlocking Concrete pavement Institute Level I Concrete paver Installer Certification program.

### 73-6.01D Quality Control and Assurance

Construct a 4 foot by 4 foot test plot before installation of interlocking concrete pavers on-site with materials, tools, equipment, and methods you will use in the work. Obtain authorization of the test plot before placing the rest of interlocking concrete pavers.

If the test area is rejected, remove and construct a new test plot, the same size as the original, until acceptance.

## 73-6.02 MATERIALS

### 73-6.02A Interlocking Concrete Pavers

Interlocking concrete pavers must comply with ASTM C 936 and the requirements shown in the following table:

**ASTM Requirements**

| ASTM | Description |
|---|---|
| C 936 | Average compressive strength of 8,200 PSI with no individual unit under 7,200 PSI |
| C140 | Average absorption between 5%to 7% |
| C 67 | Resistance to 50 freeze-thaw cycles |

Pavers must be: nominal 4 inch by 8 inch by 2 3/8 inches thick.

Length and width must not vary by more than 0.06 inches, and the height must not vary more than 0.12 inches from specified height.

Paver color must be "carmel", blend closely resembling color no. 20260 of FED-STD-595.

### 73-6.02B Bedding and Joint Sand

#### 73-6.02B(1) General

Bedding and joint sand must:

1. Be clean, non-plastic, free from deleterious or foreign matter, natural or manufactured from crushed rock
2. Be suitable for the purpose intended
3. Not use stone dust, limestone screenings or sand material that does not conform to ASTM C 33

#### 73-6.02B(2) Bedding Sand

Bedding sand must comply with grading requirements for the sieve sizes shown in the following table:

**Grading Requirements for Bedding SandASTM C 33**

| Sieve Size | Percentage Passing |
|---|---|
| 3/8 in | 100 |
| No. 4 | 95 to 100 |
| No. 8 | 85 to 100 |
| No. 16 | 50 to 85 |
| No. 30 | 25 to 60 |
| No. 50 | 10 to 30 |
| No. 100 | 2 to 10 |
| No. 200 | 0 to 1 |

**73-6.02B(3) Joint Sand**

Joint sand must comply with grading requirements for the sieve sizes shown in the following table:

**Grading Requirements for Joint Sand**

| | **ASTM C 144** | **ASTM C 144** |
|---|---|---|
| | Natural Sand | Manufactured Sand |
| Sieve Size | Percentage Passing | Percentage Passing |
| No. 4 | 100 | 100 |
| No. 8 | 95 to 100 | 95 to 100 |
| No. 16 | 70 to 100 | 70 to 100 |
| No. 30 | 40 to 75 | 40 to 100 |
| No. 50 | 10 to 35 | 20 to 40 |
| No. 100 | 2 to 15 | 10 to 25 |
| No. 200 | 0 to 1 | 0 to 10 |

**73-6.02C Filter Fabric**

Geosynthetic material used for filter fabric must be Class A and comply with section 88-1.02B

**73-6.02D Aggregate Base**

Comply with section 26 for Class 2 aggregate base.

**73-6.03 CONSTRUCTION**

Place paving fabric under manufacturer's instructions.

Spread bedding sand evenly over the aggregate base course and screed to a nominal 1 inch thickness not exceeding 1 5/8 inch thickness.

Do not disturb screeded sand. Screed sand must not substantially exceed area to be covered by pavers in one day.

Do not use bedding sand to fill depressions in the base surface.

Lay pavers in patterns as shown. Make horizontal adjustments to laid pavers as required.

Joints between the pavers on average must be between 1 /16 inch and 3 /16 inch No more than 5 percent of the joins shall exceed 1/4 inch.

Fill gaps at the edges of the paved area with cut pavers or edge units.

Joint lines must not deviate more than ± 1/2 inch over 50 feet from string lines.

Cut pavers with a double blade paver splitter or masonry saw.

Use a low-amplitude plate compactor capable of at least 4,000 lbf minimum at a frequency of 75 to 100 Hz to vibrate the pavers into the sand. Replace any cracked or damaged pavers with new units.

Spread dry joint sand over pavers in accordance with the paver manufacturer's instructions and simultaneously, sweep and compact into joints continuously until completely filled.

Make a minimum of 4 passes over the area with the plate compactor. Do not compact within 6 feet of unrestrained paver edge.

All work to within 6 feet of the laying face must be left fully compacted with sand-filled joints at the end of each day.

Adjust bond pattern at pavement edges such that cutting of edge pavers is minimized

Cover the laying face of pavers with plastic sheets overnight if not closed with cut and compacted pavers.

Remove excess sand from paver surface when installation is complete. Surface must be broom clean after removal of excess joint sand.

**73-6.04 PAYMENT**

Not Used

# 77 LOCAL INFRASTRUCTURE

**Replace "Reserved" in section 77 with:**

**77-1 LIGHTING (CITY STREET)**

**77-1.01 GENERAL**

**77-1.01A Summary**

Section 77-1 includes specifications for installing lighting (city street).

Lighting (city street) includes conduit, pull boxes, conductors, bonding and grounding, city lighting standards, LED fixtures, and PEUs.

**77-1.01B Definitions**

Not used

**77-1.01C Submittals**

Submit shop drawings for the city lighting standards. Shop drawings must include the anchorage details for installing the city lighting standards.

Submit warranty documentation before installation.

**77-1.01D Quality Control and Assurance**

Not Used

**77-1.02 MATERIALS**

**77-1.02A General**

Not Used

**77-1.02B Conduit**

Comply with section 86-2.05.

**77-1.02C Pull Boxes**

Comply with section 86-2.06.

**77-1.02D Conductors**

Comply with section 86-2.08 and 86-2.09

**77-1.02E Bonding and Grounding**

Comply with section 86-2.10.

**77-1.02F City Lighting Standards and LED Fixtures**

The lighting must be manufactured by:

SCL North
3982 Short St, Suite 100-B
San Luis Obispo, CA 93401
Telephone (805) 548-0200

The price quoted by the manufacturer for the lighting (city street) is not including sales tax. The price includes freight charge to the job-site. Freight allowed quotes include two hours of offloading time. Additional charges at $200 per hour apply if the delivery offloading time exceeds the maximum two hour limit.

Lighting for city street must include the equipment in the following table:

**Price Quote**

| Item | Description | Quantity | Unit | Amounts |
|---|---|---|---|---|
| 1 | Deco Assemblies include:<br>(1) 24' Fluted Pole with El Camino Style Base<br>(1) Double CA-WAV-24-OCT Arm<br>(1) 5' Davit arm KA115-MOD<br>(1) K803-P4SH-III-150(SSL)-8084-120:277V-KPL20-PR7-LED Pendant Fixture<br>(2) K703-P4SH-III-60(SSL)-8060-120:277V-KPL20-PR7 LED Pendant Fixture | 19 | $15,482.00 | $294,158.00 |
| 2 | Wall Mount Decorative Fixtures:<br>(1) K118R-B3AR-IV-100W(SSL)-1054-120:277V-K23-GRS-PR7 LED Post Top Fixture<br>(1) KA52W Wall Mount Arm | 8 | $3,604.00 | $28,832.00 |
| | | | Total | $322,990.00 |

The above price will be firm for orders placed on or before December 31, 2017, provided delivery is accepted within 120 days after the order is placed.

**77-1.02G Photoelectric Controls**

Comply with section 86-6.11.

**77-1.03 CONSTRUCTION**

Install conduit, pull boxes, conductors, bonding and grounding, and PEU complying with section 86.

Install the city lighting standards and LED fixtures as shown.

Notify the Engineer and City Engineer for testing 48 hours before setting up the city lighting standards.

**77-1.04 PAYMENT**

Not Used

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# 83 RAILINGS AND BARRIERS

**Add to section 83-1.02B(2):**

The offset from the face of the Type WB-31 transition railing to the hinge point must be at least 3'-6".

The offset from the face of the adjacent midwest guardrail system to the hinge point must be transitioned from the offset at the Type WB-31 transition railing to 4'-0" using a ratio of 6:1.

**Replace section 83-1.02C(2) with:**

**83-1.02C(2) Alternative In-Line Terminal System**

Alternative in-line terminal system must be furnished and installed as shown on the plans and under these special provisions.

The allowable alternatives for an in-line terminal system must consist of one of the following or a Department-authorized equal.

1. TYPE SKT-SP-MGS for steel posts or Type SKT-W-MGS for wood posts TERMINAL SYSTEM - Type SKT-MGS terminal system must be a SKT 350 sequential kinking terminal, system length 53'-1-1/2", manufactured by Road Systems, Inc., located in Big Spring, Texas, and must include items detailed for Type SKT-MGS terminal system shown on the plans. The SKT 350 sequential kinking terminal can be obtained from the distributor, Universal Industrial Sales, P.O. Box 699, Pleasant Grove, UT 84062, telephone (801) 785–0505 or from the distributor, Gregory Highway Products, 4100 13th Street, S.W., Canton, OH 44708, telephone (330) 477–4800.
2. TYPE X-LITE - Type X-Lite terminal system must be a 31" X-Lite Guard Rail End Terminal as manufactured by Barrier Systems, Inc., located in Vacaville, CA, and must include items detailed for Type 31" X-Lite terminal system shown on the plans. The 31" X-Lite Guard Rail End Terminal can be obtained from the distributor, Statewide Safety and Signs, Inc., 130 Grobric Court, Fairfield, CA 94533, telephone (800) 770–2644.
3. TYPE 31" X-TENSION - Type 31" X-Tension terminal system must be a 31" X-Tension Guard Rail End Terminal as manufactured by Barrier Systems, Inc., located in Vacaville, CA, and must include items detailed for Type 31" X-Tension terminal system shown on the plans. The 31" X-Tension Guard Rail End Terminal can be obtained from the distributor, Statewide Safety and Signs, Inc., 130 Grobric Court, Fairfield, CA 94533, telephone (800) 770–2644.
4. TYPE SOFT-STOP - Type Soft-Stop terminal system must be a SOFT-STOP terminal, system length 50'-9½" for test level 3 and system length 38'-3½" for test level 2, as manufactured by Trinity Highway Products, LLC, and must include items detailed for SOFT-STOP terminal system shown on the plans. The SOFT-STOP terminal can be obtained from the manufacturer, Trinity Highway Products, LLC, P.O. Box 99, Centerville, UT 84012, telephone (800) 772-7976.

Submit a certificate of compliance for terminal systems.

Terminal systems must be installed under the manufacturer's installation instructions and these specifications. Each terminal system installed must be identified by painting the type of terminal system in neat black letters and figures 2 inches high on the backside of the rail element between system posts numbers 4 and 5. Paint must be metallic acrylic resin type spray paint. Before applying terminal system identification, the surface to receive terminal system identification must be removed of all dirt, grease, oil, salt, or other contaminants by washing the surface with detergent or other suitable cleaner. Rinse thoroughly with fresh water and allow to fully dry.

For Type SKT-SP-MGS terminal system, install the soil tube with soil plate attached at Post 1, hinged breakaway post at Post 2, and 6'-0" W6 x 9 steel posts at Posts 3 through 8. Use a W6 x 15 steel post at Post 1. The soil tube with soil plate must be, at the Contractor's option, driven with or without pilot holes, or placed in drilled holes. Space around the steel foundation tubes must be backfilled with selected earth, free of rock, placed in layers approximately 4 inches thick and each layer must be moistened and thoroughly compacted.

For Type SKT-W-MGS terminal system, install the soil tube with soil plate attached at Post 1, breakaway cable terminal post at Post 2, and controlled release terminal posts at Posts 3 through 8. The soil tube must be, at the Contractor's option, driven with or without pilot holes, or placed in a drilled hole. Space around the steel foundation tube must be backfilled with selected earth, free of rock, placed in layers approximately 4 inches thick and each layer must be moistened and thoroughly compacted. A wood post must be inserted into the steel foundation tube by hand. Before the wood terminal post is inserted, the inside surfaces of the steel foundation tube to receive the wood post must be coated with a grease that will not melt or run at a temperature of 149 degrees F or less. The edge of the wood post may be slightly rounded to facilitate insertion of the post into the steel foundation tube.

For Type 31" X-Lite terminal system, all crimped posts and line posts must be W6 x 8.5 or W6 x 9 steel posts. All posts, must be, at the Contractor's option, either driven or placed in drilled holes. Space around the crimped posts, Post 2 with attached soil plate and lines posts must be backfilled with selected earth, free of rock, placed in layers approximately 4 inches thick and each layer must be moistened and thoroughly compacted. All blocks must be wood or plastic.

For Type 31" X-Tension terminal system, the steel post and soil anchor must be, at the Contractor’s option, driven with or without pilot holes, or placed in drilled holes. Space around the steel post and soil anchor must be backfilled with selected earth, free of rock, placed in layers approximately 4 inches thick and each layer must be moistened and thoroughly compacted. The wood terminal posts must be inserted into the drilled holes by hand and backfilled in the same manner as the steel post and soil anchor. Wood terminal posts must not be driven. All blocks must be wood or plastic.

For Type 31" X-Tension terminal system, the steel bottom post and I-beam post must be placed in drilled hole. The soil anchor and steel line posts must be, at the Contractor's option, either driven or placed in drilled holes. Space around the steel bottom post, steel line posts and soil anchor must be backfilled with selected earth, free of rock, placed in layers approximately 4 inches thick and each layer must be moistened and thoroughly compacted. All blocks must be plastic.

For Type SOFT-STOP terminal system, Posts 1 and 2 must be W6 x 8.5 steel yielding terminal posts and the other posts must be standard W6 x 8.5 steel posts. All posts must be at the Contractor's option, either driven or placed in drilled holes. Space around the posts must be backfilled with selected earth, free of rock, placed in layers approximately 4 inches thick and each layer must be moistened and thoroughly compacted. For the 50'-9½" system, all blocks must be wood or plastic and must be 8 or 12 inches deep.

After installing the terminal system, dispose of surplus excavated material in a uniform manner along the adjacent roadway where designated by the Engineer.

**Replace section 83-1.02C(3) with:**

**83-1.02C(3) Alternative Flared Terminal System**

Alternative flared terminal system must be furnished and installed as shown on the plans and under these special provisions.

The allowable alternatives for a flared terminal system must consist of one of the following or a Department-authorized equal.

1. TYPE FLEAT-SP-MGS for steel or FLEAT-W-MGS for wood TERMINAL SYSTEM - Type FLEAT-MGS terminal system must be a Flared Energy Absorbing Terminal 350, system length 37'-6", manufactured by Road Systems, Inc., located in Big Spring, Texas, and must include items detailed for Type FLEAT-MGS terminal system shown on the plans. The Flared Energy Absorbing Terminal 350 can be obtained from the distributor, Universal Industrial Sales, P.O. Box 699, Pleasant Grove, UT 84062, telephone (801) 785–0505 or from the distributor, Gregory Industries, Inc., 4100 13th Street, S.W., Canton, OH 44708, telephone (330) 477–4800.
2. TYPE SRT-31 TERMINAL SYSTEM - Type SRT-31 terminal system must be an SRT-350 Slotted Rail Terminal (6-post system), system length 37'-6", as manufactured by Trinity Highway Products, LLC, and must include items detailed for Type SRT-31 terminal system shown on the plans. The SRT-350 Slotted Rail Terminal (6-post system) can be obtained from the manufacturer, Trinity Highway Products, LLC, P.O. Box 99, Centerville, UT 84012, telephone (800) 772–7976.

3. TYPE 31" X-TENSION - Type 31" X-Tension terminal system must be a 31" X-Tension Guard Rail End Terminal as manufactured by Barrier Systems, Inc., located in Vacaville, CA, and must include items detailed for Type 31" X-Tension terminal system shown on the plans. The 31" X-Tension Guard Rail End Terminal can be obtained from the distributor, Statewide Safety and Signs, Inc., 130 Grobric Court, Fairfield, CA 94533, telephone (800) 770–2644.

Submit a certificate of compliance for terminal systems.

Terminal systems must be installed under the manufacturer's installation instructions and these specifications. Each terminal system installed must be identified by painting the type of terminal system in neat black letters and figures 2 inches high on the backside of the rail element between system posts numbers 4 and 5. Paint must be metallic acrylic resin type spray paint. Before applying terminal system identification, the surface to receive terminal system identification must be removed of all dirt, grease, oil, salt, or other contaminants by washing the surface with detergent or other suitable cleaner. Rinse thoroughly with fresh water and allow to fully dry.

For Type SRT-31 terminal system, install a cable release post at Post 1 and 6'-0" steel yielding terminal posts at Posts 2 through 6. The cable release post and steel yielding terminal posts must be, at the Contractor's option, either driven, with or without pilot holes, or placed in drilled holes. If placed in pilot or drilled holes, space around the posts must be backfilled with selected earth, free of rock, placed in layers approximately 4 inches thick and each layer must be moistened and thoroughly compacted.

For Type FLEAT-SP-MGS terminal system, install the soil tube with soil plate attached at Post 1, hinged breakaway post at Post 2, and 6'-0" W6 x 9 steel posts at Posts 3 through 7. Use a W6 x 15 steel post at Post 1. The soil tube with soil plate must be, at the Contractor's option, driven with or without pilot holes, or placed in drilled holes. Space around the steel foundation tubes must be backfilled with selected earth, free of rock, placed in layers approximately 4 inches thick and each layer must be moistened and thoroughly compacted.

For Type FLEAT-W-MGS terminal system, install the soil tubes with soil plate attached at Posts 1 and 2, breakaway cable terminal posts at Posts 1 and 2, and controlled release terminal posts at Posts 3 through 6. The soil tubes with soil plates must be, at the Contractor's option, driven with or without pilot holes, or placed in drilled holes. Space around the steel foundation tubes must be backfilled with selected earth, free of rock, placed in layers approximately 4 inches thick and each layer must be moistened and thoroughly compacted. The breakaway cable terminal posts must be inserted into the steel foundation tubes by hand and must not be driven.

For Type 31" X-Tension terminal system, the steel post and soil anchor must be, at the Contractor’s option, driven with or without pilot holes, or placed in drilled holes. Space around the steel post and soil anchor must be backfilled with selected earth, free of rock, placed in layers approximately 4 inches thick and each layer must be moistened and thoroughly compacted. The wood terminal posts must be inserted into the drilled holes by hand and backfilled in the same manner as the steel post and soil anchor. Wood terminal posts must not be driven. All blocks must be wood or plastic.

For Type 31" X-Tension terminal system, the steel bottom post and I-beam post must be placed in drilled hole. The soil anchor and steel line posts must be, at the Contractor's option, either driven or placed in drilled holes. Space around the steel bottom post, steel line posts and soil anchor must be backfilled with selected earth, free of rock, placed in layers approximately 4 inches thick and each layer must be moistened and thoroughly compacted. All blocks must be plastic.

After installing the terminal system, dispose of surplus excavated material in a uniform manner along the adjacent roadway where designated by the Engineer.

**Replace the 1st paragraph of section 83-2.02D(3)(b) with:**

Concrete barriers constructed using an extrusion or slip form machine or other similar type of equipment must be made of well-compacted, dense concrete, and the exposed surfaces must comply with section 51. You may be required to submit evidence of successful operation of the extrusion or slip form machine or other equipment.

Submit a QC plan for use of the extrusion or slip form construction method if reinforcement is not fixed in place before placing concrete.

The QC plan must include:

1. Contingency plan for correcting problems in production, transportation, or placement
2. Procedure for splicing concrete barrier reinforcement
3. Procedure for positioning reinforcement during extrusion or slip form operations
4. Test procedure for verifying final positions of horizontal reinforcement at 100-foot intervals, evaluated a minimum of 20 feet behind the trailing extrusion or slip form edge
5. Test report forms to be used that shows (1) positions of reinforcement relative to the top of the barrier, (2) clearance cover from the faces of the barrier to the reinforcement, and (3) station of the tests

If a QC plan is submitted, submit the test report forms within 48 hours of constructing the concrete barrier.

The Department rejects concrete barrier with any reinforcement deviating more than 1 inch from the positions shown.

**nSSP (NEW)Replace section 83-2.02E(6) with:**

**83-2.02E(6) Type SMART Crash Cushion**

Install Type SMART crash cushion where shown.

Submit as informational submittals:

1. Manufacturer's plan and parts list
2. Manufacturer's certificate of compliance for the Type SMART crash cushion
3. Manufacturer's installation instructions

Type SMART crash cushion and additional components must comply with the description shown in the following table:

| Bid item description | Manufacturer's product description |
|---|---|
| Type SMART SCI 70GM Crash Cushion | SMART CUSHION Impact Attenuator (SCI 70GM) (TL-2)<br>Including transition to concrete block (Part No. 9433) and TL2 asphalt anchor kit |

The Type SMART crash cushion must be as manufactured by:

WORK AREA PROTECTION CORPORATION
2500 PRODUCTION DRIVE
ST CHARLES IL 60174

You may obtain the Type SMART crash cushion from the manufacturer's distributor:

D&M TRAFFIC SERVICES, INC.
845 REED STREET
SANTA CLARA CA 95050
TELEPHONE: (408) 591-3108

The price quoted by the manufacturer for Type SMART crash cushion is $20,511, not including sales tax.

The above price is firm for orders placed before November 13, 2015 , and provided delivery is accepted within 90 days after the order is placed.

The price quoted for Type SMART crash cushion includes the concrete anchorage devices.

Install the Type SMART crash cushion under the manufacturer's instructions.

Installation of the front delineation plate will be determined by the location of the crash cushion. Apply right shoulder black diagonal striping to the yellow background on crash cushion.

Concrete anchorage devices used for attaching the Type SMART crash cushion to the base slab must be limited to those that have been provided by the manufacturer.

The concrete anchor slab and anchor block must comply with sections 51 and 52.

The concrete anchor slab and anchor block must be constructed of concrete containing not less than 590 pounds of cementitious material per cubic yard.

Payment for structure excavation, structure backfill, concrete anchor slab with bar reinforcing steel, and concrete anchor block with bar reinforcing steel is included in the payment for Type SMART SCI-70GM crash cushion.

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## 84 TRAFFIC STRIPES AND PAVEMENT MARKINGS

**Replace Section 84-2.02 with:**

**84-2.02 MATERIALS**

84-2.02A General

Thermoplastic must comply with State Specification PTH-02SPRAY, PTH-02HYDRO, or PTH-02ALKYD.

Primer must comply with the thermoplastic manufacturer's recommendations. Do not thin the primer.

84-2.02B Preformed Thermoplastic

The material must be a preformed thermoplastic product containing a minimum thirty percent (30%) intermix of anti-skid/anti-slip elements and where the top surface contains anti-skid/anti-slip elements.

The material must be composed of an ester-modified resin in conjunction with aggregates, pigments, binders, and anti-skid/anti-slip elements uniformly distributed throughout the material.

The thermoplastic material must conform to AASHTO designation M249, with the exception of the relevant differences due to the material being supplied in a preformed state, being non-reflective, and being of a color different from white or yellow.

Supply the material in segments measuring 2 ft. x 3 ft. .

Supply the material at a minimum thickness of 125 mil .

The surface of the preformed thermoplastic material must contain factory applied anti-skid elements with a minimum hardness of 8 (Mohs scale). Upon application, the material must provide a minimum skid resistance value of 60 BPN when tested according to ASTM E 303. Upon application, the material must provide a minimum static coefficient of friction of 0.6 when tested according to ASTM C 1028 (wet and dry), and a minimum static coefficient of friction of 0.6 when tested according to ASTM D 2047.

The material must be capable of conforming to pavement contours, breaks and faults through the action of traffic at normal pavement temperatures.

The material must be resistant to the detrimental effects of motor fuels, antifreeze, lubricants, and hydraulic fluids; resistant to deterioration due to exposure to sunlight, water, salt or adverse weather conditions; and impervious to oil and gasoline.

The manufacturer must be ISO 9001:2008 certified for design, development and manufacturing and provide proof of current certification. The scope of the certification must include the design, development and manufacture of preformed thermoplastic marking material.

Pigment: The color of the pavement marking material must be in accordance with FHWA Memorandum dated April 15, 2011: Interim Approval for Optional Use of Green Colored Pavement for Bike Lanes (IA-14).

Daytime chromaticity coordinates for the color used for green colored pavement must be as follows:

| 1 | | | 2 | | | 3 | | | 4 | |
|---|---|---|---|---|---|---|---|---|---|---|
| X | y | | X | y | | x | Y | | x | y |
| 0.230 | 0.754 | | 0.266 | 0.500 | | 0.367 | 0.500 | | 0.444 | 0.555 |

Nighttime chromaticity coordinates for the color used for green colored pavement must be as follows:

| 1 | | | 2 | | | 3 | | | 4 | |
|---|---|---|---|---|---|---|---|---|---|---|
| X | y | | X | y | | x | Y | | x | y |
| 0.230 | 0.754 | | 0.336 | 0.540 | | 0.450 | 0.500 | | 0.479 | 0.520 |

The pigment system must not contain heavy metals or any carcinogen, as defined in 29 CFR 1910.1200 in amounts exceeding permissible limits as specified in relevant Federal Regulations.

Asphalt application: the material must be capable of being applied using the propane torch method or infrared or blue flame heater recommended by the manufacturer. The material must be capable of being applied at ambient and road temperatures down to 45ºF without any preheating of the pavement to a specific temperature and without any special storage, preheating or treatment of the material before application. A sealer specified by the manufacturer must be applied to the pavement surface prior to material

application to ensure proper adhesion. A thermometer must not be required during the application process. The pavement must be clean, dry and free of debris. Supplier must enclose application instructions with each box/package.

Portland cement concrete application: the same application procedure must be used as described above for application on asphalt. The material must be capable of being affixed to green concrete (concrete that has set but not appreciably hardened). The material must not require the Portland cement concrete application areas to be cured or dried out.

Heating indicators: the top surface of the material must have regularly spaced indents. The closing of these indents during application must act as a visual cue that the material has reached a molten state, allowing for satisfactory adhesion and proper embedment of the anti-skid/anti-slip elements, and a post-application visual cue that proper application procedures have been followed.

Packaging: the preformed thermoplastic material must be packaged in cardboard cartons. The cartons in which packed must be non-returnable and must not exceed 40 in. (1.02 m) in length and 25 in. (.64 m) in width. The cartons must be labeled for ease of identification. The weight of the individual carton must not exceed fifty (50) pounds (23 kg). A protective film around the carton must be applied in order to protect the material from rain or premature aging.

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## 86 ELECTRICAL SYSTEMS

**Add to the end of the 1st paragraph of the RSS for section 86-1.01:**

This work is shown on plan sheets labeled E and SES. The work involved in each bid item is shown on a sheet with a title matching the bid item description except for the following bid item:

1. Maintaining the existing traffic management system elements during construction

Traffic signal work must be performed at the following locations:

1. Signal and Lighting (Location 1)
2. Signal and Lighting (Location 2)

**Replace "15" in the 1st paragraph of the RSS for section 86-1.03 with:**

55

**Add to the list in the 5th paragraph of the RSS for section 86-1.03:**

**Replace "Reserved" in section 86-1.06B with:**

Traffic Management System (TMS) elements include, but are not limited to ramp metering (RM) system, communication system, traffic monitoring stations, video image vehicle detection system (VIVDS), microwave vehicle detection system (MVDS), loop detection system, changeable message sign (CMS) system, extinguishable message sign (EMS) system, highway advisory radio (HAR) system, closed circuit television (CCTV) camera system, roadway weather information system (RWIS), visibility sensor, and fiber optic system.

Existing TMS elements, including detection systems, shown and located within the project limits must remain in place and be protected from damage. If the construction activities require existing TMS elements to be nonoperational or off line, and if temporary or portable TMS elements are not shown, the Contractor must provide for temporary or portable TMS elements. The Contractor must receive authorization on the type of temporary or portable TMS elements and installation method.

Before work is performed, the Engineer, the Contractor, and the Department's Traffic Operations Electrical representatives must jointly conduct a pre-construction operational status check of all existing TMS elements and each element's communication status with the Traffic Management Center (TMC), including existing TMS elements not shown and elements that may not be impacted by the Contractor's activities. The Department's Traffic Operations Electrical representatives will certify the TMS elements' location and status, and provide a copy of the certified list of the existing TMS elements within the project limits to the Contractor. The status list will include the operational, defined as having full functionality, and the nonoperational components.

The Contractor must obtain authorization at least 72 hours before interrupting existing TMS elements' communication with the TMC that will result in the elements being nonoperational or off line. The Contractor must notify the Engineer at least 72 hours before starting excavation activities.

Traffic monitoring stations and their associated communication systems, which were verified to be operational during the pre-construction operational status check, must remain operational on freeway/highway mainline at all times, except:

1. For a duration of up to 15 days on any continuous segment of the freeway/highway longer than 3 miles
2. For a duration of up to 60 days on any continuous segment of the freeway/highway shorter than 3 miles

If the construction activities require existing detection systems to be nonoperational or off line for a longer time period or the spacing between traffic monitoring stations is more than the specified criteria above, and temporary or portable detection operations are not shown, the Contractor must provide provisions for temporary or portable detection operations. The Contractor must receive authorization on the type of detection and installation before installing the temporary or portable detection.

If existing TMS elements shown or identified during the pre-construction operational status check, except traffic monitoring stations, are damaged or fail due to the Contractor's activity, where the elements are not fully functional, the Engineer must be notified immediately. If the Contractor is notified by the Engineer that existing TMS elements have been damaged, have failed or are not fully functional due to the Contractor's activity, the damaged or failed TMS elements, excluding structure-related elements, must be repaired or replaced, at the Contractor's expense, within 24 hours. For a structure-related elements, the Contractor must install temporary or portable TMS elements within 24 hours. For nonstructure-related TMS elements, the Engineer may authorize temporary or portable TMS elements for use during the construction activities.

If fiber optic cables are damaged due to the Contractor's activities, the Contractor must install new fiber optic cables from an original splice point or termination to an original splice point or termination, unless otherwise authorized. Fiber optic cable must be spliced at the splice vaults if available. The amount of new fiber optic cable slack in splice vaults and the number of new fiber optic cable splices must be equivalent to the amount of slack and number of splices existing before the damage or as directed by the Engineer. Fusion splicing will be required.

The Contractor must demonstrate that repaired or replaced elements operate in a manner equal to or better than the replaced equipment. If the Contractor fails to perform required repairs or replacement

work, the Department may perform the repair or replacement work and the cost will be deducted from monies due to the Contractor.

A TMS element must be considered nonoperational or off line for the duration of time that active communications with the TMC is disrupted, resulting in messages and commands not transmitted from or to the TMS element.

The Contractor must provide provisions for replacing existing TMS elements within the project limits, including detection systems that were not identified on the plans or during the pre-construction operational status check that became damaged due to the Contractor's activities.

If the pre-construction operational status check identified existing TMS elements, then the Contractor, the Engineer, and the Department's Traffic Operations Electrical representatives must jointly conduct a post construction operational status check of all existing TMS elements and each element's communication status with the TMC. The Department's Traffic Operations Electrical representatives will certify the TMS elements' status and provide a copy of the certified list of the existing TMS elements within the project limits to the Contractor. The status list will include the operational, defined as having full functionality, and the nonoperational components. TMS elements that cease to be functional between pre and post construction status checks must be repaired at the Contractor's expense.

The Engineer will authorize the schedule for final replacement, the replacement methods and the replacement elements, including element types and installation methods before repair or replacement work is performed. The final TMS elements must be new and of equal or better quality than the existing TMS elements.

If no electrical work exists on the project and no TMS elements are identified within the project limits, the pre-construction operational status check is change order work.

Furnishing and installing temporary or portable TMS elements that are not shown, but are required when an existing TMS element becomes nonoperational or off line due to construction activities, is change order work.

Furnishing and installing temporary or portable TMS elements and replacing TMS elements that are not shown nor identified during the pre-construction operational status check and were damaged by construction activities is change order work.

If the Contractor is required to submit provisions for the replacement of TMS elements that were not identified, submitting the provisions is change order work.

**Add to section 86-2.03B:**

Use sleeve nuts on Type 1-B standards. The bottom of the base plate must be flush with finished grade.

**Add to section 86-2.04A:**

Where the side tenon detail at the end of the signal mast arm is shown, you may substitute the applicable tip tenon detail.

The sign mounting hardware must be installed at the locations shown.

Install non-illuminated street name signs on signal mast arms using a minimum 3/4 by 0.020-inch round edge stainless steel strap and saddle bracket. Wrap the strap at least twice around the mast arm, tighten, and secure with a 3/4-inch stainless strap seal. Level the sign panel and tighten the hardware securely.

Set the Type 1 standards with the handhole on the downstream side of the pole in relation to traffic or as shown.

**Add to section 86-2.05A:**

Conduit installed underground must be Type 1 or Type 3.

**Add to section 86-2.05B:**

The conduit in a foundation and between a foundation and the nearest pull box must be Type 1.

**Add to section 86-2.05C:**

Where 6 or more 3-inch conduits enter a No. 6 pull box, the conduits must enter at an angle not greater than 45-degrees from the horizontal.

If a standard coupling cannot be used for joining Type 1 conduit, use a UL-listed threaded union coupling under section 86-2.05C, a concrete-tight split coupling, or a concrete-tight set screw coupling.

If Type 3 conduit is placed in a trench, not in the pavement or under concrete sidewalk, after the bedding material is placed and the conduit is installed, backfill the trench to not less than 4 inches above the conduit with minor concrete under section 90-2, except the concrete must contain not less than 421 pounds of cementitious material per cubic yard. Backfill the remaining trench to finished grade with backfill material.

After conductors have been installed, the ends of the conduits terminating in pull boxes, service equipment enclosures, and controller cabinets must be sealed with an authorized type of sealing compound.

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

The final 2 feet of conduit entering a pull box in a reinforced concrete structure may be Type 4.

**Add to section 86-2.06A(1) of the RSS for section 86-2.06, after the 1st paragraph:**

Cover marking must be as follows:

1. *SERVICE* for service circuits between service point and service disconnect
2. *SERVICE IRRIGATION* for circuits from service equipment enclosure to irrigation controller
3. SERVICE BOOSTER PUMP for circuits from service equipment enclosure to the booster pump
4. *TDC POWER* for circuits from service equipment enclosure to telephone demarcation cabinet
5. *LIGHTING* for lighting system
6. *SIGN ILLUMINATION* for sign illumination system
7. *SIGNAL AND LIGHTING* for signal and lighting system
8. *RAMP METER* for ramp metering system
9. *TMS* for traffic monitoring station
10. *FLASHING BEACON* for flashing beacon system
11. *CMS* for changeable message sign system
12. *INTERCONNECT* for interconnect conduit and cable system

**Replace the 3rd paragraph in section 86-2.06A(2) of the RSS for section 86-2.06 with:**

In a ground or sidewalk area, embed the bottom of a pull box in crushed rock.

**Replace "Reserved" in section 86-2.06B of the RSS for section 86-2.06 with:**

**86-2.06B(1) General**

**86-2.06B(1)(a) Summary**

Section 86-2.06B includes specifications for installing non-traffic-rated pull boxes.

**86-2.06B(1)(b) Submittals**

Before shipping pull boxes to the job site, submit a list of materials used to fabricate the pull boxes to METS. Include:

1. Contract number
2. Manufacturer's name
3. Manufacturer's installation instructions
4. Your contact information

Submit reports for pull boxes from an NRTL-accredited laboratory.

Before installing a pull box and cover, submit the manufacturer's replacement warranty for them.

**86-2.06B(1)(c) Quality Control and Assurance**

**86-2.06B(1)(c)(i) Functional Testing**

The pull box and cover must be tested under ANSI/SCTE 77, "Specification for Underground Enclosure Integrity."

**86-2.06B(1)(c)(ii) Warranty**

Provide a 2-year manufacturer's replacement warranty for the pull box and cover. The warranty period starts on the date of Contract acceptance.

Deliver replacement parts within 5 business days after you receive notification of a failed pull box, cover, or both to the Department's Maintenance Electrical Shop at:

CALTRANS MAINTENANCE ELECTRICAL SHOP
30 RICKARD STREET
SAN FRANCISCO, CA 94134-1224
Tel (415) 330-6500

**86-2.06B(2) Materials**

The pull box and cover must comply with ANSI/SCTE 77, "Specification for Underground Enclosure Integrity," for tier 22 load rating and must be gray or brown.

Each pull box cover must have an electronic marker cast inside.

A pull box extension must be made of the same material as the pull box and attached to the box to maintain the minimum combined depths.

Include recesses for a hanger if a transformer or other device must be placed in a pull box.

The bolts, nuts, and washers must be a captive design.

The captive bolt must be capable of withstanding a torque from 55 to 60 ft-lb and a minimum pull-out strength of 750 lb. Perform the test with the cover in place and the bolts torqued. The pull box and cover must not be damaged while performing the test.

Hardware must be stainless steel with 18 percent chromium and 8 percent nickel content.

Galvanize ferrous metal parts under section 75-1.05.

The manufacturer's instructions must include:

1. Quantity and size of entries that can be made without degrading the strength of the pull box below the tier 22 load rating
2. Locations where side entries cannot be made
3. Acceptable method for creating the entry

The tier 22 load rating must be labeled or stenciled by the manufacturer on the inside and outside of the pull box and on the underside of the cover.

**86-2.06B(3) Construction**

Do not install a pull box in curb ramps or driveways.

A pull box for a post or a pole standard must be located within 5 feet of the standard. Place the pull box adjacent to the back of the curb or edge of the shoulder. If this is impractical, place the pull box in a suitable, protected, and accessible location.

**Add to section 86-2.08A:**

Wrap conductors around the projecting end of conduit in pull boxes as shown. Secure conductors and cables to the projecting end of the conduit in pull boxes.

**Replace the 1st sentence of the 1st paragraph of section 86-2.08E with:**

Signal interconnect cable must be the 6-pair type with stranded tinned copper no. 20 conductors.

**Add to section 86-2.09A:**

The neutral conductor must run from the service equipment enclosure to the controller cabinet without splicing to any other neutral conductor.

**Replace the 1st paragraph of section 86-2.09E with:**

Splices must be insulated by "Method B."

**Delete the 6th and 7th paragraphs of section 86-2.09E.**

**Replace 8th & 9th paragraphs of section 86-2.09E with:**

Splices must be insulated by "Method B."

Use Method B as follows:

1. Cover the splice area completely with an electrical insulating coating and allow it to dry.
2. Apply 3 layers of half-lapped 80 mils PVC tape.
3. Apply 2 layers of 120 mils Butyl rubber stretchable tape with liner.
4. Apply 3 layers of half-lapped 6 mils PVC pressure-sensitive adhesive tape.
5. Cover the entire splice with an electrical insulating coating and allow it to dry.

**Add to section 86-2.11A:**

Continuous welding of exterior seams in service equipment enclosures is not required.

Circuit breakers must be the cable-in/cable-out type mounted on non-energized clips. All circuit breakers must be mounted vertically with the up position of the handle being the "ON" position.

Each service must be provided with up to 2 main circuit breakers that will disconnect ungrounded service entrance conductors. Where the "Main" circuit breaker consists of 2 circuit breakers as described, each of the circuit breakers must have a minimum interrupting capacity of 10,000 A, rms.

**Add to section 86-2.11A, after 5th paragraph:**

The main and neutral busses of the enclosure must be made of tin-plated copper and rated for 125 A and be suitable for copper or aluminum conductors.

Identify each circuit breaker and component by description using an engraved phenolic nameplate.

The nameplate must be installed using stainless steel rivets or screws:

1. Adjacent to the breaker on the dead front panel. The characters must be a minimum of 1/8 inch high.
2. Adjacent to the component on the back panel. The characters must be a minimum of 1/8 inch high.
3. At the top exterior of the door panel. The nameplate must include the system number, voltage, and number of phases engraved in a minimum 3/16-inch-high characters.

A plastic-laminated wiring diagram must be attached inside the enclosure with brass eyelets by a UL listed or NRTL certified method.

Locate the foundation such that the minimum clearance around the front and back of the enclosure complies with NEC, Article 110.26, "Spaces About Electrical Equipment" (600 V, nominal or less).

The meter area must be have a sealable, lockable, weathertight cover that can be removed without the use of tools.

Service equipment enclosure must be factory wired.

The dead front panel on a Type III service equipment enclosure must have a continuous stainless steel or aluminum piano hinge. This panel or dead front panel must be secured with a latch or captive screws. No live part must be mounted on this panel or dead front panel.

The enclosures must be rated NEMA 3R and include a dead front panel and a hasp with a 7/16-inch-diameter hole for a padlock.

If a Type III enclosure houses a transformer of more than 1 kVA, the enclosure must have an effective screened ventilation louvers of no less than 50 sq. in for each louver. The framed screen must be stainless no. 304 with a no. 10 size mesh and secured with at least 4 bolts.

The fasteners on the exterior of an enclosure must be vandal-resistant and not removable. The exterior screws, nuts, bolts, and washers must be stainless steel.

Landing lugs must be sized for the incoming service utility conductors, be compatible with either copper or aluminum conductors and be copper or tin-plated aluminum. Live parts of the electrical equipment must be guarded against accidental contact.

The interior of the enclosure must accept plug-in circuit breakers. A minimum of 6 standard single pole circuit breakers, 3/4" nominal, must be provided for branch circuits. Circuit breakers for a service equipment enclosure must have interior made of copper.

For Type III-A, -B, and -C enclosures, the meter socket must be a 5-clip type and the landing lug must be suitable for multiple conductors.

For Type III-D enclosure, the meter socket must be a 7-clip type and the landing lug must be suitable for multiple conductors. The pedestal must comply with the Electric Utility Service Equipment Requirements Committee (EUSERC) drawing no. 308 or 309.

Install a grounding electrode for each cabinet, service equipment enclosure, and transformer. Attach a grounding conductor from the electrode to the equipment using either a ground clamp or exothermic weld. Connect the other end to the cabinet, service equipment enclosure and transformer.

The clearance between the bottom of the lowest circuit breaker and the bottom of the service equipment enclosure for a type III-A series must be 24 inches minimum.

**Replace "Reserved" in section 86-2.11B with:**

Electric service (irrigation) must be from the service points to the irrigation controllers (IC) and to the spaces provided in the irrigation controller enclosure cabinets (CEC) for irrigation controllers as shown.

**Replace section 86-2.18 with:**

## 86-2.18 NUMBERING ELECTRICAL EQUIPMENT

The placement of numbers on electrical equipment will be done by others.

**Add to section 86-2:**

## 86-2.19 LAYER 2 ETHERNET SWITCH

### 86-2.19A General

#### 86-2.19A(1) Summary

Section 86-2.19 includes specifications for installing the layer 2 Ethernet switch.

#### 86-2.19A(2) Definitions

Not Used

#### 86-2.19A(3) Submittals

Submit:

1. Manufacturer's cut sheets indicating performance and environmental requirement.
2. Operation manual that include:
   - 2.1. Equipment specification summary
   - 2.2. Theory of the operation
   - 2.3. Trouble shooting information
   - 2.4. Removal and installation
   - 2.5. Schematic diagrams identifying all circuit components

#### 86-2.19A(4) Quality Control and Assurance

##### 86-2.19A(4)(a) General

Not Used

##### 86-2.19A(4)(b) Warranty

Furnish 5-year replacement warranty from the manufacturer of the layer 2 Ethernet switch against any defects or failures. The effective date of the warranty is the date of installation. Furnish replacement within 5 days after receipt of the failed parts. The Department does not pay for the replacement parts. Deliver replacement layer 2 Ethernet switch to:

CALTRANS MAINTENANCE ELECTRICAL SHOP
30 RICKARD STREET
SAN FRANCISCO, CA 94134-1224
Tel (415) 330-6500

### 86-2.19B Materials

#### 86-2.19B(1) General

The layer 2 Ethernet switch includes layer 2 Ethernet switch unit, small form-factor pluggable (SFP) module, CAT-5E cable, and power supply.

#### 86-2.19B(2) Layer 2 Ethernet Switch Unit

Layer 2 Ethernet switch unit must:

1. Have Ethernet copper interface with 6 Ethernet 10/100/1000 Mbps ports minimum
2. Have Ethernet fiber optic interface with 4 SFP ports minimum total, with 2 gigabit ports minimum
3. Have console port for unit configuration
4. Have protocols for:
   - 4.1. Transmission Control Protocol (TCP)
   - 4.2. User Datagram Protocol (UDP)
   - 4.3. Internet Protocol (IP)

4.4. Hypertext Transfer Protocol (HTTP)

4.4.1. IGMP

4.4.2. SNMP V1/V2/V3

4. Be IP multicast capable
5. Comply with:
   5.1. IEEE 802.1Q Standard VLAN
   5.2. IEEE 802.1D-Spanning Tree Protocol
   5.3. IEEE 802.1p-Class of Service, Quality of Service
   5.4. IEEE 802.1Q-VLAN Tagging
   5.5. IEEE 802.1w-Rapid Spanning Tree Protocol
   5.6. IEEE 802.1x-Port Based Network Access Control
   5.7. IEC 62439-2, Media Redundancy Protocol

6. Be compatible with existing network, switch management, and monitoring software
7. Meet environmental requirement without use of fans shown in the following table:

**Environmental Requirements**

| Parameter | Range |
|---|---|
| Operating temperature (ºF) | -40 – 167 |
| Relative humidity (non-condensing) (%) | 10 – 95 |

8. Have an integrated mounting including 4 keyhole screw mounts in 19 inch rack or mounting bracket using DIN rail
9. Meet electromechanical requirements:
   9.1. IEC 60068 2-6, 2-27 – Vibration and Shock
   9.2. IEC 61850-3, NEMA TS-2 Environment Rating – EMI Immunity
   9.3. UL508 – Electrical Safety
   9.4. Electric Substations – IEEE 1613

**86-2.19B(3) Small Form-Factor Pluggable Module**

SFP module must:

1. Be one of the types shown in the following table:

**SFP Module**

| SFP Module Type | Media Type | Wavelength | Typical Transmission Distance | Transmit Power (dBm) | Receive Power Range (dBm) |
|---|---|---|---|---|---|
| 10/100/1000 Base-TX | CAT-5E | N/A | <328 ft | -- | -- |
| 100Base-LX | Singlemode | 1310 nm | 6.2 miles | -8 – -15 | -8 – -28 |
| 1000Base-LX/LH | Singlemode | 1310 nm | 6.2 miles | -3 – -9.5 | -3 – -20 |
| 1000Base-ZX | Singlemode | 1550 nm | 43.4 miles | 5 – 0 | -3 – -23 |

2. Support a minimum connection and distance shown in the following table:

**Minimum Connection Distance**

| Type | Distance |
|---|---|
| Fiber optic (ft) | 6.2 |
| Copper (ft) | 3.1 |

3. Operate in temperature ranging from -30 – 158 degrees F
4. Be compatible and from the same manufacturer of the layer 2 Ethernet switch unit
5. Be determined on the distance of the fiber optic link

6. Be compatible with the type of fiber optic link
7. Be compatible with LC (International Electrotechnical Commission standard IEC 61754-20) type fiber connector

**86-2.19B(4) CAT-5E Cable**

The CAT-5E cable must comply with the requirements of TIA-568 performance for Ethernet cabling systems.

**86-2.19B(5) Power Supply**

The power supply must meet the requirements shown in the following tables:

**Power Supply Requirements**

| Input voltage V(ac) | Input current (A) |
|---|---|
| 85 – 265 | Not more than 1.3 |
| 18 – 60 | |

**Environmental Requirements**

| Parameter | Range |
|---|---|
| Operating temperature (ºF) | -40 – 167 |
| Relative humidity (non-condensing) (%) | 10 – 95 |

**86-2.19C Construction**

Install layer 2 Ethernet switch unit in Model 334 controller cabinet. Configuration must be done by a manufacturer authorized representative. The layer 2 switch may be connected via SFP module to other layer 2 switches served by the same communications link or to a telecommunications service point in a telephone demarcation cabinet. The Department will provide configuration parameters at the time of installation.

In case of too high optical power at receiving end, 5 or 10 db, inline optical attenuator must be used at both ends to avoid overloading the receiver.

Make connections to cabinet equipment using manufacturer certified CAT-5E network patch cables as TIA-568 standard compliant. Connectors at both ends of the CAT-5E copper patch cables must be T568B termination.

**86-2.19D Payment**

Not Used

**Add to section 86-2:**

**86-2.20 ETHERNET FIBER OPTIC EXTENDER**

**86-2.20A General**

**86-2.20A(1) Summary**

Section 86-2.20 includes specifications for installing the Ethernet fiber optic extender.

**86-2.20A(2) Definitions**

Not Used

**86-2.20A(3) Submittals**

Submit:

1. Warranty documentation before installation
2. Documentation required for acceptance testing, maintenance, and operation
3. Test plan to the Engineer indicating proposed dates, duration and methods of the testing
4. Performance test report and collected data to the Engineer for authorization

5. One set of documents with the parameters configured and related wiring installed

### 86-2.20A(4) Quality Control and Assurance

#### 86-2.20A(4)(a) General

Tests data must be collected in the presence of the Engineer.

#### 86-2.20A(4)(b) Warranty

Furnish a 2-year replacement warranty from the manufacturer of the Ethernet switch against any defects or failures. The effective date of the warranty is the date of acceptance of the installation. Furnish replacement parts within 15 days after receipt of the failed parts. The Department does not pay for the replacement. Deliver replacement parts to:

CALTRANS MAINTENANCE ELECTRICAL SHOP
30 RICKARD STREET
SAN FRANCISCO, CA 94134-1224
Tel (415) 330-6500

### 86-2.20B Materials

#### 86-2.20B(1) General

The Ethernet fiber optic extender includes Ethernet fiber optic extender unit, mounting hardware, power supply, cables, and connectors.

#### 86-2.20B(2) Ethernet Fiber Optic Extender Unit

The Ethernet fiber optic extender unit must:

1. Comply with FCC Part 15 Class B, UL 60950
2. Operate over singlemode fiber optic cable to extend or bridge field Ethernet networks
3. Be interoperable with industry standard Ethernet network capable equipment and rated for use in outdoor enclosures without the use of mechanical cooling
4. Have transparent operations to end users and other industry standard Ethernet network capable equipment
5. Include web browser
6. Include a front panel diagnostic LED status indicators for power status, alarm, port network link connection and data activity status
7. Have ports for:
   7.1. Fiber optic
   7.2. Local management TIA-232 via DE9
   7.3. MES: Four type autosensing 10/100BaseT half/full duplex minimum
8. Meet environmental requirement shown in the following table:

**Environmental Requirements**

| Parameter | Range |
|---|---|
| Operating temperature (ºF) | 14 – 140 |
| Relative humidity (non-condensing (%)) | 10 – 90 |

9. Be 3.4 by 10 by 12 (Height x Width x Depth) inches maximum
10. Have operational uptime of 99.5 percent measured over a 30-day period, excluding maintenance
11. Weight 1 lb maximum
12. Have point to point, linear add-drop (daisy chain) supported network architecture
13. Have a supported add-drop locations
14. Have a 6 ms end to end delay between Ethernet fiber optic extender
15. Sustain data transfer between connected Ethernet fiber optic extender
16. Operate without any unit, power and communication faults or alarms for 14 consecutive days

Ethernet fiber optic extender unit must comply with the standards and protocols shown in the following tables:

**Network Standards**

| Standards |
|---|
| IEEE 802.1 - Dynamic Bridging |
| IEEE 802.1Q - VLAN Tagging |
| IEEE: 802.1d - STP |
| IEEE 802.3ad - Link Aggregation |
| IEEE 802.1ad - Provider Bridges |
| IEEE 802.3ah clause 57 - OAM |
| IEEE 802.1ag - Connectivity Fault Management |
| IEEE 802.1p - Class of Service (CoS) |
| IEEE 802.3i - Ethernet |
| IEEE 802.3u - Fast Ethernet |

**Network Protocols**

| Protocols |
|---|
| LLDP - Discovery Mechanisms |
| Q-in-Q RSTP - Double Tagging |
| TCP/IP, UDP/IP |
| SNMP: SNMP v1, SNMP v2c |
| TL1 - Command Line Interface |
| Telnet - Remote Access |
| SNTP v3 - Time Synchronization |
| HTTP - Web Access |
| FTP - File Transfer |

### 86-2.20B(3) Mounting Hardware

The mounting hardware must be for shelf and wall mount installation.

### 86-2.20B(4) Power Supply

The power supply must meet the requirements shown in the following table:

**Power Supply Requirements**

| Input voltage | Power |
|---|---|
| 120 V(ac) | 75 W |
| 6 – 24 V(dc) | |

### 86-2.20B(5) Cables

The cables must comply with RUS-Chapter XVII, Title 7, Section 1755.900.

### 86-2.20B(6) Connectors

The Ethernet fiber optic connectors must be Type RJ-45 for MES port, and ST singlemode for fiber optic cable.

### 86-2.20C Construction

Install and connect Ethernet fiber optic extender unit on equipment shelf in Model 334 cabinet as shown.

Configure the Ethernet fiber optic extender under the supervision of the manufacturer's representative.

The Engineer will review the accuracy data findings and accept or reject the results within 21 days.

### 86-2.20D Payment

Not Used

**Add to section 86-2:**

## 86-2.21 FIBER OPTIC SYSTEM

### 86-2.21A General

#### 86-2.21A(1) Summary

Section 86-2.21 includes specifications for installing fiber optic system.

#### 86-2.21A(2) Definitions

**Breakout method:** See mid-span access method definition.

**Connector:** A mechanical device used to align and join two fibers together to provide a means for attaching to and decoupling from a transmitter, receiver, or another fiber (i.e., patch panel).

**Connectorized:** Termination point of a fiber after connectors have been affixed.

**Connector Module Housing (CMH):** A patch panel used in the FDU to terminate fibers with most common connector types. It may include a jumper storage shelf and a hinged door.

**Couplers:** Devices which mate two fiber optic connectors to facilitate the transition of optical light signals from one connector into another. Couplers may also be referred to as: adapters, feed-through, and barrels. They are normally located within FDUs mounted in panels. They may also be used unmounted, to join two simplex fiber runs.

**End-to-End Loss:** The maximum permissible end-to-end system attenuation is the total loss in a given link. This loss could be the actual measured loss, or calculated using typical (or specified) values. This number will determine the amount of optical power (in dB) needed to meet the System Performance Margin.

**Fiber Distribution Unit (FDU):** A rack mountable enclosure containing both a connector module housing (CMH) and a splice module housing in one enclosure.

**FO:** Fiber optic.

**FOOP:** Fiber optic outside plant cable.

**FOTP:** Fiber optic test procedure(s) as defined by ANSI EIA/TIA standards.

**FPC:** Fiber pigtail drop cable.

**FTC:** Fiber trunkline cable.

**Light Source:** A portable fiber optic test equipment that, in conjunction with a power meter, is used to perform end-to-end attenuation testing. It contains a stabilized light source operating at the designed wavelength of the system under test. It also couples light from the source into the fiber to be received at the far end by the receiver.

**Link:** A passive section of the system, the ends of which are to be connectorized to active components. A link may include splices and couplers. For example, a video data link may be from video FO transmitter to video FO receiver.

**Link Loss Budget:** A calculation of the overall permissible attenuation from the fiber optic transmitter (source) to the fiber optic receiver (detector).

**Loose Tube Cable:** Type of cable construction in which fibers are placed in buffer tubes to isolate them from outside forces (stress). A flooding compound or material is applied to the interstitial cable core to prevent water migration and penetration. This type of cable is primarily for outdoor applications.

**Mid-Span Access Method:** Description of a procedure in which fibers from a single buffer tube are accessed and spliced to an adjoining cable without cutting the unused fibers in the buffer tube, or disturbing the remaining buffer tubes in the cable.

**Optical Time Domain Reflectometer (OTDR):** A fiber optic test equipment (similar in appearance to an oscilloscope) that is used to measure the total amount of power loss between two points and over the corresponding distance. It provides a visual and printed display of the relative location of system

components such as fiber sections, splices and connectors as well as the losses that are attributed to each component and or defects in the fiber.

**Patch cord:** A short jumper used to join two components.

**Pigtail:** Relatively short length of fiber optic cable that is connectorized on only one end. All pigtails must be tight buffered cable.

**Power Meter:** A portable fiber optic test equipment that, when coupled with a light source, is used to perform end-to-end attenuation testing. It contains a detector that is sensitive to light at the designed wavelength of the system under test. Its display indicates the amount of power injected by the light source that arrives at the receiving end of the link.

**SM:** Singlemode.

**SMFO:** Singlemode Fiber Optic Cable.

**Splice:** The permanent joining of fiber ends to identical or similar fibers.

**Splice Enclosure:** An environmentally sealed container used to organize and protect splice trays. The container allows splitting or routing of fiber cables from and to multiple locations.

**Splice Module Housing (SMH):** Stores splice trays as well as pigtails and short cable lengths.

**Splice Tray:** A container used to organize and protect spliced fibers.

**Segment:** A section of fiber optic cable that is not connected to any active device and may or may not have splices per the design.

**Splice or Fiber Optic Vault:** An underground container used to house excess cable and splice enclosures.

**System Performance Margin:** A calculation of the overall "End to End" permissible attenuation from the fiber optic transmitter (source) to the fiber optic receiver (detector). The system performance margin should be at least 6 dB. This includes the difference between the active component link loss budget, the passive cable attenuation (total fiber loss) and the total connector/splice loss.

**Tight Buffered Cable:** Type of non-breakout cable construction where each glass fiber is tightly buffered (directly coated) with a protective thermoplastic coating to 900 μm. The tight buffered cable must meet all the characteristics of the fiber in the fiber optic outside plant cable specified elsewhere in these specifications.

### 86-2.21A(3) Submittals

#### 86-2.21A(3)(a) General

Submit to the Engineer, the cable manufacturer's certificate of compliance for the fiber optic cables. Before shipment, but while on the shipping reel, test 100 percent of all fibers must be tested for attenuation. Copies of test results must be:

1. Maintained on file with a file identification number by the manufacturer for a minimum of seven years
2. Attached to the cable reel in a waterproof pouch

Submit the manufacturer's instructions procedures for installing FO cable and splice enclosures, 20 working days before installation.

Submit detailed test procedure at least 15 days before starting field testing. Include:

1. Date and description of the test
2. Test plan
3. Name of the manufacturer and production date of the testing equipment
4. Equipment operating instructions

### 86-2.21A(4) Quality Control and Assurance

#### 86-2.21A(4)(a) General

Fiber optic system components must be tested:

1. At the factory
2. At the site, before installation
3. During final system testing

Notify the Engineer 2 working days before performing field testing. Include exact location of the system or components to be tested. Do not proceed with the testing until authorized.

#### 86-2.213A(4)(b) Factory Testing

1. Factory testing of cables must include the following tests under part 7 of ICEA S-87-640:
   - 1.1. Jacket print
   - 1.2. Length and marking accuracy
   - 1.3. Cable high and low temperature bend
   - 1.4. Compound flow (drip) for gel filled cables
   - 1.5. Water penetration
   - 1.6. Cable impact
   - 1.7. Cable tensile loading and fiber strain
   - 1.8. Cable compressive loading
   - 1.9. Cable twist
   - 1.10. Lightning damage susceptibility
2. Part 8 of ICEA S-87-640 "Finished cable optical performance requirements":
   - 2.1. Attenuation coefficient
   - 2.2. Point discontinuity
   - 2.3. Multimode optical bandwidth
   - 2.4. Singlemode cable cutoff wavelength

#### 86-2.21A(4)(c) Fiber Optic Cable Testing

Test the cable under ICEA S-87-640 and NECA/FOA 301.

Perform the following tests after installation, under post splicing tests:

1. End to end attenuation, using optical power meter and light source.
2. Optical anomalies using OTDR in both directions.

### 86-2.21B Materials

#### 86-2.21B(1) General

The FO cable properties must be compliant with Chapter XVII, Title 7, Part 1755.900 of the Code of Federal Regulations, "*REA Specification for Filled Fiber Optic Cables*".

FO cable identification and marking must comply with Part 6 of ICEA S-87-640. Markings must be placed on the cable jacket.

#### 86-2.21B(2) Fiber Optic Cable

#### 86-2.21B(2)(a) General

Detailed specifications for Class IVa dispersion unshifted singlemode optical fibers as described by TIA-492CAAAXBBQB is shown in the following table:

**FO Singlemode Cable**

| Property | FOTP(s) | Test Conditions | Requirement |
|---|---|---|---|
| Cladding diameter (µm) | 45 or 48 or 176 | | 125±1.0 |
| Cladding non-circularity (%) | 45 or 48 or 176 | | < 1.0 |
| Core/cladding concentricity error (µm) | 45 or 176 | | < 1.0 |
| Coating diameter (µm) | 163 or 173 | | 250±15 |
| Coating/cladding concentricity error (µm) | 163 or 173 | | < 20 |
| Tensile strength proof test (GPa) | 31 | | 0.69 |
| Coating strip force (N) | 178 | 30 mm length | 1.0 min, 9.0 max |
| Attenuation coefficient (dB/km) | 78 or 61 or 120 | @ 1310 nm | 0.5 |
| | 78 or 61 or 120 | @ 1500 nm | 0.4 |
| Mode field diameter (µm) | 164 or 174 | @ 1310 nm<br>@ 1500 nm | 9.1±0.5<br>10.4±0.6 |
| Point discontinuity (dB/pt) | 59 | | <0.10 |

### 86-2.21B(2)(b) Cable Layup

#### 86-2.21B(2)(b)(i) General

FO cable must include the following components:

1. Central strength member
2. Color coded buffer tubes containing color coded coated fibers and hydrocarbon blocking gel
3. Outer strength member
4. Core wrap
5. Ripcord
6. Jacket

#### 86-2.21B(2)(b)(ii) Buffer Tubes

Buffer tube must contain one of the following flooding material:
1. Hydrocarbon blocking gel
2. Water blocking swellable polymer yarn or tape

Buffer tubes containing fibers must also be color coded with distinct and recognizable colors according to the following table:

**Buffer Tube Color Coding**

| | |
|---|---|
| 1. Blue (BL) | 7. Red (RD) |
| 2. Orange (OR) | 8. Black (BK) |
| 3. Green (GR) | 9. Yellow (YL) |
| 4. Brown (BR) | 10. Violet (VL) |
| 5. Slate (SL) | 11. Rose (RS) |
| 6. White (WT) | 12. Aqua (AQ) |

#### 86-2.21B(2)(b)(iii) Ripcord

The cable must contain at least one ripcord under the jacket for easy sheath removal.

### 86-2.21B(3) Post-Installation Labels

Labels must be made of a material designed for permanent labeling. Metal tags must be constructed of stainless steel. Metal tags are required for use on fiber optic cables. Use non-metal label materials only if approved. At vaults and other underground locations, all labels and imprinting must be weatherproof.

### 86-2.21B(4) Conduit Sealing Plugs

Sealing plugs must be removable and reusable. Sealing plugs must be the split type that permits installation or removal without removing cables. Sealing plugs must seal the conduit simultaneously with one self-contained assembly having an adjustable resilient filler of neoprene or silicone rubber clamped between backing ends and compressed with stainless steel hardware.

To provide suitable sealing between future varying size cables and the plugs, split neoprene or silicone adapting sleeves used singularly or in multiples must be inserted within the body of the plugs. Sealing plugs used to seal the fiber optic conduit must be capable of withstanding a pressure of 5 psi.

### 86-2.213B(5) Conduit Innerduct

Innerduct must be as shown. A separate pull tape must be installed in each innerduct.

Innerduct must made of one of the following:

1. An extruded flexible, smooth or ribbed high density polyethylene (HDPE) tubing
2. Fabric mesh pouch

Innerduct within a conduit run must be continuous without splices or joints.

Innerduct must be color coded in accordance with the cable type:

1. Type A – black
2. Type B – orange
3. Type C – yellow
4. Type D – blue

The innerducts must be shipped on reels marked with the manufacturer's name, contract number, and the size and length of the innerduct. The product on reels must be covered with aluminized material to protect colors from UV deterioration during shipment and storage.

### 86-2.21B(6) Conduit Concrete Backfill

Colored concrete backfill for installation of duct bank must be a medium to dark, red or orange color. The concrete must conform to the provisions in section 51 and section 90-2.

The concrete backfill must be colored by a coloring agent specifically manufactured for coloring concrete.

### 86-2.21B(7) Cable Marker

Cable markers must be as shown.

### 86-2.21B(8) Communication Conduit Anchors

Anchors used to attach communication conduits (electrical conduits) to the exterior surfaces of existing concrete structures and walls consist of metal straps and anchoring devices. Metal straps must be made of steel and must be fabricated to the details and dimensions shown. Anchoring devices must consist of mechanical expansion stud anchors. Anchors must conform to the provisions in section 75-1.03.

### 86-2.21B(9) Warning Tape

The warning tape must comply with the following table:

**Warning Tape**

| Description | Parameters |
|---|---|
| Thickness | Minimum 4 mil |
| Width | 4 inches |
| Material | Orange color polyolefin film |
| Tensile strength of material | Minimum of 2800 psi |
| Elongation | Minimum of 500 percent elongation before breakage |
| Printed message content | CAUTION: BURIED FIBER OPTIC CABLE<br>CALTRANS RADIO ROOM (510) 286-4444 |
| Printed message text height and color | 1 inch, black color text over bright orange background |
| Message spacing intervals | 3 feet |

The printed warning must not be removed by the normal handling and burial of the tape and must be rated to last the service life of the tape. Warning tape must not delaminate when it is wet. It must be resistant to insects, acid, alkaline and other corrosive elements in the soil.

**86-2.21B(10) Fiber Optic Pull Box**

Each fiber optic pull box must be no. 6 with extensions and conform to the requirements of section 86-2.06.

**86-2.21B(11) Fiber Optic Vault**

Fiber optic vault must be minimum of 48 (L) by 30 (W) by 24 (D) inches nominal inside dimensions and must conform to the requirements in section 86-2.06.

Vault, cover and extensions may be constructed of non-PCC material with concrete gray color or comply with section 86-2.06.

Fiber optic vault and covers must have an AASHTO HS 20-44 rating. Metallic or non-metallic cable racks must be installed on the interior of both long sides of the fiber optic vaults. The racks must be capable of supporting a load of 100 pounds, minimum, per rack arm. Racks must be supplied in lengths appropriate to the box in which they will be placed. All metallic cable racks must be fabricated from ASTM A36 steel plate and must be hot-dip galvanized after fabrication. Steel plate, hardware and galvanizing must comply with the requirements in section 75. Metallic cable racks must be bonded and grounded.

**86-2.21B(12) Splice Enclosure**

The splice enclosure must be suitable for a direct burial or pull box application.

The splice enclosure must comply with the following:

1. Non-filled thermoplastic case
2. Rodent proof, water proof, re-enterable and moisture proof
3. Expandable from 2 cables per end to 8 cables per end by using adapter plates
4. Cable entry ports must accommodate from 3/8 to 1 inch diameter cables
5. Multiple grounding straps
6. Accommodate up to 8 splice trays
7. Suitable for "butt" or "through" cable entry configurations
8. Place no stress on finished splices within the splice trays

**86-2.21B(13) Fiber Distribution Units**

**86-2.21B(13)(a) General**

FDU must include the following:

1. A patch panel to terminate the appropriate number of singlemode fibers with ST type connectors feed through couplers.
2. Splice trays.
3. Storage for splice trays.

4. A slide out metal drawer for storage of spare jumpers.

Provide strain relief for incoming fiber optic cables. Cable accesses must have rubber grommets to prevent cables from contacting bare metal. Fibers must be terminated and individually identified in FDUs and on patch panels.

Patch panels must be hinged or have coupler plates to provide easy access and maintenance. Brackets must be provided to spool incoming fibers a minimum of 2 turns. Turns must be at least 1 foot before separating out individual fibers to splice trays.

FDUs dimensions must not exceed 10 inches in height and 15 inches in depth.

Termination and distribution cable trays must accommodate fiber optic cables and must have sufficient tray areas for excess optical fiber storage with provisions to assure that optical fibers do not exceed a 2 inch bend radius. Termination and distribution cable trays must include a designation strip for identification of optical fibers. Splice drawers must include splice trays with each splice tray capable of accommodating fusion type splices. Splice drawers must allow storage of excess lengths of optical fibers of fiber optic cables. FDUs must have cable clamps to secure fiber optic cables to the chassis.

#### 86-2.21B(13)(b) Splice Trays

Splice trays must accommodate a minimum of 12 fusion splices and must allow for a minimum bend radius of 2 inches. The splice tray cover may be transparent.

Splice trays in the splice enclosure must comply with the following:

1. Accommodate up to 24 fusion splices
2. Place no stress on completed splices within the tray
3. Stackable with a snap-on or hinged cover
4. Secure buffer tubes and pigtails entering the tray
5. Labeled after splicing is completed.

Only one single splice tray may be secured by a bolt through the center of the tray in the fiber termination unit. Multiple trays must be securely held in place as per the manufacturer’s instruction.

### 86-2.21B(14) Fiber Optic Pigtails and Jumpers

#### 86-2.21B(14)(a) General

Cable assemblies (jumpers and pigtails) must be produced by the same manufacturer. The cable used for cable assemblies must be made with optical fiber meeting the performance requirements.

#### 86-2.21B(14)(b) Pigtails

Pigtails must be of simplex (one fiber) construction, in 900-μm tight buffer form, surrounded by Aramid yarn for strength, with a PVC jacket with manufacturer's identification information, and a nominal outer jacket diameter not exceeding 1/8 inch. Pigtails must be factory terminated and tested and at least 3 feet long.

#### 86-2.21B(14)(c) Jumpers

Jumpers may be of simplex or duplex design. Duplex jumpers must be of duplex round cable structure, and must not have zipcord (siamese) structure. All jumpers must be at least 6 feet in length, sufficient to avoid stress and allow orderly routing.

#### 86-2.21B(14)(d) Connectors

Connectors must be one of the following types:

1. ST for normal applications
2. SC for normal applications
3. 586SC for network applications
4. LC for network applications

Associated couplers must be the same material as connector housings.

ST and SC type FO connectors must be 1 inch ferrule type with Zirconia ceramic material with a physical contact pre-radiused tip.

The connector operating temperature range must be -40 to +70 degrees C. Insertion loss must not exceed 0.4 dB for singlemode, and the return reflection loss on singlemode connectors must be at least -35 dB. Connection durability must be less than a 0.2 dB change per 500 mating cycles under TIA-455-21A (FOTP-21). All terminations must provide a minimum 50 lbf pull out strength. Factory test results must be documented and submitted before installing any of the connectors.

Field terminations must be limited to splicing of adjoining cable ends or cables to pigtails.

All connectors must be factory-installed and tested. Do not install connectors in the field.

All unmated connectors must have protective caps installed.

### 86-2.21B(15) Packaging and Shipping Requirements

Package the completed cable for shipment on reels. The cable must be wrapped in weather-and temperature-resistant covering. Both ends of the cable must be sealed to prevent the ingress of moisture.

Both ends of the cable must be securely fastened to the reel. Six feet of cable length on each end of the cable must be accessible for testing.

Each cable reel must have a durable weatherproof label or tag showing the manufacturer's name, the cable type, the actual length of cable on the reel, your name, the contract number, and the reel number. Provide a shipping record in a weatherproof envelope showing the above information and also include the date of manufacture, cable characteristics such as size, attenuation, bandwidth, factory test results, cable identification number and any other pertinent information.

The minimum hub diameter of the reel must be at least thirty times the diameter of the cable. The FO cable must be in one continuous length per reel with no factory splices in the fiber. Each reel must be marked to indicate the direction of rolling to prevent loosening of the cable.

Furnish manufacturer’s installation instructions at the time of delivery.

## 86-2.21C Construction

### 86-2.21C(1) General

FO cable must be installed in conduit or cable tray system as shown.

Comply with the manufacturer’s installation instructions. Mechanical aids may be used provided that a tension measuring device is placed to the end of the cable. The tension applied must not exceed 600 lb force or the manufacturers recommended pulling tension, whichever is less.

### 86-2.21C(2) Pulled Cable Installation

Use a cable pulling lubricant recommended by the cable manufacture and a non-abrasive pull tape. Station your personnel at each pull box, vault, and cabinet to lubricate and prevent kinking or other damage during cable pulling.

The bend radius must be at least twenty times the outside diameter of the cable. The cable grips for installing the FO cable must have a ball bearing swivel to prevent the cable from twisting during installation.

### 86-2.21C(3) Air Blown Installation

The fiber cable must be installed using the air blown method. If integral innerduct is used, the duct splice points or any temporary splices of innerduct used for installation must withstand a static air pressure of 110 psi.

The fiber installation equipment must incorporate a mechanical drive unit or pusher that feeds cable into the pressurized innerduct to provide a sufficient push force on the cable, which is coupled with the drag force created by the high-speed airflow. The unit must be equipped with controls to regulate the flow rate of compressed air entering the duct and any hydraulic or pneumatic pressure applied to the cable. It must accommodate longitudinally ribbed or smooth wall ducts from nominal 0.625-inch to 2-inch inner diameter. Mid assist or cascading of equipment must be for the installation of long cable runs. The

equipment must incorporate safety shutoff valves to disable the system in the event of sudden changes in pneumatic or hydraulic pressure.

The equipment must not require the use of a piston or any other air capturing device to impose a pulling force at the front end of the cable, which also significantly restricts the free flow of air through the inner duct. It must incorporate the use of a counting device to determine the speed of the cable during installation and the length of the cable installed.

### 86-2.21C(4) Splices and Termination

The cable must be installed without splices except where shown. Minimum 30 feet slack of the cable must be provided at each cable access location without a cable splice or fiber optic splice locations.

Field cable splices must be done either in splice vaults or in cabinets as shown.

The cable splices must be fusion type. The mean splice loss must not exceed 0.07 dB per splice. The mean splice loss is an average value of 2 loss measurements taken in the opposite directions.

Use mid-span access method to access the individual fibers in FO cable for splicing. Follow cable manufacturer’s instructions, use tools recommended by the manufacturer. Cut only the fibers to be spliced. Do not damage buffer tubes and individual fibers.

Use the breakout method to access individual fiber as follows:

1. Remove the jacket just beyond the last tie-wrap point
2. Expose 3 to 6 feet of the cable buffers, aramid strength yarn and central fiberglass strength member
3. Cut aramid yarn, central strength member and the buffer tubes to expose the individual glass fibers for splicing or connecting.

Cable manufacturer's instructions procedures and approved tools must be used when performing a mid-span access. Measures must be taken to avoid damaging buffer tubes and individual fibers not being used in the mid-span access. You are allowed to splice up to 5 fibers to repair any damage done during mid-span access splicing without penalty. You will be assessed $300.00 penalty for each additional splice. Any single fiber may not have more than 3 unplanned splices. If the fiber needs to be spliced more than 3 times, the entire length of fiber optic cable must be replaced at your expense.

The termination splices must connect the cable span ends with pigtails. The termination splices must be placed in splice trays and the splice trays must then be placed in the FDU.

Splice trays must accommodate a minimum of 12 fusion splices. The individual fibers must be looped at least one full turn within the splice tray to avoid micro bending. A 2 inch minimum bend radius must be maintained during installation and after final assembly in the optical fiber splice tray. Each bare fiber must be individually restrained in a splice tray. The optical fibers in buffer tubes and the placement of the bare optical fibers in the splice tray must be such that there is no discernable tensile force on the optical fiber.

All splices must be protected with a metal reinforced thermal shrink sleeve.

### 86-2.21C(5) Post-Installation Cable Labeling

#### 86-2.21C(5)(i) General

Label all fiber optic cables with tags. All tags placed along one cable must contain the same cable identification code unique for that cable.

Tags must be placed on the cables at the following points:

1. Fiber optic vault entrance and exit
2. Splice enclosures entrance and exit
3. FDU entrance

All tags must be made of the same material designed for long term permanent labeling of fiber optic and copper communications cables. Metal tags must be constructed of stainless steel. Material for non-metal tags must be approved in writing by the Engineer.

Metal tags must be marked with embossed lettering. Non-metal tags must be marked with the permanent ink. Handwritten label markings must not be allowed.

Labels must be affixed to the cable under the manufacturer's instructions in a manner that will not cause damage to the cable.

Cable identification code must consists of the groups shown in the following table:

**Cable Identification Code**

| No. | Description | Code | Numbers of Characters |
|---|---|---|---|
| 1 | Fiber Type | **S:** Singlemode | 1 |
| 2 | Fiber Count | **048 (example):** Actual number of fibers or conductor pairs | 3 |
| 3 | Begin Point | **T:** TMC<br>**H:** Hub<br>**V:** Video Node<br>**D:** Data Node<br>**C:** Cable Node<br>**TV:** CCTV Camera<br>**CM:** CMS<br>**E:** Traffic Signal<br>**RM:** Ramp Meter<br>**TM:** Traffic Monitoring/ Count Station/Vehicle Count Station (VDS, TMS)<br>**SV:** Splice Vault or Fiber Optic Vault<br>**SC:** Splice Cabinet | 1 or 2 |
| 4 | Begin Point County Code Number | **35:** San Mateo<br>**37:** Santa Clara | 2 |
| 5 | Begin Point Route Number | One of the following: 082, 084, 101, 109, 114 | 3 |
| 6 | Begin Point Post Mile | **02470 (example):** Actual PM value | 5 |
| 7 | End Point | In the same manner as for Begin Point | 1 or 2 |
| 8 | End Point County Code Number | In the same manner as for Begin Point | 2 |
| 9 | End Point Route Number | In the same manner as for Begin Point | 3 |
| 10 | End Point Post Mile | In the same manner as for Begin Point | 5 |
| 11 | Cable ID number | **03 (example):** Actual cable number in a vault or pullbox | 2 |

Use the following table to determine begin and end points. Begin point must be associated with the lower numbered item. End point must be associated with the higher numbered item. When both points are associated with the same item, begin point must be associated with the lower equipment number.

| No. | Location |
|---|---|
| 1 | TMC |
| 2 | HUB |
| 3 | Video Node (VN) |
| 4 | Data Node (DN) |
| 5 | Cable Node |
| 6 | CCTV Camera |
| 7 | CMS |
| 8 | Traffic Signal |
| 9 | Ramp Meter |
| 10 | Traffic Monitoring Count Station |
| 11 | HAR |
| 12 | EMS |
| 13 | Weather Station |
| 14 | Weight In Motion |
| 15 | Splice Vault or Cabinet |

**County Code**

| County | County Code |
|---|---|
| Alameda | 33 |
| Contra Costa | 28 |
| Marin | 27 |
| Napa | 21 |
| San Francisco | 34 |
| San Mateo | 35 |
| Santa Clara | 37 |
| Santa Cruz | 36 |
| Sonoma | 20 |
| Solano | 23 |

### 86-2.21C(5)(ii) Begin and End Point Determination Examples

A cable between:

1. HUB and TMC must begin at TMC and end at HUB
2. Vault and CMS must begin at CMS and end at Vault
3. HUB-03 and HUB-01 must begin at HUB-01 and end at HUB-03

### 86-2.21C(5)(iii) Cable Code Example

The cable code S 048 SV 35 084 02470 SV 37 082 02510 03 must be interpreted as a singlemode, 48 strand, cable starting at a fiber optic vault in San Mateo County on Route 84 at post mile 24.70, and ending at another fiber optic vault in Santa Clara County on Route 82 at postmile 25.10. Cable ID number indicates that the cable is the third of the fiber optic cables in the vault.

### 86-2.21C(6) Conduit Sealing Plugs

Install conduit sealing plugs in all fiber optic conduits and innerducts.

A sealing plug that seals an empty conduit must have an eye or other type of capturing device on the side of the plug that enters the conduit to attach onto the pull tape so that the pull tape will be easily accessible when the plug is removed.

### 86-2.21C(7) Conduit Innerduct

Install innerducts in conduits as shown. Install fiber optic cables in innerducts.

### 86-2.21C(8) Conduit Concrete Backfill

Concrete backfill must conform to the provisions in section 86-2.05C.

The concrete backfill must be colored by a coloring agent specifically manufactured for coloring concrete. The coloring agent must be fine ground, synthetic mineral oxide and must be uniformly and homogeneously mixed with the concrete.

The color of the concrete backfill after curing and when air dry must be red conforming to color no. 31105 of Federal Standard no. 595B.

Adequate spacers, tie-downs and bracing must be provided to maintain conduits in place during the pouring of the concrete. For trenches in paved areas, only the top 4 inch of concrete backfill must be pigmented concrete.

### 86-2.21C(9) Cable Marker

Cable markers must be provided for FO conduits constructed in unpaved locations and placed at 50 feet spacing.

### 86-2.21C(10) Communication Conduit Anchors

When communication conduits are installed vertically on a structure for a distance of 2 feet or more, but less than 8 feet, an anchor must be installed at the top and bottom of the pipe within 0.5-foot of the elbows. Vertical distances of 10 feet or more must have anchors installed at 5 feet on centers as shown. Anchors used to support vertically installed pipe and conduit must be installed as shown.

Holes for anchorage devices must conform to the following:

1. Reinforcing steel must be located by nondestructive means before drilling holes for anchors. Holes must not be drilled closer than 0.5-foot to the edge of a concrete structure.
2. Holes must be drilled with rotary drills. Impact drills must not be used. Coring is not allowed.
3. Holes must be relocated if reinforcing steel is encountered. Abandoned holes must be filled with portland cement concrete mortar conforming to the provisions in section 51-1.03E.
4. Holes must be drilled to a minimum depth of 8 times the diameter of the anchor bolt or stud anchor.
5. Anchors must be on the Department approved list for mechanical expansion anchors and installed under manufacturer's instructions:

   http://www.dot.ca.gov/hq/esc/approved_products_list/

### 86-2.21C(11) Warning Tape

Warning tape must be installed in the trench over new conduits for fiber optic cable as shown.

### 86-2.21C(12) Fiber Optic Pull Box

Conduits must not protrude more than 2 inches inside the pull box and must enter at the angle not exceeding 20 degrees to either vertical or horizontal axis of the pull box.

### 86-2.21C(13) Fiber Optic Vault

Fiber optic vault must be installed as shown. Fiber optic vault must be installed at gradeFO vault must be installed outside of the pavement. Maintain 5 feet typical distance from the vault cover centerline to the edge of the pavement or back of the dike. Minimum distance from any part of the vault or backfill material to the edge of the pavement or back of the dike must be 18 inches. The top of the vault cover must be within 1 ±0.5 inch of adjacent finished grade.

When fiber optic vaults are installed in paved areas:

1. Distance from the centerline of the vault cover to the edge of pavement or back of dike must not exceed 3 feet
2. Top of vault cover must be 0.1 ±0.05 inch below of the adjacent pavement finished grade

Conduits must not protrude more than 2 inches inside the vault and must enter at the angle not exceeding 20 degrees to either vertical or horizontal axis of the vault.

### 86-2.21C(14) Splice Enclosure

The splice enclosure must be bolted to the side wall of the splice vault.

### 86-2.21C(15) Fiber Distribution Units

#### 86-2.21C(15)(a) General

Install components to terminate incoming fiber optic communication cables.

Install sufficient quantity of fiber distribution units to terminate fibers in the largest cable. Mount fiber distribution in equipment racks as shown. Terminate optical fibers at fiber distribution units. Optical fibers must be fusion spliced to optical fiber cables assemblies within splice trays.

Optical fibers must have sufficient lengths to allow future splicing with splice drawers and must be appropriately identified. Splices must be fusion type and must be arranged within splice trays of fiber distribution units in accordance with the organizational design of splice trays. Appropriate protective coatings must be applied to fusion splices.

#### 86-2.21C(15)(b) Splice Trays

Individual fibers must be looped one full turn within the splice tray to allow for future splicing. No stress is to be applied on the fiber when it is located in its final position.

### 86-2.21D Payment

Not Used

**Add to section 86-2:**

## 86-2.22 CLOSED CIRCUIT TELEVISION

### 86-2.22A General

#### 86-2.22A(1) Summary

Section 86-2.22 includes specifications for furnishing and installing closed circuit television (CCTV) system.

#### 86-2.22A(2) Definitions and Abbreviations

**APA:** Aluminum polymer and aluminum shield with adhesive.

**CCU:** The camera control unit is a part of a live television broadcast "chain". It is responsible for powering the professional video camera, handling signals sent over the camera cable to and from the camera.

**CLI:** A Command-line Interface is a means of interaction with a computer program where the user issues commands to a program in the form of successive lines of text.

**DE9:** D-sub 9 male and female connectors for network cable connection.

**DHCP:** The dynamic host configuration protocol is a network protocol to configure network devices so that they can communicate on an IP network.

**HCC:** Hybrid camera cable is a power and communication cable for CCTV system.

**MPEG-4-ISO/IEC 14496-2:** A moving picture expert group is a method of defining compression of audio and visual digital data.

**PE:** Polyethylene is an insulated material for the cables and conductors.

**PTZ:** Pan/tilt/zoom is a function for the CCTV camera.

**SD:** Secure digital memory card format.

**SMPTE-170M:** Society of motion picture and television engineers committee on television technology. SMPTE 170M is used for TV broadcasts

**SNMP:** Simple network management protocol is an Internet-standard protocol for managing devices on IP networks.

**TDR:** A Time-domain reflectometer is an electronic instrument used to characterize and locate faults in metallic cables. It can also be used to locate discontinuities in a connector, printed circuit board, or any other electrical path.

**TELNET:** network protocol used on the internet or local area networks to provide a bidirectional interactive text-oriented communication facility using a virtual terminal connection.

**TIA:** Telecommunications industries association organization who developed a common interface standard for data communications equipment.

**UTP:** Unshielded twisted pair cable. UTP cable is a 100 ohm copper cable that consists of 2 to 1800 unshielded twisted pairs surrounded by an outer jacket. They have no metallic shield. This makes the cable small in diameter but unprotected against electrical interference. The twist helps to improve its immunity to electrical noise.

**VEU:** Video encoder unit is a device enables compression or decompression of digital video.

### 86-2.22A(2)(a) Abbreviations

| | |
|---|---|
| LED | Light Emitting Diode |
| AC | Alternating Current |
| AMP | Amphenol Connector Type |
| SNMP | Simple Network Management Protocol |
| CLI | Command Line Interface |
| NTSC | National Television System Committee |
| SIF | Source Input Format |
| QSIF | Quarter Source Input Format |
| CIF | Common Intermediate Format |
| QCIF | Quarter Common Intermediate Format |
| BNC | Bayonet Neill-Counclman Connector |
| RJ | Registered Jack |
| IP | Internet Protocol |
| DHCP | Dynamic Host Configuration Protocol |
| bps | Bits Per Second |
| fps | Frame Per Second |
| MPEG | Motion Picture Experts Group |
| ISO | International Organization for Standardization |
| IEC | International Electrotechnical Commission |
| DiffServ (QoS) | DIFFerentiated SERVices (Quality Of Service) |
| UDP | User Datagram Protocol |
| RTP | Real-time Transport Protocol |
| RTSP | Real Time Streaming Protocol |
| RTCP | Real-time Transport Control Protocol |
| HTTP | HyperText Transfer Protocol |
| MIL | MILitary |
| MCTU | Multiple Camera Termination Unit |
| USB | Universal serial bus |

### 86-2.22A(3) Submittals

### 86-2.22A(3)(a) General

Not Used

### 86-2.22A(3)(b) Service Manuals

Submit a minimum of 3 copies of service manuals for the CCTV (PTZ) camera unit, fixed camera unit, CCU, MCTU, and VEU.

The manuals must include the following:

1. General information:
   1.1. A list of applicable subassemblies that comprise the specified equipment
   1.2. Overall description of the equipment design features including all enhance features, performance, and applications
   1.3. Equipment installation instructions
2. Theory of operations:
   2.1. Theory of operation of the standard equipment, with unique or unusual circuitry described in detail
   2.2. Theory of operation reflecting any modifications to the standard equipment
3. Maintenance:
   3.1. Recommended test equipment and fixtures, or minimum operational and performance requirements for appropriate test equipment
   3.2. Trouble shooting information and charts
   3.3. Removal and installation procedures for replacing assemblies and subassemblies, if not obvious or if improper sequencing of steps may result in component damage
4. Replacement parts:
   4.1. Each manual must contain an equipment replacement parts list including electrical parts, mechanical parts and assemblies.
   4.2. All semiconductors must be identified by the supplier's numbers and by Joint Electron Device Council (JEDEC) numbers if applicable
5. Diagram and physical requirements:
   5.1. Schematic diagram(s) identifying all circuit components and showing normal test voltages and levels
   5.2. An overall functional block diagram
   5.3. Detailed interconnecting diagram(s) showing wiring between modules, circuit boards and major components
   5.4. Pictorial circuit board layout diagram(s) showing both component placement and printed wiring detail
   5.5. Diagram(s) showing location of circuit boards and other subassemblies
   5.6. Exploded view diagram(s) of complex mechanical assemblies
6. Physical requirements:
   6.1. All pages, including latest revisions, must be securely fastened together between protective covers (loose-leaf ring binding is acceptable)
   6.2. No page shall be subject to fading from exposure to any normal source of ambient lighting (ozalid reproduced pages are not acceptable)

### 86-2.22A(4) Quality Control and Assurance

#### 86-2.22A(4)(a) General

Not Used

#### 86-2.22A(4)(b) Camera Station Equipment Testing

The following items must be submitted to the Department of Transportation Laboratory, 5900 Folsom Blvd, Sacramento, CA 95819 for acceptance testing:

1. CCTV (PTZ) camera unit and fixed camera unit
2. Camera control unit
3. Video encoder unit
4. Multiple camera termination unit

You are responsible for the costs of shipping, handling and the transportation of equipment to and from the Laboratory.

#### 86-2.22A(4)(c)..Testing CCTV (PTZ) and Fixed Camera Station

Upon completion of work, each CCTV (PTZ) and fixed camera must be subjected to post-installation tests as outlined herein. All software must be provided and loaded before the start of testing.

The testing consists of five consecutive days of continuous satisfactory operation of each camera station. Replace any material and equipment found to be defective, unsuitable or violating standards. The Department does not pay for replacement parts.

After all defects have been corrected, the camera station must be re-tested until five consecutive days of continuous satisfactory operation is obtained.

Inspection must consist of verification of correct wiring terminations, correct cable interconnections, good workmanship.

Functional testing for CCTV (PTZ) camera station must include the following:

1. Verify all local mode CCTV operations using the CCU front panel controls.
2. Verify video signal output from CCU with NTSC monitor.
3. Verify the correct operation of the auto/manual iris and focus, and manual zoom functions.
4. Verify the correct operation of the pan/tilt function. The pan/tilt function must be tested over 355 degrees in the horizontal plane and +20 to -90 degrees in the vertical plane.
5. Verify the correct operation of the preset positions.

Functional testing for CCTV fixed camera station must include the following:

1. Verify video signal output from fixed camera with a NTSC monitor.
2. Verify the correct operation of the auto/manual iris and focus, and manual zoom functions with a laptop PC software.
3. Verify the correct operation of the preset positions.

### 86-2.22A(4)(d) Inspection and Testing Cable and Connectors

Before beginning of work, test the entire length of HCC for attenuation and faults using a TDR. One or more of the following defines a fault in a long length of cable:

1. Return loss measurements indicating that attenuation exceeds 3 dB in the band from 5 MHz to 30 MHz in a portion of cable less than 10 feet long.
2. A return loss measurement indicating that there is a short in the cable.
3. A return loss measurement indicating a cut or open circuit in the cable.
4. A visual inspection that reveals exposure of or damage to the cable shielding.

Testing of HCC and connectors must comply with section 86-2.14B. Replace and retest any cable lengths found to have faults. Dispose of the removed faulty cable. The cable termination must be randomly inspected for contact crimping quality control. Any contact found not crimped with the correct crimping tool and is defect must be rejected. Redo the termination until all defects are corrected.

### 86-2.22A(4)(e) Warranty

Furnish a 1 year replacement written warranty from the manufacturer of the camera station equipment against any defects or failures. The effective date of the warranty is the date of installation. Camera station equipment must be replaced within 10 days after receipt of the failed camera station equipment. The Department does not pay for the replacement. Deliver replacement camera station to the following department maintenance electrical shop:

CALTRANS MAINTENANCE ELECTRICAL SHOP
30 RICKARD STREET
SAN FRANCISCO, CA 94134-1224
Tel (415) 330-6500

## 86-2.22B Materials

### 86-2.22B(1) General

The CCTV system includes the following equipment:

1. CCTV (PTZ) Camera Station:
   - 1.1. CCTV pole and camera mounting adapter
   - 1.2. CCTV (PTZ) camera unit
   - 1.3. Hybrid camera cable (HCC), connectors and fittings as required
   - 1.4. Interface cable and conductors as required
   - 1.5. CCU
   - 1.6. VEU

1.7. Equipment shelf with brackets as required
1.8. Rack-mount power strip

2. CCTV (Fixed) Camera Station:
   2.1. CCTV (fixed) camera unit
   2.2. HCC, connectors and fittings as required
   2.3. Interface cable and conductors as required
   2.4. MCTU
   2.5. VEU
   2.6. Equipment shelf with brackets as required
   2.7. Rack-mount power strip

**86-2.22B(2)..CCTV (PTZ) and Fixed Camera Station**

Each camera must comply with the specifications in the following table:

**CCTV (PTZ) Camera Unit**

| Quality Characteristic | Requirement |
|---|---|
| Imager | Interline transfer Progressive Scan CCD with mosaic-type color compensating filter |
| Image Area | 1/4 inch Format |
| Resolution | 540 horizontal; 350 vertical |
| Video Output | NTSC, 1 V p-p at 75 ohms, unbalanced |
| Lens | Aperture: f/1.4 (wide angle) to f/4.2 (telephoto) |
| Optical Zoom Range | 35X, 0.13 to 4.68 inches |
| Digital Zoom Range | 1X (Off) through 210X, Smooth transition from Optical to Digital Zoom |
| Horizontal Angle of View | Optical: From 55.8 to 1.7 degrees; At 10X Digital: From 55.8 to 0.17 degrees. |
| Focus Distance. | 40 inches in telephoto, 0.4 inch in wide angle |
| Auto Focus | Selectable Auto/Manual |
| Manual Focus Speed | Approximately 2.0 seconds to full range |
| Minimum Scene Illumination | For Reliable Auto Focus, 30 percent video |
| Zoom & Focus Presets | 64 preset positions with auto focus and ID |
| Flash Memory | Update firmware and new features via serial communication |
| Auto Iris | Automatically adjusts to compensate for changes in scene illumination to maintain constant video level output within sensitivity specifications |
| Manual Iris | Changing the video level to give the effect of open iris/close iris |
| Gamma | 0.45 |
| AGC | From 0 to 28 dB |
| Color Balance | Auto Tracking Color Balance/Manual with adjustable Red and Blue Levels |
| Signal to Noise Ratio | >50 dB |
| Synchronization | Crystal or Phase-Adjust Line Lock on 60 Hz |
| Sensitivity | At F1.4, Wide Angle 35 IRE<br>0.5-Lux at 1/60 s, F1.4, Shutter, Color I.R. Cut On<br>0.05-Lux at 1/2 s, F1.4, Shutter, Color I.R. Cut On<br>0.2-Lux at 1/60 s, F1.4, Shutter, monochrome mode I.R. Cut Off<br>0.01-Lux at 1/4 s, F1.4, Shutter, monochrome mode I.R. Cut Off |

Pan and tilt function must comply with the specifications in the following table:

**Pan and tilt**

| | |
|---|---|
| 1 | Continuous pan rotation capability in either direction |
| 2 | 110 degrees of tilt movement, +20 degree to –90 degree unobstructed |
| 3 | Pan Speed (Operator Control): Variable from 0.1 degrees to 80 degrees |
| 4 | Pan Speed (Preset Control): >140 degree/s |
| 5 | Tilt Speed (Operator Control): Variable from 0.1 degrees to 80 degrees |
| 6 | Tilt Speed (Preset Control): 140 degree/s |
| 7 | 64 Pan and Tilt preset positions with repeatability within ±0.5 degrees |

### 86-2.22B(3) CCTV (PTZ) Camera Unit

#### 86-2.22B(3)(a) General

Each CCTV (PTZ) camera unit consists of a camera, lens, receiver/driver, pan/tilt assembly, environmental housing, sunshield and pigtail cable with connector. The CCTV (PTZ)camera unit must automatically switch to monochrome mode when ambient light level is at 20 foot-candles and switch back to color at 180 foot-candles.

The CCTV (PTZ) camera unit must have eight programmable camera movement sequences. Each sequence is programmed by selecting the preset position by number, and then selecting a dwell time. The presets can be used in any order, and the same preset may be used more than once as long as the total number of preset positions used does not exceed 32. The dwell time defines the length of time paused at each preset position. It can be from 1 second to 60 seconds. The dwell time can be changed individually for all stops on the sequence. If the appropriate preset ID is programmed, it must be displayed for each preset position used on the sequence. The sequence must stop upon receipt of a pan/tilt command. All programmable functions must be stored in non-volatile memory.

Preset ID must be 1 line, up to 24 characters long, user programmable for each of the 64 preset positions. When a preset position is recalled the corresponding preset ID must be displayed. The preset ID must remain displayed until a pan, tilt, zoom, manual focus, auto focus select, or another preset command is received.

#### 86-2.22B(3)(b) CCTV (PTZ) Camera Pigtail Cable and Connector

The camera pigtail cable must comply with the specifications for HCC. The length of the camera pigtail cable must not be less than 32 inches.

The contact pin assignment of the connector must be as shown in the following table:

**CCTV (PTZ) Camera Pigtail Cable Connector Pin Position**

| Position | Function | Position | Function |
|---|---|---|---|
| 1 | Video, 75 ohm | 9 | Not Used |
| 2 | Video Ground | 10 | Not Used |
| 3 | Data Ground | 11 | Not Used |
| 4 | Tx- | 12 | 115 V(ac) Line, Hot |
| 5 | Tx+ | 13 | 115 V(ac), Neutral |
| 6 | Rx+ | 14 | Not Used |
| 7 | Rx- | 15 | 115 V(ac), Ground |
| 8 | Not Used | 16 | Not Used |

Furnish a mating connector and sixteen contact crimping sockets for each CCTV (PTZ) camera unit supplied in the contract.

#### 86-2.22B(3)(c)..CCTV (PTZ) Camera Physical and Mechanical Requirements

Each CCTV (PTZ) camera unit must weigh less than 20 pounds. Its dimensions must be less than 14 inches in length, 7 inches in width and 12 inches in height, including mounting base. The CCTV (PTZ) camera unit must be a pole mount version. There must be four equal spaced mounting holes on the mounting base. Each CCTV (PTZ) camera unit must be provided with four stainless steel hex head bolts to secure the CCTV (PTZ) camera unit to the camera mounting plate. All fasteners and nuts used in attaching the CCTV (PTZ) camera unit to the mounting plate must be of grade 18-8 stainless steel. A camera-mounting adapter must be provided as shown.

### 86-2.22B(4) CCTV Fixed Camera Unit and Connector

#### 86-2.22B(4)(a) General

Each CCTV fixed camera unit must consists of a camera, lens, receiver/driver, environmental housing, sunshield and a cable connector. The CCTV fixed camera unit must automatically switch to monochrome mode when ambient light level is at 20 foot-candles and switch back to color at 180 foot-candles.

Camera connector must be mounted on the backplate of the camera housing. The camera connector must be equivalent to an AMP PT07-14-18P.

The contact pin assignment of the connector shown in the following table:

**CCTV Fixed Camera Cable Connector Pin Position**

| Position | Function | Position | Function |
|---|---|---|---|
| S | Video, 75 Ω | J | Not Used |
| H | Video Ground | K | Not Used |
| G | Data Ground | R | Not Used |
| F | Tx- | T | Not Used |
| E | Tx+ | L | Not Used |
| M | Rx+ | D | 115 V(ac) Line, Hot |
| N | Rx- | C | 115 V(ac), Neutral |
| A | Not Used | P | 115 V(ac), Ground |
| B | Not Used | U | Overall Shield |

Furnish a mating connector, AMP PT06A-14-18S (SR) with 90 degree back shell.

#### 86-2.22B(4)(b) Fixed Camera Unit Physical and Mechanical Requirements

The CCTV fixed camera unit must weigh less than 10 pounds. Each camera and lens must be mounted in a sealed, cylindrical, environmental housing which must be less than 5 inches in diameter and 15 inches in length. The CCTV fixed camera unit must have 3 equal spaced mounting holes on the mounting base. Each CCTV fixed camera unit must be provided with 3 stainless steel hex head bolts to secure the CCTV fixed camera unit to the camera mounting plate. All fasteners and nuts used in attaching the CCTV fixed camera unit to the mounting plate must be of grade 18-8 stainless steel. A camera-mounting bracket must be provided as shown.

### 86-2.22B(5) Common Camera Unit Features for PTZ and Fixed Camera Unit

#### 86-2.22B(5)(a) General

The camera housing must be a corrosion resistant and tamper proof sealed and pressurized housing with five pounds dry nitrogen with purge fitting and 20 psi relief valve for each camera. The size of the housing must be 3-1/2 inches diameter or smaller. The housing exterior must be finished by pre-treatment with conversion coating and baked enamel paint. The camera enclosure must be designed to withstand the effects of sand, dust and hose-directed water.

The internal humidity of the housing must be less than 10 percent, when sealed and pressurized. Desiccant packs must be securely placed inside the housing to absorb any residual moisture and maintain internal humidity at 10 percent or less. The housing must include a thermostatically controlled heating pad rated at 115 V(ac) 100 W maximum.

Low-pressure indicator must use 1 line with messages displayed in "blinking" or "non-blinking" mode when activated by low internal pressure. Adjustable set points by altitude must be provided via the serial port to activate low-pressure. Message must be enabled or disabled. In maintenance mode readings of the internal pressure of the camera housing must be displayed from 5 psi down to 1 psi, in 0.1-psi increments.

Internal temperature indicator must use 1 line with messages displayed in "blinking" or "non-blinking" mode. Message must be enabled or disabled. In maintenance mode, camera readings of the internal temperature of the camera housing must be in 1-degree increments.

Video blanked for up to 8 privacy zones must be provided. One line numeric messages must be displayed. Message must be displayed in "blinking" or "non-blinking" mode and be enabled or disabled. Privacy zones must be programmed through serial communications.

Control and addressing the camera unit must be done through TIA-422 optically isolated serial communications. Additional protocols must consist of Cohu, American Dynamics, Javelin, Philips/Bosch, Vicon and Pelco-D. The National Transportation Communications for ITS Protocol (NTCIP) 1205 protocol communications protocol shall be included as an option.

The camera unit must respond in less than 1.0 second upon receipt of any given command.

All programmable functions including camera last operating position must be stored in non-volatile memory and must not be lost if a power failure occurs. Upon power restoration, the camera must go through a series of self-testing/calibration and return to the same position it left before the power interruption. System configurations such as video privacy zones, preset text and sector ID must be able to be stored in a computer file and uploaded into a camera.

### 86-2.22B(5)(b) Power Requirements

The camera unit must operate between 89 to 135 V(ac), 120 V(ac) nominal voltage and 60 Hz (±3.0 Hz). The camera unit must comply with NEMA standard TS-2 for traffic control system 2.1.2. The camera unit must comply with the requirements of Section 2.1.6 "transients, power service" of the NEMA standard TS-2 The line variation and surge performance must be tested to meet these specifications The power consumption must not exceed a total of 200 watts, in which 100 watts for camera, receiver, pan/tilt driver and 100 watts for heater on.

### 86-2.22B(5)(c) Environmental Requirements

The camera unit must operate in ambient temperature range from -34 to +74 degrees C, in relative humidity up to 100 percent. The unit must operate when exposed to sand, dust, fungus and salt atmosphere per MIL-STD-810, and with shock for up to 10 Gs, 11 ms, in any axis under non-operating conditions, per MIL-STD-810. The unit must not be damaged with sine vibration from 5 to 30 Hz, 1/2 G, 3 axis in one hour.

### 86-2.22B(5)(d) Hybrid Camera Cable and Connectors

HCC is applicable to both PTZ Camera Station and Fixed Camera Units, but the Connectors are different for PTZ and fixed cameras.

HCC consists of one RG-59/U type analog video coaxial cable, one 6-no. 22 AWG conductor group, one 8-no. 26 AWG conductor group and a two twist pair 4-no. 26 AWG conductor group in a common outer jacket.

### 86-2.22B(5)(e) Electrical Requirements

The coaxial cable must comply with the following table:

**Coaxial Cable Electrical Properties**

| Electrical | Values |
|---|---|
| Capacitance (picofarads/ft nominal) | 17.3 |
| Impedance (ohms-nominal) | 75 |
| Velocity of propagation (nominal, %) | 78 |
| Nominal Diameter (inch) | 0.242 |
| Insulation Rating (V) | 300 |

The cable attenuation at 20 degrees C must comply with the following table:

**Cable Attenuation at 20 degrees C**

| Frequency (MHz) | Nominal dB/ 100 ft |
|---|---|
| 1 | 0.30 |
| 10 | 0.90 |
| 50 | 2.10 |

The coaxial cable physical measurements must comply with the following table:

**Size Requirements for Coaxial Cable Components**

| Component | Nominal OD (inches) |
|---|---|
| Copper center conductor | 0.040 |
| Foam polyethylene dielectric | 0.180 |
| Sealed APA tape with 0.06-inch overlap | 0.216 |
| Woven aluminum braid | 0.241 |
| PVC outer jacket | 0.297 |

HCC conductors must comply with the requirements in the following table:

**HCC Connectors**

| Conductor quantity and type | Wire material | Minimum PVC insulation thickness (mils) | Nominal OD with insulation (mils) | Color-coding |
|---|---|---|---|---|
| 6 - No. 22 AWG | Stranded (7x30), tinned copper | 9 | 48 | black, red, green, white, blue, yellow |
| 8 - No. 26 AWG | Stranded (7x34), tinned copper | | 37 | brown, blue, orange, yellow, purple, gray, white/black stripe, red/green stripe |
| 4 - No. 26 AWG in 2 twisted pairs | Stranded (7x34), tinned copper | | 37 | Pair No.1: black, white<br>Pair No.2: red, green |

The outer jacket must have an insulation rating of 300 volts and must include:

1. 1 mil thick polyester sheet wrapped with 25 percent overlap
2. 36 AWG tinned copper braid shield with 90 percent coverage
3. 32 mils thick UV-resistant PVC insulation passing VW-1 test
4. Manufacturer's identification surface-printed in white ink every foot along the length

Color of the outer jacket must be dark-gray matching color no. 24091 of FED-STD-595.

### 86-2.22B(5)(f) Interface Cables

All interface cables when required to interface with other equipment must be minimum of 6 feet in length. All interface cables must be commercially made high quality type with appropriate connectors on the cable ends as shown.

### 86-2.22B(5)(g) Network Straight Through Data Cable

The network straight through data cable must be made of Ethernet twisted pair cable (ETPC) and terminated with an 8-conductor, 8P8C modular plug on both ends. ETPC must consist of 4 unshielded twisted pair (UTP) No.24 AWG solid copper conductors insulated with high-density polyethylene (PE). The insulated conductors must be tightly twisted into individual pairs and jacketed with PE or PVC.

### 86-2.22B(5)(h) Video Patch Cable

The video patch cable must be RG-59/U coaxial cable terminated at both end with BNC connectors. The coaxial cable must comply with the following table:

**Video Patch Cable Electrical Properties**

| Electrical | Coaxial |
|---|---|
| Capacitance (picofarads/ft nominal) | 17.3 |
| Impedance (ohms-nominal) | 75 |
| Velocity of propagation (nominal, %) | 78 |
| Nominal Diameter (inch) | 0.242 |

The cable attenuation at 20 degrees C must measure at maximum as the following table:

**Cable Attenuation at 20 degrees C**

| Frequency (MHz) | Nominal dB/ 100 ft |
|---|---|
| 1 | 0.30 |
| 10 | 0.90 |
| 50 | 2.1 |

The video patch cable physical measurements must be as shown in the following table:

**Size Requirements for Video Patch Cable Components**

| Component | Nominal OD (inches) |
|---|---|
| Copper center conductor | 0.040 |
| Foam polyethylene dielectric | 0.146 |
| Sealed APA tape with 0.06-inch overlap | 0.216 |
| Bare copper braid | 0.241 |
| PVC outer jacket | 0.297 |

### 86-2.22B(5)(i) TIA-232 Data Patch Cable

The TIA-232 data patch cable must comply with TIA-232 standard. The data cable must have multiple no. 20 AWG conductors with (UL) Type CM shielded or AWM 2464 80C 300 Volts – C (UL). One end of data cable must be terminated with a DE9 female connector. All contact socket pins must be gold plated. The contact pin assignment must be as shown. The other end of the data cable must be either terminated with an 8P8C modular plug or not terminated. When there is no connector required on the other end of cable, each conductor's insulation must be stripped 1/4 inch long from the end of cable and the bare conductor must be tinned with solder.

### 86-2.22B(6) Camera Control Unit

### 86-2.22B(6)(a) General

The CCU consist of a rack-mounted field unit. The CCU must have the same manufacturer as the CCTV (PTZ) camera unit. The CCU must be designed to provide on-site camera control functions. The control functions include pan/tilt positioning, zoom in/out control, auto/manual focus, and auto/manual iris.

CCU must include a local/remote switch that transfers control from the remote system to local. This allows the remote control system and the CCU to remain connected while transferring the control function without disconnection of the camera site equipment. The local function must time-out and return to remote mode in 10 minutes.

LED indicators on the CCU must provide positive feedback of the automatic and manual mode status of the camera focus and iris functions, and the manual mode status of the pan/tilt function.

### 86-2.22B(6)(b) Physical and Mechanical Requirements

Each CCU must be rack-mountable in 2 inches (1 rack unit) of EIA-310 rack space with a maximum depth of 14 inches. The front panel must be black gloss color number 17986 as per Federal Standard Color Chart 595B. The front and rear panel lettering must be white color number 17886 as per Federal Standard Color Chart 595B.

A high-impedance connector BNC must be installed on the front and rear panel as shown. These connectors must provide video input to a test monitor without affecting the remainder of the CCTV system. These connectors must be directly monitoring the video input from the camera. The connectors must be of copper material with bright nickel (tarnish resistant) finish for the body and silver finish for the contact.

An automobile glass (AG), size 1/4 by 1-1/4 inches, slow blow fuse must be installed and replaceable from the outside of the unit.

Switches must protrude no more than 0.5 inch from the front panel and must be mounted as shown. Each switch must be labeled as to its functions.

The rear panel connectors must meet the following requirements:

1. Camera connector must be of the following type or equivalent, square flange type. The socket contacts for camera connector must be constructed with brass contact body material and with stainless steel spring that are sub-plated with 0.00050-inch nickel and plated with 0.00030-inch gold. Contact size must be no. 16. Contact extraction tool must be used to replace contact.
2. The TIA-232 connectors must be a DE9 pin connector and TIA-422 connector must be a DE9 socket connector.
3. One mating connector, with a full set crimp contact pins and strain relief back shell, must be supplied with each CCU supplied in the contract.

Each LED must be high intensity untinted, Non-diffused LED.

The CCU must have an on/off switch to turn on/off and an LED to indicate the AC power is on.

Each CCU must not weight more than 5 pounds.

**86-2.22B(6)(c) Camera Control Unit Functions**

Each CCU must have circuitry to detect the absence and presence of video sync on its video input. Each CCU must have auto-iris override. Each CCU must have a transfer switch between local and remote mode. The local function must time-out and return to the remote mode within 5 minutes. A system-reset switch with momentary-pushbutton type must be mounted on the front panel to function as external reset input to the microprocessor. The system-reset must exercise the pan and tilt movements through their ranges and return the camera to the prior position. The system-reset function must allow remote execution.

The CCU must have, as a minimum, control and drive circuits for the following camera control functions:

**CCU Requirements**

| Control Function | Switch Position |
|---|---|
| Pan momentary toggle switch | Left-Stop-Right |
| Tilt momentary toggle switch | Up-Stop-Down |
| Zoom In/Out momentary toggle switch | Telephoto-Stop-Wide Angle |
| Focus Automatic/Manual momentary toggle Switch | Auto Focus -Manual |
| Manual Focus toggle Switch | Near-Stop-Far |
| Iris Automatic/Manual toggle Switch | Auto Iris -Manual Override |
| Manual Iris toggle Switch | Open-Stop-Close |
| Remote/Local momentary toggle Switch<br>(Local function must time-out and return to remote mode in 10 minutes) | Remote-Local |
| Reset momentary push button switch | Reset |

Camera connector contact assignment must be as shown in the following table:

**CCU Camera Connector**

| Position | Function | Position | Function |
|---|---|---|---|
| 1 | Video, 75 Ω | 9 | Not Used |
| 2 | Video Ground | 10 | Not Used |
| 3 | Data Ground | 11 | Not Used |
| 4 | Rx- | 12 | 115 V(ac), Hot |
| 5 | Rx+ | 13 | 115 V(ac), Neutral |
| 6 | Tx+ | 14 | Not Used |
| 7 | Tx- | 15 | 115 V(ac), Ground |
| 8 | Not Used | 16 | Not Used |

TIA-232 connector contact assignment (DE9 Pins) must be as shown in the following table:

**CCU TIA-232 Connector**

| Position | Function | Position | Function |
|---|---|---|---|
| 1 | Not Used | 6 | Not Used |
| 2 | Receive Data, Rx | 7 | RTS |
| 3 | Transmit Data, Tx | 8 | CTS |
| 4 | Not Used | 9 | Not Used |
| 5 | Signal Ground | | |

TIA-422 connector contact assignment (DE9 Sockets) must be as shown in the following table:

**CCU TIA-422 Connector**

| Position | Function | Position | Function |
|---|---|---|---|
| 1 | Tx+ | 6 | Signal Ground |
| 2 | Tx- | 7 | Not Used |
| 3 | Signal Ground | 8 | Not Used |
| 4 | Rx+ | 9 | Not Used |
| 5 | Rx- | | |

### 86-2.22B(6)(d) Communication and Camera Addressing Protocol

The execution of CCU functions, other than the hardware controls on the front panel, must be done through either TIA-232 or TIA-422 optically isolated serial communication ports on the back panel. A minimum 9,600-baud data rate must be used. The CCU must have a front panel TIA-232 port for connection to a local laptop computer. The (NTCIP) 1205MIB communications protocol must be included.

### 86-2.22B(6)(e) Power Consumption

The maximum power consumption for the CCU must not exceed 45 W. Power consumption of equipment attached to CCU must not exceed 250 W.

### 86-2.22B(6)(f) Environmental Requirements

Each CCU must operate in an ambient temperature environment from –34 to +74 degrees C and up to 90 percent relative humidity. Each CCU must pass 5 Gs, 11 ms, in any axis under non-operating conditions, MIL-STD-810. Each CCU must pass vibration tests:

1. Sine vibration from 5 to 60 Hz with 0.082-inch total excursion without damage.
2. Random vibration from 60 to 1,000 Hz, 5 Gs RMS (0.027-$G^2$/Hz) without damage.

### 86-2.22B(7) Multiple Camera Termination Unit

### 86-2.22B(7)(a) General

Install MCTU and MTCU to laptop PC cable at each fixed CCTV camera location. The camera control units must consist of a rack-mounted field unit. The MCTU must be designed to provide camera power, camera control data and video output functions for minimum of four and maximum of eight fixed cameras attached.

### 86-2.22B(7)(b) Physical and Mechanical Requirements

Each MCTU must be rack-mountable in 2 inches (1 rack unit) of ECA-310 rack space with a maximum depth of 14 inches. The front panel must be black gloss color number 17986 as per Federal Standard Color Chart 595B. The front and rear panel lettering must be white color number 17886 as per Federal Standard Color Chart 595B.

A high-impedance connector BNC must be installed on the front and rear panel as shown. These connectors must provide video input to a test monitor without affecting the remainder of the CCTV system. These connectors must be directly monitoring the video input from the camera. The connectors must be of copper material with bright nickel (tarnish resistant) finish for the body and silver finish for the contact.

An automobile glass (AG), size 1/4 by 1-1/4 inches, slow blow fuse must be installed and replaceable from the outside of the unit.

Switches must protrude no more than 0.5 inch from the front panel and must be mounted as shown. Each switch must be labeled as to its functions.

Each LED must be High Intensity Untinted, Non-diffused LED.

The MCTU must have an on/off switch to turn on/off and an LED to indicate the AC power is on.

Each MCTU must not weight more than 5 pounds.

The rear panel connectors must comply with the following requirements:

1. Camera connector must be of the following type or equivalent, square flange type. The socket contacts for camera connector must be constructed with brass contact body material and with stainless steel spring that are sub-plated with 0.00050-inch nickel and plated with 0.00030-inch gold. Contact size must be no. 16. Contact extraction tool must be used to replace contact.
2. The TIA-232 connectors must be a DE9 pin connector.
3. Eight mating connectors with a full set crimp contact pins and strain relief back shell must be supplied with each MCTU supplied in the contract.

### 86-2.22B(7)(c) Multiple Camera Termination Unit Functions

MCTU camera connector contact assignment must be as shown in the following table:

**MCTU Camera Connector**

| Position | Function | Position | Function |
|---|---|---|---|
| 1 | Video, 75 Ω | 9 | Not Used |
| 2 | Video Ground | 10 | Not Used |
| 3 | Data Ground | 11 | Not Used |
| 4 | Rx- | 12 | 115 V(ac), Hot |
| 5 | Rx+ | 13 | 115 V(ac), Neutral |
| 6 | Tx+ | 14 | Not Used |
| 7 | Tx- | 15 | 115 V(ac), Ground |
| 8 | Not Used | 16 | Not Used |

MCTU TIA-232 connector contact assignment (DE9 Pins) must be as shown in the following table:

**MCTU TIA-232 Connector**

| Position | Function | Position | Function |
|---|---|---|---|
| 1 | Not Used | 6 | Not Used |
| 2 | Receive Data, Rx | 7 | RTS |
| 3 | Transmit Data, Tx | 8 | CTS |
| 4 | Not Used | 9 | Not Used |
| 5 | Signal Ground | | |

MCTU must have electronic circuitry to convert TIA-422 from camera connector to TIA-232 connector on the rear of the MCTU for external camera control functions.

### 86-2.22B(7)(d) Power Consumption

The maximum power consumption for the MCTU must not exceed 10 W. Power consumption of equipment attached to MCTU must not exceed 800 W.

### 86-2.22B(7)(e) Environmental Requirements

Each MCTU must operate in an ambient temperature environment from –34 to +74 degrees C and up to 90 percent relative humidity. Each MCTU must pass 5 Gs, 11 ms, in any axis under non-operating conditions, per MIL-STD-810. Each MCTU must pass vibration tests:

1. Sine vibration from 5 to 60 Hz with 0.082-inch total excursion without damage.
2. Random vibration from 60 to 1,000 Hz, 5 Gs RMS (0.027-$G^2$/Hz) without damage.

### 86-2.22B(8) Video Encoder Unit

#### 86-2.22B(8)(a) General

A prototype of the VEU is not acceptable. All equipment must be off-the-shelf production units. All equipment must be new. Provide all necessary interface cables to connect communication equipment to CCU or MCTU for a complete and successful installation and operation of the VEU.

#### 86-2.22B(8)(b) Physical and Mechanical Requirements

The VEU must be mountable in a standard EIA-310 equipment rack. The VEU and shelve any shall must fit in 5.25 inches of a standard EIA-310 equipment rack space.Each VEU must have all the cable connections on the rear of the unit. A main power switch to turn the unit on/off must be provided. An LED to indicate the AC power on must be provided.

#### 86-2.22B(8)(c) Electrical Requirements

The VEU must be able to be remotely managed, configured and maintained without the use of any third party software with the management and performed using SNMP, TELNET and CLI. The VEU must operate with both color and black/white video input signal without modification to the hardware.

The input video resolution of the VEU must comply with the following table:

**VEU Input Video Resolution**

| Video Resolution | NTSC |
|---|---|
| SIF | 352 x 240 |
| QSIF | 166 x 120 |
| CIF | N/A |
| QCIF | N/A |
| Custom | 64 x 48 |
| Custom | 128 x 96 |
| Custom | 192 x 144 |
| Custom | 256 x 192 |
| Custom | 352 x 240 |

The input video formats of the VEU must be composite NTSC with 525 lines at 60 Hz. The VEU must have four composite video input channels. The input video connector must be compatible with SMPTE-170M at 75 Ω impedance with BNC type.

The network communication interface of the VEU must be Ethernet 10/100 Mbps through 8P8C connector port, either in static IP or assigned through DHCP.

The camera control data interface must include a maintenance serial port for local maintenance and a control serial Port for Data transport. The port must be TIA-232 at a user selectable data rate from 1,200 to 56,000 bps, asynchronous. The connector type for the port must be a DE9 pin type.

The VEU must provide bandwidth for camera control within the bandwidth allocated for video only when bandwidth is needed for camera control/status data transmission.

The video compression of the VEU must meet MPEG 4-ISO/IEC 14496-2 standard and H.264 standard. The MPEG-4 compliant levels are:

1. Level 1 – up to 64 kbps
2. Level 2 – up to 128 kbps
3. Level 3 – up to 384 kbps

The video rates of the VEU must be scaleable from 1 fps to 30 fps and from 8 kbps to 2 Mbps. User selectable options are:

1. Constant bit rate at constant frame rate
2. Variable bit rate at constant frame rate
3. Constant bit rate at variable frame rate

The video delivery options of the VEU are either unicast or multicast with protocols DiffServ (QoS), UDP, IP, RTP, RTSP, RTCP, HTTP, SNMP, and TELNET.

### 86-2.22B(8)(d) Power Requirements

The VEU must operate from 89 to 135 V(ac), 120 V(ac) nominal voltage and 60 Hz (±3.0 Hz). The VEU must comply with NEMA standard TS-2 for Traffic Control System 2.1.2. The VEU must comply with the requirements of Section 2.1.6 "Transients, Power Service," of the NEMA standard TS-2.

### 86-2.22B(8)(e) Environmental Requirements

Each VEU must operate in an ambient temperature environment range from –20 to +70 degrees C and up to 90 percent relative humidity. Each VEU must pass 5 Gs, 11 ms, in any axis under non-operating conditions, MIL-STD-810 shock test. Each VEU must pass vibration tests**:**

1. Sine vibration from 5 to 60 Hz with 0.082-inch total excursion without damage
2. Random vibration from 60 to 1,000 Hz, 5 G's RMS (0.027-$G^2$/Hz) without damage

### 86-2.22B(9) Equipment Shelf With Brackets

Furnish equipment shelf with 2 mounting brackets as shown.

Each mounting bracket must extend from the front to back mounting rails of the controller cabinet rack cage. Each bracket must be designed to support a minimum of 50 pounds. The horizontal side of each bracket must be a minimum of 3 inches. Each bracket must be attached to front and rear of the rack cage with four 10-32 stainless steel Phillips round head bolts.

Each shelf must be fabricated of 0.075-inch cold rolled steel sheet or 0.125-inch aluminum sheet. Each shelf must be the width of the control cabinet rack cage and 18 inches deep. Each shelf must have equally distributed holes or slots throughout the shelf that must provide 40 percent minimum open area for vertical flow-through ventilation. Each hole or slot must not exceed 0.75-square inches in area. Each steel shelf must be cadmium-plated or zinc-plated after cutting and drilling.

### 86-2.22B(10) Rack-Mount Power Strip

### 86-2.22B(10)(a) General

Not Used

### 86-2.22B(10)(b) Electrical

Each rack-mount power strip must meet the following requirements:

1. A maximum rating of 15 A, 120 V(ac), 60 Hz.
2. A surge protection with UL 1449 Clamping Level of 400 V, an IEEE Let-Through Voltage rating of less than 336 V, a single-pulse energy rating of 210 J and EMI/RFI noise protection rating of 40 dB.
3. One 15 A circuit breaker.
4. One internally illuminated switch to cut off power to all outlets.
5. Six NEMA 5-15R outlets.

### 86-2.22B(10)(c) Mechanical

Each rack-mount power strip must meet the following requirements:

1. Dimensions of 2 (H) by 19 (W) by 2-4/5 (D) inches (D) maximum and must not weigh more than 4.5 pounds.
2. The front plate of the rack-mount power strip must have two cut-off EIA mounting screw holes on each end.
3. Each outlet must have 1-1/2 inch minimum spacing center-to-center to its adjacent outlet.
4. The power cord must enter from the rear with a length of 7 feet minimum.
5. The clearance between the power cord entrance and the nearest outlet must be 3-3/8 inches minimum.
6. Both the circuit breaker and the switch must be front-mounted.
7. Each outlet must be rear-mounted.

### 86-2.22C Construction

#### 86-2.22C(1) General

Not Used

#### 86-2.22C(2) Installation of CCTV (PTZ) Camera Station

Install CCTV pole with foundation, conduits and pull boxes as required and as shown. Install and terminate the HCC with connectors as shown. The HCC must connect to camera pigtail cable and secure to the pole as shownfor strain-relief.

The CCTV (PTZ) camera unit must be installed on camera mounting plate as shown. The CCTV (PTZ) camera unit must be secured to the mounting plate using the stainless steel bolts provided with the CCTV (PTZ) camera unit. Before each bolt is fastened, a locking type coating must be applied to the threads. The coating must lock the bolt and nut in place, making it impossible to turn the bolt or nut without tools. This coating must last through and be effective through at least ten insertions and withdrawals of the bolt or nut.

Install CCU, VEU, router, rack-mount power strip, equipment shelves and all the interface cables in the controller cabinet as shown. The rack-mount power strip must be mounted on the rear mounting rack of the controller cabinet.

#### 86-2.22C(3) Installation of CCTV Fixed Camera Station

Install fixed camera with mounting hardware as shown. Install and terminate the HCC with connectors as shown.

Install MCTU, VEU, router, rack-mount power strip, equipment shelves and all the interface cables in the controller cabinet as shown. The rack-mount power strip must be mounted on the rear mounting rack of the controller cabinet.

#### 86-2.22C(4) Installation of HCC

The HCC must be continuous from the CCTV (PTZ) camera unit to CCU and from a fixed camera unit to MCTU in the controller cabinet without splicing.

For the CCTV (PTZ) camera unit, the HCC must be terminated with cable connectors on both ends. Connector with a full set crimp contact pins and strain relief back shell must be installed on the cable end toward CCU. Connector with a full set crimp contact sockets and strain relief back shell must be installed on the cable end toward the CCTV (PTZ) camera unit. All connector contact must be of brass contact body material and with stainless steel spring that is electroless nickel plated with coating thickness of 0.00050 inch under MIL-C-26074B, grade B and plated with 0.00030 inch under MIL-G-45204B, class 4. The contact size must be 16.

For a fixed camera unit, the camera end of HCC must be terminated with a cable connector AMP PT06A-14-18S (SR), which will mate with the connector on the fixed camera.

#### 86-2.22C(5) Installation of Camera Control Unit

#### 86-2.22C(5)(a) General

Install CCU and CCU to laptop PC cable at each CCTV (PTZ) camera station.

The rear panel connectors must be mounted as shown.

Provide all necessary interface cables for CCU to connect to other camera equipment.

#### 86-2.22C(5)(b) CCU to Laptop PC Cable

Install a USB to TIA-232 serial adapter at each PTZ camera location. The adapter must have a DE9 socket connector for TIA-232 and Type A plug connector for USB. Supply a 6 feet straight through USB extension cable. The USB function must be version 2.0. Furnish the adapter software in 32 GB Secure Digital (SD) memory card format.

#### 86-2.22C(6) Installation of Multiple Camera Termination Unit

#### 86-2.22C(6)(a) General

Install MCTU and MCTU to laptop PC cable at each fixed CCTV camera location.

The rear panel connectors must be mounted as shown.

Provide all necessary interface cables for MCTU to connect to all other camera equipment.

**86-2.22C(6)(b) MCTU to Laptop PC Cable**

Provide a USB to TIA-232 serial adapter at each camera location. The adapter must have a DE9 socket connector for TIA-232 and Type A plug connector for USB. Also supply a 6 feet straight through USB extension cable. The USB function must be version 2.0. Furnish the adapter software in 32 GB Secure Digital (SD) memory card format.

**86-2.22C(7) Installation of Equipment Shelf With Brackets**

Each shelf must be attached to the top of its pair of brackets in all four corners with stainless steel hardware, with the front of the shelf abutting against the front rail of the control cabinet rack cage.

**86-2.22C(8) Installation of Rack-Mount Power Strip**

The rack-mount power strip must be plugged into the non-GFCI duplex outlet normally labeled with "Controller Unit Receptacle" in the back of the power distribution assembly (PDA). The rack-mount power strip must be mounted on the rear of the standard EIA-310 rack cage and across the two vertical back rails with four stainless steel EIA mounting screws, two on each side. The rack-mount power strip must not hinder the accessibility to the back of all existing electrical equipment. All power cords for permanently field installed electrical equipment must be plugged into the power strip.

**86-2.22D Payment**

Not Used

**Add to section 86-3.02A(2):**

Submit the manufacturer's warranty documentation before installing the batteries.

**Add to section 86-3.02A(3):**

Batteries must have a 5-year manufacturer's warranty against defects in materials and workmanship. The warranty period starts on the date of Contract acceptance. Provide replacement batteries within 5 business days after notification of failed batteries. The Department pays to ship the failed batteries. Deliver replacement batteries to:

CALTRANS MAINTENANCE ELECTRICAL SHOP
30 RICKARD STREET
SAN FRANCISCO, CA 94134-1224
Tel (415) 330-6500

**Add to section 86-3.02B:**

The external cabinet must be capable of housing:

1. 8 batteries
2. Inverter/charger unit
3. Power transfer relay
4. Manually-operated bypass switch
5. Required control panels
6. Wiring and harnesses

**Delete the 3rd paragraph of section 86-3.02B:**

**Add to section 86-3.04:**

Cabinet must be Model 334L and consist of a housing (B), a mounting cage 1, and the following listed equipment. The equipment must comply with chapter 6 of TEES.

1. Service panel no. 1
2. Power distribution assembly no. 3
3. Input file (I file)
4. C1 harness
5. Controller and equipment shelves
6. Dual fan assembly with thermostatic control
7. Mechanical armature-type relays
8. Input panel

Before shipping to the job site, submit each 334L cabinet to METS for acceptance testing.

Notify the Engineer when each 334L cabinet is ready for functional testing. Functional testing will be conducted by the Department.

Each power distribution assembly must include the following equipment:

1. Two duplex NEMA 5-15R controller receptacle (rear mount)
2. One 30 A, 1-pole, 120 V(ac) main circuit breaker
3. Three 15 A, 1-pole, 120 V(ac) circuit breaker
4. One duplex GFCI NEMA 15 A, receptacle (front mount)

Furnish 3 shelves as shown. Each shelf must be attached to the tops of 2 supporting angles with 4 screws. Supporting angles must extend from the front to the back rails. The front of the shelf must abut the front member of the mounting cage. Arrange shelves as shown. The angles must be designed to support a minimum of 50 pounds each. The horizontal side of each angle must be a minimum of 3 inches. The angles must be vertically adjustable.

Furnish 3 terminal blocks as shown. Terminal blocks must comply with Chapter 6 of TEES, except the screw size must be 8-32.

Furnish a maintenance manual or a combined maintenance and operation manual for all controller units, auxiliary equipment, vehicle detector sensor units, and amplifiers. Submit manual when the controllers are delivered for testing or, if ordered by the Engineer, before purchasing. The manual must include the following:

1. Specifications
2. Design characteristics
3. General operation theory
4. Function of all controls
5. Troubleshooting procedure (diagnostic routine)
6. Block circuit diagram
7. Geographical layout of components
8. Schematic diagrams
9. List of replaceable component parts with stock numbers

**Add to section 86-3.02C:**

Install a grounding electrode for each cabinet. Attach a grounding conductor from the electrode to the equipment using either a ground clamp or exothermic weld. Connect the other end to the cabinet.

**Add to section 86-3:**

## 86-3.05 GENERAL PACKET RADIO SYSTEM WIRELESS MODEM ASSEMBLY

### 86-3.05A General

#### 86-3.05A(1) Summary

Section 86-3.05 includes specifications for installing the general packet radio system (GPRS) wireless modem assembly at the controller cabinet.

#### 86-3.05A(2) Submittals

Submit warranty documentation before installation.

#### 86-3.05A(3) Warranty

Furnish a 1-year replacement warranty from the manufacturer of the modems and power supplies against any defects or failures. The effective date of the warranty is the date of installation. Furnish replacement modems and power supplies within 5 days after receipt of the failed parts. The Department does not pay for the replacement parts. Deliver replacement modems and power supplies to:

CALTRANS MAINTENANCE ELECTRICAL SHOP
30 RICKARD STREET
SAN FRANCISCO, CA 94134-1224
Tel (415) 330-6500

### 86-3.05B Materials

#### 86-3.05B(1) General

The GPRS wireless modem assembly consists of a modem, power supply, mounting bracket and hardware, serial communication cable, or RJ-45 ethernet cable, and antenna.

#### 86-3.05B(2) Modem

The modem must:

1. Be configurable remotely through the wireless network and through multiple communication ports including serial, Ethernet and USB ports.
2. Be configured before acceptance.
3. Have a minimum 53.6 Kbps raw data transfer rate.
4. Have a full duplex transceiver.
5. Have 1900/850 MHz dual band networking.
6. Have an integrated transmission control/internet protocol (TCP/IP) stack with user datagram protocol (UDP).
7. Have a user-settable password to prevent unauthorized access.
8. Include a DC power cable at least 3 feet long with a connector compatible with the modem power connector.
9. Have a packet buffering and forwarding feature that provides discipline to the output of the serial port. The packet forwarding time interval must be configurable from a rate of 0 (undisciplined) to 400 ms in increments of 100 ms or less.
10. Have a choice of "Friends Only" access mode.
11. Comply with TIA-678.
12. Have an operating temperature range from -30 to +70 degrees C with humidity from 5 to 95 percent (non-condensing) and have transmissions at 10 percent duty cycle above 60 degrees C.
13. Weigh less than 1 pound and have overall dimensions of 3.0 by 3.5 by 1.0 inches.
14. Have the following status indicators:
    - 14.1. Network
    - 14.2. Signal
    - 14.3. Activity
    - 14.4. Power
15. Operate in a static IP addressing environment of GPRS networks and meet the operational parameters shown in the following table:

| Operational parameter | Requirements |
|---|---|
| Transmit power at antenna port | 1.0 W for 1900 MHz<br>0.8 W for 850 MHz |
| Receiver sensitivity | -107 dBm (2.439 % bit error rate) |
| Input voltage | 3.3 to 30 V(dc) |
| Input current | 200 mA @ 30 V(dc) |

16. Have the following standard interfaces:
    16.1. Host communicates with modem using either UDP or TCP packet modes.
    16.2. Computer terminal platform using dial-up networking communicates with the modem using point to point protocol (PPP).

Provide the Engineer with the modem serial number, and international mobile equipment identification (IMEI) number 30 days before requiring the packet data protocol (PDP) context. The Engineer will program the PDP context.

The modem and associated firmware, software, hardware, protocol, and other features must be fully compatible with the existing GPRS network. The existing GPRS network utilizes the AT&T Wireless cellular system (3G and later) and the AirLink Gateway. Demonstrate the compatibility to the Engineer by actual installation or by other authorized means.

**86-3.05B(3) Power Supply**

The power supply must:

1. Be vertically mountable on a 19-inch standard rack rail using 2 machine screws and 2 wing nuts.
2. Have provisions to attach the modem power cable securely without the modifying the cable.
3. Meet the requirements shown in the following table:

| Characteristics | Requirements |
|---|---|
| Power cord | Standard 120 V(ac), 3 prong cord, at least 3 feet long (may be added by Contractor) |
| Type | Switching type |
| Power rated | 40 W minimum with no minimum load required |
| Input voltage | From 85 to 264 V(ac) or 120 to 370 V(dc) |
| Input frequency | From 47 to 63 Hz |
| Inrush current | Cold start, 25 A at 115 V |
| Output voltage | 12 V(dc), adjustable over a ±10 percent range |
| Overload protection | From 105 to 150 percent in output pulsing mode |
| Over voltage protection | From 115 to 135 percent of output voltage |
| Setup, rise, hold up time | 800 ms, 50 ms,15 ms at 115 V(ac) |
| Withstand voltage | I/P-0/P:3 kV, I/P-FG:1.5 kV, for 60 seconds |
| Safety standards | UL 1012, UL 60950 |

**86-3.05B(4) Mounting Bracket and Hardware**

The mounting bracket must:

1. Be stainless steel
2. Securely hold the modem in a vertical position with all cables and conductors installed
3. Contain the modem using a method that allows the removal of the modem without tools or without removing the bracket from its attachment to the cabinet frame

**86-3.05B(5) Serial Communication Cable**

If the modem is designed to interface with a Department-furnished Model 170E controller, provide a C2 cable. The C2 cable interfaces the controller C2 connector and the GPRS modem and includes all conductors and connectors required for that purpose. The GPRS modem connector must comply with TIA-232 standard using a 9-pin D shell miniature connector. The Department-furnished controller end connector must comply with AMP 201360-2 or equivalent. All pins in both connectors must be gold

plated. The cable must have 4 no. 20 AWG conductors with (UL) Type CM shielded or AWM 2464 80C 300 Volts. The cable must be at least 3 feet long. The cable wiring must comply with the following:

1. AMP 201360-2-ND -L to DE9-P - 2
2. AMP 201360-2-ND -K to DE9-P - 3
3. AMP 201360-2-ND -N to DB9-P - 5
4. AMP 201360-2-ND -D to AMP 201360-2-ND - H
5. AMP 201360-2-ND -J to AMP 201360-2-ND – M

**86-3.05B(6) RJ-45 Ethernet Cable**

If the modem is designed to interface with a Department-furnished Model 2070E controller, provide a 10/100 Base-T, RJ-45 Ethernet cable. The cable must be at least 3 feet long.

**86-3.05B(7) Antenna**

The antenna must:

1. Be the low profile disc type, and adhere to the cabinet using a factory installed double-sided waterproof acrylic foam adhesive. The coax cable must be at least 3 feet long and have a 50 Ω SMA connector on the modem end.
2. Meet the requirements shown in the following table:

| Parameter | Requirements |
|---|---|
| VSWR (at resonant point) | 2:1 or less |
| Frequency | 1850-1990 MHz and 824-894 MHz |
| Nominal impedance | 50 Ω |
| Gain | 2 dB |
| Radiation pattern | Omni-directional |
| Polarization | Vertical |
| Ground plane | Required[a] |

[a] The antenna requires a reflective ground plane to function properly. The required ground plane must extend beyond the antenna at least 8 inches in all directions.

**86-3.05C Construction**

Install the modem under the manufacturer's instructions.

You may adjust the modem Installation for field conditions if authorized.

**86-3.05D Payment**

Not Used

**Replace section 86-4.01D(1)(c)(ii) with:**

**86-4.01D(1)(c)(ii) Warranty**

The manufacturer must provide a written warranty against defects in materials and workmanship for LED signal modules for a minimum period of 48 months after installation of LED signal modules. Replacement LED signal modules must be provided within 15 days after receipt of failed LED modules at your expense. The Department pays for shipping the failed modules to you. All warranty documentation must be submitted to the Engineer before installation. Replacement LED signal modules must be delivered to:

CALTRANS MAINTENANCE ELECTRICAL SHOP
30 RICKARD STREET
SAN FRANCISCO, CA 94134-1224
Tel (415) 330-6500

**Add to section 86-4.01D(2)(a):**

LED signal module must be manufactured for 12-inch circular, 8-inch circular, arrow, and lane control sections.

**Replace section 86-4.03H with:**

### 86-4.03H LED Countdown Pedestrian Signal Face Modules

#### 86-4.03H(1) General

##### 86-4.03H(1)(a) Summary

Section 86-4.03H includes specifications for installing a LED countdown PSF module into a standard Type A pedestrian signal housing. Comply with TEES.

##### 86-4.03H(1)(b) Definitions

Not Used

##### 86-4.03H(1)(c) Submittals

Before shipping LED countdown PSF modules to the job site, submit all modules and the following items to METS:

1. Delivery form with Contract number and contact information
2. Installation manual and schematic wiring diagram
3. Product information, including manufacturer's name and month and year of manufacture
4. List of model, lot, and serial numbers

Submit documentation of the manufacturer's production QA, including test data showing the modules comply with the following requirements:

1. Luminous intensity as shown in the table titled "Luminance Values."
2. Power factor after burn-in.
3. Test current flow measurements in amperes after burn-in. The measured values must comply with the design qualification figures. Record the measured ampere values with rated voltage on the product labels.

Submit the manufacturer's warranty before installing LED countdown PSF modules.

##### 86-4.03H(1)(d) Quality Control and Assurance

##### 86-4.03H(1)(d)(i) General

The Engineer rejects a module if a visual inspection reveals any of the following defects:

1. Exterior physical damage
2. Assembly anomalies
3. Scratches
4. Abrasions
5. Cracks
6. Chips
7. Discoloration
8. Other surface defects

The Department tests LED countdown PSF modules under ANSI/ASQ Z1.4 and California Test 606. The module submitted for testing must be representative of typical production units.

Comply with testing requirements for electrical material and equipment under section 86-2.14.

##### 86-4.03H(1)(d)(ii) Warranty

Provide a 5-year manufacturer's replacement warranty against defects or failures. The warranty period starts on the date of Contract acceptance. Furnish replacement parts within 15 days after notification of a failed module. The Department does not pay for replacement modules. Deliver replacement modules to:

CALTRANS MAINTENANCE ELECTRICAL SHOP
30 RICKARD STREET
SAN FRANCISCO, CA 94134-1224
Tel (415) 330-6500

**86-4.03H(2) Materials**

A LED countdown PSF module must:

1. Use LED as the light source.
2. Be made of material complying with ASTM D 3935.
3. Be designed to mount behind or to replace face plates of a standard Type A housing as specified in the ITE publication *Equipment and Material Standards,* chapter 3, "Pedestrian Traffic Control Signal Indications," and the *California MUTCD*.
4. Have a minimum power consumption of 10 W for the "Upraised Hand."
5. Have internal components supported such that they withstand mechanical shock and vibration from high winds and other sources.
6. Use the required color and be the ultra-bright type rated for 100,000 hours of continuous operation for a temperature range from -40 to +74 degrees C.
7. Have replaceable signal lamp optical units.
8. Fit into the housing of a pedestrian signal section without modification.
9. Be a single, self-contained device that does not require on-site assembly for installation.
10. Have the following information permanently marked on the back of the module:
    - 10.1. Manufacturer's name
    - 10.2. Trademark
    - 10.3. Model number
    - 10.4. Serial number
    - 10.5. Lot number
    - 10.6. Month and year of manufacture
    - 10.7. Required operating characteristics, including:

10.7.1. Rated voltage

10.7.2. Power consumption

10.7.3. Volt-ampere

10.7.4. Power factor

11. Have prominent and permanent vertical markings for accurate indexing and orientation within the signal housing if a specific mounting orientation is required. Markings must be a minimum of 1 inch in height and include an up arrow and the word "up" or "top."

The circuit board and the power supply must be contained inside of the LED countdown PSF module. The circuit board must comply with TEES, chapter 1, section 6.

The enclosure containing the power supply or the electronic components of the module, except the lens, must be made of UL 94 V-0 flame-retardant material.

Each symbol must be at least 9 inches high and 5-1/4 inches wide. The lens' signal output for the "Walking Person" and "Upraised Hand" symbols and the countdown display must not exceed a ratio of 5 to 1 for the highest and lowest luminance values. The symbols must comply with ITE publication *Equipment and Material Standards,* chapter 3, "Pedestrian Traffic Control Signal Indications," and the *California MUTCD*. The 2-digit countdown timer, "Upraised Hand," and "Walking Person" indications must be electronically isolated from each other. The 3 indications must not share a power supply or interconnect circuitry.

The module must maintain an average luminance value for at least 5 years of continuous signal operation for a temperature range from -40 to +74 degrees C.

The module must operate over the specified ambient temperature and voltage range and be readable both day and night at distances up to the full width of the area to be crossed. Upon initial testing at 25 degrees C, the module must have at least the luminance values shown in the following table:

**Luminance Values**

| PSF module symbol | Luminance |
|---|---|
| "Upraised Hand" and 2-digit countdown timer | 1,094 fL |
| "Walking Person" | 1,547 fL |

The color output of the module must comply with chromaticity requirements in section 5.3 of ITE publication *Equipment and Material Standards* chapter 3, "Pedestrian Traffic Control Signal Indications."

When operating over a temperature range from -40 to +74 degrees C, the measured chromaticity coordinates of the module must comply with the following requirements for 5 years after Contract acceptance:

**Chromaticity Standards (CIE Chart)**

| | |
|---|---|
| "Upraised Hand" and 2-digit countdown timer (portland orange) | 0.600 ≤ X ≤ 0.659<br>Y: Not greater than 0.390 or less than 0.331 or less than 0.990 - X |
| "Walking Person" (lunar white) | X: Not less than 0.280 or greater than 0.400<br>Y: Not less than 0.0483 + 0.7917*X or greater than 0.0983 + 0.7917*X |

The module must not exceed the power consumption requirements shown in the following table:

**Maximum Power Consumption Requirements**

| PSF module display | At 24 ºC | At 74 ºC |
|---|---|---|
| "Upraised Hand" | 10.0 W | 12.0 W |
| "Walking Person" | 9.0 W | 12.0 W |
| 2-digit countdown timer | 6.0 W | 8.0 W |

The wiring and terminal block must comply with section 13.02 of ITE publication *Equipment and Material Standards*, chapter 2, "Vehicle Traffic Control Signal Heads." The PSF module must have spade lugs and 3 secured, jacketed copper wires that comply with NEC and are:

1. Color coded
2. 3 feet long
3. 600 V(ac)
4. 20 AWG minimum stranded
5. Rated for service at +105 degrees C

The module must operate:

1. At a frequency of 60 ± 3 Hz over a voltage range from 95 to 135 V(ac) without flicker perceptible to the unaided eye. Fluctuations of the line voltage must have no visible effect on the luminous intensity of the indications. The rated voltage for measurements must be 120 V(ac).
2. With currently-used Department controller assemblies, including solid-state load switches, flashers, and conflict monitors. Comply with TEES, chapters 3 and 6. If an alternating current of 20 mA or less is applied to the unit, the voltage read across the 2 leads must not exceed 15 V(ac).
3. With a smart control and regulation mode that exhibits countdown displays automatically adjusted to the traffic controller's programmed intervals.

The countdown PSF module must operate during the pedestrian change interval. The module must begin counting down when the flashing "Upraised Hand" interval turns on, counting down to 0 and turning off when the steady "Upraised Hand" interval turns on.

The module's on-board circuitry must:

1. Include voltage surge protection to withstand high-repetition noise transients. The voltage surge protection must comply with NEMA Standard TS, section 2.1.6.

2. Comply with Class A emission limits for electronic noise under 47 CFR 15, subpart B.

The module must provide a power factor of 0.90 or greater.

The total harmonic distortion from a current and voltage induced in an alternating-current power line by a PSF module must not exceed 20 percent at an operating temperature of 25 degrees C.

The module's circuitry must prevent light emission perceptible to the unaided eye when a voltage of 50 V(ac) or less is applied to the unit.

When power is applied to the module, light emission must occur within 90 ms.

**86-4.03H(3) Construction**

Use LED countdown PSF modules from the same manufacturer.

Install the module in a standard Type A pedestrian signal housing. Special tools must not be required for installing the modules.

The installation of the module into the pedestrian signal face must require only the removal of the lens, reflector, and existing LED module.

**86-4.03H(4) Payment**

Not Used

**Add to section 86-5.01A(1):**

Loop wire must be Type 2.

Loop detector lead-in cable must be Type B.

Slots must be filled with elastomeric sealant or hot-melt rubberized asphalt sealant.

You may use a Type E loop where a Type A or a Type B loop is shown.

For Type E detector loops, sides of the slot must be vertical and the minimum radius of the slot entering and leaving the circular part of the loop must be 1-1/2 inches. Slot width must be a maximum of 5/8 inch. Loop wire for circular loops must be Type 2. Slots of circular loops must be filled with elastomeric sealant or hot-melt rubberized asphalt sealant.

Fill slots in concrete with elastomeric, hot-melt rubberized asphalt or epoxy sealant for loop detectors.

Install Type 1 or 2 inductive loop conductor except for Type E loops detectors use Type 2.

Install conductor continuous without splices except at the pull box.

Center the detectors in the traffic lanes.

Do not splice the detector conductor.

Mark the location of the inductive loop detectors so the distance between the side of the loop and a lead-in sawcut from an adjacent detector is at least 2 feet. The distance between lead-in sawcuts must be at least 6 inches.

Sawcut the slots. The slot bottoms must be smooth with no sharp edges. For Type E detector loops, saw the slots so the sides are vertical.

Do not allow residue from slot-cutting activities to flow across shoulders or lanes occupied by traffic. Remove the residue before it flows off the pavement surface and dispose of it.

Wash the slots clean using water and blow dry with compressed air to remove all moisture and debris.

Identify the start of the conductor.

Waterproof the ends of Type 2 loop conductor before installing it in the conduit to prevent moisture from entering the cable.

Install the loop conductor in the slots and lead-in sawcut using a 3/16- to 1/4-inch-thick wood paddle. Hold the conductors in place at the bottom of the slot with wood paddles during placement of the sealant.

Wind adjacent loops on the same sensor unit channel in opposite directions.

Twist the conductors for each loop into a pair consisting of a minimum of 2 turns per foot before placing them in the lead-in sawcut and the conduit leading to the pull box. Do not install more than 2 twisted pairs of conductors per lead-in sawcut.

Provide 5 feet of slack in the pull box.

Test each loop for continuity, circuit resistance, and insulation resistance before filling the slots with sealant.

Remove excess sealant from the adjacent road surface before it sets. Do not use solvents to remove the excess.

Identify the loop conductor pair in the pull box with the start with the letter *S* and the end with the letter *F*. Band conductors in pairs by lane in the pull box adjacent to the loops and in the cabinet. Identify each pair with detector designation and loop number.

All splices must be soldered using the hot iron, pouring, or dipping method. Do not perform open-flame soldering.

For Detector lead-in cable:

1. Waterproof the ends of the lead-in cable before installing it in the conduit to prevent moisture from entering the cable.
2. Splice loop conductors for each direction of travel for the same phase, terminating in the same pull box, to a separate lead-in cable which must run from the pull box adjacent to the loop detector to a sensor unit mounted in the controller cabinet. Install lead-in cable continuous without splices except at the pull box.
3. Verify in the presence of the Engineer that the loops are operational before making the final splices between loop conductors and the lead-in cable.
4. Identify and tag each lead-in cable with detector designation at the cabinet and pull box adjacent to the loops.

**Replace "Reserved" in section 86-5.03 of the RSS with:**

**86-5.03A General**

**86-5.03A(1) Summary**

Section 86-5.03 includes specifications for installing accessible pedestrian signals (APS). Comply with TEES.

**86-5.03A(2) Definitions**

**accessible pedestrian signal:** Accessible pedestrian signal as defined in the *California MUTCD*.

**accessible walk indication:** Activated audible and vibrotactile action during the walk interval.

**ambient sound level:** Background sound level in dB at a given location.

**ambient sound sensing microphone:** Microphone that measures the ambient sound level in dB and automatically adjusts the APS speaker's volume.

**APS assembly:** Assembly that includes a pushbutton to actuate the APS components.

**audible speech walk message:** Audible prerecorded message that communicates to pedestrians which street has the walk interval.

**programming mechanism:** Device to program the APS' operation.

**pushbutton information message:** Pushbutton information message as defined in the *California MUTCD.*

**pushbutton locator tone:** Pushbutton locator tone as defined in the *California MUTCD*.

**vibrotactile pedestrian device:** Vibrotactile pedestrian device as defined in the *California MUTCD*.

### 86-5.03A(3) Submittals

Before shipping the APS units to the job site, submit the units with the following to METS:

1. Delivery form including Contract number and your contact information
2. Manufacturer's name
3. Model, lot, and serial numbers
4. Month and year of manufacture
5. Wiring diagram
6 Product data
7. Programming mechanism if not integral to the APS

Submit 3 APS user and operator manuals for each signalized location as informational submittals. Each manual must have a master item index that includes:

1. Descriptions of the APS and its associated equipment and cables
2. Illustrative block diagrams
3. Manufacturer's contact information
4. Technical data specifications
5. Parts list, descriptions, and settings
6 Fault diagnostic and repair procedures
7. Preventative maintenance procedures for maintaining APS performance parameters

Submit the manufacturer's warranty documentation as an informational submittal before installing the APS.

Submit a record of completed field tests, the APS' final configuration, audible sound level and threshold, and a list of all parameter settings.

### 86-5.03A(4) Quality Control and Assurance

#### 86-5.03A(4)(a) General

The APS must be compatible with the Department-furnished Model 170E/2070L controller assembly.

The power to the APS must be connected to the pedestrian signal's terminal blocks.

#### 86-5.03A(4)(b) Functional Testing

Perform 2 field tests on the APS: (1) when traffic is noisy during peak traffic hours and (2) when traffic is quiet during off-peak hours. Notify the Engineer 15 days before testing the APS.

#### 86-5.03A(4)(c) Warranty

The APS must have a 2-year manufacturer's warranty against any defects or failures. The 2-year warranty period starts at Contract acceptance. Deliver a replacement within 10 days after you receive notification of a failed APS. The Department does not pay for the replacement. Deliver the replacement to:

CALTRANS MAINTENANCE ELECTRICAL SHOP
30 RICKARD STREET
SAN FRANCISCO, CA 94134-1224
Tel (415) 330-6500

#### 86-5.03A(4)(d) Training

Provide a minimum of 16 hours of training by a certified manufacturer's representative for up to 4 Department employees selected by the Engineer. The training must include instruction in installing, programming, adjusting, calibrating, and maintaining the APS.

Furnish materials and equipment for the training.

**86-5.03B Materials**

The housing for the APS assembly must be made of corrosion-resistant material. Theft proof bolts used for mounting the APS housing to the standard must be stainless steel with a chromium content of 17 percent and a nickel content of 8 percent.

The color of metallic housing must match color no. 33538 of FED-STD-595.

The color of plastic housing must match color no. 17038, 27038, or 37038 of FED-STD-595.

The APS assembly must be rainproof and shockproof in any weather condition.

The APS assembly must include:

1. Pushbutton actuator with a minimum diameter of 2 inches. If a mechanical switch is used, it must have:
   1.1. Operating force of 3.5 lb
   1.2. Maximum pretravel of 5/64 inch
   1.3. Minimum overtravel of 1/32 inch
   1.4. Differential travel from 0.002 to 0.04 inch
2. Vibrotactile device on the pushbutton or on the arrow
3. Enclosure with an ambient-sound-level-sensing microphone and weatherproof speaker. The enclosure must:
   3.1. Weigh less than 7 lb
   3.2. Measure less than 16 by 6 by 5 inches
   3.3. Fit the traffic signal and Type 1-B standard
   3.4. Have a wiring hole with a diameter not exceeding 1-1/8 inches
   3.5. Be attached to the pole with 2 screws with a diameter from 1/4 to 3/8 inch suitable for use in tapped holes. The clear space between any 2 holes in the post must be at least twice the diameter of the larger hole
4. Pushbutton sign

The APS speakers and electronic equipment must be installed inside the APS assembly's enclosure. The speaker grills must be located on the surface of the enclosure.

Speakers must not interfere with the housing or its mounting hardware.

The conductor cable between the APS assembly and the pedestrian signal head must be a 9 No. 20-conductor cable complying with MIL-W-16878D. The wiring must comply with section 13.02 of ITE publication *Equipment and Material Standards* chapter 2, "Vehicle Traffic Control Signal Heads," and be NEC rated for service at +105 degrees C.

The APS must:

1. Include a mechanism for enabling and disabling its operation.
2. Have electronic switches, a potentiometer, or a handheld device for controlling and programming the volume level and messaging. Deliver any handheld programming device to the Engineer.
3. Provide information using:
   3.1. Audible speech message that plays when the pushbutton is actuated. The message must include the name of the street to be crossed. The APS must have at least 5 audible message options. The Engineer selects the message. The message must have a percussive tone consisting of multiple frequencies with a dominant component of 880 Hz. If the tone is selected as the message, it must repeat 8 to 10 ticks per second.
   3.2. Pushbutton locator tone that clicks or beeps. The pushbutton must produce the locator tone at an interval of 1 tone per second. Each tone must have a maximum duration of 0.15 second. The tone volume must adjust in response to the ambient sound level and be audible up to 12 feet from the pushbutton or to the building line, whichever is less.
4. Have a pushbutton that remains functional during an APS failure.

For signalized intersections, the APS must:

1. Have a pushbutton that when actuated activates the pedestrian walk signal's timing during an APS failure.
2. Provide information using:
   2.1. Audible speech walk message. The message must be activated from the beginning of the walk interval and repeated for its duration. An example of the message is "Peachtree. Walk sign is on to cross Peachtree."
   2.2. Pushbutton information message that provides the name of the street to be crossed. The message must play when the pushbutton is actuated. An example of the message is "Wait to cross Howard at Grand. Wait."
3. Have a functional pushbutton that activates the pedestrian walk signal whenever actuated, even if the audible speech walk message, the pushbutton information message, the pushbutton locator tone, and the vibrating surface features are disabled.

**86-5.03C Construction**

Arrange to have a manufacturer's representative at the job site when the APS is installed, modified, connected, or reconnected.The APS must not interfere with the Department-furnished controller assembly, the signal installation on signal standards, the pedestrian signal heads, or the terminal compartment blocks. The APS electronic control equipment must reside inside the APS assembly and the standard pedestrian signal head.

You are responsible for the compatibility of the components and for making the necessary calibration adjustments to deliver the performance specified. Furnish the equipment and hardware, and then set up, calibrate, and verify the performance of the APS.

Point arrows on the pushbutton signs in the same direction as the corresponding crosswalk. Attach the sign to the APS assembly.

Do not install an APS on a standard smaller than Type 1.

**86-5.03D Payment**

Not Used

**Replace section 86-6.02 with:**

**86-6.02 LED LUMINAIRES**

**86-6.02A General**

**86-6.02A(1) Summary**

Section 86-6.02 includes specifications for installing LED luminaires.

**86-6.02A(2) Definitions**

**CALiPER:** Commercially Available LED Product Evaluation and Reporting. A U.S. DOE program that individually tests and provides unbiased information on the performance of commercially-available LED luminaires and lights.

**correlated color temperature:** Absolute temperature in kelvin of a blackbody whose chromaticity most nearly resembles that of the light source.

**house side lumens:** Lumens from a luminaire directed to light up areas between the fixture and the pole, such as sidewalks at intersection or areas off the shoulders on freeways.

**International Electrotechnical Commission (IEC):** Organization that prepares and publishes international standards for all electrical, electronic, and related technologies.

**junction temperature:** Temperature of the electronic junction of the LED device. The junction temperature is critical in determining photometric performance, estimating operational life, and preventing catastrophic failure of the LED.

**L70:** Extrapolated life in hours of the luminaire when the luminous output depreciates 30 percent from initial values.

**LM-79:** Test method from the Illumination Engineering Society of North America specifying test conditions, measurements, and report format for testing solid state lighting devices, including LED luminaires.

**LM-80:** Test method from the Illumination Engineering Society of North America specifying test conditions, measurements, and report format for testing and estimating the long-term performance of LEDs for general lighting purposes.

**National Voluntary Laboratory Accreditation Program (NVLAP):** U.S. DOE program that accredits independent testing laboratories.

**power factor:** Ratio of the real power component to the complex power component.

**street side lumens:** Lumens from a luminaire directed to light up areas between the fixture and the roadway, such as traveled ways and freeway lanes.

**surge protection device (SPD):** Subsystem or component that protects the unit against short-duration voltage and current surges.

**total harmonic distortion:** Ratio of the rms value of the sum of the squared individual harmonic amplitudes to the rms value of the fundamental frequency of a complex waveform.

**86-6.02A(3) Submittals**

Submit a sample luminaire to METS for testing after the manufacturer's testing is completed. Include the manufacturer's test data.

Product submittals must include:

1. LED luminaire checklist.
2. Product specification sheets, including:
   - 2.1. Maximum power in watts.
   - 2.2. Maximum designed junction temperature.
   - 2.3. Heat sink area in square inches.
   - 2.4. Designed junction to ambient thermal resistance calculation with thermal resistance components clearly defined.
   - 2.5. L70 in hours when extrapolated for the average nighttime operating temperature.
3. LM-79 and LM-80 compliant test reports from a CALiPER-qualified or NVLAP-approved testing laboratory for the specific model submitted.
4. Photometric file based on LM-79 test report.
5. Initial and depreciated isofootcandle diagrams showing the specified minimum illuminance for the particular application. The diagrams must be calibrated to feet and show a 40 by 40 foot grid. The diagrams must be calibrated to the mounting height specified for that particular application. The depreciated isofootcandle diagrams must be calculated at the minimum operational life.
6. Test report showing SPD performance as tested under ANSI/IEEE C62.41.2 and ANSI/IEEE C62.45.
7. Test report showing mechanical vibration test results as tested under California Test 611 or equal.
8. Data sheets from the LED manufacturer that include information on life expectancy based on junction temperature.
9. Data sheets from the power supply manufacturer that include life expectancy information.

Submit documentation of a production QA performed by the luminaire manufacturer that:

1. Ensures the minimum specified performance level
2. Includes a documented process for resolving problems

Submit the QA documentation as an informational submittal.

Submit the manufacturer's warranty documentation as an informational submittal before installing LED luminaires.

### 86-6.02A(4) Quality Control and Assurance

#### 86-6.02A(4)(a) General

The Department may test random samples of the luminaires under section 86-2.14A. The Department tests luminaires under California Test 678 and may test any parameters specified in section 86-6.01.

Fit 1 sample luminaire with a thermistor or thermocouple temperature sensor. A temperature sensor must be mounted on the:

1. LED solder pad as close to the LED as possible
2. Power supply case
3. Light bar or modular system as close to the center of the module as possible

Other configurations must have at least 5 sensors per luminaire. The Engineer provides advice on sensor location. Thermocouples must be either Type K or C. Thermistors must be a negative-temperature-coefficient type with a nominal resistance of 20 kΩ. Use the appropriate thermocouple wire. The leads must be a minimum of 6 feet. Submit documentation with the test unit describing the type of sensor used.

Before performing any testing, energize the sample luminaires for a minimum of 24 hours at 100 percent on-time duty cycle and a temperature of +70 degrees F.

Depreciate the luminaire lighting's performance for the minimum operating life by using the LED manufacturer's data or the data from the LM-80 test report, whichever results in a higher lumen depreciation.

Failure of the luminaire that renders the unit noncompliant with section 86-6.02 specifications is cause for rejection.

#### 86-6.02A(4)(b) Warranty

Provide a 7-year manufacturer's warranty against any defects or failures. The warranty period begins on the date of Contract acceptance. Furnish a replacement luminaire within 10 days after receipt of the failed luminaire. The Department does not pay for the replacement. Deliver replacement luminaires to:

CALTRANS MAINTENANCE ELECTRICAL SHOP
30 RICKARD STREET
SAN FRANCISCO, CA 94134-1224
Tel (415) 330-6500

### 86-6.02B Materials

#### 86-6.02B(1) General

The luminaire must include an assembly that uses LEDs as the light source. The assembly must include a housing, an LED array, and an electronic driver. The luminaire must:

1. Be UL listed under UL 1598 for luminaires in wet locations or an equivalent standard from a recognized testing laboratory
2. Have a minimum operational life of 63,000 hours
3. Operate at an average operating time of 11.5 hours per night
4. Be designed to operate at an average nighttime operating temperature of 70 degrees F
5. Have an operating temperature range from -40 to +130 degrees F
6. Be defined by the following applications:

| Application | Replaces |
|---|---|
| Roadway 1 | 200 W high-pressure sodium luminaire mounted at 34 ft |
| Roadway 2 | 310 W high-pressure sodium luminaire mounted at 40 ft |
| Roadway 3 | 310 W high-pressure sodium luminaire mounted at 40 ft with back side control |
| Roadway 4 | 400 W high-pressure sodium luminaire mounted at 40 ft |

The individual LEDs must be connected such that a catastrophic loss or a failure of 1 LED does not result in the loss of more than 20 percent of the luminous output of the luminaire.

### 86-6.02B(2) Luminaire Identification

Each luminaire must have the following identification permanently marked inside the unit and outside of its packaging box:

1. Manufacturer's name
2. Trademark
3. Model number
4. Serial number
5. Month and year of manufacture
6. Lot number
7. Contract number
8. Rated voltage
9. Rated wattage
10. Rated power in VA

### 86-6.02B(3) Electrical Requirements

The luminaire must operate from a 60 ± 3 Hz AC power source. The fluctuations of line voltage must have no visible effect on the luminous output. The operating voltage may range from 120 to 480 V(ac). The luminaire must operate over the entire voltage range or the voltage range must be selected from either of the following options:

1. Luminaire must operate over a voltage range of 95 to 277 V(ac). The operating voltages for this option are 120 V(ac) and 240 V(ac).
2. Luminaire must operate over a voltage range of 347 to 480 V(ac). The operating voltage for this option is 480 V(ac).

The power factor of the luminaire must be 0.90 or greater. The total harmonic distortion, current, and voltage induced into an AC power line by a luminaire must not exceed 20 percent. The maximum power consumption allowed for the luminaire must be as shown in the following table:

| Application | Maximum consumption (watts) |
|---|---|
| Roadway 1 | 165 |
| Roadway 2 | 235 |
| Roadway 3 | 235 |
| Roadway 4 | 300 |

### 86-6.02B(4) Surge Suppression and Electromagnetic Interference

The luminaire's on-board circuitry must include an SPD to withstand high repetition noise transients caused by utility line switching, nearby lightning strikes, and other interferences. The SPD must protect the luminaire from damage and failure due to transient voltages and currents as defined in Tables 1 and 4 of ANSI/IEEE C64.41.2 for location category C-High. The SPD must comply with UL 1449. The SPD must be tested under ANSI/IEEE C62.45 based on ANSI/IEEE C62.41.2 definitions for standard and optional waveforms for location category C-High.

The luminaires and associated on-board circuitry must comply with the Class A emission limits under 47 CFR 15, subpart B, for the emission of electronic noise.

### 86-6.02B(5) Compatibility

The luminaire must be operationally compatible with currently-used lighting control systems and photoelectric controls.

### 86-6.02B(6) Photometric Requirements

The luminaire must maintain a minimum illuminance level throughout the minimum operating life. The L70 of the luminaire must be the minimum operating life or greater. The measurements must be calibrated to

standard photopic calibrations. The minimum maintained illuminance values measured at a point must be as shown in the following table:

| Application | Mounting height (ft) | Minimum maintained illuminance (fc) | Light pattern figure (isofootcandle curve) |
|---|---|---|---|
| Roadway 1 | 34 | 0.15 | Pattern defined by an ellipse with the equation: $$\frac{x^2}{(82)^2} + \frac{(y-20)^2}{(52)^2} = 1$$ where:<br>$x$ = direction longitudinal to the roadway<br>$y$ = direction transverse to the roadway and the luminaire is offset from the center of the pattern by 20 feet to the house side of the pattern. |
| Roadway 2 | 40 | 0.2 | Pattern defined by an ellipse with the equation: $$\frac{x^2}{(82)^2} + \frac{(y-20)^2}{(52)^2} = 1$$ where:<br>$x$ = direction longitudinal to the roadway<br>$y$ = direction transverse to the roadway and the luminaire is offset from the center of the pattern by 20 feet to the house side of the pattern. |
| Roadway 3 | 40 | 0.2 | Pattern defined by an ellipse with the equation: $$\frac{x^2}{(82)^2} + \frac{(y-20)^2}{(52)^2} = 1$$ for $y \geq 0$ (street side)<br>where:<br>$x$ = direction longitudinal to the roadway<br>$y$ = direction transverse to the roadway and the luminaire is offset from the center of the pattern by 20 feet to the house side of the pattern. |
| Roadway 4 | 40 | 0.2 | Pattern defined by an ellipse with the equation: $$\frac{x^2}{(92)^2} + \frac{(y-23)^2}{(55)^2} = 1$$ where:<br>$x$ = direction longitudinal to the roadway<br>$y$ = direction transverse to the roadway and the luminaire is offset from the center of the pattern by 23 feet to the house side of the pattern. |

The luminaire must have a correlated color temperature range from 3,500 to 6,500 K. The color rendering index must be 65 or greater.

The luminaire must not allow more than:

1. 10 percent of the rated lumens to project above 80 degrees from vertical
2. 2.5 percent of the rated lumens to project above 90 degrees from vertical

**86-6.02B(7) Thermal Management**

The passive thermal management of the heat generated by the LEDs must have enough capacity to ensure proper operation of the luminaire over the minimum operation life. The LED maximum junction temperature for the minimum operation life must not exceed 221 degrees F.

The junction-to-ambient thermal resistance must be 95 degrees F per watt or less. The use of fans or other mechanical devices is not allowed. The heat sink material must be aluminum or other material of equal or lower thermal resistance.

The luminaire must contain circuitry that automatically reduces the power to the LEDs so the maximum junction temperature is not exceeded when the ambient outside temperature is 100 degrees F or greater.

**86-6.02B(8) Physical and Mechanical Requirements**

The luminaire must:

1. Be a single, self-contained device not requiring job-site assembly for installation
2. Have an integral power supply
3. Weigh no more than 35 lb
4. Have a maximum-effective projected area of 1.4 sq ft when viewed from either side or end
5. Have a housing color that matches color number from 26152 to 26440, from 36231 to 36375, or 36440 of FED-STD-595.

The housing must be fabricated from materials designed to withstand a 3,000-hour salt spray test under ASTM B 117. All aluminum used in housings and brackets must be made of a marine-grade alloy with less than 0.2 percent copper. All exposed aluminum must be anodized.

Each refractor or lens must be made from UV-inhibited high-impact plastic such as acrylic or polycarbonate or heat- and impact-resistant glass and be resistant to scratching. Polymeric materials except lenses of enclosures containing either the power supply or electronic components of the luminaire must be made of UL94VO flame retardant materials. The housing's paint must comply with section 86-2.16. A chromate conversion undercoating must be used underneath a thermoplastic polyester powder coat.

Provide each housing with a slip fitter capable of mounting on a 2-inch pipe tenon. This slip fitter must fit on mast arms with outside diameters from 1-5/8 to 2-3/8 inches. The slip fitter must be capable of being adjusted a minimum of ±5 degrees from the axis of the tenon in a minimum of 5 steps: +5, +2.5, 0, -2.5, -5. The clamping brackets of the slip fitter must not bottom out on the housing bosses when adjusted within the designed angular range. No part of the slip fitter's mounting brackets must develop a permanent set in excess of 1/32 inch when the bracket's two or four 3/8-inch-diameter cap screws are tightened to 10 ft-lb. Two sets of cap screws may be furnished to allow the slip fitter to be mounted on the pipe tenon in the acceptable range without the cap screws bottoming out in the threaded holes. The cap screws and the clamping brackets must be made of corrosion-resistant materials or treated to prevent galvanic reactions and be compatible with the luminaire housing and the mast arm.

The LED luminaire must be assembled and manufactured such that its internal components are adequately supported to withstand mechanical shock and vibration from high winds and other sources. When tested under California Test 611, the luminaire to be mounted horizontally on the mast arm must be capable of withstanding the following cyclic loading for a minimum of 2 million cycles without failure of any luminaire part:

**Cyclic Loading**

| Plane | Power supply | Minimum peak acceleration level |
|---|---|---|
| Vertical | Installed | 3.0 g peak-to-peak sinusoidal loading (same as 1.5 g peak) |
| Horizontal[a] | Installed | 1.5 g peak-to-peak sinusoidal loading (same as 0.75 g peak) |

[a]Perpendicular to the direction of the mast arm

The housing must be designed to prevent the buildup of water on top of the housing. Exposed heat sink fins must be oriented to allow water to freely run off of the luminaire and carry dust and other accumulated debris away from the unit. The optical assembly of the luminaire must be protected against dust and moisture intrusion to at least an ANSI/IEC rating of IP66. The power supply enclosure must be protected to at least an ANSI/IEC rating of IP43.

Furnish each mounted luminaire with an ANSI C136.10-compliant, locking-type photocontrol receptacle and a raintight shorting cap. The receptacle must comply with section 86-6.11A.

When the components are mounted on a down-opening door, the door must be hinged and secured to the luminaire housing separately from the refractor or flat lens frame. The door must be secured to the housing such that accidental opening is prevented. A safety cable must mechanically connect the door to the housing.

Field wires connected to the luminaire must terminate on a barrier-type terminal block secured to the housing. The terminal screws must be captive and equipped with wire grips for conductors up to no. 6. Each terminal position must be clearly identified.

The power supply must be rated for outdoor operation and have at least an ANSI/IEC rating of IP65.

The power supply must be rated for a minimum operational life equal to the minimum operational life of the luminaire or greater.

The power supply case temperature must have a self rise of 77 degrees F or less above ambient temperature in free air with no additional heat sinks.

The power supply must have 2 leads to accept standard 0-10 V(dc). The dimming control must be compatible with IEC 60929. If the control leads are open or the analog control signal is lost, the circuit must default to 100-percent power.

Conductors and terminals must be identified.

**86-6.02C Construction**

Not Used

**86-6.02D Payment**

Not Used

**Replace "Reserved" in section 86-6.10B with:**

**86-6.10B Information Message Sign**

**86-6.10B(1) General**

**86-6.10B(1)(a) Summary**

Section 86-6.10B includes specifications for installing information message sign (IMS).

**86-6.10B(1)(b) Definitions**

Not Used

**86-6.10B(1)(c) Submittals**

Submit:

1. Warranty documentation
2. Documentation required for acceptance testing, maintenance, and operation
3. Test plan to the Engineer indicating proposed dates, duration and methods of the testing
4. Functional testing by the manufacturer prior to shipment to job site
5. Performance test report and collected data to the Engineer for approval
6. One set of documents with the parameters configured and related wiring installed

### 86-6.10B(1)(d) Quality Control and Assurance

#### 86-6.10B(1)(d)(i) General

Tests data must be collected in the presence of the Engineer.

#### 86-6.10B(1)(d)(ii) Warranty

Furnish a 4-year replacement warranty from the manufacturer against any defects or failures. The effective date of the warranty is the date of acceptance of the installation. Furnish replacement parts within 15 days after receipt of the failed parts. The Department does not pay for the replacement. Deliver replacement parts to:

CALTRANS MAINTENANCE ELECTRICAL SHOP
30 RICKARD STREET
SAN FRANCISCO, CA 94134-1224
Tel (415) 330-6500

### 86-6.10B(2) Materials

#### 86-6.10B(2)(a) General

The information message sign includes sign panel, sign controller assembly, mounting hardware, NEMA 4 enclosure and sign interface cable.

#### 86-6.10B(2)(b) Information Message Sign Unit

Information message sign must be compatible with existing systems in San Mateo County.

#### 86-6.10B(2)(c) Sign Panel and Sign Assembly

Sign panel and sign controller assembly must be manufactured by Skyline Products. The price quoted by the certified distributor for each component is as follows, not including sales tax or shipping.

**Price Quote**

| Item | Description | Quantity | Unit | Extension |
|---|---|---|---|---|
| 1 | IMS LED Variable Message Sign | 2 | $12,500 | $25,000 |
| 2 | EnvoyDMS Tech Edition Software | 1 | $3,125 | $3,125 |
| | | | | |
| | | | Total | $28,125 |

The above price will be firm for orders placed on or before March 5, 2016, provided delivery is accepted within 120 days after the order is placed.

#### 86-6.10B(2)(d) Mounting Hardware

The mounting hardware must be provided for installation on poles as shown.

#### 86-6.10B(2)(e) NEMA 4 Enclosure

NEMA 4 enclosure dimensions must not exceed dimensions as shown. Enclosure weight must not exceed 20 pounds.

The enclosure must be fabricated from galvanized sheet steel, or must be fabricated from sheet steel and zinc- or cadmium-plated after fabrication, or must be fabricated from aluminum.

The enclosure must be furnished with a rear mounting board made of 0.08-inch thick aluminum. Mounting board must be centered on the enclosure wall and must have 0.5 inch clearance to the adjacent walls.

The enclosure must have one door, which must be side-hung with a continuous stainless steel piano hinge. The hinge must be mounted so that it is not accessible from the outside when the enclosure door is closed. The door and hinges must be able to withstand a vertical load of 50 pounds per foot of door height applied to the outer edge of the open door without permanent deformation of the door or cabinet body. The door opening must be double flanged on all four sides. Dust and weather resistant seal at the enclosure door must be created by installing closed-cell neoprene gasket. Manufacturer's name and trademark must be permanently marked inside the enclosure.

**86-6.10B(2)(f) Sign Interface Cable**

Sign interface cable connects the sign panel to sign controller assembly and must be continuous without splicing. The sign interface cable must be approved for use by the sign manufacturer. Manufacturer's identification must be printed in white ink every foot along the surface of the cable.

**86-6.10B(3) Construction**

Install IMS as shown. Manufacturer certified representative must configure the sign controller assembly to make each IMS operational and ready to communicate with an Ethernet network. Provide documentation of the configuration of each IMS assembly to Engineer.

After installation at the site, a minimum of 5 different messages composed of text and graphics must be displayed and verified. Other tests recommended by the manufacturer must also be conducted.

The Engineer will review the accuracy data findings and accept or reject the results within 14 days.

**86-6.10B(4) Payment**

Not Used

**Add to section 86-6:**

**86-6.14 LED BLANK-OUT SIGNS**

**86-6.14A General**

**86-6.14A(1) Summary**

Section 86-6.14 includes specifications for installing LED blank-out R3-1 signs on Type 1 standard.

**86-6.14A(2) Definitions**

**LED module:** An assembly of the blank-out sign consisting of the LEDs, electronic driver for the LEDs, power inverter (alternating current to direct current) and step-down transformer.

**Special tools:** Tools that are not readily available in a local hardware store or require special order.

**86-6.14A(3) Submittals**

Submit a work plan with the manufacturer's data sheet as an action submittal 15 days prior to installation. The manufacturer's data sheet must include parts list, installation instructions, and maintenance instructions.

Submit a sample as specified in section 86-6.14A(4)(c) within 15 days of submitting the contract form.

Submit all necessary documents, warranty submittal, and departmental acceptance for approval before installation.

**86-6.14A(4) Quality Control and Assurance**

**86-6.14A(4)(a) General**

Not Used

**86-6.14A(4)(b) Warranty**

The manufacturer must provide a written warranty against defects in material and workmanship of the LED blank-out sign for a minimum period of 12 months after installation of LED blank-out sign. The replacement LED blank-out sign must be provided within 15 days after receipt of failed LED blank-out sign at no cost to the Department, except the cost of shipping the failed LED blank-out sign. Submit to the manufacturer all necessary warranty forms to initiate the warranty period.

The replacement LED blank-out sign must be delivered to:

CALTRANS MAINTENANCE ELECTRICAL SHOP
30 RICKARD STREET
SAN FRANCISCO, CA 94134-1224
Tel (415) 330-6500

**86-6.14A(4)(c) Department Acceptance**

The Department will test the LED blank-out sign. Testing will be completed within 30 days of delivery to the METS Transportation Laboratory. LED Blank-out sign submitted for testing must be representative of those to be installed.

Before shipping LED blank-out sign to the job site, submit the following to the METS Transportation Laboratory:

1. The delivery form must include the district number, EA, and contact information
2. A sample of the LED blank-out sign
3. A copy of this specification
4. A copy of the manufacturer's data sheet

Delays resulting from submittal of non-compliant material do not relieve you from executing the contract within the allotted time. Non-compliant material will be rejected. You must resubmit new LED blank-out sign for retesting and pick up the failed unit within 5 business day of notification. You must provide new LED blank-out sign and allow a minimum of 30 days for the retest. You must pay for all shipping and handling costs related to testing and retesting. Delays resulting from resubmittal and retesting are your responsibility and no extra time will be allowed.

**86-6.14B Materials**

**86-6.14B(1) General**

The operating temperature for all electronic components including the LEDs must be between -40 to 165 degrees F. You must not use forced-air mechanism to cool the inside of the sign. Ventilation louvers with removable filter may be allowed.

Lens and enclosure material must comply with the ASTM specifications.

The enclosure of the LED blank-out sign, except lenses, must comply with UL94VO flame-retardant material.

**86-6.14B(2) Light sources**

The light source of the blank-out sign must be from LEDs forming a symbol with the following characteristics:

1. Be weather tight and connect directly to electrical wiring
2. Be capable of replacing each individual LED
3. Have manufacturer's name, trademark, model number, serial number, lot number, month and year of manufacture, and required operating characteristics, including rated voltage, power consumption, and volt-ampere, permanently marked on the back of the module
4. Be high intensity AlInGaP or InGaN technology
5. Be rated for 100,000 hours of continuous operation
6. Have an average luminous intensity of at least 1,547 foot-lambert throughout the operational lifecycle and operating temperature range.
7. The arrow must be lunar white with measured chromatically coordinates as follows:

   x: not less than 0.270, nor greater than 0.330
   y: not less than 0.272, nor greater than 0.355

8. The color of the other symbols must be as follows:

| Symbol | Color | Wavelength |
|---|---|---|
| circle | red | 700-635 nm |
| slash | red | 700-635 nm |

The LED blank-out sign must have an operational lifecycle rating of 48 months. During the operational lifecycle, the LED module must meet all parameters of this specification.

Each individual LED must be wired so a catastrophic loss or failure of one LED must result in a loss of not more than 5 percent of the blank-out sign's light output. The failure of an individual LED in a string must not result in the loss of an entire string or other indication.

The LED blank-out sign must:

1. Operate at a frequency of 60 ± 3 Hz, over a voltage range from 95 to 135 V(ac), without perceptible flicker to the unaided eye. Fluctuations of line voltage must have no visible effect on luminous intensity of the indications. The rated voltage must be 120 V(ac).
2. Be compatible with currently used Department's controller assembly, including solid-state load switch, flasher, and conflict monitor.

The LED blank-out sign must provide a power factor of 0.90 or greater.

When power is applied to LED blank-out sign, light emission must occur within 1second.

Internal components must be adequately supported to withstand mechanical shock and vibration from high winds and other sources.

The drive current must be limited to about 75 percent of the LED's rated maximum.

The LED blank-out sign must be visible at a distance of 2,100 feet.

**86-6.14B(3) Dimmer**

The LED blank-out sign must have a dimming feature. The dimmer is a two level design (bright and dim) allowing the LED to normally operate at full intensity. When the dimmer is active, the power to the LED is reduced by approximately 50 percent which reduces the intensity. The dimmer will incorporate a failsafe feature where the LED will continue operating at its full intensity in the event of a dimmer relay or resistor failure. The dimmer will have the capability to be controlled locally by an optional photoelectric unit mounted on the enclosure, or by an external 120 V(ac) signal.

**86-6.14B(4) Lenses**

The lens must be fabricated from a nominal 0.120 inch thick matte finish polycarbonate polymer.

**86-6.14B(5) Enclosures**

The enclosure must be a NEMA 3R. The enclosure must be constructed from aluminum. The enclosure must have a minimum thickness of 0.090 inches. The side of the enclosure where the mounting bracket is located must have a 0.125 inches thick reinforcement plate welded on the inside of the enclosure for additional strength when mounting the sign. This reinforcement area must withstand loads greater than 6,600 lb. All exposed seams must be continuously welded using Gas Metal Arc Welding (GMAW) or Gas Tungsten Arc Welding (GTAW) to ensure a watertight seal. Weep holes must be incorporated in the bottom of the enclosure to prevent buildup of condensation. Weep holes must be of a design to prevent the infiltration of insects or debris. The viewable area must be 24 by 24 inches. All exposed seams must be sealed to be watertight. The enclosuremust use a neoprene gasket strip to ensure a watertight seal between the door and the lens.

**86-6.14B(6) Finishes**

The standard finish for the NEMA 3R enclosure is powder coated satin black on all external surface. The black mounting board for the LEDs must be finished in a flat black powder coat.

**86-6.14B(7) Hardware**

All hardware must be stainless steel to prevent corrosion.

The door latch and keeper must be turn-lock style or similar locking mechanism which does not require tools to open the enclosure.

The hinge must be stainless steel and a full-length continuous piano hinge style construction.

### 86-6.14B(8) Mounting brackets

Mounting bracket must support the weight of the LED blank-out sign. The mounting bracket must be constructed of ductile iron, galvanized steel, bronze, aluminum Type AC-84B, no. 380 or manufacturer's recommended type of material.

### 86-6.14B(9) Conduit and conductors

The conduit and conductors must comply with section 86-2.

### 86-6.14B(10) Terminal blocks

The terminal block may be light duty and must comply with section 86-3.04D(4) except a minimum of 6 positions are required.

### 86-6.14C Construction

You are not allowed to use special tools to install the LED blank-out sign on the Type 1 standard.

Install the mounting bracket as specified in section 86-4.04, paragraph 2, 5, 6 and 7.

Install a terminal block in the back panel for ease of accessibility and must be used for field connection.

The minimum horizontal clearance between any part of the blank-out sign and the face of curb is 24 inches.

Install the LED blank-out sign as shown.

Install the conduit and conductors as specified in section 86-2. You must wire the conductors in the controller cabinets as specified in section 86-3.04C and as shown.

### 86-6.14D Payment

Not Used

# REVISED STANDARD SPECIFICATIONS APPLICABLE TO THE 2010 EDITION OF THE STANDARD SPECIFICATIONS

# REVISED STANDARD SPECIFICATIONS DATED 02-12-16

## ORGANIZATION

Revised standard specifications are under headings that correspond with the main-section headings of the *Standard Specifications*. A main-section heading is a heading shown in the table of contents of the *Standard Specifications*. A date under a main-section heading is the date of the latest revision to the section.

Each revision to the *Standard Specifications* begins with a revision clause that describes or introduces a revision to the *Standard Specifications*. For a revision clause that describes a revision, the date on the right above the clause is the publication date of the revision. For a revision clause that introduces a revision, the date on the right above a revised term, phrase, clause, paragraph, or section is the publication date of the revised term, phrase, clause, paragraph, or section. For a multiple-paragraph or multiple-section revision, the date on the right above a paragraph or section is the publication date of the paragraphs or sections that follow.

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

^^^

**Replace "MSDS" in the 1st table in section 1-1.06 with:**

10-17-14

MSDS[b]

**Add to the 1st table in section 1-1.06:**

10-30-15

| | |
|---|---|
| LCS | Department's lane closure system |
| *MPQP* | *Material Plant Quality Program* published by the Department |
| 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

[b]Interpret a reference to MSDS as a reference to SDS under 29 CFR 1910.1200.

06-20-12

**Delete the abbreviation and its meaning for *UDBE* in the 1st table of section 1-1.06.**

10-19-12

**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.**

**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:**

10-19-12

work

**Replace "excusable delay" and its definition in section 1-1.07B with:**

10-19-12

**delay:** Event that extends the completion of an activity.

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:**

10-19-12

work

**Replace the definition of "traveled way" in section 1-1.07B with:**

01-15-16

Portion of the roadway for the movement of vehicles, exclusive of the shoulders, berms, sidewalks, and parking lanes.

**Add to section 1-1.07B:**

10-30-15

**abandon:** Render unserviceable in place.

**adjust:** Raise or lower a facility to match a new grade line.

10-19-12

**Contract time:** Number of original working days as adjusted by any time adjustment.

06-20-12

**Disadvantaged Business Enterprise:** Disadvantaged Business Enterprise as defined in 49 CFR 26.5.

10-30-15

**modify:** Add to or subtract from an appurtenant part.

**obliterate:** Place an earth cover over or root, plow, pulverize, or scarify.

**quality characteristic:** Characteristic of a material that is measured to determine conformance with a given requirement.

**reconstruct:** Remove and disassemble and construct again at an existing or new location.

**relocate:** Remove and install or place in a new location.

**remove:** Remove and dispose of.

**reset:** Remove and install or place laterally at the same station location.

**salvage:** Remove, clean, and haul to a specified location.

**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

**Add to the table in section 1-1.11:**

10-30-15

| | | | |
|---|---|---|---|
| *MPQP* | http://www.dot.ca.gov/manuals.htm | -- | -- |

^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

# 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 Labor Code section 1725.5 [with limited exceptions from this requirement for bid purposes only under Labor Code 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.

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.

02-27-15

### 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 List form 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 DBEs 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 of and control over the truck. This does not preclude the leased truck from working for others during the term of the lease with the consent of the DBE, so long as the lease gives the DBE absolute priority for use of the leased truck. Leased trucks must display the name and identification number of the DBE.

[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

02-27-15

### 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.

#### 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.

04-10-15

##### 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:

**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[a] | 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 |

[a]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) Contracts with 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[a] | 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[a] | Time of bid |
| Certified Small Business Listing for the Non–Small Business Preference[a] | No later than 4 p.m. on the 2nd business day after bid opening |

[a]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.

01-23-15

**Delete items 4 and 6 of the 2nd paragraph of section 3-1.18.**

02-27-15

**Delete the 3rd paragraph of section 3-1.18.**

**Replace "For all other contracts, the" in the 4th paragraph of section 3-1.18 with:**

02-27-15

The

^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

## 4 SCOPE OF WORK

10-30-15

**Replace the 2nd paragraph of section 4-1.13 with:**

10-30-15

The Department does not require you to remove warning, regulatory, or guide signs before Contract acceptance.

^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

## 5 CONTROL OF WORK

10-30-15

**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.

10-19-12

**Delete the 2nd paragraph of section 5-1.09C.**

**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.

07-19-13

**Delete the 1st sentence in the 10th paragraph of section 5-1.23B(2).**

**Add to the list in the 1st paragraph of section 5-1.36A:**

07-19-13

10. Survey monuments

**Add to section 5-1.36C:**

07-20-12

If the Contract does not include an agreement with a railroad company, do not allow personnel or equipment on railroad property.

Prevent material, equipment, and debris from falling onto railroad property.

**Add to section 5-1.36:**

07-19-13

**5-1.36E Survey Monuments**

Protect survey monuments on and off the highway. Upon discovery of a survey monument not identified and located immediately:

1. Stop work near the monument
2. Notify the Engineer

Do not resume work near the monument until authorized.

**Add between the 1st and 2nd paragraphs of section 5-1.37A:**

10-19-12

Do not remove any padlock used to secure a portion of the work until the Engineer is present to replace it. Notify the Engineer at least 3 days before removing the lock.

**Replace the 1st sentence of the 1st paragraph of section 5-1.39C(2) with:**

10-19-12

Section 5-1.39C(2) applies if a plant establishment period of 3 years or more is shown on the *Notice to Bidders*.

**Replace "working days" in the 1st paragraph of section 5-1.43E(1)(a) with:**

10-19-12

original working days

**Replace "settled" in the last paragraph of section 5-1.43E(1)(d) with:**

04-10-15

resolved

**Replace items 3.1 and 3.2 in the list in the paragraph of section 5-1.43E(3)(b) with:**

04-24-15

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

**Add between "held" and "no later than" in the 2nd sentence of the 1st paragraph of section 5-1.43E(3)(e):**

10-30-15

no sooner than 30 days and

^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

# 6 CONTROL OF MATERIALS

10-30-15

**Add between "replacing" and "Department-furnished" in the 1st sentence in the last paragraph of section 6-2.03:**

10-30-15

lost or damaged

**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

10-24-15

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.

04-19-13

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 the 2nd paragraph of section 6-3.04 with:**

10-30-15

Develop, implement, and maintain a QC program.

Prepare and maintain QC records, including:

1. Names and qualifications of:
   1.1. Samplers
   1.2. Testers
   1.3. Inspectors
2. Testing laboratories' identification and certifications
3. Testing equipment calibrations and certifications
4. Inspection reports
5. Sampling and testing records organized by date and type of material
6. Test results with comparison of quality characteristic requirements
7. Test results in relation to action and any suspension limits
8. Records of corrective actions and suspensions

Within 24 hours, notify the Engineer of any noncompliance identified by your QC program.

Allow the Department access to all QC records.

Submit QC test data and QC test results within 2 business days of test completion.

**Add between the 1st and 2nd paragraphs of section 6-3.05A:**

10-30-15

The Department may inspect, sample, and test materials for compliance with the Contract at any time.

The Department's independent assurance program is described in the Department's *Independent Assurance Manual: Procedures for Accreditation of Laboratories and Qualification of Testers*. For the manual, go to the METS website.

10-30-15

**Delete "if they are available at the job site" from the 3rd paragraph of section 6-3.05A.**

**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 tier 1 or tier 2 in section 90-4.01D(1)

^^^

# 7 LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC

02-12-16

**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

05-30-14

**Add between the 1st and 2nd sentences in the 2nd paragraph of section 7-1.02K(6)(b):**

10-30-15

Shop drawings of protective systems for which the Construction Safety Orders require design by a registered professional engineer must be sealed and signed by an engineer who is registered as a civil engineer in the State.

**Delete "water or" in the 9th paragraph of section 7-1.03.**

**Add to the end of the 10th paragraph of section 7-1.03:**

10-30-15

Flagging must comply with section 12-1. The Department pays you for this work under section 12-1.04.

**Add between the 1st and 2nd sentences of the 7th paragraph of section 7-1.04:**

10-30-15

Flagging must comply with section 12-1. The Department pays you for this work under section 12-1.04.

**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.

10-30-15

**Delete "lane" in the 2nd sentence in the 27th paragraph of section 7-1.04.**

**Add between the 1st and 2nd paragraphs of section 7-1.11A:**

02-12-16

Comply with 46 CFR 381.7(a)–(b).

**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

ATTACHMENTS

A. Employment and Materials Preference for Appalachian Development Highway System or Appalachian Local Access Road Contracts (included in Appalachian contracts only)

## 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).

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.

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.

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).

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.

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.

## 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.

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 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.

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.

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.

**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 contacting agency shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (2.) of this section.

**4. Subcontracts.** The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (1.) through (4.) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (1.) through (4.) of this section.

## VI. SUBLETTING OR ASSIGNING THE CONTRACT

This provision is applicable to all Federal-aid construction contracts on the National Highway System.

1. The contractor shall perform with its own organization contract work amounting to not less than 30 percent (or a greater percentage if specified elsewhere in the contract) of the total original contract price, excluding any specialty items designated by the contracting agency. Specialty items may be performed by subcontract and the amount of any such specialty items performed may be deducted from the total original contract price before computing the amount of work required to be performed by the contractor's own organization (23 CFR 635.116).

a. The term "perform work with its own organization" refers to workers employed or leased by the prime contractor, and equipment owned or rented by the prime contractor, with or without operators. Such term does not include employees or equipment of a subcontractor or lower tier subcontractor, agents of the prime contractor, or any other assignees. The term may include payments for the costs of hiring leased employees from an employee leasing firm meeting all relevant Federal and State regulatory requirements. Leased employees may only be included in this term if the prime contractor meets all of the following conditions:

(1) the prime contractor maintains control over the supervision of the day-to-day activities of the leased employees;
(2) the prime contractor remains responsible for the quality of the work of the leased employees;
(3) the prime contractor retains all power to accept or exclude individual employees from work on the project; and
(4) the prime contractor remains ultimately responsible for the payment of predetermined minimum wages, the submission of payrolls, statements of compliance and all other Federal regulatory requirements.

b. "Specialty Items" shall be construed to be limited to work that requires highly specialized knowledge, abilities, or equipment not ordinarily available in the type of contracting organizations qualified and expected to bid or propose on the contract as a whole and in general are to be limited to minor components of the overall contract.

2. The contract amount upon which the requirements set forth in paragraph (1) of Section VI is computed includes the cost of material and manufactured products which are to be purchased or produced by the contractor under the contract provisions.

3. The contractor shall furnish (a) a competent superintendent or supervisor who is employed by the firm, has full authority to direct performance of the work in accordance with the contract requirements, and is in charge of all construction operations (regardless of who performs the work) and (b) such other of its own organizational resources (supervision, management, and engineering services) as the contracting officer determines is necessary to assure the performance of the contract.

4. No portion of the contract shall be sublet, assigned or otherwise disposed of except with the written consent of the contracting officer, or authorized representative, and such consent when given shall not be construed to relieve the contractor of any responsibility for the fulfillment of the contract. Written consent will be given only after the contracting agency has assured that each subcontract is evidenced in writing and that it contains all pertinent provisions and requirements of the prime contract.

5. The 30% self-performance requirement of paragraph (1) is not applicable to design-build contracts; however, contracting agencies may establish their own self-performance requirements.

## VII. SAFETY: ACCIDENT PREVENTION

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

1. In the performance of this contract the contractor shall comply with all applicable Federal, State, and local laws governing safety, health, and sanitation (23 CFR 635). The contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions as it determines, or as the contracting officer may determine, to be reasonably necessary to protect the life and health of employees on the job and the safety of the public and to protect property in connection with the performance of the work covered by the contract.

2. It is a condition of this contract, and shall be made a condition of each subcontract, which the contractor enters into pursuant to this contract, that the contractor and any subcontractor shall not permit any employee, in performance of the contract, to work in surroundings or under conditions which are unsanitary, hazardous or dangerous to his/her health or safety, as determined under construction safety and health standards (29 CFR 1926) promulgated by the Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 3704).

3. Pursuant to 29 CFR 1926.3, it is a condition of this contract that the Secretary of Labor or authorized representative thereof, shall have right of entry to any site of contract performance to inspect or investigate the matter of compliance with the construction safety and health standards and to carry out the duties of the Secretary under Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C.3704).

## VIII. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

In order to assure high quality and durable construction in conformity with approved plans and specifications and a high degree of reliability on statements and representations made by engineers, contractors, suppliers, and workers on Federal-aid highway projects, it is essential that all persons concerned with the project perform their functions as carefully, thoroughly, and honestly as possible. Willful falsification, distortion, or misrepresentation with respect to any facts related to the project is a violation of Federal law. To prevent any misunderstanding regarding the seriousness of these and similar acts, Form FHWA-1022 shall be posted on each Federal-aid highway project (23 CFR 635) in one or more places where it is readily available to all persons concerned with the project:

18 U.S.C. 1020 reads as follows:

"Whoever, being an officer, agent, or employee of the United States, or of any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of the material used or to be used, or the quantity or quality of the work performed or to be performed, or the cost thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction on any highway or related project submitted for approval to the Secretary of Transportation; or

Whoever knowingly makes any false statement, false representation, false report or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or

Whoever knowingly makes any false statement or false representation as to material fact in any statement, certificate, or report submitted pursuant to provisions of the Federal-aid Roads Act approved July 1, 1916, (39 Stat. 355), as amended and supplemented;

Shall be fined under this title or imprisoned not more than 5 years or both."

## IX. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

By submission of this bid/proposal or the execution of this contract, or subcontract, as appropriate, the bidder, proposer, Federal-aid construction contractor, or subcontractor, as appropriate, will be deemed to have stipulated as follows:

1. That any person who is or will be utilized in the performance of this contract is not prohibited from receiving an award due to a violation of Section 508 of the Clean Water Act or Section 306 of the Clean Air Act.
2. That the contractor agrees to include or cause to be included the requirements of paragraph (1) of this Section X in every subcontract, and further agrees to take such action as the contracting agency may direct as a means of enforcing such requirements.

## X. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

This provision is applicable to all Federal-aid construction contracts, design-build contracts, subcontracts, lower-tier subcontracts, purchase orders, lease agreements, consultant contracts or any other covered transaction requiring FHWA approval or that is estimated to cost $25,000 or more – as defined in 2 CFR Parts 180 and 1200.

### 1. Instructions for Certification – First Tier Participants:

a. By signing and submitting this proposal, the prospective first tier participant is providing the certification set out below.

b. The inability of a person to provide the certification set out below will not necessarily result in denial of participation in this covered transaction. The prospective first tier participant shall submit an explanation of why it cannot provide the certification set out below. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective first tier participant to furnish a certification or an explanation shall disqualify such a person from participation in this transaction.

c. The certification in this clause is a material representation of fact upon which reliance was placed when the contracting agency determined to enter into this transaction. If it is later determined that the prospective participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the contracting agency may terminate this transaction for cause of default.

d. The prospective first tier participant shall provide immediate written notice to the contracting agency to whom this proposal is submitted if any time the prospective first tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

e. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180 and 1200. "First Tier Covered Transactions" refers to any covered transaction between a grantee or subgrantee of Federal funds and a participant (such as the prime or general contract). "Lower Tier Covered Transactions" refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). "First Tier Participant" refers to the participant who has entered into a covered transaction with a grantee or subgrantee of Federal funds (such as the prime or general contractor). "Lower Tier Participant" refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

f. The prospective first tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency entering into this transaction.

g. The prospective first tier participant further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transactions," provided by the department or contracting agency, entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the $25,000 threshold.

h. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the Excluded Parties List System website (https://www.epls.gov/), which is compiled by the General Services Administration.

i. Nothing contained in the foregoing shall be construed to require the establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of the prospective participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

j. Except for transactions authorized under paragraph (f) of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default.

* * * * *

**2. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion – First Tier Participants:**

a. The prospective first tier participant certifies to the best of its knowledge and belief, that it and its principals:

(1) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency;

(2) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(3) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (a)(2) of this certification; and

(4) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

b. Where the prospective participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

2. **Instructions for Certification - Lower Tier Participants:**

(Applicable to all subcontracts, purchase orders and other lower tier transactions requiring prior FHWA approval or estimated to cost $25,000 or more - 2 CFR Parts 180 and 1200)

a. By signing and submitting this proposal, the prospective lower tier is providing the certification set out below.

b. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department, or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

c. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous by reason of changed circumstances.

d. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180 and 1200. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations. "First Tier Covered Transactions" refers to any covered transaction between a grantee or subgrantee of Federal funds and a participant (such as the prime or general contract). "Lower Tier Covered Transactions" refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). "First Tier Participant" refers to the participant who has entered into a covered transaction with a grantee or subgrantee of Federal funds (such as the prime or general contractor). "Lower Tier Participant" refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

e. The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.

f. The prospective lower tier participant further agrees by submitting this proposal that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the $25,000 threshold.

g. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the Excluded Parties List System website (https://www.epls.gov/), which is compiled by the General Services Administration.

h. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

i. Except for transactions authorized under paragraph e of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the

department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

* * * * *

**Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--Lower Tier Participants:**

1. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency.

2. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

* * * * *

**XI. CERTIFICATION REGARDING USE OF CONTRACT FUNDS FOR LOBBYING**

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts which exceed $100,000 (49 CFR 20).

1. The prospective participant certifies, by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

a. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

b. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

2. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

3. The prospective participant also agrees by submitting its bid or proposal that the participant shall require that the language of this certification be included in all lower tier subcontracts, which exceed $100,000 and that all such recipients shall certify and disclose accordingly.

^^^

**Replace "Contract" in the 3rd paragraph of section 8-1.02D(2) with:**

10-19-12

work

**Replace "Contract" in item 9 in the list in the 4th paragraph of section 8-1.02D(4) with:**

10-19-12

work

**Replace "Contract completion" in the 4th paragraph of section 8-1.02D(6) with:**

10-19-12

work completion

**Replace "Contract working days" in the 4th paragraph of section 8-1.02D(6) with:**

10-19-12

original working days

04-20-12

**Delete items 1.3 and 1.4 in the list in the 1st paragraph of section 8-1.02D(10).**

**Replace the last paragraph of section 8-1.04B with:**

10-30-15

The Department does not adjust time for work performed before Contract approval.

**Replace the 1st paragraph of section 8-1.05 with:**

10-30-15

Contract time starts on the earlier of the following:

1. Day you start job site activities after Contract approval
2. Last day specified to start job site activities in section 8-1.04

**Replace the 2nd paragraph of section 8-1.05 with:**

10-19-12

Complete the work within the Contract time.

10-19-12

**Delete "unless the Contract is suspended for reasons unrelated to your performance" in the 4th paragraph of section 8-1.05.**

**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 smooth and unobstructed passageway through the work during the suspension and deduct the cost from payments. The Department does not make a time adjustment for the suspension.

Upon the Engineer's order of suspension, suspend work immediately. Resume work when ordered.

**Replace the 1st sentence in the 1st paragraph of section 8-1.07B with:**

10-19-12

For a critical delay, the Department may make a time adjustment.

**Add to the end of section 8-1.07C:**

10-30-15

The Department does not make a payment adjustment for overhead incurred during non–working days of additional construction seasons experienced by reason of delay.

**Replace the 1st paragraph of section 8-1.07C with:**

10-19-12

For an excusable delay that affects your costs, the Department may make a payment adjustment.

**Replace "8-1.08B and 8-1.08C" in the 1st paragraph of section 8-1.10A with:**

08-05-11

8-1.10B and 8-1.10C

**Replace section 8-1.10D with:**

10-19-12

**8-1.10D Reserved**

^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

# 9 PAYMENT

10-30-15

**Add to the list in the 1st paragraph of section 9-1.03:**

07-19-13

3. Any royalties and costs arising from patents, trademarks, and copyrights involved in the work

**Replace item 1 in the 3rd paragraph of section 9-1.03 with:**

01-18-13

1. Full compensation for all work involved in each bid item shown on the Bid Item List by the unit of measure shown for that bid item

**Replace "10" in the last paragraph of section 9-1.03 with:**

01-23-15

7

**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 *Xa* in section 9-1.07B(2) with:**

04-20-12

total weight of HMA

**Replace the formula in section 9-1.07B(3) with:**

04-20-12

*Qrh* = *RHMATT* x 0.80 x *Xarb*

**Replace "weight of dry aggregate" in the definition of the variable *Xarb* in section 9-1.07B(3) with:**

04-20-12

total weight of rubberized HMA

**Replace the heading of section 9-1.07B(4) with:**

04-20-12

**Hot Mix Asphalt with Modified Asphalt Binder**

**Add between "in" and "modified" in the introductory clause of section 9-1.07B(4):**

04-20-12

HMA with

**Replace the formula in section 9-1.07B(4) with:**

04-20-12

*Qmh* = *MHMATT* x [(100 - *Xam*) / 100] x *Xmab*

**Replace "weight of dry aggregate" in the definition of the variable *Xmab* in section 9-1.07B(4) with:**

04-20-12

total weight of HMA

**Replace the formula in section 9-1.07B(5) with:**

04-20-12

*Qrap* = *HMATT* x *Xaa*

**Replace "weight of dry aggregate" in the definitions of the variables *Xaa* and *Xta* in section 9-1.07B(5) with:**

04-20-12

total weight of HMA

**Add after the variable definitions in section 9-1.07B(9):**

04-20-12

The quantity of extender oil is included in the quantity of asphalt.

**Replace the headings and paragraphs in section 9-1.11 with:**

10-19-12

### 9-1.11A General

Section 9-1.11 applies if a bid item for time-related overhead is included in the Contract. If a bid item for time-related overhead is included, you must exclude the time-related overhead from every other bid item price.

### 9-1.11B Payment Quantity

The TRO quantity does not include the number of working days to complete plant establishment work.

For a contract with a TRO lump sum quantity on the Bid Item List, the Department pays you based on the following conversions:

1. LS unit of measure is replaced with WDAY
2. Lump sum quantity is replaced with the number of working days bid
3. Lump sum unit price is replaced with the item total divided by the number of working days bid

### 9-1.11C Payment Inclusions

Payment for the TRO bid item includes payment for time-related field- and home-office overhead for the time required to complete the work.

The field office overhead includes time-related expenses associated with the normal and recurring construction activities not directly attributed to the work, including:

1. Salaries, benefits, and equipment costs of:
   1.1. Project managers
   1.2. General superintendents
   1.3. Field office managers
   1.4. Field office staff assigned to the project
2. Rent
3. Utilities
4. Maintenance
5. Security
6. Supplies
7. Office equipment costs for the project's field office

The home-office overhead includes the fixed general and administrative expenses for operating your business, including:

1. General administration
2. Insurance
3. Personnel and subcontract administration
4. Purchasing
5. Accounting
6. Project engineering and estimating

Payment for the TRO bid item does not include payment for:

1. The home-office overhead expenses specifically related to:
   1.1. Your other contracts or other businesses
   1.2. Equipment coordination
   1.3. Material deliveries
   1.4. Consultant and legal fees
2. Non-time-related costs and expenses such as mobilization, licenses, permits, and other charges incurred once during the Contract
3. Additional overhead involved in incentive/disincentive provisions to satisfy an internal milestone or multiple calendar requirements
4. Additional overhead involved in performing additional work that is not a controlling activity
5. Overhead costs incurred by your subcontractors of any tier or suppliers

### 9-1.11D Payment Schedule

For progress payments, the total work completed for the TRO bid item is the number of working days shown for the pay period on the *Weekly Statement of Working Days*.

For progress payments, the Department pays a unit price equal to the lesser of the following amounts:

1. Price per working day as bid or as converted under section 9-1.11B.
2. 20 percent of the total bid divided by the number of original working days

For a contract without plant establishment work, the Department pays you the balance due of the TRO item total as specified in section 9-1.17B.

For a contract with plant establishment work, the Department pays you the balance due of the TRO item total in the 1st progress payment after all non–plant establishment work is completed.

### 9-1.11E Payment Adjustments

The 3rd paragraph of section 9-1.17C does not apply.

The Department does not adjust the unit price for an increase or decrease in the TRO quantity except as specified in section 9-1.11E.

Section 9-1.17D(2)(b) does not apply except as specified for the audit report below.

If the TRO bid item quantity exceeds 149 percent of the quantity shown on the Bid Item List or as converted under section 9-1.11B, the Engineer may adjust or you may request an adjustment of the unit price for the excess quantity. For the adjustment, submit an audit report within 60 days of the Engineer's request. The report must be prepared as specified for an audit report for an overhead claim in section 9-1.17D(2)(b).

Within 20 days of the Engineer's request, make your financial records available for an audit by the State for the purpose of verifying the actual rate of TRO described in your audit. The actual rate of TRO described is subject to the Engineer's authorization.

The Department pays the authorized actual rate for TRO in excess of 149 percent of the quantity shown on the Bid Item List or as converted under section 9-1.11B.

The Department pays for 1/2 the cost of the report; the Contractor pays for the other 1/2. The cost is determined under section 9-1.05.

**Replace the paragraphs of section 9-1.16D with:**

07-19-13

### 9-1.16D(1) General

Section 9-1.16D applies if a bid item for mobilization is shown on the Bid Item List.

Payments for mobilization made under section 9-1.16D are in addition to the partial payments made under Pub Cont Code § 10261.

Section 9-1.16D(2) applies unless the Contract includes a special provision for section 9-1.16D(1) that specifies section 9-1.16D(3) applies.

11-15-13

### 9-1.16D(2) Mobilization for Projects Except for Those Over Water Requiring Marine Access

07-19-13

The Department makes partial payments for mobilization under Pub Cont Code § 10264(a) except the amount of work completed does not include the amount earned for mobilization. The partial payment amount is reduced by a prorated amount bid in excess of the maximum allowed under Pub Cont Code § 10264(a)(5).

The Department pays the item total for mobilization in excess of the maximum allowed under Pub Cont Code § 10264(a)(5) in the 1st payment after Contract acceptance.

**9-1.16D(3) Mobilization for Projects Over Water Requiring Marine Access**

The Department makes partial payments for mobilization under Pub Cont Code § 10264(b) except the amount of work completed does not include the amount earned for mobilization. The partial payment amount is reduced by a prorated amount bid in excess of the maximum allowed under Pub Cont Code § 10264(b)(6).

The Department pays the item total for mobilization in excess of the maximum allowed under Pub Cont Code § 10264(b)(6) in the 1st payment after Contract acceptance.

**Add to the end of the 2nd paragraph of section 9-1.16E(1):**

10-30-15

except as specified in section 9-1.16E(3)

10-19-12

**Delete "revised Contract" in item 1 of the 1st paragraph of section 9-1.16E(2).**

**Add to the end of the 1st sentence of the 1st paragraph of section 9-1.16E(3):**

10-30-15

except as specified below for the failure to submit a document during the last estimate period

**Add to the end of section 9-1.16E(3):**

10-30-15

During the last estimate period, if you fail to submit a document as specified, the Department withholds $10,000 for each document. The Department returns the withhold within 30 days after receipt of the document.

**Replace the 1st paragraph of section 9-1.16E(4) with:**

10-30-15

The Department withholds payments to cover claims filed under Civ Code § 9000 et seq.

**Replace "2014" in the 1st paragraph of section 9-1.16F with:**

10-19-12

2020

**Replace the 2nd paragraph of section 9-1.17C with:**

10-19-12

Submit either a written acceptance of the proposed final estimate or a claim statement postmarked or hand delivered before the 31st day after receiving the proposed final estimate.

**Add between "the" and "final estimate" in the 1st sentence in the 3rd paragraph of section 9-1.17C:**

10-19-12

proposed

**Replace the 1st sentence in the 6th paragraph of section 9-1.17D(2)(b) with:**

07-19-13

The CPA's audit must be performed as an examination-level engagement under the attestation engagements in the *Government Auditing Standards* published by the Comptroller General of the United States.

^^^

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)

04-19-13

### 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

^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

## 11 QUALITY CONTROL AND ASSURANCE

10-30-15

**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

**Replace the 1st sentence of the 4th paragraph of section 11-3.02G with:**

07-19-13

Requests to perform 3rd-time excavations, repairs of cracks, or repairs not included in the welding QC plan must include an engineering evaluation.

**Replace the 2nd and 3rd paragraphs in section 11-3.03B with:**

10-30-15

The AISC Certification category for overhead sign structures is Bridge and Highway Metal Component (CPT) or Simple Steel Bridge Structures (SBR).

The AISC Certification category for pole structures is Bridge and Highway Metal Component (CPT) or Standard for Steel Building Structures (STD).

^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

# 12 TEMPORARY TRAFFIC CONTROL

01-15-16

**Replace the 5th paragraph of section 12-3.01A(1) with:**

05-30-14

Repair or replace traffic-handling equipment and devices damaged from any cause during the Contract, including repainting if necessary. The condition of temporary traffic control devices must comply with the current American Traffic Safety Services Association publication "Quality Guidelines for Temporary Traffic Control Devices and Features."

**Replace the 1st paragraph of section 12-3.01A(4) with:**

10-19-12

Category 2 temporary traffic control devices must be on FHWA's list of acceptable, crashworthy Category 2 hardware for work zones. This list is available on FHWA's Safety Program Web site.

**Replace "project" in the 4th paragraph of section 12-3.02C with:**

10-19-12

work

**Add after "Display" in item 4 in the list in the 2nd paragraph of section 12-3.03B:**

04-19-13

or Alternating Diamond

**Replace the 2nd and 3rd paragraphs of section 12-3.04B with:**

10-30-15

Portable delineators must be a minimum of 36 inches in height. The vertical portion of portable delineators must be predominantly orange-colored. The posts must be not less than 3 inches in width or diameter. Retroreflectorization of portable delineators that have a height of less than 42 inches must be provided by two 3-inch-wide white bands placed a maximum of 2 inches from the top with a maximum of 6 inches between the bands. Retroreflectorization of portable delineators that have a height of 42 inches or more must be provided by four 4- to 6-inch-wide alternating orange and white stripes with the top stripe being orange.

**Add between the 1st and 2nd paragraphs of section 12-3.06A(1):**

10-30-15

Construction project funding signs must comply with section 12-2.

**Replace "project" in the 3rd paragraph of section 12-3.07C with:**

10-19-12

work

**Replace the 1st sentence of the 5th paragraph of section 12-3.08C with:**

10-30-15

Install a reflector on the top or face of the rail of each rail unit placed within 10 feet of a traffic lane.

**Add to section 12-3:**

07-19-13

**12-3.18 AUTOMATED WORK ZONE INFORMATION SYSTEM**

Reserved

**12-3.19–12-3.25 RESERVED**

**Replace the 7th through 9th paragraphs of section 12-4.02A with:**

07-19-13

If pedestrian traffic is allowed to pass through construction areas, provide a temporary pedestrian facility through the construction areas within the highway. Include protective overhead covering as necessary to ensure protection from falling objects and drippings from overhead structures.

At locations where pedestrian openings through falsework are required, provide a temporary pedestrian facility with protective overhead covering during all bridge construction activities.

Temporary pedestrian facilities must comply with section 12-7.

If an activity requires a closure of a walkway, another walkway must be made available nearby, off of the traveled way.

07-19-13

**Delete the 12th paragraph of section 12-4.02A.**

**Replace section 12-4.03 with:**

07-19-13

**12-4.03 CLOSURE SCHEDULES AND CONDITIONS**

**12-4.03A General**

Submit closure schedule requests and closure schedule amendments using LCS to show the locations and times of the requested closures.

The Department provides LCS training. Request the LCS training at least 30 days before submitting the 1st lane closure request. The Department provides the training within 15 days after your request. The training may be web based.

Except for web-based training, the training is held at a time and location you and the Engineer agree to.

For web-based training, the Engineer provides you the website address to access the training.

Within 5 business days after completion of the training, the Department provides LCS accounts and user identifications to your assigned, trained representatives.

Each representative must maintain a unique password and current user information in the LCS.

### 12-4.03B Closure Schedules

Every Monday by noon, submit a closure schedule request of planned closures for the next week period. The next week period is defined as Sunday noon through the following Sunday noon.

Submit a closure schedule request not less than 25 days and not more than 125 days before the anticipated start of any activity that reduces:

1. Horizontal clearances of traveled ways, including shoulders, to 2 lanes or less due to activities such as temporary barrier placement and paving
2. Vertical clearances of traveled way, including shoulders, due to activities such as pavement overlays, overhead sign installation, falsework, or girder erection

Submit closure schedule amendments, including adding additional closures, by noon at least 3 business days before a planned closure.

Cancel closure requests using LCS at least 48 hours before the start time of the closure.

You will be notified through LCS of unauthorized closures or closures that require coordination with other parties as a condition for authorization.

The Engineer may reschedule a closure cancelled due to unsuitable weather.

If a closure is not opened to traffic by the specified time, suspend work. No further closures are allowed until the Engineer has reviewed and authorized a work plan submitted by you that ensures that future closures will be opened to traffic by the specified time. Allow 2 business days for review of your proposed work plan. The Department does not compensate you for your losses due to the suspension of work resulting from the late opening of closures.

Notify the Engineer of delays in your activities caused by:

1. Your closure schedule request being denied although your requested closures are within the specified time frame allowed for closures. The Department does not compensate you for your losses due to amendments to the closure schedule that are not authorized.
2. Your authorized closure being denied.

10-30-15

If the Engineer orders you to remove a closure before the time designated in the authorized closure schedule, any delay caused by this order is an excusable delay.

07-19-13

### 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.

01-15-16

### 12-4.03D Closure Status

Update the status of authorized closures using the LCS Mobile web page.

For a stationary closure, use code:

1. 10-97 immediately before you place the 1st advance warning sign
2. 10-98 immediately after you remove all of the advance warning signs

For a moving closure, use code:

1. 10-97 immediately before the actual start time of the closure
2. 10-98 immediately after the actual end time of the closure

Cancel an authorized closure by using code 10-22 within 2 hours after the authorized start time.

If you are unable to access the LCS Mobile web page, immediately notify the Engineer of the closure's status.

**Add to the end of section 12-6.01:**

10-30-15

A traffic control system for a closure includes the temporary traffic control devices described as part of the traffic control system. The temporary traffic control devices must comply with section 12-3.

**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.

Protective overhead covering of temporary pedestrian facilities must be plywood at least 3/4 inch thick or wood planking with a nominal thickness of 2 inches minimum.

**12-7.03 CONSTRUCTION**

Construct hand railings on each side of a temporary pedestrian facility as necessary to protect pedestrian traffic from hazards due to work activities or adjacent vehicular traffic.

Maintain temporary pedestrian facilities in good condition and keep them clear of obstructions.

**12-7.04 PAYMENT**

Not Used

^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

# 13 WATER POLLUTION CONTROL

05-15-15

04-19-13

**Delete item 3 in the list in the 4th paragraph of section 13-1.01A.**

**Add to section 13-1.01A:**

11-15-13

Comply with the Department's general permit issued by the State Water Resources Control Board for *Order No. 2012-0011-DWQ, NPDES No. CAS000003, National Pollutant Discharge Elimination System (NPDES) Permit, Statewide Storm Water Permit and Waste Discharge Requirements (WDRs) for the State of California, Department of Transportation (Caltrans)*. The Department's general permit governs stormwater and nonstormwater discharges from the Department's properties, facilities, and activities. The Department's general permit may be viewed at the Web site for the State Water Resources Control Board, Storm Water Program, Caltrans General Permit.

**Add to the list in the 1st paragraph of section 13-1.01D(3)(b):**

10-21-11

3. Have completed SWRCB approved QSD training and passed the QSD exam

**Add to the list in the 2nd paragraph of section 13-1.01D(3)(b):**

10-21-11

3. Have completed SWRCB approved QSP training and passed the QSP exam

**Replace "NEL violation" in item 3.6.2 in the list in the 1st paragraph of section 13-1.01D(3)(c) with:**

04-19-13

receiving water monitoring trigger

**Replace the 1st paragraph in section 13-2.01B with:**

04-19-13

Within 7 days after Contract approval, submit 2 copies of your WPCP for review. Allow 5 business days for review.

After the Engineer authorizes the WPCP, submit an electronic copy and 3 printed copies of the authorized WPCP.

If the RWQCB requires review of the authorized WPCP, the Engineer submits the authorized WPCP to the RWQCB for its review and comment. If the Engineer orders changes to the WPCP based on the RWQCB's comments, amend the WPCP within 3 business days.

**Replace the 1st paragraph in section 13-3.01B(2)(a) with:**

04-19-13

Within 15 days of Contract approval, submit 3 copies of your SWPPP for review. The Engineer provides comments and specifies the date when the review stopped if revisions are required. Change and resubmit a revised SWPPP within 15 days of receiving the Engineer's comments. The Department's review resumes when a complete SWPPP has been resubmitted.

When the Engineer authorizes the SWPPP, submit an electronic copy and 4 printed copies of the authorized SWPPP.

If the RWQCB requires review of the authorized SWPPP, the Engineer submits the authorized SWPPP to the RWQCB for its review and comment. If the Engineer requests changes to the SWPPP based on the RWQCB's comments, amend the SWPPP within 10 days.

**Replace "NELs" in item 3.1 in the 3rd paragraph of section 13-3.01B(2)(a) with:**

04-19-13

receiving water monitoring triggers

**Replace 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<br>Upper limit = 9.0 |
| Turbidity | Field test with calibrated portable instrument | 1 | NTU | 500 NTU max |

The storm event daily average for storms up to the 5-year, 24-hour storm must not exceed the receiving water monitoring trigger for turbidity.

The daily average sampling results must not exceed the receiving water monitoring trigger for pH.

04-19-13

**Delete "and NELs are violated" in the 3rd paragraph of section 13-3.03C.**

**Replace "working days" at each occurrence in section 13-3.04 with.**

10-19-12

original working days

04-19-13

**Delete the 1st sentence in the 2nd paragraph of section 13-4.03C(3).**

**Add between the 2nd and 3rd paragraphs of section 13-4.03C(3):**

04-19-13

Manage stockpiles by implementing water pollution control practices on:

1. Active stockpiles before a forecasted storm event
2. Inactive stockpiles according to the WPCP or SWPPP schedule

05-30-14

**Delete the 7th paragraph of section 13-4.03C(3).**

**Replace the heading of section 13-4.03E(1) with:**

05-30-14

**General**

05-30-14

**Delete the 1st through 5th sentences in the 2nd paragraph of section 13-4.03E(1).**

**Replace the 1st sentence of the 1st paragraph of section 13-4.03E(3) with:**

05-30-14

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.

**Replace the paragraph in section 13-4.04 with:**

04-20-12

Not Used

**Replace "20-7.02D(6)" in section 13-5.02C with:**

07-19-13

20-5.03E

10-19-12

**Delete "or stockpile" in the 3rd paragraph of section 13-5.02F.**

**Replace "20-7.03I(10)" in section 13-5.03C with:**

07-19-13

20-5.03E(3)

**Replace section 13-5.03F with:**

04-20-12

**13-5.03F Reserved**

10-19-12

**Delete "or stockpile" in item 1 in the list in the 1st paragraph of section 13-5.03K.**

10-19-12

**Delete the 3rd paragraph of section 13-5.03K.**

**Replace the 2nd sentence in the 1st paragraph of section 13-9.01A with:**

10-19-12

You may use any of the following systems for temporary concrete washout:

1. Temporary concrete washout facility
2. Portable temporary concrete washout
3. Temporary concrete washout bin

**Replace the 2nd paragraph of section 13-9.01B with:**

10-19-12

Retain and submit an informational submittal for records of disposed concrete waste.

10-19-12

**Delete the 4th paragraph of section 13-9.01B.**

10-19-12

**Delete "if authorized" in the 1st sentence in the 1st paragraph of section 13-9.02A.**

**Replace "at least 3-inch" in the 3rd sentence in the 1st paragraph of section 13-9.02A with:**

10-19-12

6-inch

^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

## 14 ENVIRONMENTAL STEWARDSHIP

05-15-15

**Replace section 14-9.03 with:**

05-30-14

**14-9.03 RESERVED**

**Replace "California Department of Public Health (CDPH)" in the 2nd paragraph of section 14-11.02E(1) with:**

05-15-15

State Water Resources Control Board

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## 15 EXISTING FACILITIES

01-15-16

**Replace section 15-1.03D with:**

07-19-13

**15-1.03D Reserved**

**Replace "metal beam guard railing" in the 1st paragraph of section 15-2.01C with:**

07-19-13

guardrail

**Replace the paragraphs of section 15-2.02B(1) with:**

07-19-13

Section 15-2.02B includes specifications for removing pavement, base, subbase, and subgrade.

If only a portion of the pavement is removed, saw-cut the outline of the removal area on a neat line and with a power-driven saw before removing.

For asphalt concrete pavement, saw cuts must be at least 2 inches deep unless otherwise described.

**Replace section 15-2.02B(4)(b) with:**

07-19-13

**15-2.02B(4)(b) Reserved**

**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

10-30-15

**Delete "using Department-furnished tags" in the 4th paragraph of section 15-2.03A(2)(a).**

**Replace the heading of section 15-2.03B with:**

07-19-13

**Salvage Guardrail**

**Replace the heading of section 15-2.04D with:**

07-19-13

**Reconstruct Guardrail**

**Replace section 15-2.09D with:**

07-19-13

**15-2.09D Reserved**

**Replace the 4th paragraph of section 15-2.10B with:**

01-18-13

Instead of using new materials similar in character to those in the existing structure, you may use raising devices to adjust a manhole to grade. Before starting paving work, measure and fabricate raising devices. Raising devices must:

1. Comply with the specifications for section 75 except that galvanizing is not required
2 Have a shape and size that matches the existing frame
3. Be match marked by painting identification numbers on the device and corresponding structure
4. Result in an installation that is equal to or better than the existing one in stability, support, and nonrocking characteristics
5. Be fastened securely to the existing frame without projections above the surface of the road or into the clear opening

**Replace the heading of section 15-2.10D with:**

07-19-13

**Adjust Guardrail**

**Replace the paragraphs of section 15-3.01 with:**

07-19-13

Section 15-3 includes specifications for removing all or a portion of a concrete facility.

Concrete facilities include curbs, gutters, gutter depressions, sidewalks, driveways, slope paving, island paving, barriers, retaining walls, sound walls, minor structures, aprons, spillways, and dams.

Where broken-concrete slope protection is shown, use removed concrete for the construction of the broken-concrete slope protection.

Instead of disposing of removed concrete by removing it from the job site, you may dispose of it on the job site by one of the following methods:

1. Burying it in embankments at authorized locations. Removed concrete must be broken into pieces that can be readily handled and incorporated into embankments and placed at a depth of at least 3 feet below finished grade and slope lines. Concrete must not be buried in areas where piling is to be placed or within 10 feet of trees, pipelines, poles, buildings or other permanent objects or structures.
2. Placing it at authorized locations. The removed concrete must not present an unsightly appearance from the highway.

**Replace the paragraph of section 15-3.02 with:**

07-19-13

Not Used

07-19-13

**Delete the 5th paragraph of section 15-3.03.**

**Replace the paragraphs of section 15-3.04 with:**

10-30-15

Not Used

**Add to the end of section 15-4.01A(2):**

04-19-13

Allow 20 days for review of the bridge removal work plan.

**Replace the 2nd sentence of the 3rd paragraph of section 15-4.02C(1) with:**

10-17-14

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).

**Replace the 1st paragraph of section 15-5.01C(1) with:**

10-19-12

Before starting deck rehabilitation activities, complete the removal of any traffic stripes, pavement markings, and pavement markers.

**Replace the 2nd and 3rd paragraphs of section 15-5.01C(2) with:**

10-19-12

Perform the following activities in the order listed:

1. Abrasive blast the deck surface with steel shot. Perform abrasive blasting after the removal of any unsound concrete and placement of any rapid setting concrete patches.
2. Sweep the deck surface.
3. Blow the deck surface clean using high-pressure air.

**Replace the 2nd paragraph of section 15-5.01C(4) with:**

10-19-12

Before removing asphalt concrete surfacing, verify the depth of the surfacing at the supports and midspans of each structure (1) in each shoulder, (2) in the traveled way, and (3) at the roadway crown, if a crown is present.

04-19-13

**Delete "and concrete expansion dams" in the 3rd paragraph of section 15-5.01C(4).**

**Replace the 2nd paragraph of section 15-5.03A(2) with:**

10-19-12

For a contract with less than 60 original working days, submit certificates of compliance for the filler material and bonding agents.

**Replace "51-1.02C" in the 1st paragraph of section 15-5.03B with:**

04-19-13

51-1.02F

**Replace the 4th paragraph of section 15-5.03B with:**

10-19-12

For a contract with less than 60 original working days, alternative materials must be authorized before use.

**Add between the 5th and 6th paragraphs of section 15-5.03C:**

10-19-12

The final surface finish of the patched concrete surface must comply with section 51-1.03F.

10-19-12

**Delete the 4th paragraph of section 15-5.05C.**

**Replace "51-1.03F(5)" in the 3rd paragraph of section 15-5.06C(1) with:**

07-19-13

51-1.01D(4)(b)

**Replace "51-1.03E(5)" in the 5th paragraph of section 15-5.06C(1) with:**

10-19-12

51-1.03F(5)

10-19-12

**Delete the 9th paragraph of section 15-5.06C(1).**

04-19-13

**Delete the 15th paragraph of section 15-5.06C(1).**

**Add between the 18th and 19th paragraphs of section 15-5.06C(1):**

07-19-13

Texture the polyester concrete surface before gelling occurs by longitudinal tining under 51-1.03F(5)(b)(iii), except do not perform initial texturing.

**Replace section 15-5.06C(2) with:**

04-19-13

**15-5.06C(2) Reserved**

04-19-13

**Delete the 3rd paragraph of section 15-5.06D.**

**Replace the 1st paragraph in section 15-5.07B(4) with:**

10-19-12

Payment for furnishing dowels is not included in the payment for core and pressure grout dowel.

**Replace section 15-5.09 with:**

04-19-13

## 15-5.09 POLYESTER CONCRETE EXPANSION DAMS

### 15-5.09A General

Section 15-5.09 includes specifications for constructing polyester concrete expansion dams.

Polyester concrete expansion dams must comply with the specifications for polyester concrete overlays in section 15-5.06, except a trial slab is not required.

Reinforcement must comply with section 52.

### 15-5.09B Materials

Not Used

### 15-5.09C Construction

For new asphalt concrete overlays, place the asphalt concrete overlay before starting polyester concrete activities. Saw cut and remove asphalt concrete at expansion dam locations.

For existing asphalt concrete overlays, remove expansion dams and asphalt concrete to the limits shown. Removing expansion dams must comply with section 15-4 except a bridge removal work plan is not required.

Where a portion of the asphalt concrete overlay is to remain, saw cut a 2-inch-deep neat line along the edge to remain in place before removing the asphalt concrete. Do not damage the existing surfacing to remain in place.

Prepare the deck surface under section 15-5.01C(2).

You may use a mechanical mixer to mix the polyester concrete for expansion dams. The mixer capacity must not exceed 9 cu ft unless authorized. Initiate the resin and thoroughly blend it immediately before mixing it with the aggregate. Mix the polyester concrete for at least 2 minutes before placing.

The application rate of methacrylate resin must be approximately 100 sq ft/gal.

You may place and finish expansion dams using hand methods.

Protect expansion dams from moisture, traffic, and equipment for at least 4 hours after finishing.

For expansion dams over 6 feet long, install 1/4-inch-wide joint material at 6-foot intervals across the width of the expansion dam. Joint material must be either expanded polyurethane or expanded polyethylene.

### 15-5.09D Payment

Not Used

**Add to section 15-6.01A(3)(a):**

07-19-13

Within 5 days of completing annular space grouting at a culvert, submit the grouting records.

**Replace "41-1.01" in item 10.3 in the list in the 2nd paragraph of section 15-6.01A(3)(d) with:**

07-19-13

41-2

**Replace "41-1.02" in 1st paragraph of section 15-6.01B(2) with:**

07-19-13

41-2

**Replace items 5 and 6 in the list in the 1st paragraph of section 15-6.01D with:**

01-15-16

5. Performing postrehabilitation inspection

**Add after the 4th paragraph of section 15-6.01D:**

01-15-16

Record the quantity of grout that is installed and submit this quantity. The Department does not pay for (1) grout that leaks through to the inside of the culvert or (2) grout material that is wasted, disposed of, or remaining on hand after the completion of the work.

**Replace the heading of section 15-6.04 with:**

01-18-13

**INVERT PAVING**

**Replace the 1st paragraph of section 15-6.13A(1) with:**

07-19-13

Section 15-6.13 includes specifications for installing machine spiral wound PVC pipeliners directly into the culvert.

**Replace the heading of section 15-6.13B with:**

07-19-13

**Machine Spiral Wound PVC Pipeliners, Grouted**

^^^

^^^

### 18-1.01D Quality Control and Assurance

A dust suppressant or dust control binder must comply with US EPA requirements and RWQCB requirements for soil stabilizers.

A dust suppressant must be tested by either an ASTM- or AMRL-AASHTO-accredited laboratory for compliance with the specified quality characteristic requirements.

A dust suppressant must be tested by an EPA-accredited laboratory for environmental requirements. Liquid chemical treatments must be tested before dilution. Solid products must be mixed with water to a 25 percent concentration before testing. The 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 |

A dust suppressant must comply with the requirements shown in the following table:

**Organic and Inorganic Requirements**

| Quality characteristic | Test method | Requirement |
|---|---|---|
| VOCs | EPA Method 8260 | Set by the CalEPA Air Resources Board and local air district |
| Semi-VOCs | EPA Method 8270 | US EPA Target Compound List and Contract-required quantitation limits |
| Synthetic precipitation leaching procedure | EPA Method 1312 | Set by the RWQCB |

A dust suppressant must comply with the aquatic toxicity requirements shown in the following table:

**Aquatic Toxicity Requirements**

| Quality characteristic | Test method | Requirement |
|---|---|---|
| Aquatic toxicity[a] (LC50 min, ppm) | ASTM E729 or EPA Method 600/4-90/027F and EPA Method 600/4-91/002 | 10 |
| Aquatic toxicity[a] (rating) | ASTM E729 or EPA Method 600/4-90/027F and EPA Method 600/4-91/002 | slightly toxic or better |
| Renewal toxicity[b] (LC50 min, ppm) | ASTM E1295 | 10 |
| Renewal toxicity[b] (rating) | ASTM E1295 | slightly toxic or better |

[a]Using *Ceriodaphnia dubia* (water flea), *Oncorhynchus mykiss* (rainbow trout), *Pimephales promelas* (fathead minnow), and *Americamysis bahia* (mysid shrimp)
[b]Using *Ceriodaphnia dubia* (water flea)

## 18-1.02 MATERIALS

### 18-1.02A General

A dust suppressant or a control binder 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

A dust suppressant must be one of the following:

1. Petroleum-based organic product
2. Nonpetroleum-based organic product
3. Hygroscopic product
4. Synthetic polymer emulsion

#### 18-1.02B(2) Petroleum-Based Organic Products

A petroleum-based organic dust suppressant must be an asphalt emulsion, petroleum resin, base oil, mineral oil, or synthetic fluid.

An asphalt emulsion must be Grade SS1h.

A petroleum resin must comply with the requirements shown in the following table:

**Petroleum Resin Requirements**

| Quality characteristic | Test method | Requirement |
|---|---|---|
| Residue (min, %) | ASTM D6934 | 60 |
| pH | ASTM D1429 | 4.0–7.0 |
| sp gr at 16 °C (min) | ASTM D1298 | 1.00 |
| Kinematic visc at 25 °C (min, Saybolt Furol seconds[a]) | ASTM D2170 | 188 |
| Flash point (min °C) | ASTM D92 | 205 |
| Particle charge test | ASTM D7402 | Positive |

[a]Use ASTM D2161 to convert the $mm^2/s$ value to Saybolt Furol seconds

A base or mineral oil must comply with the requirements shown in the following table:

**Base and Mineral Oils Requirements**

| Quality characteristic | Test method | Requirement |
|---|---|---|
| Base and mineral oil content (min, %) | -- | 75 |
| sp gr at 16 °C (min) | ASTM D1298 | 0.85–0.90 |
| Brookfield absolute visc at 20 °C (max, cP) | ASTM D2196 | 250 |
| Flash point (min, °C) | ASTM D93 | 150 |

A synthetic fluid must comply with 40 CFR 35 and the requirements shown in the following table:

**Synthetic Fluids Requirements**

| Quality characteristic | Test method | Requirement |
|---|---|---|
| Synthetic fluid content (min, %) | -- | 75 |
| sp gr at 16 °C (min) | ASTM D1298 | 0.85–0.90 |
| Brookfield absolute visc at 20 °C (max, cP) | ASTM D2196 | 250 |
| Flash point (min, °C) | ASTM D93 | 140 |

#### 18-1.02B(3) Nonpetroleum-Based Organic Products

A nonpetroleum-based organic dust suppressant must be lignosulfonate, plant oil, or tall oil pitch rosin.

A 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 |
| sp gr (min) | ASTM D1429 | 1.20 |
| Brookfield absolute visc at 25 °C (max, cP) | ASTM D2196 | 1,000 |

A 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 |
| sp gr (min) | ASTM D1429 | 0.93 |
| Brookfield absolute visc 25 °C (cP) | ASTM D2196 | 50–200 |
| Flash point (min, °C) | ASTM D93 | 288 |

A 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 |
| sp gr (min) | ASTM D1429 | 1.00 |
| Brookfield absolute visc at 25 °C (cP) | ASTM D2196 | 50–200 |

### 18-1.02B(4) Hygroscopic Products

A hygroscopic dust suppressant must be calcium chloride, calcium chloride flake, or magnesium chloride.

Calcium chloride must comply with the requirements shown in the following table:

**Calcium Chloride[a] Requirements**

| Quality characteristic | Test method | Requirement |
|---|---|---|
| Calcium chloride content (%) | ASTM E449 | 28–42 |
| Total magnesium chloride (max, %) | ASTM E449 | 6.0 |
| Total alkali chlorides as sodium chloride (max, %) | ASTM E449 | 6.0 |
| Calcium hydroxide content (max, %) | ASTM E449 | 0.2 |
| pH with 5 percent solution | ASTM D1293 | 7.0–9.0 |
| sp gr | ASTM D1429 | 1.28–1.44 |

[a]ASTM D98 or AASHTO M144

Calcium chloride flake must comply with the requirements shown in the following table:

**Calcium Chloride Flake[a] Requirements**

| Quality characteristic | Test method | Requirement |
|---|---|---|
| Calcium chloride content (min, %) | ASTM E449 | 75 |
| Total magnesium as $MgCl_2$ (max, %) | ASTM E449 | 6.0 |
| Total alkali chlorides as sodium chloride (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<br>3/8–inch sieve<br>No. 4 sieve<br>No. 30 sieve | ASTM C136 | <br>100<br>80–100<br>0–5 |

[a]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[a] | 28–33 |
| Sulfate content as magnesium sulfate (max, %) | ASTM D4691[a] | 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 |
| sp gr | ASTM D1429 | 1.31 ± 0.02 |

[a]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

A synthetic polymer emulsion 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 |
| sp gr at 16 °C | ASTM D1298 | 1.00–1.15 |
| Brookfield absolute visc (max, cP) | ASTM D2196 | 1,000 |
| Polymer film tensile strength – dry (psi) | ASTM D412 | 500 |
| Retained coagulum on no. 100 sieve (max, %) | ASTM D1417 | 0.1 |
| Ash content (max, %) | ASTM D5040 | 2 |

### 18-1.02C Dust Control Binders

A dust control binder must comply with the specifications for a tackifier in section 21-1.02F except section 21-1.01 does not apply.

Fibers must comply with section 21-1.02E except section 21-1.01 does not apply.

## 18-1.03 CONSTRUCTION

### 18-1.03A General

Monitor dust conditions and apply a dust palliative for dust control as described and as ordered. Reapply the 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 AB 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 Application**

| 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/sq 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 dust suppressants under the manufacturer's instructions.

Apply calcium chloride flakes to a moist surface.

Allow surfaces treated with a dust suppressant to cure before opening them to traffic. Adequate cure occurs when moisture is evaporated, sheen is gone, and tracking is nonextant.

Use the mix proportions and application rate for the corresponding dust control binder as shown in the following table:

**Dust Control Binder Application**

| Dust control binder | Mix proportions | Application rate |
|---|---|---|
| Guar | 11 to 15 lb per 1,000 gal of water | 44–59 lb/acre |
| Psyllium | Enough water to allow for uniform slurry flow | 80–200 lb/acre |
| Starch | Manufacturer's recommended mix proportions with water | 150 lb/acre |
| Liquid acrylic copolymers and polymers[a] | 10 parts water to 1 part polymer | 1,175 gal/acre |
| Liquid methacrylate and acrylate polymers | Manufacturer's recommended mix proportions with water | 20 gal/acre |
| Copolymers of sodium acrylates and acrylamides | Manufacturer's recommended mix proportions with water | 3–10 lb/acre |
| Polyacrylamide and copolymer of acrylamide | 10 lb per 1,000 gal of water | 5 lb/acre |
| Hydrocolloid polymers | Manufacturer's recommended mix proportions with water | 54–64 lb/acre |

[a]Mix and handle the polymeric compound in a manner that will not cause foaming. You may add an antifoaming agent.

Do not allow stormwater runoff from polyacrylamide treated soils unless water passes through:

1. Sediment basin if the total drainage area is greater than or equal to 5 acres.
2. Sediment trap or a series of check dams if the total drainage area is less than 5 acres. Maximize the number of check dams used and space them evenly in the drainage channel such that sediment settlement is maximized.

You may add fibers to dust control binders at a rate of 2,000 lb/acre.

You may reapply dust palliatives at a reduced application rate if authorized.

**18-1.04 PAYMENT**

Not Used

^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

# 19 EARTHWORK

10-17-14

**Replace "20-3.03B(4)" in the 2nd paragraph of section 19-1.01A with:**

07-19-13

20-2.02C(2)

**Replace the 3rd paragraph in section 19-2.01A with:**

07-19-13

Pavement removal within the limits of roadway excavation must comply with section 15-2.02B.

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.

01-18-13

3. Grout and shotcrete have cured for at least 72 hours.

01-20-12

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.

**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**

^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

# 20 LANDSCAPE

01-15-16

**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

10-30-15

The Engineer performs a progress inspection:

1. Before cultivating work starts
2. During pressure testing of irrigation pipe on the supply side of control valves
3. During testing of low voltage conductors
4. During irrigation system functional tests
5. Before planting work starts
6. After completion of planting work

07-19-13

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

10-30-15

Unless there is a bid item for irrigation water service charges, the Department furnishes water if it is available from an existing Department-owned facility within the project limits or an irrigation system to be installed under the Contract.

07-19-13

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

05-30-14

3. Causing excess runoff

10-30-15

If water use calculations are provided as supplemental project information, water plants under the Model Water Efficient Landscape Ordinance, 23 CA Code of Regs § 490 et seq., and local water agency requirements.

05-30-14

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

10-30-15

6. Rain sensors
7. Remote control valves
8. Backflow preventers

07-19-13

#### 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

10-30-15

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.

07-19-13

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.

10-30-15

2. Marked "WATER" in cast-in letters not less than 1 inch high unless shown.

07-19-13

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.

10-30-15

### 20-2.01B(8) Wye Strainers

Wye strainers, except those used for drip valve assemblies, must:

1. Have a cast iron or all bronze body
2. Have a removable stainless steel strainer screen with 40-mesh woven wire
3. Have a 20-mesh woven wire screen or perforated sheet with 0.045-inch-diameter holes when on a backflow preventer assembly
4. Be capable of withstanding a working pressure of 150 psi
5. Be equipped with a garden valve at the outlet

07-19-13

## 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

10-30-15

Trench and backfill under section 86-2.01.

07-19-13

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.

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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.

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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

10-30-15

Install pull boxes under section 86-2.06 at the following locations:

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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.

01-15-16

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. In open areas, install signs on metal posts under section 56-4.

07-19-13

### 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.

10-30-15

Work performed on existing irrigation facilities must comply with section 15.

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### 20-2.02A(2) Definitions

Reserved

### 20-2.02A(3) Submittals

Submit a list of irrigation system deficiencies within 7 days after checking the existing facilities.

### 20-2.02A(4) Quality Control and Assurance

After irrigation facilities have been relocated, demonstrate in the presence of the Engineer that the relocated facilities function properly.

Certify each existing backflow preventer under section 20-2.03A(4).

### 20-2.02B Materials

Valve box covers must be the same size as the covers they replace.

Control and neutral conductors must be the same size and color as the control and neutral conductors they replace.

### 20-2.02C Construction

### 20-2.02C(1) General

Notify the Engineer at least 4 business days before shutting off the water supply to any portion of the existing irrigation system and immediately after restoring the water supply to any portion of the existing irrigation system.

If an irrigation facility to be relocated is determined unsuitable by the Engineer, replace irrigation facility under section 20-2. This work is change order work.

### 20-2.02C(2) Check and Test Existing Irrigation Facilities

Before performing irrigation system work, check existing irrigation facilities to remain in place or to be relocated. The Engineer determines the test watering cycle lengths. Check for deficiencies including missing parts, damaged components, and improper operation. Correct deficiencies as ordered. The correction of deficiencies is change order work.

### 20-2.02C(3) Operate Existing Irrigation Facilities

If the Contract includes a bid item for operate existing irrigation facilities, after performing work under section 20-2.02C(2), operate existing irrigation facilities through Contract acceptance.

Operate existing irrigation facilities except for water meters, underground supply lines, control and neutral conductors, and electrical conduits.

Check for proper operation at least once every 30 days. Adjust, repair, or replace existing irrigation facilities within 7 days of finding any deficiency.

Operate irrigation systems using the automatic irrigation controller until Contract acceptance. You may operate irrigation controllers manually during plant replacement, fertilization, weed germination, and repair work.

Program the irrigation controllers for seasonal requirements.

### 20-2.02C(4) Replace Valve Box Covers

Existing valve box covers shown to be replaced must remain in place until the new covers are ready to be installed.

Dispose of removed valve box covers.

### 20-2.02C(5) Relocate Backflow Preventer Assemblies

Relocate backflow preventer assembly as shown and install under section 20-2.03C.

### 20-2.02C(6) Relocate Water Meters

Relocate water meter as shown.

### 20-2.02C(7) Relocate Irrigation Controllers

Relocate irrigation controller as shown and install under section 20-2.07C.

10-30-15

### 20-2.02C(8) Remove Irrigation Facilities

Irrigation facilities to be removed that are more than 6 inches below the finished grade may be abandoned in place unless salvaging is specified or shown.

Immediately after disconnecting an existing irrigation facility to be removed or abandoned from an existing facility to remain, the remaining facility must be capped or plugged, or connected to a new or existing irrigation facility.

### 20-2.02C(9) Salvage Irrigation Facilities

Salvage irrigation facilities under section 15-2.03.

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### 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.

10-30-15

#### 20-2.03B(4) Backflow Preventer Enclosures

Each backflow preventer enclosure must:

1. Be Type 304 stainless steel
2. Have expanded metal side, end, and top panels fabricated from 9-gauge minimum-thickness sheet with openings of approximately 3/4 by 1-3/4 inches
3. Have expanded metal panels attached to the 3/16-inch-thick 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
4. Have lock guards with a minimum thickness of 12 gauge
5. Have hexagonal nuts and lock-type washers
6. Have padlock-clasp or latch-and-lock mechanism

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### 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

10-30-15

Perform field tests on control and neutral conductors. Field tests must comply with the specifications in section 86-2.14B.

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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

10-30-15

Control and neutral conductors must comply with the requirements in section 86-2.08.

Electrical conduit and fittings must comply with section 86.

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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. Of the size recommended by the manufacturer of the controllers to be installed
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

10-30-15

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.

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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

10-30-15

## 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

**base station**: Designated computer that collects data from a series of satellite controllers through a centralized server.

**centralized server:** Designated server that collects data from all base stations.

**network communication:** Identified means through which satellite controllers, base stations, and a centralized server communicate to one another, such as fiber optics, spread spectrum, and phone lines.

**remote access device:** Wireless device, such as an FCC-compliant radio remote, web-enabled smart phone, or wireless computer or tablet, used to communicate with satellite controllers from a remote location.

**remote irrigation control system**: Centralized water-management system that consists of:

1. Base station
2. Centralized server or web-based application
3. Satellite controllers
4. Remote access device

**satellite controller:** Irrigation controller that communicates directly to a base station or centralized server.

**smart controller:** Irrigation controller that estimates or measures depletion of available plant soil moisture in order to operate an irrigation system, replenishing water as needed while minimizing excess water use.

**web-based application:** Encrypted managing software that is coded in a browser-supported language and is executable via a common Internet web browser, such as Internet Explorer, Firefox, and Safari.

### 20-2.07A(3) Submittals

Submit a complete manufacturer's maintenance and operations manual for each type of installed controller as an informational submittal.

After the work 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-inch 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.

### 20-2.07A(4) Quality Control and Assurance

Provide training by a qualified person on the use and adjustment of the installed irrigation controllers at least 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 AC-powered irrigation controllers must operate on 120 V(ac), 60 Hz, and supply from 24 to 30 V(ac), 60 Hz for operating electrical remote control valves.

Concrete for the pad and foundation must be minor concrete except the cementitious material content of the concrete must be at least 463 lb/cu yd. 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 smart controller from a single manufacturer.
2. Be fully automatic and capable of operating a complete 30-day or longer irrigation program.
3. 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.
4. Have nonvolatile memory.
5. Have a watering time display on the face of the control panel.
6. 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.
7. Have a variable or incremental timing adjustment ranging from 1 to 360 minutes per station.
8. Be capable of operating at least 3 program schedules.
9. Be capable of having at least 4 start times per program schedule.
10. Have an output that can energize a pump start circuit or a remote control master valve.
11. Be protected by fuses and circuit breakers.
12. Display a program and station affected by a sensory alert without changing other watering schedules not affected by the alert.
13. Be capable of global manual and automatic seasonal adjustments to all valves in any given program.
14. Automatically change watering schedule based on evapotranspiration data provided by a local weather station or have an internal programmed default of historical evapotranspiration data for a given region.
15. Support a flow sensor, and a rain sensor or access to a weather station, and have automatic shut-off capability.
16. 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 20-2.07B(3).

Irrigation controllers not installed in enclosure cabinets must be weatherproof, constructed of fiberglass or metal and have a door lock with 2 keys provided.

A remote irrigation system must comply with the specifications for 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-secured 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 comply with section 86 and:

1. Be minimum 14-gauge Type 304 stainless steel.
2. Include a mounting panel. Fabricate mounting panels using any of the following materials:
   - 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 if 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 from 24 to 30 V(ac)
2. Wireless and FCC compliant

### 20-2.07C Construction

Finish the exposed top surface of concrete pad with a medium broom finish applied parallel to the long dimension.

Install electrical components for automatic irrigation systems under section 86-1.02.

Install irrigation controllers under the manufacturer's instructions.

If 2 or more irrigation controllers operate the same remote master control valve, 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 120-volt or higher electrical service is not included in the payment for any type of irrigation controller.

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## 20-2.08 IRRIGATION CONDUIT

### 20-2.08A General

### 20-2.08A(1) Summary

Section 20-2.08 includes specifications for installing irrigation conduit under a roadway or other facility to accommodate electrical conduit for control and neutral conductors and irrigation supply lines.

Before performing work on irrigation systems, locate existing conduits shown to be incorporated into the new work.

Before removing or disturbing existing Type A pavement markers that show the location of the existing conduit, mark the location of the existing conduit on the pavement.

### 20-2.08A(2) Definitions

Reserved

### 20-2.08A(3) Submittals

Reserved

### 20-2.08A(4) Quality Control and Assurance

Demonstrate the conduits are free of obstructions after placement of base and surfacing.

Before and after extending the irrigation supply line in a conduit, pressure test the supply line under section 20-2.01A(4)(b).

After conductors are installed in a conduit, test the conductors under section 20-2.05A(4).

Assign a technical representative to direct and control the directional bore activities. The representative must be present during directional bore activities. Unless otherwise authorized, perform directional bore activities in the presence of the Engineer.

## 20-2.08B Materials

### 20-2.08B(1) General

Reserved

### 20-2.08B(2) ABS Composite Pipe Conduit

ABS composite pipe and couplings must comply with ASTM D 2680. Couplings must be solvent cement type.

### 20-2.08B(3) Corrugated High Density Polyethylene Pipe Conduit

Corrugated high density polyethylene pipe must comply with ASTM F 405 and F 667 or be Type S and comply with AASHTO M252 and M294. Couplings and fittings must be as recommended by the pipe manufacturer.

### 20-2.08B(4) Corrugated Steel Pipe Conduit

Corrugated steel pipe conduit must comply with section 66. The nominal thickness of metal sheets for pipe must be 0.064 inch for corrugated steel pipe and 0.060 inch for corrugated aluminum pipe. Coupling bands and hardware must comply with section 66.

### 20-2.08B(5) Polyvinyl Chloride Pipe Conduit

PVC pipe conduit must be schedule 40 and comply with ASTM D 1785.

Fittings must be schedule 80.

### 20-2.08B(6) Welded Steel Pipe Conduit

Welded steel pipe must comply with ASTM A 53. Pipe must be black and have either welded or threaded joints.

The minimum wall thickness for the various sizes of welded steel pipe must comply with the dimensions shown in the following table:

| Pipe size, nominal (inch) | Minimum wall thickness (inch) |
|---|---|
| 3 | 0.216 |
| 4 | 0.237 |
| 6 | 0.280 |
| 8 | 0.277 |
| 10 | 0.279 |
| 12 | 0.330 |

## 20-2.08C Construction

### 20-2.08C(1) General

When existing conduits are to be incorporated in new work, excavate exploratory holes for locating existing conduits at the locations indicated by existing markers or as directed. Excavate and backfill exploratory holes to a maximum size of 2-1/2 feet in width, 5 feet in depth, and 5 feet on each side of the marker or directed location parallel to the roadway. If the conduit is not found and if ordered, increase the size of the exploratory holes beyond the dimensions specified. The additional excavation and backfill is change order work.

If extending an existing conduit, remove conductors from the conduit.

Use a coupling band if the new conduit matches the existing conduit diameter, otherwise overlap the conduit at least 12 inches.

After extending existing conduits, install conductors that match the color and size of the existing conductors without splices. Splice conductors in adjacent pull boxes.

If installing a control and neutral conductor and electrical conduit through the irrigation conduit, install a no. 5 pull box at each end.

Remove debris found in the conduit before performing other work. Debris found more than 3 feet from the ends of the conduits is removed as change order work.

Extend conduit 2 feet beyond all paving unless otherwise shown.

Cap the ends of unused conduit.

Designate the location of each conduit by cementing a Type A pavement marker as shown. Type A pavement markers and adhesive must comply with section 85.

### 20-2.08C(2) Welded Steel Pipe Conduit

#### 20-2.08C(2)(a) General

Install welded steel pipe by directional boring or jack and drill.

Install top of conduits:

1. 18 to 30 inches below the finished surface in sidewalk areas
2. 40 to 52 inches below the finished grade in other paved areas

#### 20-2.08C(2)(b) Directional Boring

Notify the Engineer 2 business days before starting directional bore activities.

The diameter of the boring tool for directional boring must be only as large as necessary to install the conduit.

Mineral slurry or wetting solution may be used to lubricate the boring tool and to stabilize the soil surrounding the boring path. The mineral slurry or wetting solution must be water based.

The directional bore equipment must have directional control of the boring tool and have an electronic boring tool location detection system. During operation, the directional bore equipment must be able to determine the location of the tool both horizontally and vertically.

#### 20-2.08C(2)(c) Jack and Drill

Notify the Engineer 2 business days before starting jack and drill activities.

Jacking or drilling pits must be no closer than 2 feet from pavement edge whenever possible.

If authorized, small holes may be cut in the pavement to locate or remove obstructions.

Do not use excessive water that will soften subgrade or undermine pavement.

### 20-2.08C(3) Schedule 40 Pipe Conduit

Where schedule 40 pipe conduit 2 inches or less in outside diameter is installed under surfacing, you may install by directional boring under section 20-2.08C(2)(b).

For conduit 2 inches or less in diameter, the top of the conduit must be a minimum of 18 inches below surfacing.

Extend schedule 40 pipe conduit 6 inches beyond surfacing. Cap ends of conduit until used.

### 20-2.08D Payment

Schedule 40 PVC pipe conduit is paid for as plastic pipe (schedule 40) (supply line).

## 20-2.09 IRRIGATION SUPPLY LINE

### 20-2.09A General

#### 20-2.09A(1) Summary

Section 20-2.09 includes specifications for installing irrigation supply line.

If the supply line location interferes with the excavation of plant holes, relocate the plant hole to clear the supply line. Do not install supply lines through plant holes unless shown.

Supply lines, control and neutral conductors and electrical conduits installed in common trenches must not be installed above each other.

#### 20-2.09A(2) Definitions

Reserved

#### 20-2.09A(3) Submittals

Submit a certificate of compliance for polyethylene pipe and plastic pipe supply line.

#### 20-2.09A(4) Quality Control and Assurance

Solvent cement must comply with the local Air Quality Management District requirements.

### 20-2.09B Materials

#### 20-2.09B(1) General

Irrigation supply pipe must be metal or plastic as shown.

PCC for thrust blocks must be produced from commercial-quality aggregates. The concrete must contain at least 295 pounds of cementitious material per cubic yard.

#### 20-2.09B(2) Copper Pipe Supply Line

Copper pipe must be Type K rigid pipe and comply with ASTM B 88. Fittings must be wrought copper or cast bronze either soldered or threaded.

Solder must be 95 percent tin and 5 percent antimony.

#### 20-2.09B(3) Galvanized Steel Pipe Supply Line

Galvanized steel pipe supply line and couplings must be standard weight and comply with ASTM A 53, except that the zinc coating must not be less than 90 percent of the specified amount. Except for couplings, fittings must be galvanized malleable iron, banded and threaded, and comply with ANSI B16.3, Class 150.

Joint compound must be nonhardening and noncorrosive. Do not use pipe thread sealant tape.

#### 20-2.09B(4) Drip Irrigation Tubing

Drip irrigation tubing must be virgin polyethylene plastic and comply with ASTM D 2737.

The drip irrigation tubing must be distribution tubing with preinstalled in-line emitters.

If preinstalled in-line drip irrigation tubing is not shown, you may install emitters that match the distribution requirements shown. The emitters must be barbed or threaded-type outlet devices with dual silicone diaphragms and installed under the manufacturer's instructions.

The emitters must meet the flow rate and operating pressure range shown.

The wall thickness of polyethylene tubing must comply with the following requirements when tested under ASTM D 2122:

| Pipe size, nominal (inch) | Minimum wall thickness (inch) | Maximum wall thickness (inch) |
|---|---|---|
| 1/2 | 0.050 | 0.070 |
| 5/8 | 0.055 | 0.075 |
| 3/4 | 0.060 | 0.080 |

The polyethylene tubing fittings must be leak-free, compression type and have female sockets with an internal barb to provide a positive pipe-to-fitting connection that will not separate at the designed pressure.

**20-2.09B(5) Plastic Pipe Supply Line**

Plastic pipe supply line must be PVC pipe that is NSF approved.

Schedule 40 plastic pipe supply line must comply with ASTM D 1785.

Class 315 plastic pipe supply line must comply with ASTM D 2241.

PVC gasketed bell joints must comply with ASTM D 2672, ASTM D2241, ASTM D 3139, and ASTM F 477.

For solvent-cemented type joints, the primer and solvent cement must be made by the same manufacturer. The primer color must contrast with the color of the pipe and fittings.

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Solvent-cemented fittings for schedule 40 plastic pipe supply line must be injection molded PVC, schedule 40, and comply with ASTM D2466.

Solvent-cemented fittings for class 315 plastic pipe supply line must be injection molded PVC, schedule 80, and comply with ASTM D1784 and ASTM D2467.

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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.

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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.

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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

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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.

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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

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Not Used

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### 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 |

### 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.

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11. Be bottom, angled, or straight inlet configuration.

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#### 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

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All valves must be installed in a valve box with a cover except:

1. Check valves
2. Garden valves
3. Pressure regulating valves installed on backflow preventers

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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

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## 20-2.12–20-2.13 RESERVED

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## 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

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Submit nursery invoices showing sizes, quantities, and botanical names of plants, including genus, species, and variety. Include lot numbers for plants grown from the same seed lot or cutting source.

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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.

The Engineer inspects the roots of container-grown sample plants by removing earth from the rootball of not less than 2 plants, nor more than 2 percent of the total number of plants of each species or variety. If container-grown plants are purchased from several sources, the Engineer inspects the roots of not less than 2 of each sample plant species or variety from each source. The rootball of container grown plants must not show evidence of being underdeveloped, deformed, or having been restricted.

If the Engineer finds noncompliant plants, the entire lot represented by the noncompliant sample plants will be rejected.

Cuttings with mature or brown stems and cuttings that have been trimmed will be rejected.

### 20-3.01B Materials

#### 20-3.01B(1) General

Notify the Engineer at least 10 days before the plants are shipped to the job site.

#### 20-3.01B(2) Plants

##### 20-3.01B(2)(a) General

Plants must be the variety and size shown and true to the type or name shown. Plants must be individually tagged or tagged in groups identifying the plants by species or variety. Tagging is not required for cuttings.

Plants must be healthy, well-formed, not root-bound, free from insect pests and disease, and grown in nurseries inspected by the Department of Food and Agriculture.

The plants must comply with the size and type shown in the following table:

| Plant group designation | Description | Container size (cu in) |
|---|---|---|
| A | No. 1 container | 152–251 |
| B | No. 5 container | 785–1242 |
| C | Balled and burlapped | -- |
| E | Bulb | -- |
| F | In flats | -- |
| H | Cutting | -- |
| I | Pot | -- |
| K | 24-inch box | 5775–6861 |
| M | Liner[a] | -- |
| O | Acorn | -- |
| P | Plugs[a, b] | -- |
| S | Seedling[c] | -- |
| U | No. 15 container | 2768–3696 |

[a]Do not use containers made of biodegradable material.
[b]Grown in individual container cells.
[c]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 ± 1 grams and must comply with the chemical analysis shown in the following table:

| Ingredient | Content (percent) |
|---|---|
| Nitrogen(N) | 20 |
| Phosphoric acid (P) | 10 |
| Water soluble potash (K) | 5 |

**20-3.01B(4)(d) Organic Fertilizers**

Organic fertilizer must be pelleted or granular with a cumulative nitrogen release rate of no more than 70 percent for the first 70 days after incubation at 86 degrees F with 100 percent at 350 days or more. Organic fertilizer must comply with the chemical analysis shown in the following table:

| Ingredient | Content (percent) |
|---|---|
| Nitrogen (N) | 5–7 |
| Phosphoric acid (P) | 1–5 |
| Water soluble potash (K) | 1–10 |

**20-3.01B(5) Root Stimulants**

Root stimulant must be a commercial quality product.

**20-3.01B(6) Plaster Sand**

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Backfill material for the palm tree planting holes must be 100 percent commercial quality washed plaster sand.

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**20-3.01B(7) Root Barrier**

Root barrier must be an injection molded or extruded modular panel made of high-density polypropylene or polyethylene plastic.

Each panel must:

1. Be at least 1/16-inch thick
2. Have at least 4 molded root-deflecting vertical ribs 0.5- to 0.8-inch wide, 6 to 8 inches apart
3. Have a locking strip or an integral male-female sliding lock designed to resist slippage between panels
4. Be at least 2 feet wide and 2 feet in depth

**20-3.01B(8) Root Protectors**

Each root protector must be:

1. Fabricated from 1-inch, hexagonal pattern, 20-gauge mesh wire
2. Closed bottom design with a height and diameter that provides a minimum of 6 inches of clearance between the root ball and the sides and bottom of the wire cylinder

Wire edges at the top of the cylinder must be the uncut manufactured finished edge free of sharp points.

### 20-3.01B(9) Foliage Protectors

Each foliage protector must be:

1. Fabricated from 1-inch, hexagonal pattern, 20-gauge mesh wire
2. Approximately 4 feet high and 2 feet in diameter

Wire edges at the top of the cylinder must be the uncut manufactured finished edge free of sharp points. Other wire edges that are cut must be free of sharp points.

Support stakes must be one of the following:

1. 3/4-inch reinforcing steel bar a minimum of 5 feet long with an orange or red plastic safety cap that fits snugly onto the top of the reinforcing steel bar
2. 2 inch nominal diameter or 2 by 2 inch nominal size wood stakes a minimum of 5 feet long. Wood stakes must be straight

The jute mesh cover must comply with section 21-1.02O(2). Twine required to hold the jute mesh cover in place must be 1/8-inch diameter manila hemp twine.

### 20-3.01B(10) Wood Plant Stakes

Each plant stake must be nominal 2 by 2 inch or nominal 2-inch diameter and of sufficient length to keep the plant in an upright position.

Plant stakes for vines must be nominal 1 by 1 inch,18 inches long.

### 20-3.01B(11) Plant Ties

Plant ties must be extruded vinyl-based tape, 1 inch wide and at least 10 mils thick.

## 20-3.01C Construction

### 20-3.01C(1) General

Apply a root stimulant under the manufacturer's instructions to the plants specified in the special provisions.

Before transporting the plants to the planting area, thoroughly wet the root ball.

### 20-3.01C(2) Pruning

Prune plants under the latest edition of ANSI A300 part 1, *Pruning*, published by the Tree Care Industry Association.

Do not use tree seal compounds to cover pruning cuts.

### 20-3.01C(3) Watering

Water existing plants to be maintained, transplanted trees, and new plants as needed to keep the plants in a healthy growing condition.

### 20-3.01C(4) Replacement Plants

Plants that show signs of failure to grow at any time or are so injured or damaged as to render them unsuitable for the purpose intended, must be removed, replaced, and replanted. Replace unsuitable plants within 2 weeks after the Engineer marks or indicates that the plants must be replaced.

Replacement planting must comply with the original planting requirements, spacing, and size provisions described for the plants being replaced.

Replacement planting for transplanted trees must comply with the work plan and be planted in the same planting hole.

Replacement ground cover plants must be the same species specified for the ground cover being replaced. Other replacement plants must be the same species as the plants being replaced.

Place orders for replacement plants with the vendor at the appropriate time so that the replacement plants are not in a root-bound condition.

The Department does not pay for replacement plants or the planting of replacement plants.

### 20-3.01C(5) Maintain Plants

Maintain plants from the time of planting until Contract acceptance if no plant establishment period is specified or until the start of the plant establishment period.

### 20-3.01D Payment

Reserved

## 20-3.02 EXISTING PLANTING

### 20-3.02A General

### 20-3.02A(1) Summary

Section 20-3.02 includes specifications for pruning existing plants, transplanting trees, and maintaining existing planted areas.

Transplant palm trees between March 15 and October 15.

### 20-3.02A(2) Definitions

Reserved

### 20-3.02A(3) Submittals

Submit a work plan for:

1. Transplanting trees. The work plan must include methods for lifting, transporting, storing, planting, guying, and maintaining each tree to be transplanted. Include root ball size, method of root ball containment, and a maintenance program for each tree.
2. Maintaining existing planted areas. The work plan must include weed control, fertilization, mowing and trimming of turf areas, watering, and controlling rodents and pests.

Submit a copy of the manufacturer's product sheet for root stimulant including application instructions.

### 20-3.02A(4) Quality Control and Assurance

Inspect for deficiencies of existing planted areas in the presence of the Engineer. Complete the inspection within 15 days after the start of job site activities.

Deficiencies requiring corrective action include:

1. Weeds
2. Dead, diseased, or unhealthy plants
3. Missing plant stakes and tree ties
4. Inadequate plant basins and basin mulch
5. Other deficiencies needing corrective action to promote healthy plant life
6. Rodents and pests

### 20-3.02B Materials

Not Used

### 20-3.02C Construction

### 20-3.02C(1) General

Correct deficiencies of existing planted areas as ordered within 15 days of the order. Correction of deficiencies is change order work.

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

### 20-3.02C(2) Prune Existing Plants

Prune existing plants as shown.

If no bid item for prune existing plants is included, prune existing plants as ordered. Pruning existing plants is change order work.

### 20-3.02C(3) Transplant Trees

Prune each tree to be transplanted immediately before lifting.

If the tree to be transplanted is a palm, prune by removing dead fronds and frond stubs from the trunk. Remove green fronds up to 2 rows of fronds away from the center of growth. Tie the remaining 2 rows of fronds in an upright position with light hemp or manila rope. Remove fronds and frond stubs at the trunk in a manner that will not injure the trunk. Remove fronds and frond stubs for *Phoenix dactylifera* (Date Palm) approximately 4 inches from the trunk.

Prepare each hole in the new location before lifting the tree to be transplanted.

Lift tree to be transplanted as described in the work plan.

Comply with section 20-3.03C(3) for handling and planting each tree to be transplanted.

Until replanted, cover exposed root ball with wet burlap or canvas and cover the crown with 90 percent shade cloth.

Replant each tree on the same day it is lifted if possible. If the transplant location is not ready to receive the tree, store and maintain the tree to be transplanted until the transplant location is authorized. Store tree in an upright position.

Replace damaged transplanted tree under 20-3.01C(4) and with the number of trees specified in the special provisions.

The replacement trees must be planted in individual plant holes at the location determined by the Engineer within the area of the tree being replaced. Comply with section 20-3.03C(2) for the planting of the replacement trees.

### 20-3.02C(4) Maintain Existing Planted Areas

If a bid item for maintain existing planted areas is included, the existing plant basins must be kept well-formed and free of sediment. If the existing plant basins need repairs, and the basins contain mulch, replace the mulch after the repairs are done.

Control weeds within the existing planted area and:

1. From the existing planted area limit to the adjacent edges of paving and fences if less than or equal to 12 feet
2. From the existing planted area limit to 6 feet beyond the outer limit of the existing planted area if the adjacent edge of paving or fence is more than 12 feet away
3. Within a 3-foot radius from each existing tree and shrub

If no bid item for maintain existing planted areas is included, maintain existing planted areas as ordered. Maintain existing planted areas is change order work.

### 20-3.02D Payment

Not Used

## 20-3.03 PLANTING WORK

### 20-3.03A General

Section 20-3.03 includes specifications for planting plants.

### 20-3.03B Materials

Not Used

### 20-3.03C Construction

### 20-3.03C(1) General

Do not begin planting until authorized.

If an irrigation system is required, do not begin planting in an area until the functional test has been completed and authorized for the irrigation system serving that area.

### 20-3.03C(2) Preparing Planting Areas

The location of each plant is as shown unless the Engineer designates otherwise. If the Engineer designates the location, it will be marked by a stake, flag, or other marker.

Conduct work so the existing flow line in drainage ditches is maintained. Material displaced by your operations that interferes with drainage must be removed.

Where a minimum distance to a drainage ditch is shown, locate the plant so that the outer edge of its basin wall is at least the minimum distance shown for each plant involved.

Excavate each planting hole by hand digging or by drilling. The bottom of each planting hole must be flat. Do not use water for excavating the hole.

Unless a larger planting hole is specified, the planting hole must be large enough to receive the root ball or the total length and width of roots, backfill, amendments, and fertilizer. Where rock or other hard material prohibits the hole from being excavated, a new hole must be excavated and the abandoned hole backfilled.

### 20-3.03C(3) Planting Plants

#### 20-3.03C(3)(a) General

Do not plant plants in soil that is too wet, too dry, not properly conditioned as specified, or in an unsatisfactory condition for planting.

Do not distribute more plants than can be planted and watered on that day.

Water plants immediately after planting. Apply water until the backfill soil around and below the roots or ball of earth around the roots of each plant is thoroughly saturated. When watering with a hose, use a nozzle, water disbursement device, or pressure reducing device. Do not allow the full force of the water from the open end of the hose to fall within the basin around any plant. Groundcover plants in areas with an irrigation system must be watered by sprinklers. Several consecutive watering cycles may be necessary to thoroughly saturate the soil.

If shown, install root barriers between trees and concrete sidewalk or curb. Install panels flush with finished grade and join with locking strips or integral male-female sliding locks. Install barriers with root deflectors facing inward.

If a tree grate is shown, install root barrier panels 0.5 inch above finish grade or as shown.

Adjust planting locations so that each tree or shrub is at least 8 feet away from any sprinkler.

Where a tree, shrub, or vine is to be planted within a groundcover area or cutting planting area, plant it before planting groundcover or cuttings.

Where shrubs and groundcovers are shown to be planted in groups, the outer rows directly adjacent to the nearest roadway or highway fence must be parallel to the nearest roadway or highway fence. Stagger shrubs and groundcovers in adjacent rows. Adjust the alignment of the plants within the outer rows.

Core holes in concrete masonry block wall as shown.

Where a vine is to be planted against a wall or fence, plant it as close as possible to the wall or fence. If a vine planted next to a wall is to be staked, stake and tie the vine at the time of planting. A vine planted next to a fence must be tied to the fence at the time of planting.

Protect tree trunks from injury. Do not:

1. Drag tree
2. Use chains to move a tree
3. Lay tree on the ground

#### 20-3.03C(3)(b) Trees, Shrubs, and Vines

After preparing holes, thoroughly mix soil amendment and granular fertilizer at the rate shown with native soil to be used as backfill material. Remove containers from plants in such a manner that the ball of earth

surrounding the roots is not broken. Do not cut plant containers before delivery of the plants to the planting area. Plant and water plants immediately after removal from their containers.

Place packet fertilizer in the backfill within 6 to 8 inches of the ground surface and approximately 1 inch from the root ball. If more than 1 packet is required per plant, distribute the packets evenly around the root ball.

If a root stimulant is to be used, apply it according to the manufacturer's instructions.

If required, install root protectors in the plant holes as shown.

Ensure roots are not restricted or distorted.

Distribute backfill uniformly throughout the entire depth of the plant hole without clods or lumps. After the planting holes have been backfilled, jet water into the backfill with a pipe or tube inserted into the bottom of the hole until the backfill material is saturated for the full depth. If the backfill material settles below this level, add additional backfill to the required level. If a plant settles deeper than shown, replant it at the required level.

Remove nursery stakes after planting.

Install 2 plant stakes for each plant to be staked at the time of planting as shown. Ensure the rootball is not damaged.

Tie the plant to the stakes with 2 plant ties, 1 tie to each stake. Each tie must form a figure 8 by crossing the tie between the plant and the stake as shown. Install ties at the lowest position that will support the plant in an upright position. Ties must provide trunk flexibility but not allow the trunk to rub against the stakes. Wrap each end of the tie 1-1/2 turns around the stake and securely tie.

Construct a watering basin around each plant as shown.

If required, install a foliage protector:

1. Over the plant within 2 days after planting.
2. Vertically and centered over the plant as shown

If foliage protectors are required:

1. Cut the bottom of the wire cylinder to match the slope of the ground. Do not leave sharp points of wire after cutting. Sharp points must be bent over or blunted.
2. Install 2 support stakes for foliage protectors vertically and embed in the soil on opposite sides of the plant as shown and in a transverse direction to the prevailing wind.
3. Either weave the support stakes through the wire cylinder mesh at 6 inch maximum centers or fasten the wire cylinder to the support stakes at 6 inch maximum centers.
4. Wire cylinder must be snug against the support stakes but loose enough to be raised for pesticide application or to perform weeding within the plant basin.
5. Install jute mesh cover over the foliage protector and secure with twine as shown.

#### 20-3.03C(3)(c) Groundcover Plants

Each groundcover planting area irrigated by a single control valve must be completely planted and watered before planting other groundcover planting areas.

Plant groundcover plants in moist soil, and in neat, straight rows, spaced as shown.

Apply fertilizer to groundcover plants and water into the soil immediately after planting.

#### 20-3.03C(3)(d) Cuttings, Liners, Plugs, and Seedling Plants

##### 20-3.03C(3)(d)(i) General

Apply fertilizer to cuttings, liners, plugs, and seedling plants and water immediately after planting.

Ensure the soil is moist to a minimum depth of 8 inches before planting cuttings.

If a root stimulant is to be used, apply it according to the manufacturer's instructions.

### 20-3.03C(3)(d)(ii) Willow Cuttings

Unless otherwise shown, for willow cuttings excavate planting holes perpendicular to the ground line by using a steel bar, auger, post hole digger, or similar tools. Holes must be large enough to receive the cuttings and fertilizer packet. Plant willow cuttings to the specified depths without damaging the bark.

Where rock or other hard material prohibits the excavation of the planting holes, excavate new holes and backfill the unused holes.

Plant willow cuttings during the period specified in the special provisions.

Apply root stimulant according to the manufacturer's instructions.

Plant the base of the cutting 10 to 12 inches deep with 3 to 5 bud scars exposed above the ground. If more than 5 bud scars are exposed, trim off the excess willow cutting length.

Place 1 fertilizer packet in the backfill of each cutting, 6 to 8 inches below the ground surface and approximately 1 inch from the cutting.

Backfill the plant holes with excavated material after planting. Distribute the excavated material evenly within the hole without clods, lumps, or air pockets. Compact the backfill so that the cutting cannot be easily removed from the soil. Do not damage the cutting's bark.

Dispose of trimmings and unused cuttings.

### 20-3.03C(3)(d)(iii) Cottonwood Cuttings

Reserved

### 20-3.03C(3)(d)(iv) *Carpobrotus* and *Delosperma* Cuttings

Plant *Carpobrotus* cuttings to a depth so that not less than 2 nodes are covered with soil. The basal end of *Delosperma* cuttings must not be less than 2 inches below the surface of the soil and the basal end of *Carpobrotus* cuttings must not be less than 4 inches below the surface of the soil.

Apply root stimulant to *Delosperma* cuttings before planting.

Do not plant *Carpobrotus* or *Delosperma* cuttings in soil that does not contain sufficient moisture at an average depth of 2 inches below the surface.

### 20-3.03C(3)(d)(v) Liner Plants

Plant liner plants during the period specified in the special provisions.

If a foliage protector is required, install under section 20-3.03C(3)(b).

### 20-3.03C(3)(d)(vi) Plug Plants

Plant plug plants during the period specified in the special provisions.

### 20-3.03C(3)(d)(vii) Seedling Plants

Plant seedling plants during the period specified in the special provisions.

### 20-3.03C(3)(e) Sod

After all other planting is performed, grade sod areas to drain and to a smooth and uniform surface. Fine grade and roll sod areas before placing sod.

Areas adjacent to sidewalks, edging, and other paved borders and surfaced areas must be 1 inch below the finished surface elevation of the facilities, after fine grading, rolling, and settlement of the soil.

Place sod such that the end of each adjacent strip is staggered a minimum of 2 feet. Place the edge and end of sod firmly against adjacent sod and against sidewalks, edging, and other paved borders and surfaced areas.

Lightly roll the entire sodded area to eliminate air pockets and ensure close contact with the soil after placement of sod. Water the sodded areas so that the soil is moist to a minimum depth of 4 inches after rolling. Do not allow the sod to dry out.

If irregular or uneven areas appear in the sodded areas, restore to a smooth and even appearance.

Trim sod to a uniform edge at sidewalks, edging, and other paved borders and surfaced areas. Trimming must be repeated whenever the edge of sod extends 1 inch beyond the edge of the edging, sidewalks, and other paved borders and surfaced areas. Remove and dispose of trimmed sod.

Mow sod when it has reached a height of 4 inches. Mow sod to a height of 2.5 inches.

### 20-3.03D Payment

Soil amendment is measured in the vehicle at the point of delivery.

Measurement for slow-release fertilizer, organic fertilizer, or iron sulfate is determined from marked weight or sack count.

Various sizes and types of plants are measured by either the product of the average plant density and the total area planted or by actual count of the living plants in place, determined by the Engineer. The average plant density is the number of living plants per sq yd determined from actual count of test areas chosen representing the total planted area. The size and location of the test areas is determined by you and the Engineer, except that the total area tested must be equal to not less than 3 percent nor more than 5 percent of the planted area being determined. The Engineer makes the final determination of the areas to be tested.

### 20-3.04–20-3.08 RESERVED

## 20-4 PLANT ESTABLISHMENT WORK

### 20-4.01 GENERAL

### 20-4.01A Summary

Section 20-4 includes specifications for performing plant establishment work.

Plant establishment consists of caring for the plants, including watering, fertilizing, pruning, replacing damaged plants, pest control, and operating and repairing of all existing irrigation facilities used and irrigation facilities installed as part of the new irrigation system.

Working days on which no work is required, as determined by the Engineer, will be credited as a plant establishment working day, regardless of whether or not you perform plant establishment work.

Working days whenever you fail to adequately perform plant establishment work will not be credited toward the plant establishment working days.

### 20-4.01B Definitions

**Type 1 plant establishment:** Plant establishment period with the number of working days specified for plant establishment beginning after all work has been completed except for plant establishment work and other bid items specified to be performed until Contract acceptance.

**Type 2 plant establishment:** Plant establishment period with the number of working days specified for plant establishment beginning after all planting work has been completed except for plant establishment work and other bid items specified to be performed until Contract acceptance, provided that the Contract must not be accepted unless the plant establishment work has been satisfactorily performed for at least the number of working days specified for plant establishment.

If maintenance and protection relief is granted for a completed portion of the work under section 5-1.38, Type 2 plant establishment period for the completed portion of the work is the time between completion of all planting work except for plant establishment work, and the granting of maintenance and protection relief, provided that the relief must not be granted unless the plant establishment work in the completed portion of the work has been satisfactorily performed for at least the number of working days specified for the plant establishment period.

### 20-4.01C Submittals

### 20-4.01C(1) General

Submit seasonal watering schedules for use during the plant establishment period within 10 days after the start of the plant establishment period. Remote irrigation control system watering schedule must utilize the remote irrigation control system software program.

Submit updated watering schedules within 5 business days after any changes have been made to the authorized schedules.

Submit a revised watering schedule for each irrigation controller not less than 30 days before completion of the plant establishment period.

### 20-4.01C(2) Notification

The Engineer will notify you in writing when the plant establishment period begins and will furnish statements regarding the number of working days credited to the plant establishment period after the notification.

Notify the Engineer at least 5 business days before applying each application of fertilizer.

### 20-4.01D Quality Control and Assurance

Provide training by a qualified person on the use and adjustment of the irrigation controllers installed, 30 days before completion of the plant establishment period.

Perform a final inspection of the plant establishment work in the presence of the Engineer between 20 and 30 days before Contract acceptance.

## 20-4.02 MATERIALS

### 20-4.02A General

Reserved

### 20-4.02B Fertilizers

Fertilizer must comply with section 20-3.01B(5).

## 20-4.03 CONSTRUCTION

### 20-4.03A General

Remove trash and debris.

Surplus earth accumulated in roadside clearing and planting areas must be removed.

Trim and mow turf areas as specified for sod in section 20-3.03C(3)(e). Dispose of trimmed and mowed material.

If irregular or uneven areas appear within turf areas, restore to a smooth and even appearance. Reseed turf seed areas.

Remove the tops of foliage protectors if plants become restricted.

Remove foliage protectors, including support stakes, within 30 days before the completion of the plant establishment period.

Keep plant basin walls well formed.

Clean new wye strainers and existing wye strainers that are a part of the new irrigation system annually until the completion of the plant establishment period. The last cleaning must be done within 15 days before the completion of the plant establishment period.

Remove, clean, and reinstall new filters and existing filters that are a part of the new irrigation system annually until the completion of the plant establishment period. The last cleaning must be done within 15 days before the completion of the plant establishment period.

### 20-4.03B Plant Growth Control

Prune plants planted as part of the Contract as authorized.

Remove plant growth that extends within 2 feet of sidewalks, curbs, dikes, shoulders, walls or fences.

Remove proposed and existing ground cover from within the plant basins, including basin walls, turf areas, and planting areas within edging.

Vines next to walls and fences must be kept staked and tied. Train vines on fences and walls or through cored holes in walls.

**20-4.03C Fertilizers**

Apply fertilizer to the plants as specified and water into the soil after each application.

Apply fertilizer at the rates shown and spread with a mechanical spreader, whenever possible.

**20-4.03D Weed Control**

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

**20-4.03E Plant Staking**

Replace the plant stakes that are inadequate to support plants with larger stakes.

Remove plant stakes when the Engineer determines they are no longer needed.

**20-4.03F Replacement Plants**

Replacement plants must comply with section 20-3.01C(4).

Replacement of plants up to and including the 125th plant establishment working day must be with a plant of the same size as originally specified. Plants of a larger container size than those originally specified for replacement plants may be used during the first 125 working days of the plant establishment period.

Replacement of plants after the 125th plant establishment working day must comply with the following size requirements:

| Plant size (Original) | Plant size (Replacement) |
|---|---|
| Pot/liner/plug/ seedling | No. 1 container |
| No. 1 container | No. 5 container |
| No. 5 container | No. 15 container |

Other replacement plants must be the same size as originally specified.

Replacement ground cover plants must comply with the following spacing requirements:

| Original spacing (inches) | On center spacing of replacement ground cover plants (inches) | | |
|---|---|---|---|
| | Number of completed plant establishment working days | | |
| | 1–125 | 126–190 | 191–End of plant establishment period |
| 9 | 9 | 6 | 6 |
| 12 | 12 | 9 | 6 |
| 18 | 18 | 12 | 9 |
| 24 | 24 | 18 | 12 |
| 36 | 36 | 24 | 18 |

**20-4.03G Watering**

Operate the electric automatic irrigation systems in the automatic mode unless authorized.

If any component of the electric automatic irrigation system is operated manually, the day will not be credited as a plant establishment working day unless the manual operation is authorized.

Water plants utilizing the remote irrigation control system software program unless authorized.

Implement the watering schedule at least 10 days before completion of the plant establishment period.

### 20-4.04 PAYMENT

Not Used

## 20-5 LANDSCAPE ELEMENTS

### 20-5.01 GENERAL

#### 20-5.01A General

Section 20-5 includes specifications for constructing and installing landscape elements.

#### 20-5.01B Materials

Not Used

#### 20-5.01C Construction

Earthwork must comply with section 19.

#### 20-5.01D Payment

Not Used

### 20-5.02 EDGING

#### 20-5.02A General

Section 20-5.02 includes specifications for constructing landscape edging.

#### 20-5.02B Materials

##### 20-5.02B(1) General

Reserved

##### 20-5.02B(2) Header Board Edging

Lumber for header board edging must be one of the following types:

1. Construction grade cedar
2. Pressure-treated Douglas fir
3. Construction heart grade redwood complying with section 57-2.01B(2)

Lumber must be:

1. Rough cut from sound timber.
2. Straight. Sweep must not exceed 1 inch in 6 feet.
3. Free from loose or unsound knots. Knots must be sound, tight, well spaced, and not to exceed 2 inches in size on any face.
4. Free of shakes in excess of 1/3 the thickness of the lumber.
5. Free of splits longer than the thickness of the lumber.
6. Free of other defects that would render the lumber unfit structurally for the purpose intended.

Edging anchors for header board edging must be stakes of the size and shape shown.

##### 20-5.02B(3) Metal Edging

Metal edging must be commercial quality, made of aluminum or steel, and have an L-shaped design. Edging must be a minimum of 4 inches in height. The thickness must be as recommended by the manufacturer for the use intended.

Edging anchors must be from the same manufacturer as the metal edging.

##### 20-5.02B(4) High Density Polyethylene Edging

HDPE edging must be commercial quality and a minimum of 4 inches in height. The thickness must be as recommended by the manufacturer for commercial installation for the use intended.

Edging anchors must be from the same manufacturer as HDPE edging.

#### 20-5.02B(5) Concrete Edging

Concrete for edging must be minor concrete.

#### 20-5.02B(6)–20-5.02B(10) Reserved

### 20-5.02C Construction

#### 20-5.02C(1) General

Where edging is used to delineate the limits of inert ground cover or mulch areas, install edging before installing inert ground cover or mulch areas.

Saw cut surfaces where (1) asphalt concrete or concrete surfacing must be removed to permit the installation of edging and (2) no joint exists between the surfacing to be removed and the surfacing to remain in place. The surfacing must be cut in a straight line to a minimum depth of 2 inches with a power-driven saw before the surfacing is removed. Spike or stake spacing must comply with the manufacturer's instructions for use and site conditions.

#### 20-5.02C(2) Header Board Edging

Each stake must be driven flush with the top edge of the header board edging and the stake top must be beveled away from the header board at a 45 degree angle. Attach stake to header board with a minimum of two 12-penny hot dipped galvanized nails per stake.

#### 20-5.02C(3) Metal and High Density Polyethylene Edging

Spike or stake spacing must comply with the manufacturer's instructions for use and site conditions.

#### 20-5.02C(4) Concrete Edging

Construct and finish minor concrete edging under section 73-2.

#### 20-5.02C(5)–20-5.02C(9) Reserved

### 20-5.02D Payment

Edging is measured parallel to the ground surface.

## 20-5.03 INERT GROUND COVERS AND MULCHES

### 20-5.03A General

#### 20-5.03A(1) General

#### 20-5.03A(1)(a) Summary

Section 20-5.03 includes specifications for installing inert ground covers and mulches.

#### 20-5.03A(1)(b) Definitions

Reserved

#### 20-5.03A(1)(c) Submittals

Submit:

1. Filter fabric product data including the manufacturer's product sheet and installation instructions
2. Certificate of compliance for filter fabric at least 5 business days before delivery of the material to the job site

#### 20-5.03A(1)(d) Quality Control and Assurance

Reserved

#### 20-5.03A(2) Materials

Soil sterilant must be oxadiazon granular preemergent and must comply with section 20-1.02C.

Filter fabric must be Class A. Staples for filter fabric must comply with section 21-1.02R.

#### 20-5.03A(3) Construction

#### 20-5.03A(3)(a) General

Before performing inert ground cover and mulch work, remove plants and weeds to ground level.

**20-5.03A(3)(b) Earthwork**

Excavate areas to receive inert ground cover or mulch to the depth shown. Maintain the planned flow lines, slope gradients, and contours of the job site. Grade subgrade to a smooth and uniform surface and compact to not less than 90 percent relative compaction.

**20-5.03A(3)(c) Treatment of Soil**

After compaction, apply soil sterilant at the maximum label rate. Do not apply soil sterilant more than 12 inches beyond the inert ground cover or mulch limits. The soil sterilant application and inert ground cover or mulch placement must be completed within the same work day.

**20-5.03A(3)(d) Filter Fabric**

Immediately before placing filter fabric, surfaces to receive filter fabric must be free of loose or extraneous material and sharp objects that may damage the filter fabric during installation.

Align fabric and place in a wrinkle-free manner.

Overlap adjacent rolls of the fabric from 12 to 18 inches. Spread each overlapping roll in the same direction. Fasten fabric with staples flush with the adjacent fabric to prevent movement of fabric by placement of inert ground cover or mulch.

Repair or replace fabric damaged during placement of inert ground cover or mulch with sufficient fabric to comply with overlap requirements.

**20-5.03A(4) Payment**

Not Used

**20-5.03B Rock Blanket**

**20-5.03B(1) General**

**20-5.03B(1)(a) Summary**

Section 20-5.03B includes specifications for placing rock blanket.

**20-5.03B(1)(b) Definitions**

Reserved

**20-5.03B(1)(c) Submittals**

Submit a 1 sq yd sample of the various rock sizes.

**20-5.03B(1)(d) Quality Control and Assurance**

Reserved

**20-5.03B(2) Materials**

**20-5.03B(2)(a) General**

Do not use filter fabric.

**20-5.03B(2)(b) Concrete**

Concrete must be minor concrete.

**20-5.03B(2)(c) Rock**

Rock must be clean, smooth, and obtained from a single source and must comply with the following grading requirements:

**Grading Requirements**

| Screen size (inches) | Percentage passing |
|---|---|
| 8 | 100 |
| 6 | 50-85 |
| 4 | 0-50 |

**20-5.03B(2)(d) Mortar**

Mortar must comply with section 51-1.02F.

**20-5.03B(3) Construction**

Place concrete as shown.

Rock must be placed while concrete is still plastic. Remove concrete adhering to the exposed surfaces of the rock.

Loose rocks or rocks with a gap greater than 3/8 inch must be reset by an authorized method. The rock gap is measured from the edge of the rock to the surrounding concrete bedding.

Place mortar as shown.

**20-5.03B(4) Payment**

Rock blanket is measured parallel to the rock blanket surface.

**20-5.03C Gravel Mulch**

**20-5.03C(1) General**

**20-5.03C(1)(a) Summary**

Section 20-5.03C includes specifications for placing gravel mulch.

**20-5.03C(1)(b) Definitions**

Reserved

**20-5.03C(1)(c) Submittals**

Submit a 5-lb sample of the gravel mulch.

**20-5.03C(1)(d) Quality Control and Assurance**

Reserved

**20-5.03C(2) Materials**

Gravel mulch must be:

1. Uniform gray color
2. From a single source only
3. Crushed rock that complies with the following grading requirements:

**Grading Requirements**

| Sieve size | Percent passing |
|---|---|
| 1-1/4 inch | 100 |
| 3/4 inch | 60-80 |
| 1/2 inch | 45-65 |
| No. 40 | 5-20 |

**20-5.03C(3) Construction**

Place gravel and compact by rolling.

The finished gravel mulch surface must be smooth and uniform, maintaining original flow lines, slope gradients, and contours of the job site.

**20-5.03C(4) Payment**

Gravel mulch is measured parallel to the gravel mulch surface.

**20-5.03D Decomposed Granite**

**20-5.03D(1) General**

**20-5.03D(1)(a) Summary**

Section 20-5.03D includes specifications for placing decomposed granite.

### 20-5.03D(1)(b) Definitions

Reserved

### 20-5.03D(1)(c) Submittals

Five business days before delivery of the materials to the job site, submit:

1. Solidifying emulsion product data including the manufacturers' product sheets and installation instructions
2. Certificate of compliance for solidifying emulsion
3. 5-lb sample of the decomposed granite

### 20-5.03D(1)(d) Quality Control and Assurance

Test plot must be:

1. Constructed at an authorized location
2. At least 3 by 12 feet
3. Constructed using the materials, equipment, and methods to be used in the work
4. Authorized before starting work

Notify the Engineer not less than 7 days before constructing the test plot.

The Engineer uses the authorized test plot to determine acceptability of the work.

If ordered, prepare additional test plots. Additional test plots are change order work.

If the test plot is not incorporated into the work, the Engineer may order you to remove it.

### 20-5.03D(2) Materials

### 20-5.03D(2)(a) General

Decomposed granite must be:

1. Uniform gray or tan color
2. From one source only
3. Crushed granite rock that complies with grading requirements shown in the following table:

**Grading Requirements**

| Sieve size | Percent passing |
|---|---|
| 3/8 inch | 100 |
| No. 4 | 95–100 |
| No. 8 | 75–80 |
| No. 16 | 55–65 |
| No. 30 | 40–50 |
| No. 50 | 25–35 |
| No. 100 | 20–25 |
| No. 200 | 5–15 |

Note:
Grading based upon AASHTO T11-82 and T27-82

### 20-5.03D(2)(b) Solidifying Emulsion

Solidifying emulsion must be either a water-based polymer or nontoxic organic powdered binder specifically manufactured to harden decomposed granite. The solidifying emulsion must not alter the decomposed granite color.

### 20-5.03D(3) Construction

Do not place decomposed granite during rainy conditions.

Mix solidifying emulsion thoroughly and uniformly throughout the decomposed granite and under the manufacturer's instructions. Mix the material in the field using portable mixing equipment, or delivered in mixer trucks from a local ready-mixed plant.

Place decomposed granite uniformly in layers no more than 1-1/2 inch thick. Compact each layer of decomposed granite to a relative compaction of not less than 90 percent. Begin compaction within 6 to 48 hours of placement.

If the material was mixed in the field, apply an application of solidifying emulsion after compaction as recommended by the manufacturer. Prevent runoff or overspray of solidifying emulsion onto adjacent paved or planting areas.

The finished decomposed granite surface must be smooth and uniform, compacted to a relative compaction of not less than 90 percent, maintaining original flow lines, slope gradients, and contours of the job site.

#### 20-5.03D(4) Payment

Not Used

### 20-5.03E Wood Mulch

#### 20-5.03E(1) General

#### 20-5.03E(1)(a) Summary

Section 20-5.03E includes specifications for placing wood mulch.

#### 20-5.03E(1)(b) Definitions

Reserved

#### 20-5.03E(1)(c) Submittals

Submit a certificate of compliance for mulch.

Submit a 2 cu ft mulch sample with the mulch source listed on the bag and obtain approval before delivery of mulch to the job site.

#### 20-5.03E(1)(d) Quality Control and Assurance

Reserved

#### 20-5.03E(2) Materials

#### 20-5.03E(2)(a) General

Mulch must not contain more than 0.1 percent of deleterious materials such as rocks, glass, plastics, metals, clods, weeds, weed seeds, coarse objects, sticks larger than the specified particle size, salts, paint, petroleum products, pesticides or other chemical residues harmful to plant or animal life.

Do not use filter fabric.

#### 20-5.03E(2)(b) Tree Bark Mulch

Tree bark mulch must be derived from cedar, Douglas fir, or redwood species.

01-15-16

Tree bark mulch must be ground such that at least 95 percent of the material by volume is less than 2 inches in any direction and no more than 30 percent by volume is less than 1 inch in any direction.

#### 20-5.03E(2)(c) Wood Chip Mulch

Wood chip mulch must:

1. Be derived from clean wood
2. Not contain leaves or small twigs
3. Contain at least 95 percent wood chips by volume with average thickness of 1/16 to 3/8 inch in any direction and 1/2 to 3 inches in length

#### 20-5.03E(2)(d) Shredded Bark Mulch

Shredded bark mulch must:

1. Be derived from trees
2. Be a blend of loose, long, thin wood, or bark pieces

3. Contain at least 95 percent wood strands by volume with average thickness of 1/8 to 1-1/2 inches in any direction and 2 to 8 inches in length

**20-5.03E(2)(e) Tree Trimming Mulch**

Tree trimming mulch must:

1. Be derived from chipped trees and may contain leaves and small twigs.
2. Contain at least 95 percent material by volume less than 3 inches and no more than 30 percent by volume less than 1 inch

**20-5.03E(2)(f)–20-5.03E(2)(j) Reserved**

**20-5.03E(3) Construction**

Spread mulch placed in areas outside of plant basins to a uniform thickness as shown.

Mulch must be placed at the rate described and placed in the plant basins or spread in areas as shown after the plants have been planted. Mulch placed in plant basins must not come in contact with the plant crown and stem.

Spread mulch from the outside edge of the proposed plant basin or plant without basin to the adjacent edges of shoulders, paving, retaining walls, dikes, edging, curbs, sidewalks, walls, fences, and existing plantings. If the proposed plant or plant without basin is 12 feet or more from the adjacent edges of shoulders, paving, retaining walls, dikes, edging, curbs, sidewalks, walls, fences, and existing plantings, spread the mulch 6 feet beyond the outside edge of the proposed plant basin or plant without basin.

Do not place mulch within 4 feet of:

1. Flow line of earthen drainage ditches
2. Edge of paved ditches
3. Drainage flow lines

**20-5.03E(4) Payment**

Mulch is measured in the vehicle at the point of delivery.

**20-5.03F–20-5.03J Reserved**

**20-5.04 RESERVED**

Reserved

**20-5.05 SITE FURNISHINGS**

**20-5.05A General**

Section 20-5.05 includes specifications for installing site furnishings.

**20-5.05B–20-5.05Z Reserved**

**20-5.06–20-5.10 RESERVED**

^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

# 21 EROSION CONTROL

07-19-13

**Replace ", bonded fiber matrix, and polymer-stabilized fiber matrix" in the 1st paragraph of section 21-1.01B with:**

04-20-12

and bonded fiber matrix

04-20-12

**Delete the last paragraph of section 21-1.02E.**

**Replace section 21-1.02F(2) with:**

04-20-12

**21-1.02F(2) Reserved**

**Replace "20-7.02D(1)" in the 1st paragraph of section 21-1.02H with:**

07-19-13

20-3.01B(4)

**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<br>Loss-on-ignition organic matter method (LOI)<br>% dry weight basis | 30–100 |

**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 stakes.

01-18-13

**Delete the 1st and 2nd sentences of the 3rd paragraph in section 21-1.04.**

^^^

Submittals for cementitious material must comply with section 90-1.01C(3).

Submit QC test results within 24 hours of test completion.

### 28-2.01C(2) Field Qualification

11-15-13

For each field qualification for each mix design, manufacture 12 specimens under ASTM C 31 and submit six of the specimens from 24 to 72 hours after manufacture. Use one batch for all 12 specimens.

07-19-13

Submit field qualification data and test reports including:

1. Mixing date
2. Mixing equipment and procedures used
3. Batch volume in cu yd, the minimum is 5 cu yd
4. Type and source of ingredients used
5. Age and strength from compression strength results

Field qualification test reports must be signed by the official in responsible charge of the laboratory performing the tests.

### 28-2.01D Quality Control and Assurance

### 28-2.01D(1) General

Stop LCB activities and immediately notify the Engineer whenever:

1. Any quality control or acceptance test result does not comply with the specifications
2. Visual inspection shows noncompliant LCB

If LCB activities are stopped, before resuming activities:

1. Inform the Engineer of the adjustments you will make
2. Remedy or replace the noncompliant LCB
3. Obtain authorization

Molds for compressive strength testing under ASTM C 31 or ASTM C 192 must be 6 by 12 inches.

Quality control and assurance for cementitious materials and admixtures must comply with section 90-1.01D(1)

### 28-2.01D(2) Aggregate Qualification Testing

Qualify the aggregate for each proposed aggregate source and gradation. Qualification tests include (1) sand equivalent and (2) average 7-day compressive strength under ASTM C 39 on 3 specimens manufactured under ASTM C 192. The cement content for this test must be 300 lb/cu yd, and the 7-day average compressive strength must be at least 610 psi. Cement must be Type II portland cement under section 90-1.02B(2).

LCB must have from 3 to 4 percent air content during aggregate qualification testing.

### 28-2.01D(3) Field Qualification Testing

Before placing LCB, you must perform field qualification testing and obtain authorization for each mix design. Retest and obtain authorization for changes to authorized mixed designs.

Proposed mix designs must be field qualified before you place the LCB represented by those mix designs. Use an American Concrete Institute (ACI) certified "Concrete Laboratory Technician, Grade I" to perform field qualification tests and calculations.

Notify the Engineer at least 5 days before field qualification. Perform field qualification within the job site or a location authorized by the Engineer.

Field qualification testing includes compressive strength, air content, and penetration or slump in compliance with the table titled "Quality Control Requirements."

Field qualification testing for compressive strength must comply with the following:

1. Manufacture 12 cylinders under ASTM C 31 from a single batch
2. Perform 3 tests; each test consists of determining the average compressive strength of 2 cylinders at 7 days under ASTM C 39
3. The average compressive strength for each test must be at least 530 psi

If you submitted a notice to produce LCB qualifying for a transverse contraction joint waiver, manufacture additional specimens and test LCB for compressive strength at 3 days. Prepare compressive strength cylinders under ASTM C 31 at the same time using the same material and procedures as the 7-day compressive strength cylinders except do not submit 6 additional test cylinders. The average 3-day compressive strength for each test must be not more than 500 psi.

### 28-2.01D(4) Quality Control Testing

Provide a testing laboratory to perform quality control tests. Maintain sampling and testing equipment in proper working condition. Perform sampling under California Test 125.

Testing laboratories and testing equipment must comply with the Department's Independent Assurance Program.

Perform quality control sampling, testing, and inspection throughout LCB production and placement. LCB must comply with the requirements for the quality characteristics shown in the following table:

**Quality Control Requirements**

| Quality characteristic | Test method | Minimum sampling and testing frequency | Requirement |
|---|---|---|---|
| Sand equivalent (min) | ASTM D 2419 | 1 per 500 cubic yards but at least 1 per day of production | 18 |
| Aggregate gradation | ASTM C 136 | | Note a |
| Air content (max, percent) [b] | ASTM C 231 | | 4 |
| Penetration (inches) | ASTM C 360 | | 0 to 1-1/2 nominal [c, d] |
| Slump (inches) | ASTM C 143 | | 0–3 nominal [c, d] |
| Compressive strength (min, psi at 7 days) | ASTM C 39 [e] | | 530 |
| Compressive strength (max, psi at 3 days) [f] | ASTM C 39 [e] | | 500 |

[a] Comply with the table titled "Aggregate Grading" in section 28-2.02C.
[b] If no single test in the first 5 air content tests exceeds 1-1/2 percent, no further air content tests are required.
[c] Maximum penetration must not exceed 2 inches and maximum slump must not exceed 4 inches
[d] Test for either penetration or slump
[e] Prepare cylinders under ASTM C 31
[f] Only applicable if you (1) submitted a notice stating intent to produce LCB qualifying for a transverse contraction joint waiver and (2) successfully field qualified the LCB for 3-day compressive strength. Make cylinders at the same time using the same material and procedures as QC testing for 7-day compressive strength.

### 28-2.01D(5) Acceptance Criteria

For acceptance, properties of LCB must comply with values shown in the following table:

**Acceptance Criteria Testing**

| Property | Test method | Value |
|---|---|---|
| Compressive strength (min, psi at 7 days) | ASTM C 39 [a] | 530 [b] |

[a] Cylinders prepared under ASTM C 31
[b] A compressive strength test represents up to (1) 1,000 cu yd or (2) 1 day's production if less than 1,000 cu yd.

## 28-2.02 MATERIALS

### 28-2.02A General

Water must comply with section 90-1.02D.

The air content in LCB must not exceed 4 percent. If the aggregate used for LCB is produced from processed reclaimed asphalt concrete or other material that may cause the air content to exceed 4 percent, reduce the air content with an admixture.

A water-reducing chemical admixture may be used. Water-reducing chemical admixture must comply with ASTM C 494, Type A or Type F.

Air-entraining admixtures must comply with section 90-1.02E.

### 28-2.02B Cementitious Material

Portland cement must comply with section 90-1.02B. Portland cement content must not exceed 300 lb/cu yd.

SCM must comply with section 90-1.02B except the equations for SCM content under 90-1.02B(3) do not apply.

For aggregate qualification testing, use Type II portland cement under section 90-1.02B(2) without SCM.

### 28-2.02C Aggregate

Aggregate must be clean and free from decomposed material, organic material, and other deleterious substances. Aggregate samples must not be treated with lime, cement, or chemicals before testing for sand equivalent.

Use either 1-1/2 inch or 1 inch grading. Do not change your selected aggregate grading without authorization.

When tested under ASTM C 136, the percentage composition by weight of the aggregate must comply with the grading requirements for the sieve sizes shown in the following table:

**Aggregate Grading**

| Sieve sizes | 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<br>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:**

07-19-13

## 28-3 RAPID STRENGTH CONCRETE BASE

Reserved

**Replace section 28-4 with:**

07-19-13

**28-4 LEAN CONCRETE BASE RAPID SETTING**

Reserved

**Replace section 28-5 with:**

07-19-13

**28-5 CONCRETE BASE**

Reserved

**Add to section 28:**

07-19-13

**28-6–28-14 RESERVED**

**28-15 REPLACE BASE**

Reserved

^^^

**Replace the introductory clause of the 2nd paragraph of section 29-1.03B with:**

04-18-14

Equipment for spreading and compacting ATPB must comply with section 39-1.03B. Compact ATPB in 1 layer using one of the following methods:

**Replace "3rd" in the 4th paragraph of section 29-1.03C with:**

07-19-13

4th

^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

**Replace section 30 with:**

04-20-12

## 30 RECLAIMED PAVEMENTS

04-20-12

### 30-1 GENERAL

**30-1.01 GENERAL**

Section 30 includes specifications for reclaiming the pavement section and constructing a base.

### 30-2 FULL DEPTH RECLAIMED—FOAMED ASPHALT

Reserved

### 30-3–30-6 RESERVED

^^^^^^^^^^^^^^^^^^^

**37-1.01B Definitions**

Reserved

**37-1.01C Submittals**

Reserved

**37-1.01D Quality Control and Assurance**

**37-1.01D(1) General**

Reserved

**37-1.01D(2) Prepaving Conference**

For seal coats and micro-surfacing, schedule a prepaving conference at a mutually agreed upon time and place to meet with the Engineer.

Prepaving conference attendees must sign an attendance sheet provided by the Engineer. The prepaving conference must be attended by your:

1. Project superintendent
2. Paving construction foreman
3. Traffic control foreman

Be prepared to discuss:

1. Quality control
2. Acceptance testing
3. Placement
4. Training on placement methods
5. Checklist of items for proper placement
6. Unique issues specific to the project, including:
   - 6.1. Weather
   - 6.2. Alignment and geometrics
   - 6.3. Traffic control issues
   - 6.4. Haul distances
   - 6.5. Presence and absence of shaded areas
   - 6.6. Any other local issues

**37-1.02 MATERIALS**

Not Used

**37-1.03 CONSTRUCTION**

Not Used

**37-1.04 PAYMENT**

Not Used

**Replace section 37-2 with:**

07-19-13

## 37-2 SEAL COATS

**37-2.01 GENERAL**

**37-2.01A General**

**37-2.01A(1) Summary**

Section 37-2 includes specifications for applying seal coats.

**37-2.01A(2) Definitions**

Reserved

### 37-2.01A(3) Submittals

Reserved

### 37-2.01A(4) Quality Control and Assurance

The following personnel must attend the prepaving conference:

1. Aggregate suppliers
2. Chip spreader operators
3. Emulsion and binder distributor
4. Coated chips producer if coated chips are used

### 37-2.01B Materials

Screenings must be broken stone, crushed gravel, or both. At least 90 percent of screenings by weight must be crushed particles as determined under California Test 205.

Screenings for seal coats must have the properties specified in the following table:

**Seal Coat Screenings**

| Properties | Test method | Specification |
|---|---|---|
| Los Angeles Rattler, %, max<br>Loss at 100 revolutions.<br>Loss at 500 revolutions. | California Test 211 | <br>10<br>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

03-21-14

Flush coat includes applying a fog seal coat to the surface, followed by sand.

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 specifictions 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**

| | Percentage passing | | | |
|---|---|---|---|---|
| Sieve sizes | 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:

**Screening Spread Rates**

| Seal coat type | Range (lb/sq yd) |
|---|---|
| Fine | 12–20 |
| Medium fine | 16–25 |
| Medium | 20–30 |
| Coarse | 23–30 |

Do not spread screenings more than 2,500 feet ahead of the completed initial rolling.

For double asphaltic emulsion seal coat, screenings must have a spread rate within the ranges shown in the following table:

**Screening Spread Rates**

| Seal coat type | Range (lb/sq yd) |
|---|---|
| Double | |
| 1st application | 23–30 |
| 2nd application | 12–20 |

Remove excess screenings on the 1st application before the 2nd application of asphaltic emulsion.

### 37-2.04B(4) Payment

If asphaltic emulsion seal coat with screenings does not comply with the cleanness value specifications, you may request that the seal coat remain in place with a pay deduction corresponding to the cleanness value shown in the following table:

**Asphaltic Emulsion Seal Coat Cleanness Value Deductions**

| Cleanness value | Deduction |
|---|---|
| 80 or over | None |
| 79 | $2.00 /ton |
| 77–78 | $4.00 /ton |
| 75–76 | $6.00 /ton |

### 37-2.04C Polymer Asphaltic Emulsion Seal Coat

#### 37-2.04C(1) General

#### 37-2.04C(1)(a) Summary

Section 37-2.04C includes specifications for applying a polymer asphaltic emulsion seal coat.

#### 37-2.04C(1)(b) Definitions

Reserved

#### 37-2.04C(1)(c) Submittals

At least 10 days before starting polymer asphaltic emulsion seal coat application, submit a signed copy of the test result report of the Vialit test method for aggregate retention in chip seals (french chip) to the Engineer and to:

DEPARTMENT OF TRANSPORTATION
Division of Maintenance, Roadway Maintenance Office
1120 N Street, MS 31
Sacramento, CA 95814

#### 37-2.04C(1)(d) Quality Control and Assurance

The authorized laboratory must test screenings for retention under the Vialit test method for aggregate in chip seals (french chip). The Vialit test results are not used for acceptance. The Vialit test is available at the METS Web site.

If the test results for polymer asphaltic emulsion do not comply with the specifications, the Engineer assesses a pay factor value for the following properties and increments:

10-30-15

**Polymer Asphaltic Emulsion Pay Factor Table**

| Test method and property | Increment | Pay factor |
|---|---|---|
| Test on polymer asphaltic emulsion | | |
| AASHTO T 59 (Viscosity, sec Saybolt Furol, at 50 °C) | Each 10 seconds above max or below min | 1 |
| AASHTO T 59 (settlement, 5 days, percent) | Each 1.5 percent above max | 1 |
| AASHTO T 59 (sieve test, percent max) | Each 0.2 percent above max | 1 |
| AASHTO T 59 (demulsibility percent) | Each 2 percent below min | 1 |
| Test on residue from evaporation test | | |
| AASHTO T 49 (penetration, 25 °C) | Each 2 dm above max or below min | 1 |
| ASTM D 36 (field softening point °C) | 2 °C below min | 1 |
| California Test 332 (torsional recovery [a]) | For each 1 increment below the min value of 18 | 1 |
| | For each 2 increments below the min value of 18 | 3 |
| | For each 3 or more increments below the min value of 18 | 10 |
| AASHTO T 301 (elastic recovery [a]) | 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 |

[a] The highest pay factor applies

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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**

| | Percentage passing | | | |
|---|---|---|---|---|
| Sieve sizes | 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:

**Screening Spread Rates**

| Seal coat type | Range (lb/sq yd) |
|---|---|
| Fine | 12–20 |
| Medium fine | 16–25 |
| Medium | 20–30 |
| Coarse | 23–30 |

Do not spread screenings more than 2,500 feet ahead of the completed initial rolling.

For double seal coat, screenings must have a spread rate within the ranges shown in the following table:

**Screening Spread Rates**

| Seal coat type | Range (lb/sq yd) |
|---|---|
| Double | |
| 1st application | 23–30 |
| 2nd application | 12–20 |

Remove excess screenings on the 1st application before the 2nd application of asphaltic emulsion.

**37-2.04C(4) Payment**

If polymer asphaltic emulsion seal coat with screenings does not comply with the specifications for cleanness value you may request that the seal coat remain in place with a pay deduction corresponding by the cleanness value shown in the following table:

**Polymer Asphaltic Emulsion Seal Coat Cleanness Value Deductions**

| Cleanness value | Deduction |
|---|---|
| 86 or over | None |
| 81–85 | $2.20/ton |
| 77–80 | $4.40/ton |
| 75–76 | $6.60/ton |

If test results for polymer asphaltic emulsion aggregate grading and cleanness value test results do not comply with the specifications, all deductions are made. A test for polymer asphaltic emulsion represents

the smaller of 55 tons or 1 day's production. A test for the screenings grading or cleanness value represents the smaller of 300 tons or 1 day's production.

The payment deduction for noncompliant polymer asphaltic emulsion is based on the total pay factor value determined from the table titled, "Polymer Asphaltic Emulsion Pay Factor Deduction." You must remove polymer asphaltic emulsion seal coat with a pay factor value greater than 20. You may request seal coat with noncompliant polymer asphaltic emulsion to remain in place with a pay deduction for the total pay factor value shown in the following table:

**Polymer Asphaltic Emulsion Pay Factor Deductions**

| Total pay factor value | Deduction |
|---|---|
| 0 | none |
| 1–2 | $5.00/ton |
| 3–5 | $10.00/ton |
| 6–9 | $15.00/ton |
| 10–14 | $25.00/ton |
| 15–20 | $50.00/ton |

## 37-2.05 ASPHALT BINDER SEAL COATS

### 37-2.05A General

Reserved

10-30-15

### 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 binder seal coat consists of applying 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:** Combination of ground or granulated high natural crumb rubber and 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

At least 5 business days before use, submit the permit issued by the local air district for asphalt rubber binder field blending equipment and application 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.

At least 10 days before starting seal coat activities, submit the name of an authorized laboratory to perform QC testing for asphalt rubber binder. The authorized laboratory must comply with the Department's Independent Assurance Program.

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 a certified volume or weight slip for each delivery of asphalt rubber binder ingredients and asphalt rubber binder.

Submit SDS for each asphalt rubber binder ingredient and the asphalt rubber binder.

At least 15 days before use, submit:

1. Four 1 qt 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, include:
     - 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, include:
     - 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, include:
     - 3.3.1. Test results for the specified quality characteristics
     - 3.3.2. Minimum reaction time and temperature

Submit a certificate of compliance and accuracy verification of test results for viscometers.

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 binder seal coat work.

Submit viscosity rest results within 2 business days after testing.

Submit resilience and softening point test results within 3 business days after testing.

### 37-2.05B(1)(d) Quality Control and Assurance

#### 37-2.05B(1)(d)(i) General

The equipment used in producing asphalt rubber binder and the equipment used in spreading asphalt rubber binder must be permitted for use by the local air district.

#### 37-2.05B(1)(d)(ii) Quality Control

#### 37-2.05B(1)(d)(ii)(A) General

Reserved

#### 37-2.05B(1)(d)(ii)(B) 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<br>Asphaltenes<br>Aromatics | ASTM D2007 | 1 per shipment |

### 37-2.05B(1)(d)(ii)(C) 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**

| Quality characteristic | Test method | Frequency |
|---|---|---|
| Scrap tire crumb rubber gradation | California Test 385 | 1 per 250 tons or 1 per project, whichever is greater |
| High natural crumb rubber gradation | California Test 385 | 1 per 250 tons or 1 per project, whichever is greater |
| 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 crumb rubber | ASTM D297 | 1 per 3,400 lb |

### 37-2.05B(1)(d)(ii)(D) Asphalt Rubber Binder

Test asphalt rubber binder under the test methods and frequencies shown in the following table:

| Quality characteristic | Test method | Sampling location | Frequency |
|---|---|---|---|
| Descending viscosity[a] | ASTM D7741/D7741M | Reaction vessel | 1 per lot[b] |
| Viscosity at 375 °F | ASTM D7741/D7741M | Distribution truck | 15 minutes before use per lot[b] |
| Cone penetration | ASTM D217 | Distribution truck | 1 per lot[b] |
| Resilience | ASTM D5329 | | |
| Softening point | ASTM D36/D36M | | |

[a]Start taking viscosity readings 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 complies with the specification requirement.
[b]The lot is defined in the Department's *MPQP*.

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.

### 37-2.05B(1)(d)(iii) Department Acceptance

### 37-2.05B(1)(d)(iii)(A) General

Reserved

### 37-2.05B(1)(d)(iii)(B) Crumb Rubber Modifier

The Department accepts CRM based on the gradation requirements shown in the following table when tested under California Test 385:

**Crumb Rubber Modifier Gradation Requirements**

| Sieve size | Scrap tire crumb rubber | | High natural crumb rubber | |
|---|---|---|---|---|
| | Operating range | Contract compliance | Operating range | Contract compliance |
| No. 8 | 100 | 100 | -- | -- |
| No. 10 | 95–100 | 90–100 | 100 | 100 |
| No. 16 | 35–85 | 32–88 | 92–100 | 85–100 |
| No. 30 | 2–25 | 1–30 | 25–95 | 20–98 |
| No. 50 | 0–10 | 0–15 | 6–35 | 2–40 |
| No. 100 | 0–5 | 0–10 | 0–7 | 0–10 |
| No. 200 | 0–2 | 0–5 | 0–3 | 0–5 |

If a test result for CRM gradation does not comply with the specifications, the Department deducts the corresponding amount for each gradation test as shown in the following table:

| Material | Test result [a] | Deduction |
|---|---|---|
| Scrap tire crumb rubber | Operating range < TR < Contract compliance | $250 |
| Scrap tire crumb rubber | TR > Contract compliance | $1,100 |
| High natural crumb rubber | Operating range < TR < Contract compliance | $250 |
| High natural crumb rubber | TR > Contract compliance | $600 |

[a] Test Result = TR

Each gradation test for scrap tire crumb rubber represents 10,000 lbs or the quantity used in that day's production, whichever is less.

Each gradation test for high natural crumb rubber represents 3,400 lbs or the quantity used in that day's production, whichever is less.

### 37-2.05B(1)(d)(iii)(C) Asphalt Rubber Binder

For Department acceptance testing, take a sample of asphalt rubber binder in the Engineer's presence every 5 lots or once a day, whichever is greater. Each sample must be in a 6 qt can with open top and friction lid.

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 | 25–60 |
| Resilience at 25 °C (% rebound) | ASTM D5329 | 18–50 |
| Softening point (°C) | ASTM D36/D36M | 55–88 |
| Viscosity at 375 °F (Pa•s x $10^{-3}$)[a] | ASTM D7741/D7741M | 1,500–2,500 |

[a]Prepare sample for viscosity test under California Test 388.

### 37-2.05B(1)(d)(iii)(D) Precoated Screenings

The Department accepts precoated screenings based on compliance with the requirements shown in the following table:

**Precoated Screenings Acceptance Criteria**

| Quality characteristic | Test method | Requirement | | |
|---|---|---|---|---|
| Los Angeles Rattler Loss (max, %)<br>Loss at 100 revolutions<br>Loss at 500 revolutions | California Test 211 | <br>10<br>40 | | |
| Film stripping (max, %) | California Test 302 | 25 | | |
| Cleanness value (min) | California Test 227 | 80 | | |
| Durability (min) | California Test 229 | 52 | | |
| Gradation (% passing by weight)<br>Sieve sizes: | California Test 202 | Coarse<br>1/2" max | Medium<br>1/2" max | Fine<br>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 |

### 37-2.05B(2) Materials

#### 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 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 ± 3 [a] |
| Flash point (CL.O.C., °C) | ASTM D92 | 207 min |
| Molecular analysis<br>Asphaltenes by mass (max, %)<br>Aromatics by mass (min, %) | ASTM D2007 | <br>0.1<br>55 |

[a] *X* denotes the proposed asphalt modifier viscosity from 19 to 36. A change in *X* requires a new asphalt rubber binder submittal.

#### 37-2.05B(2)(d) Crumb Rubber Modifier

CRM 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 CRM particles must be large enough to be ground or granulated.

Wire must not be more than 0.01 percent by weight of CRM when tested under California Test 385. CRM must be free of contaminants except fabric, which must not exceed 0.05 percent by weight of CRM.

The length of an individual CRM particle must not exceed 3/16 inch.

CRM must be dry, free-flowing particles that do not stick together. A maximum of 3 percent calcium carbonate or talc by weight of CRM may be added. CRM must not cause foaming when combined with the asphalt binder and asphalt modifier.

Specific gravity of CRM must be from 1.1 to 1.2 determined under California Test 208.

The CRM must comply with the requirements shown in the following table:

**Crumb Rubber Modifier Requirements**

| Quality characteristic | Test method | Requirement | |
|---|---|---|---|
| | | Scrap tire crumb rubber | High natural crumb rubber |
| Acetone extract (%) | ASTM D297 | 6.0–16.0 | 4.0–16.0 |
| Rubber hydrocarbon (%) | ASTM D297 | 42.0–65.0 | 50.0 min |
| Natural rubber content (%) | ASTM D297 | 22.0–39.0 | 40.0–48.0 |
| Carbon black content (%) | ASTM D297 | 28.0–38.0 | -- |
| Ash content (%) | ASTM D297 | 8.0 min | -- |

When tested under California Test 385, scrap tire crumb rubber must comply with the gradation requirements 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 |

When tested under California Test 385, high natural crumb rubber must comply with the gradation requirements 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 |

**37-2.05B(2)(e) Asphalt Rubber Binder**

Asphalt rubber binder must be a combination of:

1. Asphalt binder
2. Asphalt modifier
3. Crumb rubber modifier

Asphalt rubber binder blending equipment must be authorized under the Department's Material Plant Quality Program.

The blending equipment must allow the determination of weight percentages of each asphalt rubber binder ingredient.

Asphalt rubber binder must be 79 ± 1 percent by weight asphalt binder and 21 ± 1 percent by weight of CRM. The minimum percentage of CRM must be 20.0 percent and lower values may not be rounded up.

CRM must be 76 ± 2 percent by weight scrap tire crumb rubber and 24 ± 2 percent by weight high natural crumb 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 CRM may be proportioned and combined simultaneously.

The blend of asphalt binder and asphalt modifier must be combined with the CRM at the asphalt rubber binder production site. The asphalt binder and asphalt modifier blend must be from 375 to 440 degrees F when the CRM 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 comply with the requirements shown in the following table:

| Quality characteristic | Test method | Requirement |
|---|---|---|
| Cone penetration at 25 °C (0.10 mm) | ASTM D217 | 25–60 |
| Resilience at 25 °C (% rebound) | ASTM D5329 | 18–50 |
| Softening point (°C) | ASTM D36/D36M | 55–88 |
| Viscosity at 375 °F (Pa•s x $10^{-3}$)[a] | ASTM D7741/D7741M | 1,500–2,500 |

[a]Prepare sample for viscosity test under California Test 388.

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, screenings for asphalt rubber binder seal coat must comply with the gradation requirements shown in the following table:

**Asphalt Rubber Binder Seal Coat Screenings Gradation**

| Percentage passing by weight | | |
|---|---|---|
| Sieve sizes | Medium<br>1/2" max | Fine<br>3/8" max |
| 3/4" | 100 | 100 |
| 1/2" | 85–90 | 95–100 |
| 3/8" | 0–30 | 70–85 |
| No. 4 | 0–5 | 0–15 |
| No. 8 | -- | 0–5 |
| No. 200 | 0–1 | 0–1 |

The seal coat screenings must comply with the requirements shown in the following table:

**Seal Coat Screenings**

| Quality characteristic | Test method | Requirement |
|---|---|---|
| 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 gauges
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

Precoating of screenings must be performed at a central mixing plant. The plant must be authorized under the Department's Material Plant Quality Program.

For asphalt rubber binder 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 binder 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. The asphalt must be from 0.5 to 1.0 percent by weight of dry screenings. The Engineer determines the exact rate.

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. You may reduce the application rate by 0.050 gal/sq yd in the wheel paths.

Apply asphalt rubber binder when the ambient 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 enough screenings are available at the job site 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 pavement is damp or during high wind conditions. If authorized, you may adjust the distributor bar height and distribution speed and use shielding equipment during high wind conditions.

#### 37-2.05B(3)(e) Screenings Application

During transit, cover precoated screenings for asphalt rubber binder 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 binder 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.

If authorized for final rolling, you may use a steel-wheeled roller weighing from 8 to 10 tons in static mode only.

Perform a final sweeping before Contract acceptance. The final sweeping must not dislodge screenings.

### 37-2.05B(4) Payment

The payment quantity for precoated screenings is the weight measured after the screenings are preheated and precoated with asphalt binder.

If recorded batch weights are printed automatically, the payment quantity for screenings is the weight determined from the printed batch weights if:

1. Total aggregate weight for the 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. Copy of the recorded batch weights is certified by a licensed weighmaster

Asphalt rubber binder is measured as specified for asphalt binder.

07-19-13

### 37-2.05C Modified Asphalt Binder Seal Coat

Reserved

03-21-14

## 37-2.06 STRESS ABSORBING MEMBRANE INTERLAYER

### 37-2.06A General

Section 37-2.06 applies where a stress absorbing membrane interlayer (SAMI) is shown.

Comply with section 37-2.05B except a flush coat is not required.

### 37-2.06B Materials

For SAMI, screenings must comply with the 3/8-inch maximum gradation.

### 37-2.06C Construction

For SAMI, section 37-2.01C(7) does not apply.

Final rolling and sweeping are not required for SAMI.

### 37-2.06D Payment

Not Used

## 37-2.07–37-2.10 RESERVED

**Add to section 37-3.01D(1):**

01-18-13

Micro-surfacing spreader operators must attend the prepaving conference.

^^^

# 39 HOT MIX ASPHALT

01-15-16**Replace the headings and paragraphs in section 39 with:**

04-18-14

## 39-1 GENERAL

### 39-1.01 GENERAL

### 39-1.01A Summary

Section 39-1 includes general specifications for producing and placing hot mix asphalt.

HMA includes one or more of the following types:

1. Type A HMA
2. RHMA-G
3. OGFC
4. BWC
5. Minor HMA

10-30-15

If the use of a warm mix asphalt technology is allowed or required by a special provision, the warm mix asphalt technology to be used must be on the Authorized Materials List for approved technologies.

01-15-16

Wherever reference is made to the following test methods, the year of publication for these test methods is as shown in the following table:

| Test method | Year of publication |
|---|---|
| AASHTO M 17 | 2011 (2015) |
| AASHTO M 323 | 2013 |
| AASHTO R 30 | 2002 (2015) |
| AASHTO R 35 | 2014 |
| AASHTO R 56 | 2014 |
| AASHTO R 57 | 2014 |
| AASHTO T 27 | 2014 |
| AASHTO T 49 | 2014 |
| AASHTO T 59 | 2013 |
| AASHTO T 96 | 2002 (2010) |
| AASHTO T 164 | 2014 |
| AASHTO T 176 | 2008 |
| AASHTO T 209 | 2012 |
| AASHTO T 269 | 2014 |
| AASHTO T 275 | 2007 (2012) |
| AASHTO T 283 | 2014 |
| AASHTO T 304 | 2011 |
| AASHTO T 305 | 2014 |
| AASHTO T 308 | 2010 |
| AASHTO T 312 | 2014 |
| AASHTO T 324 | 2014 |
| AASHTO T 329 | 2013 |
| AASHTO T 335 | 2009 |
| ASTM D36/D36M | 2014$^{\varepsilon 1}$ |
| ASTM D92 | 2012b |
| ASTM D217 | 2010 |
| ASTM D297 | 2013 |
| ASTM D445 | 2014 |
| ASTM D2007 | 2011 |
| ASTM D2074 | 2007 (Reapproved 2013) |
| ASTM D2995 | 1999 (Reapproved 2009) |
| ASTM D4791 | 2010 |
| ASTM D5329 | 2009 |
| ASTM D7741/D7741M | 2011$^{\varepsilon 1}$ |
| Asphalt Institute MS-2 | 7th edition (2015) |

**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.

10-30-15

**miscellaneous areas:** Areas outside the traveled way and shoulders 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

04-18-14

**processed RAP:** RAP that has been fractionated.

10-30-15

**supplemental fine aggregate:** Mineral filler consisting of rock dust, slag dust, hydrated lime, hydraulic cement, or any combination of these and complying with AASHTO M 17.

04-18-14

### 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 ±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 ±2.00 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 ±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.

10-30-15

If your JMF fails verification testing, submit an adjusted JMF based on your testing. The adjusted JMF must include a new Contractor Job Mix Formula Proposal form, Contractor Hot Mix Asphalt Design Data form, and the results of the failed verification testing.

04-18-14

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.

10-30-15

If QC procedures, personnel, or sample testing locations change, submit a QC plan supplement at least 3 business days before implementing the proposed change. Do not implement the change without authorization.

04-18-14

### 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 T 324 (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.

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If a tapered notched wedge is used, submit compaction test result values within 24 hours of testing.

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### 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
5. 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 antistrip 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 antistrip collected from the liquid antistrip 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 antistrip content as percentage of the asphalt binder weight calculated from:
    2.9.1. Asphalt binder meter output
    2.9.2. Liquid antistrip 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 a warm mix asphalt technology is used, submit the following with your proposed JMF submittal:

1. MSDS for warm mix asphalt technology

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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.

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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.

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**39-1.01C(9)–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 inertial 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

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At least 15 days before inertial profiling, you must register with the Department's secure file sharing system. To obtain information on the registration process, send an e-mail with your contact information to the following electronic mailbox address:

smoothness@dot.ca.gov

Within 2 business days after each day of profiling, submit the profile information to the Engineer and to the Department's secure file sharing system. After submitting the profile information to the Department's file sharing system, send a notification of your electronic submittal to the Engineer and to the above electronic mailbox address with the names of the files submitted.

The profiling information must include:

1. Raw profile data for each lane.
2. ProVAL ride quality analysis report for the International Roughness Index of the left and right wheel paths of each lane. Submit each report as a PDF file.
3. ProVAL ride quality analysis report for the Mean Roughness Index of each lane. Submit each report as a PDF file.
4. ProVAL smoothness assurance analysis report for the International Roughness Index of the left and right wheel paths of each lane. Submit each report as a PDF file.
5. ProVAL smoothness assurance analysis reports for the grinding locations of the left and right wheel paths of each lane. Submit each report as a PDF file.
6. GPS data file for each lane. Submit the data file in GPS eXchange file format.
7. Manufacturer's recommended calibration and verification test results for the inertial profiler.
8. Inertial profiler's calibration and verification test results, including bounce, block, and distance measurement instrument.

Submit the raw profile data in an unfiltered electronic pavement profile file format. Use the following file-naming convention:

YYYYMMDD_TTCCCRRR_EA_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
EA = Contract number, excluding district identification number, expressed as 6 characters
D = traffic direction, *NB*, *SB*, *WB*, or *EB*
L = lane number from left to right in the direction of travel
W = wheel path, *L* for left, *R* for right, or *B* for both
B = beginning station to the nearest foot, such as 10+20, or beginning post mile to the nearest hundredth, such as 25.06, no leading zero
E = ending station to the nearest foot, such as 14+20, or ending post mile to the nearest hundredth, such as 28.06, no leading zero
X = profile operation, *EXIST* for existing pavement, *INTER* for after prepaving smoothness correction, *PAVE* for after paving, and *CORR* for after final surface pavement correction
PT = type of HMA pavement, such as Type A HMA or RHMA-G

If submitting multiple inertial profiler data files, compress the files into a zip format and submit them using the file-naming convention TT_EA_X_YYYYMMDD.zip.

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**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 7.0 ± 1.0 percent
2. Specimen height must be 60 ± 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 ± 2 degrees F for PG 58
   6.2. 122 ± 2 degrees F for PG 64
   6.3. 131 ± 2 degrees F for PG 70 and above

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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

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Take samples under California Test 125.

**39-1.01D(2) Job Mix Formula Verification**

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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 ±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.

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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 fine aggregate. 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.

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For aggregate, RAP, and HMA, split the samples into at least 4 parts and label their containers. Submit 3 parts and keep 1 part.

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 ±0.20 percent from the OBC value submitted on Contractor Hot Mix Asphalt Design Data form
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 antistrip producer, or new liquid antistrip 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:

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**Aggregate Quality Control During Lime Treatment**

| Quality characteristic | Test method | Minimum sampling and testing frequency |
|---|---|---|
| Sand equivalent[a, b] | 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 | |

[a]Report test results as the average of 3 tests from a single sample.
[b]Use of a sand reading indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, 7.1.2, and 8.4.3 do not apply. Prepare the stock solution as specified in section 4.8.1, except omit the addition of formaldehyde.

For lime slurry aggregate treatment, determine the aggregate moisture content at least once every 2 hours of treatment. Calculate moisture content under AASHTO T 255 and report it as a percent of dry aggregate weight. Use the moisture content calculations as a set point for the proportioning process controller.

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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 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:

10-30-15

1. Perform density tests using a calibrated nuclear gage at a rate of 1 test for every 750-foot section along the joint. Select random locations for testing within each 750-foot section.
2. Perform density 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 density to the maximum density test results.

04-18-19

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

10-30-15

Except for HMA pavement placed using method compaction, 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 selects. 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.

04-18-14

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 selected by the Engineer. Take cores after the adjacent lane is placed and before opening the pavement to traffic. Take cores 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

10-30-15

Where inertial profiler testing is required:

1. Determine the pavement smoothness for each traffic lane by obtaining the International Roughness Index for the left and right wheel paths in an individual lane. The average of the International Roughness Index values for the left and right wheel paths for the same traffic 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 traffic lane. Left and right wheel paths are based on the direction of travel.
2. Identify the areas of localized roughness using the FHWA's engineering software ProVAL to perform smoothness assurance analysis. Calculate the 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.

Where OGFC is required, test pavement smoothness of the final HMA or concrete pavement surface before placing OGFC and after placing OGFC.

04-18-14

### 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.

10-30-15

3. Distance measurement index test. Verify the accuracy of the distance measuring instrument under California Test 387.

04-18-14

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.

### 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

10-17-14

4. Begin and end of all at-grade intersections

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.

### 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:

10-17-14

1. At the plant
2. At the truck
3. Windrow

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

10-30-15

To obtain workability of the HMA sample for splitting, the Engineer reheats each sample of HMA mixture not more than 2 cycles. Each reheat cycle is performed by placing the loose mixture in a mechanical forced-draft oven for 2 hours or less after the sample reaches 140 degrees F.

The Engineer conditions each at-the-plant sample of HMA mixture in compliance with sections 7.1.2, 7.1.3, and 7.1.4 of AASHTO R 30.

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.

04-18-14

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.

Density cores must be taken from the final layer, cored through the entire pavement thickness shown. Where OGFC is required, take the density cores before placing OGFC.

If the percent of theoretical maximum density does not comply with the specifications, the Engineer may accept the HMA and take a payment deduction as shown in the following table:

**Reduced Payment Factors for Percent of Maximum Theoretical Density**

| 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 |

For acceptance of a completed tapered notched wedge joint, the Engineer determines density from cores you take every 3,000 feet.

04-18-14

**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 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 |

Note: These requirements do not apply to the OGFC surface. Smoothness requirements for OGFC are specified in section 39-4.01D(3)(c).

Where OGFC is required, the final HMA surface must comply with the Mean Roughness Index requirements before placing OGFC. Correct the pavement surface that does not meet the Mean Roughness Index specifications. Areas of localized roughness greater than 160 in/mi must be corrected regardless of the Mean Roughness Index values of a 0.1-mile section.

04-18-14

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.

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(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 the other's test results, submit your 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

10-30-15

If the Department's portion of the split QC samples or acceptance samples are not available, the independent third party uses any available material representing the disputed HMA for evaluation.

For a dispute involving JMF verification, the independent third party performs referee testing as specified in the 5th paragraph of section 39-1.01D(2).

04-18-14

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 antistrip.

### 39-1.02B(3) Warm Mix Asphalt Technology

10-30-15

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. Cure the samples in a forced-air draft oven at 275 degrees F for 4 hours ± 10 minutes.

04-18-14

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.

10-30-15

For hot mix asphalt (leveling) the grade of asphalt binder for the HMA must be PG 64-10 or PG 64-16.

04-18-14

### 39-1.02D Aggregate

### 39-1.02D(1) General

Aggregate must be clean and free from deleterious substances.

The aggregate for 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

10-30-15

Aggregate gradation must be determined before the addition of asphalt binder and must include supplemental fine aggregates. Test for aggregate gradation under AASHTO T 27. Do not wash the coarse aggregate. Wash the fine aggregate only. 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 *MPQP* 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 Material Plant Quality Program.

Weighing and metering devices used for the production of HMA modified with additives must comply with the requirements of the Department's *MPQP*. 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 *MPQP*

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.

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 ±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 ±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.

10-30-15

4. If dry HMA additives are used at continuous mixing HMA plants, baghouse dust systems must return all captured material to the mix. This requirement is waived for lime-treated aggregates.

04-18-14

5. HMA additive must be proportioned to within ±0.3 percent of the target additive rate.

Batch mixing plants using HMA additives must comply with the following:

1. Metered HMA additive must be placed in an intermediate holding vessel before being added to the stream of asphalt binder as it enters the pugmill.
2. If a container scale is used, weigh additive before combining with asphalt binder. Keep the container scale separate from other ingredient proportioning. The container scale capacity must be no more than twice the volume of the maximum additive batch size. The container scale's graduations must be smaller than the proportioning tolerance or 0.001 times the container scale capacity.
3. Dry HMA additive proportioning devices must be separate from metering devices for the aggregates and asphalt binder. Proportion dry HMA additive directly into the pugmill or place in an intermediate holding vessel to be added to the pugmill at the appropriate time in the batch cycle. Dry ingredients for batch production must be proportioned with a hopper scale.
4. Zero tolerance for the HMA additive batch scale is ±0.5 percent of the target additive weight. The indicated HMA additive batch scale weight may vary from the preselected weight setting by up to ±1.0 percent of the target additive weight.

### 39-1.02I 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.

10-30-15

2. Minimum asphalt binder content must be 6.40 percent for 3/8-inch aggregate and 5.70 percent for 1/2-inch aggregate. If you request and the Engineer authorizes, you may reduce the minimum asphalt binder content.

04-18-14

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.

10-30-15

### 39-1.02L Replace Asphalt Concrete Surfacing

HMA to be used for replacing asphalt concrete surfacing must comply with Type A HMA as specified in section 39-2.

The grade of asphalt binder must be PG 64-10 or PG 64-16.

04-18-14

## 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

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 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.

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.

10-30-15

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).

04-18-14

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.

04-18-14

**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 |
| Planed pavement | 0.05 | 0.06 | 0.04 |

10-30-15

If a stress absorbing membrane interlayer as specified in section 37-2.06 is applied, the tack coat application rates for new HMA apply.

04-18-14

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.

10-30-15

### 39-1.03E Pavement Edge Treatments

Construct edge treatment on the HMA pavement as shown.

Where a tapered edge is required, use the same type of HMA used for the adjacent lane or shoulder.

The edge of roadway where the tapered edge is to be placed must have a solid base, free of debris such as loose material, grass, weeds, or mud. Grade the areas to receive the tapered edge as required.

The tapered edge must be placed monolithic with the adjacent lane or shoulder and must be 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 accomplished 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 transitioning to cross roads, driveways, and obstructions.

For the tapered edge, the angle of the slope must not deviate by more than ±5 degrees from the angle shown. Measure the angle from the plane of the adjacent finished pavement surface.

If paving is done in multiple lifts, the tapered edge must be placed with each lift.

Short sections of hand work are allowed to construct tapered edge transitions.

04-18-14

### 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.

10-30-15

Do not open new HMA pavement to traffic until its mid depth temperature is below 160 degrees F.

04-18-14

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:

10-17-14

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

04-18-14

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.

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

10-30-15

If the pavement surface does not comply with section 39-1.01D(9)(c), grind the pavement to within specified tolerances, remove and replace the pavement, 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 corrections 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.

04-18-14

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

Where data core samples are taken, backfill and compact the holes with authorized material.

After data core summary and photograph submittal, dispose of cores.

## 39-1.04 PAYMENT

10-30-15

The payment quantity for geosynthetic pavement interlayer is the area measured from the actual pavement area covered.

Except for tack coat used in minor HMA, payment for tack coat is not included in the payment quantity for hot mix asphalt.

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.

The payment quantity for HMA of the type shown on 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 virgin 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.

The payment quantity for place hot mix asphalt dike of the type shown on the Bid Item List is the length measured from end to end. Payment for the HMA used to construct the dike is not included in the payment for place hot mix asphalt dike.

The payment quantity for place hot mix asphalt (miscellaneous areas) is the area measured for 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).

The payment quantity for replace asphalt concrete is the volume 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.

04-18-14

## 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

01-15-16

The JMF must be based on superpave HMA mix design as described in *MS-2 Asphalt Mix Design Methods* 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:

10-30-15

**Aggregate Testing Frequencies**

| Quality characteristic | Test method | Minimum testing frequency |
|---|---|---|
| Gradation[a] | AASHTO T 27 | 1 per 750 tons and any remaining part |
| Sand equivalent[b, c] | AASHTO T 176 | |
| Moisture content[d] | AASHTO T 255 | |
| Crushed particles | AASHTO T 335 | 1 per 10,000 tons or 2 per project whichever is greater |
| Los Angeles rattler | AASHTO T 96 | |
| Flat and elongated particles | ASTM D4791 | |
| Fine aggregate angularity | AASHTO T 304 Method A | |

[a]If RAP is used, test the combined aggregate gradation under California Test 384.
[b]Reported value must be the average of 3 tests from a single sample.
[c]Use of a sand reading indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, 7.1.2, 8.4.2 and 8.4.3 do not apply. Prepare the stock solution as specified in section 4.8.1, except omit the addition of formaldehyde.
[d]Test at continuous mixing plants only. If RAP is used, test the RAP moisture content at continuous mixing plant and batch mixing plant.

04-18-14

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 ±2.00 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 ±2.00 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 T 209 must be within ±0.06 of the average maximum specific gravity reported on page 4 of your Contractor Hot Mix Asphalt Design Data form.

During Type A 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) Type A Hot Mix Asphalt Production

01-15-16

Test the quality characteristics of Type A HMA under the test methods and frequencies shown in the following table:

**Type A HMA Production Testing Frequencies**

| Quality characteristic | Test method | Minimum testing frequency |
|---|---|---|
| Asphalt binder content | AASHTO T 308 Method A | 1 per 750 tons and any remaining part |
| HMA moisture content | AASHTO T 329 | 1 per 2,500 tons but not less than 1 per paving day |
| Air voids content | AASHTO T 269 | 1 per 4,000 tons or 2 every 5 paving days, whichever is greater |
| Voids in mineral aggregate | MS-2 Asphalt Mixture Volumetrics | 1 per 10,000 tons or 2 per project whichever is greater |
| Dust proportion | MS-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 | AASHTO T 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[a] | AASHTO T 27 | JMF ± Tolerance |
| Percent of crushed particles<br>Coarse aggregate (min, %)<br>One-fractured face<br>Two-fractured faces<br>Fine aggregate (min, %)<br>(Passing No. 4 sieve and retained on No. 8 sieve.)<br>One fractured face | AASHTO T 335 | <br><br>95<br>90<br><br><br>70 |
| Los Angeles Rattler (max, %)<br>Loss at 100 Rev.<br>Loss at 500 Rev. | AASHTO T 96 | <br>12<br>40 |
| Sand equivalent (min.)[b, c] | AASHTO T 176 | 47 |
| Flat and elongated particles (max, % by weight at 5:1) | ASTM D4791 | 10 |
| Fine aggregate angularity (min, %)[d] | AASHTO T 304 Method A | 45 |

[a]The Engineer determines combined aggregate gradations containing RAP under California Test 384.
[b]Reported value must be the average of 3 tests from a single sample.
[c]Use of a sand reading indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, 7.1.2, 8.4.2 and 8.4.3 do not apply. Prepare the stock solution as specified in section 4.8.1, except omit the addition of formaldehyde.
[d] 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 | ±2.00 |
| Specific gravity (within the average value reported) | AASHTO T 209 | ±0.06 |

3. In-place Type A HMA quality requirements shown in the following table:

**Type A HMA Acceptance In Place**

| Quality characteristic | Test method | Requirement |
|---|---|---|
| Asphalt binder content (%) | AASHTO T 308 Method A | JMF -0.30, +0.50 |
| HMA moisture content (max, %) | AASHTO T 329 | 1.00 |
| Air voids content at $N_{design}$ (%)[a, b] | AASHTO T 269 | 4.0 ± 1.5<br>(5.0 ± 1.5 for 1-inch aggregate) |
| Voids in mineral aggregate on laboratory-produced HMA (min, %)[a]<br>Gradation:<br>No. 4<br>3/8-inch<br>1/2-inch<br>3/4-inch<br>1-inch<br>with NMAS[g] = 1-inch<br>with NMAS[g] = 3/4-inch | MS-2 Asphalt Mixture Volumetrics[c] | <br><br>16.5–19.5<br>15.5–18.5<br>14.5–17.5<br>13.5–16.5<br><br>13.5–16.5<br>14.5–17.5 |
| Voids in mineral aggregate on plant-produced HMA (min, %)[a]<br>Gradation:<br>No. 4<br>3/8-inch<br>1/2-inch<br>3/4-inch<br>1-inch<br>with NMAS[g] = 1-inch<br>with NMAS[g] = 3/4-inch | MS-2 Asphalt Mixture Volumetrics[c] | <br><br>15.5–18.5<br>14.5–17.5<br>13.5–16.5<br>12.5–15.5<br><br>12.5–15.5<br>13.5–16.5 |
| Dust proportion | MS-2 Asphalt Mixture Volumetrics | 0.6–1.3[h] |
| Density of core (% of max theoretical density)[e, f] | California Test 375 | 91.0–97.0 |
| Hamburg wheel track<br>(min number of passes at 0.5-inch rut depth)<br>Binder grade:<br>PG 58<br>PG 64<br>PG 70<br>PG 76 or higher | AASHTO T 324 (Modified) | <br><br><br>10,000<br>15,000<br>20,000<br>25,000 |
| Hamburg wheel track<br>(min number of passes at inflection point)<br>Binder grade:<br>PG 58<br>PG 64<br>PG 70<br>PG 76 or higher | AASHTO T 324 (Modified) | <br><br><br>10,000<br>10,000<br>12,500<br>15,000 |
| Moisture susceptibility (min, psi, dry strength) | AASHTO T 283 | 100 |
| Moisture susceptibility (min, psi, wet strength) | AASHTO T 283 | 70 |

[a]Prepare 3 briquettes. Report the average of 3 tests.
[b]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.
[c]Determine bulk specific gravity under AASHTO T 275, Method A.
[d]The Engineer determines the laboratory-prepared HMA value for mix design verification only.
[e]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

[f]The Engineer determines theoretical maximum density under AASHTO T 209, Method A, at the frequency specified in California Test 375, Part 5D.
[g]NMAS means nominal maximum aggregate size.
[h]For treated aggregate, the dust proportion requirement is 0.6–1.5.

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## 39-2.02 MATERIALS

### 39-2.02A General

Reserved

### 39-2.02B Mix Design

01-15-16

The mix design for Type A HMA 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[a] | $N_{initial}$ > 8.0<br>$N_{design}$ = 4.0<br>($N_{design}$ = 5.0 for 1-inch aggregate)<br>$N_{max}$ > 2.0 |
| Gyration compaction (no. of gyrations) | AASHTO T 312 | $N_{initial}$ = 8<br>$N_{design}$ = 85.0<br>$N_{max}$ = 130 |
| Voids in mineral aggregate (min, %)[b]<br>Gradation:<br>No. 4<br>3/8-inch<br>1/2-inch<br>3/4-inch<br>1-inch<br>with NMAS[e] = 1-inch<br>with NMAS[e] = 3/4-inch | MS-2<br>Asphalt Mixture<br>Volumetrics | <br><br>16.5–19.5<br>15.5–18.5<br>14.5–17.5<br>13.5–16.5<br><br>13.5–16.5<br>14.5–17.5 |
| Dust proportion | MS-2<br>Asphalt Mixture<br>Volumetrics | 0.6–1.3 |
| Hamburg wheel track<br>(min number of passes at 0.5-inch rut depth)<br>Binder grade:<br>PG 58<br>PG 64<br>PG 70<br>PG 76 or higher | AASHTO T 324<br>(Modified)[c] | <br><br><br>10,000<br>15,000<br>20,000<br>25,000 |
| Hamburg wheel track<br>(min number of passes at the inflection point)<br>Binder grade:<br>PG 58<br>PG 64<br>PG 70<br>PG 76 or higher | AASHTO T 324<br>(Modified)[c] | <br><br><br>10,000<br>10,000<br>12,500<br>15,000 |
| Moisture susceptibility, dry strength (min, psi) | AASHTO T 283[c] | 100 |
| Moisture susceptibility, wet strength (min, psi) | AASHTO T 283[c, d] | 70 |

[a]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.
[b]Measure bulk specific gravity using AASHTO T 275, Method A.
[c]Test plant produced HMA.
[d]Freeze thaw required.
[e]NMAS means nominal maximum aggregate size.

10-30-15

For Type A HMA mixtures using RAP, the maximum allowed binder replacement is 25.0 percent in the upper 0.2 feet of HMA exclusive of OGFC and 40.0 percent below. Binder replacement is calculated as a percentage of the approved JMF target asphalt binder content.

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For Type A 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 Type A 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:

10-30-15

**Aggregate Quality**

| Quality characteristic | Test method | Requirement |
|---|---|---|
| Percent of crushed particles<br>Coarse aggregate (min, %)<br>One-fractured face<br>Two-fractured faces<br>Fine aggregate (min, %)<br>(Passing No. 4 sieve and retained on No. 8 sieve.)<br>One fractured face | AASHTO T 335 | <br><br>95<br>90<br><br><br>70 |
| Los Angeles Rattler (max, %)<br>Loss at 100 Rev.<br>Loss at 500 Rev. | AASHTO T 96 | <br>12<br>40 |
| Sand equivalent (min)[a, b] | AASHTO T 176 | 47 |
| Flat and elongated particles (max, % by weight at 5:1) | ASTM D4791 | 10 |
| Fine aggregate angularity (min, %)[c] | AASHTO T 304 Method A | 45 |

[a]Reported value must be the average of 3 tests from a single sample.
[b]Use of a Sand Reader Indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, 7.1.2, 8.4.2 and 8.4.3 do not apply. Prepare the stock solution as specified in section 4.8.1, except omit the addition of formaldehyde.
[c] 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.

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#### 39-2.02D(2) Aggregate Gradations

The aggregate gradations for Type A HMA must comply with the requirements shown in the following table:

**Aggregate Gradation Requirements**

| 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 for Type A HMA**
**(Percentage Passing)**

**1 inch**

| Sieve size | Target value limit | Allowable tolerance |
|---|---|---|
| 1" | 100 | -- |
| 3/4" | 88–93 | TV ± 5 |
| 1/2" | 72–85 | TV ± 6 |
| 3/8" | 55–70 | TV ± 6 |
| No. 4 | 35–52 | TV ± 7 |
| No. 8 | 22–40 | TV ± 5 |
| No. 30 | 8–24 | TV ± 4 |
| No. 50 | 5–18 | TV ± 4 |
| No. 200 | 3.0–7.0 | TV ± 2.0 |

**3/4 inch**

| Sieve size | Target value limit | Allowable tolerance |
|---|---|---|
| 1" | 100 | -- |
| 3/4" | 90–98 | TV ± 5 |
| 1/2" | 70–90 | TV ± 6 |
| No. 4 | 42–58 | TV ± 5 |
| No. 8 | 29–43 | TV ± 5 |
| No. 30 | 10–23 | TV ± 4 |
| No. 200 | 2.0–7.0 | TV ± 2.0 |

**1/2 inch**

| Sieve sizes | Target value limit | Allowable tolerance |
|---|---|---|
| 3/4" | 100 | -- |
| 1/2" | 95–98 | TV ± 5 |
| 3/8" | 72–95 | TV ± 5 |
| No. 4 | 52–69 | TV ± 5 |
| No. 8 | 35–55 | TV ± 5 |
| No. 30 | 15–30 | TV ± 4 |
| No. 200 | 2.0–8.0 | TV ± 2.0 |

**3/8 inch**

| Sieve sizes | Target value limits | Allowable tolerance |
|---|---|---|
| 1/2" | 100 | -- |
| 3/8" | 95–98 | TV ± 5 |
| No. 4 | 55–75 | TV ± 5 |
| No. 8 | 30–50 | TV ± 5 |
| No. 30 | 15–35 | TV ± 5 |
| No. 200 | 2.0–9.0 | TV ± 2.0 |

**No. 4**

| Sieve sizes | Target value limits | Allowable tolerance |
|---|---|---|
| 3/8" | 100 | -- |
| No. 4 | 95–98 | TV ± 5 |
| No. 8 | 70–80 | TV ± 6 |
| No. 30 | 34–45 | TV ± 5 |
| No. 200 | 2.0–12.0 | TV ± 4.0 |

### 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 greater than 15 percent of the aggregate blend, 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. For RAP substitution of 15 percent of the aggregate blend or less, fractionation is not required.

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[a] | 100 |
| Fine (% passing the 3/8-inch sieve) | California Test 202[a] | 98–100 |

[a]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 Type A 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.

## 39-2.03 CONSTRUCTION

10-30-15

Where the pavement thickness shown is greater than 0.30 foot, you may place Type A HMA in multiple lifts not less than 0.15 foot each. If placing Type A HMA in multiple lifts:

1. Aggregate gradation must comply with the requirements shown in the following table:

**Aggregate Gradation Requirements**

| Type A HMA lift thickness | Gradation |
|---|---|
| 0.15 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 |

2. Apply tack coat before placing a subsequent lift
3. The Engineer evaluates each HMA lift individually for compliance

Spread Type A HMA at the atmospheric and surface temperatures shown in the following table:

**Minimum Atmospheric and Surface Temperatures for Type A HMA**

| Lift 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 lift thickness must be 0.25 foot.

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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

10-17-14

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.

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.

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#### 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

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The JMF must be based on superpave HMA mix design as described in *MS-2 Asphalt Mix Design Methods* by the Asphalt Institute.

**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.

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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.

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**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.

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**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

10-30-15

Sample and test scrap tire crumb rubber and high natural crumb rubber 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 crumb rubber gradation | California Test 385 | 1 per 10,000 lb |
| High natural crumb rubber 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 crumb rubber | ASTM D297 | 1 per 3,400 lb |

### 39-3.01D(3)(b)(iv) Asphalt Rubber Binder

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[a] |
| Resilience | ASTM D5329 | |
| Softening point | ASTM D36 | |
| Viscosity | ASTM D7741 | 15 minutes before use per lot[a] |

[a]The lot is defined in the Department's *MPQP*.

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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.

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### 39-3.01D(3)(c) Aggregate

Test the quality characteristics of aggregate under the test methods and frequencies shown in the following table:

10-30-15

**Aggregate Testing Frequencies**

| Quality characteristic | Test method | Minimum testing frequency |
|---|---|---|
| Gradation | AASHTO T 27 | 1 per 750 tons and any remaining part |
| Sand equivalent[a, b] | AASHTO T 176 | |
| Moisture content[c] | AASHTO T 255 | |
| Crushed particles | AASHTO T 335 | 1 per 10,000 tons or 2 per project, whichever is greater |
| Los Angeles rattler | AASHTO T 96 | |
| Flat and elongated particles | ASTM D4791 | |
| Fine aggregate angularity | AASHTO T 304 Method A | |

[a]Reported value must be the average of 3 tests from a single sample.
bUse of a sand reading indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, 7.1.2, 8.4.2 and 8.4.3 do not apply. Prepare the stock solution as specified in section 4.8.1, except omit the addition of formaldehyde.
[c]Test at continuous mixing plants only

04-18-14

For lime treated aggregate, test aggregate before treatment and test for gradation and moisture content during RHMA-G production.

**39-3.01D(3)(d) Rubberized Hot Mix Asphalt–Gap Graded Production**

01-15-16

Test the quality characteristics of RHMA-G under the test methods and frequencies shown in the following table:

**RHMA-G Production Testing Frequencies**

| Quality characteristic | Test method | Minimum testing frequency |
|---|---|---|
| Asphalt binder content | AASHTO T 308 Method A | 1 per 750 tons and any remaining part |
| HMA moisture content | AASHTO T 329 | 1 per 2,500 tons but not less than 1 per paving day |
| Air voids content | AASHTO T 269 | 1 per 4,000 tons or 2 every 5 paving days, whichever is greater |
| Voids in mineral aggregate | MS-2 Asphalt Mixture Volumetrics | 1 per 10,000 tons or 2 per project whichever is greater |
| Dust proportion | MS-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 | AASHTO T 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:

10-30-15

**Aggregate Quality**

| Quality characteristic | Test method | Requirement |
|---|---|---|
| Aggregate gradation | AASHTO T 27 | JMF ± Tolerance |
| Percent of crushed particles<br>Coarse aggregate (min, %)<br>One-fractured face<br>Two-fractured faces<br>Fine aggregate (min, %)<br>(Passing No. 4 sieve and retained on No. 8 sieve.)<br>One fractured face | AASHTO T 335 | <br><br>--<br>90<br><br><br>70 |
| Los Angeles Rattler (max, %)<br>Loss at 100 Rev.<br>Loss at 500 Rev. | AASHTO T 96 | <br>12<br>40 |
| Sand equivalent (min)[a, b] | AASHTO T 176 | 47 |
| Flat and elongated particles (max, % by weight at 5:1) | ASTM D4791 | Report only |
| Fine aggregate angularity (min, %)[c] | AASHTO T 304 Method A | 45 |

[a]Reported value must be the average of 3 tests from a single sample.
[b]Use of a sand reading Indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, 7.1.2, 8.4.2 and 8.4.3 do not apply. Prepare the stock solution as specified in section 4.8.1, except omit the addition of formaldehyde.
[c] 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.

01-15-16

2. In-place RHMA-G quality requirements shown in the following table:

**RHMA-G Acceptance In Place**

| Quality characteristic | Test method | Requirement |
|---|---|---|
| Asphalt binder content (%) | AASHTO T 308 Method A | JMF -0.40, +0.50 |
| HMA moisture content (max, %) | AASHTO T 329 | 1.00 |
| Air voids content @ $N_{design}$ (%)[a, b] | AASHTO T 269 | 4.0 ± 1.5 |
| Voids in mineral aggregate on laboratory-produced HMA[d] (min, %)<br>Gradation:<br>1/2-inch and 3/4-inch | MS-2 Asphalt Mixture Volumetrics[c] | <br><br><br>18.0–23.0 |
| Voids in mineral aggregate on plant-produced HMA (min, %)[a]<br>Gradation:<br>1/2-inch and 3/4-inch | MS-2 Asphalt Mixture Volumetrics[c] | <br><br><br>18.0–23.0 |
| Dust proportion[a] | MS-2 Asphalt Mixture Volumetrics | Report only |
| Density of core (% of max theoretical density)[e, f] | California Test 375 | 91.0–97.0 |
| Hamburg wheel track (min number of passes at 0.5-inch rut depth)<br>Binder grade:<br>PG 58<br>PG 64<br>PG 70 | AASHTO T 324 (Modified) | <br><br><br>15,000<br>20,000<br>25,000 |
| Hamburg wheel track (min number of passes at inflection point)<br>Binder grade:<br>PG 58<br>PG 64<br>PG 70 | AASHTO T 324 (Modified) | <br><br><br>10,000<br>12,500<br>15,000 |
| Moisture susceptibility (min, psi, dry strength) | AASHTO T 283 | 100 |
| Moisture susceptibility (min, psi, wet strength) | AASHTO T 283 | 70 |

[a]Prepare 3 briquettes. Report the average of 3 tests.
[b]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.
[c]Determine bulk specific gravity under AASHTO T 275, Method A.
[d]The Engineer determines the laboratory-prepared RHMA-G value for mix design verification only.
[e]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.

[f]The Engineer determines theoretical maximum density under AASHTO T 209, Method A, at the frequency specified in California Test 375, Part 5D.

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### 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 ($m^2/s \times 10^{-6}$) | ASTM D445 | X ± 3[a] |
| 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 |

[a]The symbol "X" is the asphalt modifier viscosity.

### 39-3.01D(5)(b)(iii) Crumb Rubber Modifier

10-30-15

The Department accepts CRM, scrap tire crumb rubber, and high natural crumb rubber 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 crumb rubber gradation (% passing No. 8 sieve) | California Test 385 | 100 |
| High natural scrap tire crumb rubber 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 |
| Natural rubber content in high natural crumb rubber (%) | ASTM D297 | 40.0–48.0 |

Scrap tire crumb rubber and high natural crumb rubber 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)[a] | ASTM D7741 | 1,500–4,000 |

[a]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 Rubberized Hot Mix Asphalt–Gap Graded Mix Design

01-15-16

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[a] | $N_{design}$ = 4.0 |
| Gyration compaction (no. of gyrations) | AASHTO T 312 | $N_{design}$ = 50–150[b] |
| Voids in mineral aggregate (min, %) | MS-2 Asphalt Mixture Volumetricsc | 18.0–23.0 |
| Dust proportion | MS-2 Asphalt Mixture Volumetrics | Report only |
| Hamburg wheel track (min number of passes at 0.5-inch rut depth)<br>Binder grade:<br>PG 58<br>PG 64<br>PG 70 | AASHTO T 324 (Modified)[d] | <br><br><br><br>15,000<br>20,000<br>25,000 |
| Hamburg wheel track (min number of passes at the inflection point)<br>Binder grade:<br>PG 58<br>PG 64<br>PG 70 | AASHTO T 324 (Modified)[d] | <br><br><br><br>10,000<br>12,500<br>15,000 |
| Moisture susceptibility, dry strength (min, psi) | AASHTO T 283[d] | 100 |
| Moisture susceptibility, wet strength (min, psi) | AASHTO T 283[d, e] | 70 |

[a]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.
[b]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.
[c]Measure bulk specific gravity using AASHTO T 275, Method A.
[d]Test plant produced RHMA.
[e]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 ± 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 ± 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 |

[a]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

10-30-15

CRM must be a ground or granulated combination of scrap tire crumb rubber and high natural scrap tire crumb rubber. CRM must be 75.0 ± 2.0 percent scrap tire crumb rubber and 25.0 ± 2.0 percent high natural scrap tire crumb rubber by total weight of CRM. Scrap tire crumb rubber and high natural scrap tire crumb rubber must be derived from waste tires described in Pub Res Code § 42703.

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 crumb rubber gradation (% passing No. 8 sieve) | California Test 385 | 100 |
| High natural crumb rubber 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)[a] | -- | 3/16 |
| CRM specific gravity | California Test 208 | 1.1–1.2 |
| Natural rubber content in high natural crumb rubber (%) | ASTM D297 | 40.0–48.0 |

[a]Test at mix design and for certificate of compliance.

04-18-14

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 [a] | | | | | | | Limits |
|---|---|---|---|---|---|---|---|---|---|
| | | 45 | 60 | 90 | 120 | 240 | 360 | 1440 | |
| Cone penetration at 25 °C (0.10 mm) | ASTM D217 | X [b] | | | | 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 |

[a]Six hours (360 minutes) after CRM addition, reduce the oven temperature to 275 °F for 16 hours. After the 16-hour (960 minutes) cool down after CRM addition, reheat the binder to the reaction temperature expected during production for sampling and testing at 24 hours (1,440 minutes).
[b]"X" denotes required testing

### 39-3.02C(5) Asphalt Rubber Binder Production

#### 39-3.02C(5)(a) General

10-30-15

Deliver scrap tire crumb rubber and high natural scrap tire crumb rubber in separate bags.

04-18-14

#### 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:

10-17-14

| 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)[a] | ASTM D7741 | 1,500–4,000 |

[a]Prepare sample for viscosity test under California Test 388.

04-18-14

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.

10-30-15

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 crumb rubber to the reheated asphalt rubber binder, the binder must undergo a 45-minute reaction period. The added scrap tire crumb rubber 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.

04-18-14

### 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:

10-30-15

**Aggregate Quality**

| Quality characteristic | Test method | Requirement |
|---|---|---|
| Percent of crushed particles<br>Coarse aggregate (min, %)<br>One-fractured face<br>Two-fractured faces<br>Fine aggregate (min, %)<br>(Passing No. 4 sieve and retained on No. 8 sieve.)<br>One fractured face | AASHTO T 335 | <br><br>--<br>90<br><br><br>70 |
| Los Angeles Rattler (max, %)<br>Loss at 100 Rev.<br>Loss at 500 Rev. | AASHTO T 96 | <br>12<br>40 |
| Sand equivalent (min)[a, b] | AASHTO T 176 | 47 |
| Flat and elongated particles (max, % by weight at 5:1) | ASTM D4791 | Report only |
| Fine aggregate angularity (min, %)[c] | AASHTO T 304 Method A | 45 |

[a]Reported value must be the average of 3 tests from a single sample.
[b]Use of a sand reading indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, 7.1.2, 8.4.2 and 8.4.3 do not apply. Prepare the stock solution as specified in section 4.8.1, except omit the addition of formaldehyde.
[c] 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.

04-18-14

#### 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

**Aggregate Gradation Requirements**

| RHMA-G pavement thickness shown | Gradation |
|---|---|
| 0.10 to less than 0.20 foot | 1/2 inch |
| 0.20 foot or greater | 3/4 inch |

For RHMA-G, the aggregate gradations must be within the target value limits for the specified sieve size shown in the following tables:

**Aggregate Gradations for RHMA-G**
**(Percentage Passing)**

**3/4 inch**

| 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 | 0.0–6.0 | TV ± 2.0 |

**1/2 inch**

| 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 | 0.0–6.0 | TV ± 2.0 |

### 39-3.02E Rubberized Hot Mix Asphalt–Gap Graded Production

Asphalt rubber binder must be from 375 to 425 degrees F when mixed with aggregate.

If the dry and wet moisture susceptibility test result for treated plant-produced RHMA-G is less than the RHMA-G mix design requirement for dry and wet moisture 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.

04-18-14

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 of the 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.

10-30-15

For RHMA-O and RHMA-O-HB, the JMF submittal must comply with section 39-3.01C(3).

04-18-14

#### 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(3)(b).

###### 39-4.01D(2)(c) Aggregate

Test the quality characteristics of aggregate under the test methods and frequencies shown in the following table:

10-30-15

**Aggregate Testing Frequencies**

| Quality characteristic | Test method | Minimum testing frequency |
|---|---|---|
| Gradation | AASHTO T 27 | 1 per 750 tons and any remaining part |
| Moisture content[a] | AASHTO T 255 | 1 per 1500 tons and any remaining part |
| Crushed particles | AASHTO T 335 | 1 per 10,000 tons or 2 per project, whichever is greater |
| Los Angeles rattler | AASHTO T 96 | |
| Flat and elongated particles | ASTM D4791 | |

[a]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) Open Graded Friction Course 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 | AASHTO T 308 Method A | 1 per 750 tons and any remaining part |
| HMA moisture content | AASHTO T 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:

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<br>Coarse aggregate (min, %)<br>One-fractured face<br>Two-fractured faces<br>Fine aggregate (min, %)<br>(Passing No. 4 sieve and retained on No. 8 sieve.)<br>One fractured face | AASHTO T 335 | <br><br>90<br>90<br><br><br>90 |
| Los Angeles Rattler (max, %)<br>Loss at 100 Rev.<br>Loss at 500 Rev. | AASHTO T 96 | <br>12<br>40 |
| Flat and elongated particles (max, % by weight @ 5:1) | ASTM D4791 | Report only |

2. In-place OGFC quality requirements shown in the following table:

**OGFC Acceptance In Place**

| Quality characteristic | Test method | Requirement |
|---|---|---|
| Asphalt binder content (%) | AASHTO T 308 Method A | JMF -0.40, +0.50 |
| HMA moisture content (max, %) | AASHTO T 329 | 1.00 |

### 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 Open Graded Friction Course 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 39-3.02C.

**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<br>Coarse aggregate (min, %)<br>One-fractured face<br>Two-fractured faces<br>Fine aggregate (min, %)<br>(Passing No. 4 sieve and retained on No. 8 sieve.)<br>One fractured face | AASHTO T 335 | <br><br>--<br>90<br><br><br>90 |
| Los Angeles Rattler (max, %)<br>Loss at 100 Rev.<br>Loss at 500 Rev. | AASHTO T 96 | <br>12<br>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 for OGFC**
**(Percentage Passing)**

**1 inch**

| 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 | 0.0–6.0 | TV ± 2.0 |

**1/2 inch**

| 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 | 0.0–3.0 | TV ± 2.0 |

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 |
| Planed 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.

10-30-15

BWC consists of placing a polymer modified asphaltic emulsion and the specified HMA in a single pass with an integrated paving machine.

04-18-14

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 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.

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 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 based on compliance with the requirements shown in the following table:

10-17-14

**Asphaltic Emulsion**

| Quality characteristic | Test method | Requirement |
|---|---|---|
| Saybolt Furol Viscosity at 25 °C (SFS) [a] | AASHTO T 59 | 20–100 |
| Sieve test on original emulsion at time of delivery (max, %) | AASHTO T 59 | 0.05 |
| 24-hour storage stability (max, %) | AASHTO T 59 | 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 T 49 | 70–150 |

[a]SFS means Saybolt Furol seconds

04-18-14

The Department accepts the BWC based on the submitted asphaltic emulsion target residual rate ±0.02 gal/sq yd when tested under ASTM D2995.

**39-5.01B Materials**

**39-5.01B(1) General**

Reserved

**39-5.01B(2) Asphaltic Emulsion**

The asphaltic emulsion must comply with the requirements shown in the following table:

10-17-14

**Asphaltic Emulsion**

| Quality characteristic | Test method | Requirement |
|---|---|---|
| Saybolt Furol Viscosity at 25 °C (SFS) [a] | AASHTO T 59 | 20–100 |
| Sieve test on original emulsion at time of delivery (max, %) | AASHTO T 59 | 0.05 |
| 24-hour storage stability (max, %) | AASHTO T 59 | 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 T 49 | 70–150 |

[a] 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

01-15-16

Use a material transfer vehicle when placing BWC. The material transfer vehicle must receive HMA directly from the truck.

Use an integrated distributor paver capable of spraying the asphaltic emulsion, spreading the HMA, and leveling the mat surface in 1 pass.

Apply asphaltic emulsion at a uniform rate for the full paving width. The asphaltic emulsion 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 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 must have a target residual rate for the surfaces to receive the emulsion as shown in the following table:

**Asphaltic Emulsion Target Residual Rate**

| Surface to receive asphaltic emulsion | Target residual rates (gal/sq yd) |
|---|---|
| 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 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 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.

10-30-15

### 39-5.01D Payment

Payment for asphaltic emulsion is not included in the payment for the type of HMA used in a bonded wearing course.

04-18-14

## 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:

10-30-15

**Aggregate Testing Frequencies**

| Quality characteristic | Test method | Minimum testing frequency |
|---|---|---|
| Gradation | AASHTO T 27 | 1 per 750 tons and any remaining part |
| Sand equivalent[a, b] | AASHTO T 176 | |
| Moisture content[c] | AASHTO T 255 | 1 per 1500 tons and any remaining part |
| Crushed particles | AASHTO T 335 | 1 per 10,000 tons or 2 per project, whichever is greater |
| Los Angeles rattler | AASHTO T 96 | |
| Flat and elongated particles | ASTM D4791 | |
| Fine aggregate angularity | AASHTO T 304 Method A | |

[a]Reported value must be the average of 3 tests from a single sample.
[b]Use of a sand reading indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, 7.1.2, 8.4.2, and 8.4.3 do not apply. Prepare the stock solution as specified in section 4.8.1, except omit the addition of formaldehyde.
[c]Test at continuous mixing plants only.

04-18-14

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 | AASHTO T 308 Method A | 1 per 750 tons and any remaining part |
| HMA moisture content | AASHTO T 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 -0.40, +0.50 percent when tested under AASHTO T 308, Method A.
2. Aggregate quality requirements shown in the following table:

10-30-15

**Aggregate Quality**

| Quality characteristic | Test method | Requirement |
|---|---|---|
| Aggregate gradation | AASHTO T 27 | JMF ± Tolerance |
| Percent of crushed particles<br>Coarse aggregate (min, %)<br>One-fractured face<br>Two-fractured faces<br>Fine aggregate (min, %)<br>(Passing No. 4 sieve and retained on No. 8 sieve.)<br>One fractured face | AASHTO T 335 | <br><br>--<br>90<br><br><br>85 |
| Los Angeles Rattler (max, %)<br>Loss at 100 Rev.<br>Loss at 500 Rev. | AASHTO T 96 | <br>12<br>35 |
| Sand equivalent (min) | AASHTO T 176 | 47 |
| Flat and elongated particles (max, % by weight at 5:1) | ASTM D4791 | 25 |
| Fine aggregate angularity (min, %) | AASHTO T 304 Method A | 45 |

[a]Reported value must be the average of 3 tests from a single sample.
[b]Use of a sand reading indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, 7.1.2, 8.4.2 and 8.4.3 do not apply. Prepare the stock solution as specified in section 4.8.1, except omit the addition of formaldehyde.

04-18-14

**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.

01-15-16

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 8.1[a] | 12 |
| Drain down (max, %) | AASHTO T 305 [b] | 0.1 |

[a] 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 μm
$P_{be}$ = Effective asphalt content by total weight of mix using the MS-2 Asphalt Mix Design Methods
SA = Estimated surface area of the aggregate blend in m2/kg from Table 8.1 in the Asphalt Institute MS-2 Asphalt Mix Design Methods, 7th Edition
$G_b$ = Specific gravity of asphalt binder

[b] 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:

10-30-15

**Aggregate Quality**

| Quality characteristic | Test method | Requirement |
|---|---|---|
| Percent of crushed particles<br>Coarse aggregate (min, %)<br>One-fractured face<br>Two-fractured faces<br>Fine aggregate (min, %)<br>(Passing No. 4 sieve and retained on No. 8 sieve.)<br>One fractured face | AASHTO T 335 | <br><br>--<br>90<br><br><br>85 |
| Los Angeles Rattler (max, %)<br>Loss at 100 Rev.<br>Loss at 500 Rev. | AASHTO T 96 | <br>12<br>35 |
| Sand equivalent (min) | AASHTO T 176 | 47 |
| Flat and elongated particles (max, % by weight @ 5:1) | ASTM D4791 | 25 |
| Fine aggregate angularity (min, %) | AASHTO T 304 Method A | 45 |

[a]Reported value must be the average of 3 tests from a single sample.
[b]Use of a sand reading indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, 7.1.2, 8.4.2 and 8.4.3 do not apply. Prepare the stock solution as specified in section 4.8.1, except omit the addition of formaldehyde.

04-18-14

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 Gradations for BWC-G**
**(Percentage Passing)**

**1/2 inch**

| 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 ± 2.0 |

**3/8 inch**

| 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 ± 2.0 |

**No. 4**

| 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 ± 2.0 |

### 39-5.02C Construction

10-30-15

Apply asphaltic emulsion when the atmospheric and pavement temperatures are above 50 degrees F.

### 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 prepaving 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

10-17-14

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.

04-18-14

### 39-7.03 CONSTRUCTION

Not Used

### 39-7.04 PAYMENT

Not Used

## 39-8–39-10 RESERVED

^^^

# 40 CONCRETE PAVEMENT

10-30-15

**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:

**QC Testing Frequency**

| Property | Test method | Minimum frequency |
|---|---|---|
| Cleanness value | California Test 227 | 2 per day |
| Sand equivalent | California Test 217 | 2 per day |
| Aggregate gradation | California Test 202 | 2 per day |
| Air content (air entrainment specified) | California Test 504 | 1 per hour |
| Air content (air entrainment not specified) | California Test 504 | 1 per 4 hours |
| Density | California Test 518 | 1 per 4 hours |
| Penetration | California Test 533 | 1 per 4 hours |
| Aggregate moisture meter calibration[a] | California Test 223 or California Test 226 | 1 per day |

[a] Check calibration of the plant moisture meter by comparing moisture meter readings with California Test 223 or California Test 226 test results.

Maintain control charts to identify potential problems and assignable causes. Post a copy of each control chart at a location determined by the Engineer.

Individual measurement control charts must use the target values in the mix proportions as indicators of central tendency.

Develop linear control charts for:

1. Cleanness value
2. Sand equivalent
3. Fine and coarse aggregate gradation
4. Air content
5. Penetration

Control charts must include:

1. Contract number
2. Mix proportions
3. Test number
4. Each test parameter
5. Action and suspension limits

6. Specification limits
7. Quality control test results

For fine and coarse aggregate gradation control charts, record the running average of the previous 4 consecutive gradation tests for each sieve and superimpose the specification limits.

For air content control charts, the action limit is ±1.0 percent of the specified value. If no value is specified, the action limit is ±1.0 percent of the value used for your approved mix design.

As a minimum, a process is out of control if any of the following occurs:

1. For fine and coarse aggregate gradation, 2 consecutive running averages of 4 tests are outside the specification limits
2. For individual penetration or air content measurements:
   2.1. One point falls outside the suspension limit line
   2.2. Two points in a row fall outside the action limit line

Stop production and take corrective action for out of control processes or the Engineer rejects subsequent material.

Before each day's concrete pavement placement and at intervals not to exceed 4 hours of production, use a tachometer to test and record vibration frequency for concrete consolidation vibrators.

### 40-1.01D(6)(c) Pavement Smoothness

#### 40-1.01D(6)(c)(i) General

Notify the Engineer 2 business days before performing smoothness testing including IP calibration and verification testing. The notification must include start time and locations by station.

Before testing the pavement smoothness, remove foreign objects from the surface, and mark the beginning and ending station on the pavement shoulder.

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

1. Traffic lanes less than 1,000 feet in length including ramps, turn lanes, and acceleration and deceleration lanes
2. Areas within 15 feet of manholes
3. Shoulders
4. Weigh-in-motion areas
5. Miscellaneous areas such as medians, gore areas, turnouts, and maintenance pullouts

#### 40-1.01D(6)(c)(ii) Straightedge Testing

Identify locations of areas requiring correction by:

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

#### 40-1.01D(6)(c)(iii) Inertial Profile Testing

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

Conduct cross correlation IP verification test in the Engineer's presence before performing initial profiling. Verify cross correlation IP verification test at least annually. Conduct 5 repeat runs of the IP on an authorized test section. The test section must be on an existing concrete pavement surface 0.1 mile long.

Calculate a cross correlation to determine the repeatability of your device under Section 8.3.1.2 of AASHTO R 56 using ProVAL profiler certification analysis with a 3 feet maximum offset. The cross correlation must be a minimum of 0.92.

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

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

Collect IP data using the specified ProVAL analysis with 250 mm and IRI filters. Comply with the requirements for data collection under AASHTO R 56.

For IP testing, wheel paths are 3 feet from and parallel to the edge of a lane. Left and right are relative to the direction of travel. The IRI is the pavement smoothness along a wheel path of a given lane. The MRI is the average of the IRI values for the left and right wheel path from the same lane.

Operate the IP according to the manufacturer's recommendations and AASHTO R 57 at 1-inch recording intervals and a minimum 4 inch line laser sensor.

Collect IP data under AASHTO R 56.IP data must include:

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

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

YYYYMMDD_TTCCCRRR_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:

**Acceptance Testing**

| Property | Test Method | | Frequency[a] |
|---|---|---|---|
| | CRCP | JPCP | |
| Modulus of rupture (28 day) | California Test 523 | | 1,000 cu yd |
| Air content[b] | California Test 504 | | 1 day's paving |
| Dowel bar placement | -- | Measurement[a] | 700 sq yd |
| Tie bar placement | -- | Measurement[a] | 4,000 sq yd |
| Thickness | California Test 531 | | 1,200 sq yd |
| Coefficient of friction | California Test 342 | | 1 day's paving |

[a]A single test represents no more than the frequency specified.
[b]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:

$$t = \frac{|\overline{X}_c - \overline{X}_v|}{S_p\sqrt{\frac{1}{n_c} + \frac{1}{n_v}}} \quad \text{and} \quad S_p^2 = \frac{S_c^2(n_c - 1) + S_v^2(n_v - 1)}{n_c + n_v - 2}$$

where:

$n_c$ = Number of your quality control tests (minimum of 6 required)
$n_v$ = Number of Department's tests (minimum of 2 required)
$\overline{X}_c$ = Mean of your quality control tests
$\overline{X}_v$ = 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 tcrit, using degrees of freedom showing in the following table:

| degrees of freedom (nc+nv-2) | tcrit (for $\alpha = 0.01$) |
|---|---|
| 1 | 63.657 |
| 2 | 9.925 |
| 3 | 5.841 |
| 4 | 4.604 |
| 5 | 4.032 |
| 6 | 3.707 |
| 7 | 3.499 |
| 8 | 3.355 |
| 9 | 3.250 |
| 10 | 3.169 |

If the t-value calculated is less than or equal to tcrit, your quality control test results are verified. If the t-value calculated is greater than tcrit, quality control test results are not verified.

If your quality control test results are not verified, core at least 3 specimens from concrete pavement under section 40-1.03P. The Engineer selects the core locations. The authorized laboratory must test these specimens for air content under ASTM C 457. The Engineer compares these test results with your quality control test results using the t-test method. If your quality control test results are verified based on this comparison, the Engineer uses the quality control test results for acceptance of concrete pavement for air content. If your quality control test results are not verified based on this comparison, the Engineer uses the air content of core specimens determined by the authorized laboratory under ASTM C 457 for acceptance.

**40-1.01D(7)(a)(iii) Dowel and Tie Bar Placement**

For JPCP, drill cores under section 40-1.03P for the Department's acceptance testing.

The Engineer identifies which joint and dowel or tie bar are to be tested. Core each day's paving within 2 business days. Each dowel or tie bar test consists of 2 cores, 1 on each bar end to expose both ends and allow measurement.

If the tests indicate dowel or tie bars are not placed within the specified tolerances or if there is unconsolidated concrete around the dowel or tie bars, core additional specimens identified by Engineer to determine the limits of unacceptable work.

**40-1.01D(7)(a)(iv) Thickness**

Drill cores under section 40-1.03P for the Department's acceptance testing in the primary area, which is the area placed in 1 day for each thickness. Core at locations determined by the Engineer and in the Engineer's presence.

Do not core until any grinding has been completed.

The core specimen diameter must be 4 inches. To identify the limits of concrete pavement deficient in thickness by more than 0.05 foot, you may divide primary areas into secondary areas. The Engineer measures cores under California Test 531 to the nearest 0.01 foot. Core at least 1 foot from existing, contiguous, and parallel concrete pavement not constructed as part of this Contract.

You may request the Engineer make additional thickness measurements and use them to determine the average thickness variation. The Engineer determines the locations with random sampling methods.

If each thickness measurement in a primary area is less than 0.05 foot deficient, the Engineer calculates the average thickness deficiency in that primary area. The Engineer uses 0.02 foot for a thickness difference more than 0.02 foot over the specified thickness.

For each thickness measurement in a primary area deficient by more than 0.05 foot, the Engineer determines a secondary area where the thickness deficiency is more than 0.05 foot. The Engineer determines this secondary area by measuring the thickness of each concrete pavement slab adjacent to the measurement found to be more than 0.05 foot deficient. The Engineer continues to measure the thickness until an area that is bound by slabs with thickness deficient by 0.05 foot or less is determined.

Slabs without bar reinforcement are defined by the areas bound by longitudinal and transverse joints and concrete pavement edges. Slabs with bar reinforcement are defined by the areas bound by longitudinal joints and concrete pavement edges and 15-foot lengths. Secondary area thickness measurements in a slab determine that entire slab's thickness.

The Engineer measures the remaining primary area thickness after removing the secondary areas from consideration for determining the average thickness deficiency.

**40-1.01D(7)(a)(v)–40-1.01D(7)(a)(ix) Reserved**

**40-1.01D(7)(b) Acceptance Criteria**

**40-1.01D(7)(b)(i) General**

Reserved

**40-1.01D(7)(b)(ii) Modulus of Rupture**

For field qualification, the modulus of rupture at no later than 28 days must be at least:

1. 550 psi for each single beam
2. 570 psi for the average of 5 beams

For production, the modulus of rupture for the average of the individual test results of 2 beams aged for 28 days must be at least 570 psi.

**40-1.01D(7)(b)(iii) Air Content**

The air content must be within ±1.5 percent of the specified value. If no value is specified, the air content must be within ±1.5 percent of, the value used for your approved mix design.

**40-1.01D(7)(b)(iv) Bar Reinforcement**

In addition to requirements of Section 52, bar reinforcement must be more than 1/2 inch below the saw cut depth at concrete pavement joints.

**40-1.01D(7)(b)(v) Dowel Bar and Tie Bar Placement**

Tie bar placement must comply with the tolerances shown in the following table:

**Tie Bar Tolerance**

| Dimension | Tolerance |
|---|---|
| Horizontal and vertical skew | 5 1/4 inch, max |
| Longitudinal translation | ± 2 inch |
| Horizontal offset (embedment) | ± 2 inch |
| Vertical depth | 1. At least 1/2 inch below the bottom of the saw cut<br>2. When measured at any point along the bar, not less than 2 inches clear of the pavement's surface and bottom |

NOTE: Tolerances are measured relative to the completed joint.

Dowel bar placement must comply with the tolerances shown in the following table:

**Dowel Bar Tolerances**

| Dimension | Tolerance |
|---|---|
| Horizontal offset | ±1 inch |
| Longitudinal translation | ±2 inch |
| Horizontal skew | 5/8 inch, max |
| Vertical skew | 5/8 inch, max |
| Vertical depth | The minimum distance measured from concrete pavement surface to any point along the top of dowel bar must be:<br>DB + 1/2 inch<br><br>where:<br>DB = one third of pavement thickness in inches, or the saw cut depth, whichever is greater<br><br>The maximum distance below the depth shown must be 5/8 inch. |

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

10-30-15

Construct edge treatments as shown. Regrade when required for the preparation of tapered edge areas.

Sections 40-1.03J(2) and 40-1.03J(3) do not apply to tapered edges.

For tapered edges placed after the concrete pavement is complete, concrete may comply with the requirements for minor concrete.

For tapered edges placed after the concrete pavement is complete, install connecting bar reinforcement under section 52.

Saw cutting or grinding may be used to construct tapered edges.

For tapered edges, the angle of the slope must not deviate by more than ± 5 degrees from the angle shown. Measure the angle from the plane of the adjacent finished pavement surface.

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### 40-1.03J Finishing

### 40-1.03J(1) General

Reserved

### 40-1.03J(2) Preliminary Finishing

#### 40-1.03J(2)(a) General

Preliminary finishing must produce a smooth and true-to-grade finish. After preliminary finishing, mark each day's paving with a stamp. The stamp must be authorized before paving starts. The stamp must be approximately 1 by 2 feet in size. The stamp must form a uniform mark from 1/8 to 1/4 inch deep. Locate the mark 20 ± 5 feet from the transverse construction joint formed at each day's start of paving and 1 ± 0.25 foot from the pavement's outside edge. The stamp mark must show the month, day, and year of placement and the station of the transverse construction joint. Orient the stamp mark so it can be read from the pavement's outside edge.

Do not apply water to the pavement surface before float finishing.

#### 40-1.03J(2)(b) Stationary Side Form Finishing

If stationary side form construction is used, give the pavement a preliminary finish by the machine float method or the hand method.

If using the machine float method:

1. Use self-propelled machine floats.
2. Determine the number of machine floats required to perform the work at a rate equal to the pavement delivery rate. If the time from paving to machine float finishing exceeds 30 minutes, stop pavement delivery. When machine floats are in proper position, you may resume pavement delivery and paving.
3. Run machine floats on side forms or adjacent pavement lanes. If running on adjacent pavement, protect the adjacent pavement surface under section 40-1.03L. Floats must be hardwood, steel, or steel-shod wood. Floats must be equipped with devices that adjust the underside to a true flat surface.

If using the hand method, finish pavement smooth and true to grade with manually operated floats or powered finishing machines.

#### 40-1.03J(2)(c) Slip-Form Finishing

If slip-form construction is used, the slip-form paver must give the pavement a preliminary finish. You may supplement the slip-form paver with machine floats.

Before the pavement hardens, correct pavement edge slump in excess of 0.02 foot exclusive of edge rounding.

### 40-1.03J(3) Final Finishing

After completing preliminary finishing, round the edges of the initial paving widths to a 0.04-foot radius. Round transverse and longitudinal construction joints to a 0.02-foot radius.

Before curing, texture the pavement. Perform initial texturing with a burlap drag or broom device that produces striations parallel to the centerline. Perform final texturing with a steel-tined device that produces grooves parallel with the centerline.

Construct longitudinal grooves with a self-propelled machine designed specifically for grooving and texturing pavement. The machine must have tracks to maintain constant speed, provide traction, and maintain accurate tracking along the pavement surface. The machine must have a single row of rectangular spring steel tines. The tines must be from 3/32 to 1/8 inch wide, on 3/4-inch centers, and must have enough length, thickness, and resilience to form grooves approximately 3/16 inch deep. The machine must have horizontal and vertical controls. The machine must apply constant down pressure on the pavement surface during texturing. The machines must not cause raveling.

Construct grooves over the entire pavement width in a single pass except do not construct grooves 3 inches from the pavement edges and longitudinal joints. Final texture must be uniform and smooth. Use a guide to properly align the grooves. Grooves must be parallel and aligned to the pavement edge across the pavement width. Grooves must be from 1/8 to 3/16 inch deep after the pavement has hardened.

For irregular areas and areas inaccessible to the grooving machine, you may hand-construct grooves using the hand method. Hand-constructed grooves must comply with the specifications for machine-constructed grooves.

For ramp termini, use heavy brooming normal to the ramp centerline to produce a coefficient of friction of at least 0.35 determined on the hardened surface under California Test 342.

### 40-1.03K Curing

Cure the concrete pavement's exposed area under section 90-1.03B using the waterproof membrane method or curing compound method. If using the curing compound method use curing compound no. 1 or 2. When side forms are removed within 72 hours of the start of curing, also cure the concrete pavement edges.

Apply curing compound with mechanical sprayers. Reapply curing compound to saw cuts and disturbed areas.

### 40-1.03L Protecting Concrete Pavement

Protect concrete pavement under section 90-1.03C.

Maintain the concrete pavement surface temperature at not less than 40 degrees F for the initial 72 hours.

Protect the concrete pavement surface from activities that cause damage and reduce texture and coefficient of friction. Do not allow soil, gravel, petroleum products, concrete, or asphalt mixes on the concrete pavement surface.

Construct crossings for traffic convenience. If authorized, you may use RSC for crossings. Do not open crossings until the Department determines that the pavement's modulus of rupture is at least 550 psi under California Test 523 or California Test 524.

Do not open concrete pavement to traffic or use equipment on the concrete pavement for 10 days after paving nor before the concrete has attained a modulus of rupture of 550 psi based on Department’s testing except:

1. If the equipment is for sawing contraction joints
2. If authorized, one side of paving equipment's tracks may be on the concrete pavement after a modulus of rupture of 350 psi has been attained, provided:
   - 2.1. Unit pressure exerted on the concrete pavement by the paver does not exceed 20 psi
   - 2.2. You change the paving equipment tracks to prevent damage or the paving equipment tracks travel on protective material such as planks
   - 2.3. No part of the track is closer than 1 foot from the concrete pavement's edge

If concrete pavement damage including visible cracking occurs, stop operating paving equipment on the concrete pavement and repair the damage.

### 40-1.03M Early Use of Concrete Pavement

If requesting early use of concrete pavement:

1. Furnish molds and machines for modulus of rupture testing
2. Sample concrete
3. Fabricate beam specimens
4. Test for modulus of rupture under California Test 523

If you request early use, concrete pavement must have a modulus of rupture of at least 350 psi. Protect concrete pavement under section 40-1.03L.

### 40-1.03N Reserved

### 40-1.03O Shoulder Rumble Strip

10-30-15

Construct shoulder rumble strips by 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.

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,

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.

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### 40-1.03P Drilling Cores

Drill concrete pavement cores under ASTM C 42/C 42M. Use diamond impregnated drill bits.

Clean, dry, and fill core holes with hydraulic cement grout (nonshrink) or pavement concrete. Coat the core hole walls with epoxy adhesive for bonding new concrete to old concrete under section 95. Finish the backfill to match the adjacent surface elevation and texture.

### 40-1.03Q Pavement Repair and Replacement

#### 40-1.03Q(1) General

If surface raveling or full-depth cracks occur within one year of Contract acceptance, repair or replace the pavement under section 6-3.06.

Repair and replace pavement in the following sequence:

1. Replace pavement
2. Repair spall, ravel, and working cracks
3. Correct smoothness and coefficient of friction
4. Treat partial depth cracks
5. Replace damaged joint seals under section 41-5

In addition to removing pavement for other noncompliance, remove and replace JPCP slabs that:

1. Have one or more full depth crack
2. Have raveled surfaces such that either:
   - 2.1. Combined raveled areas are more than 5 percent of the total slab area
   - 2.2. Single area is more than 4 sq ft

Remove and replace JPCP 3 feet on both sides of a joint with a rejected dowel bar.

#### 40-1.03Q(2) Spall and Ravel Repair

Repair spalled or raveled areas that are:

1. Deeper than 0.05 foot
2. Wider than 0.10 foot
3. Longer than 0.3 foot

Repairs must comply with section 41-4 and be completed before opening pavement to traffic.

#### 40-1.03Q(3) Crack Repair

Treat partial depth cracks for JPCP under section 41-3.

If the joints are sealed, repair working cracks by routing and sealing. Use a powered rotary router mounted on wheels, with a vertical shaft and a routing spindle that casters as it moves along the crack. Form a reservoir 3/4 inch deep by 3/8 inch wide in the crack. Equipment must not cause raveling nor spalling.

Treat the contraction joint adjacent to the working crack by either:

1. Epoxy resin under ASTM C 881/C 881M, Type IV, Grade 2
2. Pressure injecting epoxy resin under ASTM C 881/C881M, Type IV, Grade 1

**40-1.03Q(4) Smoothness and Friction Correction**

Correct pavement that is noncompliant for:

1. Smoothness by grinding under section 42-3
2. Coefficient of friction by grooving or grinding under section 42

Do not start corrective work until:

1. Pavement has cured 10 days
2. Pavement has at least a 550 psi modulus of rupture
3. Your corrective method is authorized

Correct the entire lane width. Begin and end grinding at lines perpendicular to the roadway centerline. The corrected area must have a uniform texture and appearance.

If corrections are made within areas where testing with an IP is required, retest the entire lane length with an IP under sections 40-1.01D(6)(c) and 40-1.01D(7)(b)(vii).

If corrections are made within areas where testing with a 12-foot straightedge is required, retest the corrected area with a straightedge under sections 40-1.01D(6)(c) and 40-1.01D(7)(b)(vii).

Allow 25 days for the Department's coefficient of friction retesting.

**40-1.03R–40-1.03U Reserved**

**40-1.04 PAYMENT**

The payment quantity for pavement is based on the dimensions shown.

The deduction for pavement thickness deficiency in each primary area is shown in the following table:

**Deduction for Thickness Deficiency**

| Average thickness deficiency (foot)[a] | Deduction($/sq yd) |
|---|---|
| 0.01 | 0.90 |
| 0.02 | 2.30 |
| 0.03 | 4.10 |
| 0.04 | 6.40 |
| 0.05 | 9.11 |

[a]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.

Saw cut full slabs at the longitudinal and transverse joints. Saw cut partial slabs at joints and at locations determined by the Engineer. Saw cut must be vertical.

After lifting the slab, paint the cut ends of dowels and tie bars.

Construct transverse and longitudinal construction joints between the new slab and existing concrete. If slabs are constrained at both longitudinal edges by existing pavement, use dowel bars instead of tie bars. For longitudinal joints, offset dowel bar holes from original tie bars by 3 inches. For transverse joints, offset dowel bar holes from the original dowel bar by 3 inches.

Drill and bond bars to the existing concrete. Comply with section 41-10. Clean the faces of joints and underlying base from loose material and contaminants. Coat the faces with a double application of pigmented curing compound under section 28-2.03F. For partial slab replacements, place preformed sponge rubber expansion joint filler at new transverse joints under ASTM D 1752. Place concrete in the removal area.

**40-4.03C–40-4.03G Reserved**

**40-4.04 PAYMENT**

Not Used

## 40-5 JOINTED PLAIN CONCRETE PAVEMENT WITH RAPID STRENGTH CONCRETE

Reserved

## 40-6–40-15 RESERVED

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# 41 CONCRETE PAVEMENT REPAIR

10-30-15

**Replace the headings and paragraphs in section 41 with:**

10-30-15

## 41-1 GENERAL

**41-1.01 GENERAL**

**41-1.01A Summary**

Section 41-1 includes general specifications for repairing concrete pavement.

Dowel bars must comply with section 40-1.

**41-1.01B Definitions**

Reserved

**41-1.01C Submittals**

At least 15 days before delivering fast-setting concrete, polyester resin binder, or bonding agent to the job site, submit the manufacturer's recommendations, instructions, MSDS, and certificates of compliance. Notify the Engineer if polyester resin binder will be stored in containers over 55 gallons.

**41-1.01D Quality Control and Assurance**

**41-1.01D(1) General**

Before using polyester concrete:

1. Allow 14 days for sampling and testing of the polyester resin binder
2. Arrange for a representative from the manufacturer to provide training for:
   - 2.1. Cleaning and preparing the area
   - 2.2. Mixing and applying the bonding agent
   - 2.3. Mixing, placing, and curing polyester concrete

Do not use polyester concrete until your personnel and the Department's personnel have been trained.

**41-1.01D(2) Reserved**

**41-1.02 MATERIALS**

**41-1.02A General**

Water for washing aggregates, mixing concrete, curing, and coring must comply with section 90-1.02D.

Use the minimum amount of water to produce workable concrete and comply with the manufacturer's instructions.

**41-1.02B Fast-Setting Concrete**

Fast-setting concrete must be one of the following:

1. Magnesium phosphate concrete that is either:
   1.1. Single component water activated
   1.2. Dual component with a prepackaged liquid activator
2. Modified high-alumina based concrete
3. Portland cement based concrete

Fast-setting concrete must be stored in a cool and dry environment.

If used, the addition of retarders must comply with the manufacturer's instructions.

You may use any accelerating chemical admixtures complying with ASTM C494/C494M, Type C and section 90-1.02E.

Fast-setting concrete properties must have the values shown in the following table:

**Fast-Setting Concrete**

| Property | Test method | Value |
|---|---|---|
| Compressive strength[a] (psi, min) | | |
| at 3 hours | California Test 551 | 3,000 |
| at 24 hours | California Test 551 | 5,000 |
| Flexural strength[a] (psi, min, at 24 hours) | California Test 551 | 500 |
| Bond strength[a] (psi, min, at 24 hours) | | |
| Saturated surface dry concrete | California Test 551 | 300 |
| Dry concrete | California Test 551 | 400 |
| Water absorption (%, max) | California Test 551 | 10 |
| Abrasion resistance[a] (g, max, at 24 hours) | California Test 550 | 25 |
| Drying shrinkage (%, max, at 4 days) | ASTM C596 | 0.13 |
| Water soluble chlorides[b] (%, max, by weight) | California Test 422 | 0.05 |
| Water soluble sulfates[b] (%, max, by weight) | California Test 417 | 0.25 |
| Thermal stability (%, min) | California Test 553 | 90 |

[a]Perform test with aggregate filler if used.
[b]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:

**Aggregate Filler Grading**

| Sieve size | Percentage passing |
|---|---|
| 3/8 inch | 100 |
| No. 4 | 50–100 |
| No. 16 | 0–5 |

### 41-1.02C Polyester Concrete

Polyester concrete consists of polyester resin binder and dry aggregate. The polyester resin binder must be an unsaturated isophthalic polyester-styrene copolymer.

Polyester resin binder properties must have the values shown in the following table:

**Polyester Resin Binder**

| Property | Test method | Value |
|---|---|---|
| Viscosity[a] (Pa·s)<br>RVT, No. 1 spindle, 20 RPM at 77 °F | ASTM D2196 | 0.075–0.200 |
| Specific gravity[a] (77 °F) | ASTM D1475 | 1.05–1.10 |
| Elongation (%, min)<br>Type I specimen, 0.25 ± 0.03 inch thick<br>Speed of testing = 0.45 inch/minute<br>Condition 18/25/50+5/70: T—23/50 | ASTM D638<br><br><br><br>ASTM D618 | 35 |
| Tensile strength (min, MPa)<br>Type I specimen, 6.3 ± 0.76 mm (0.25 ± 0.03 inch) thick<br>Speed of testing = 11.4 mm/min (0.45 inch/minute)<br>Condition 18/25/50+5/70: T—23/50 | ASTM D638<br><br><br><br>ASTM D618 | 17.24<br>(2,500 psi) |
| Styrene content[a] (%, by weight) | ASTM D2369 | 40–50 |
| Silane coupler (%, min, by weight of polyester resin binder) | -- | 1.0 |
| PCC saturated surface-dry bond strength at 24 hours and 70 ± 2 °F (psi, min) | California Test 551 | 500 |
| Static volatile emissions[a] (g/sq m, max) | South Coast Air Quality Management District, Method 309-91[b] | 60 |

[a]Perform the test before adding initiator.
[b]For the test method, go to:
http://www.aqmd.gov/

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 sections 90-1.02C(1), 90-1.02C(2), and 90-1.02C(3).

When tested under California Test 202, the combined aggregate grading must comply with one of the gradations in the following table:

**Combined Aggregate Grading**

| Sieve size | Percentage passing | | |
|---|---|---|---|
| | A | B | C |
| 1/2" | 100 | 100 | 100 |
| 3/8" | 83–100 | 100 | 100 |
| No. 4 | 65–82 | 62–85 | 45–80 |
| No. 8 | 45–64 | 45–67 | 35–67 |
| No. 16 | 27–48 | 29–50 | 25–50 |
| No. 30 | 12–30 | 16–36 | 15–36 |
| No. 50 | 6–17 | 5–20 | 5–20 |
| No. 100 | 0–7 | 0–7 | 0–9 |
| No. 200 | 0–3 | 0–3 | 0–6 |

Aggregate retained on the no. 8 sieve must have a maximum of 45 percent crushed particles under California Test 205. Fine aggregate must be natural sand.

The weighted average absorption must not exceed 1 percent when tested under California Tests 206 and 207.

You may submit an alternative grading or request to use manufactured sand as fine aggregate but 100 percent of the combined grading must pass the 3/8 inch sieve. Allow 21 days for authorization.

Polyester concrete must have a minimum compressive strength of 1250 psi at 3 hours and 30 minutes under California Test 551 or ASTM C109.

### 41-1.02D Bonding Agent

Bonding agent must comply with the concrete manufacturer's recommendations.

### 41-1.02E Temporary Pavement Structure

Temporary pavement structure consists of RSC or aggregate base with HMA. RSC not conforming to the specifications may serve as temporary pavement structure if:

1. The modulus of rupture is at least 200 psi before opening to traffic
2. RSC thickness is greater than or equal to the existing concrete pavement surface layer
3. RSC is replaced during the next paving shift

Aggregate base for temporary pavement structure must comply with the 3/4-inch maximum grading specified in section 26-1.02B.

HMA must comply with the specifications for minor HMA in section 39.

### 41-1.02F Reserved

## 41-1.03 CONSTRUCTION

### 41-1.03A General

Repair only the portion of pavement where the work will be completed during the same lane closure. If removal is required, remove only the portion of pavement where the repair will be completed during the same traffic closure. Completion of concrete repair includes curing until the concrete attains the specified minimum properties required before opening the repaired pavement to traffic.

If you fail to complete the concrete pavement repair during the same lane closure, construct temporary pavement before opening the lane to traffic.

Before starting repair work except saw cutting, the equipment, materials, and personnel for constructing temporary pavement structure must be at the job site or an approved location. If HMA can be delivered to the job site within 1 hour, you may request 1-hour delivery as an alternative to having the HMA at the job site.

Maintain the temporary pavement structure and replace it as a first order of work as soon as you resume concrete pavement repair work.

After removing temporary pavement structure, you may stockpile that aggregate base at the job site and reuse it for temporary pavement structure.

### 41-1.03B Mixing and Applying Bonding Agent

Mix and apply the bonding agent at the job site under the manufacturer's instructions and in small quantities.

Apply bonding agent after cleaning the surface and before placing concrete.

Apply a thin, even coat of bonding agent with a stiff bristle brush until the entire repair surface is scrubbed and coated with bonding agent.

### 41-1.03C Mixing Concrete

#### 41-1.03C(1) General

Mix concrete in compliance with the manufacturer's instructions. For repairing spalls, mix in a small mobile drum or paddle mixer. Comply with the manufacturer’s recommended limits for the quantity of aggregate filler, water, and liquid activator.

Mix the entire contents of prepackaged dual-component magnesium phosphate concrete as supplied by the manufacturer. Use the full amount of each component and do not add water to dual-component magnesium phosphate concrete.

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

Modified high-alumina based concrete must not be mixed in containers or worked with tools containing aluminum.

#### 41-1.03C(2) Polyester Concrete

When mixing with resin, the moisture content of the combined aggregate must not exceed 1/2 of the average aggregate absorption when tested under California Test 226.

Proportion the polyester resin and aggregate to produce a mixture with suitable workability for the intended work. Only a minimal amount of resin may rise to the surface after finishing.

### 41-1.03D Placing Concrete

The pavement surface temperature must be at least 40 degrees F before placing concrete. You may propose methods to heat the surfaces.

Place magnesium phosphate concrete on a dry surface.

Place portland cement and modified high-alumina concrete on surfaces treated with a bonding agent recommended by the concrete manufacturer. If no bonding agent is recommended by the manufacturer, place concrete on damp surfaces that are not saturated.

Do not retemper concrete. Use dry finishing tools cleaned with water before working the concrete.

### 41-1.03E Curing Concrete

Cure concrete under the manufacturer's instructions. When curing compound is used, comply with section 90-1.03B for curing compound no. 1 or 2.

### 41-1.03F Reserved

### 41-1.04 PAYMENT

Not Used

## 41-2 SUBSEALING AND JACKING

### 41-2.01 GENERAL

#### 41-2.01A Summary

Section 41-2 includes specifications for filling voids under existing concrete pavement.

### 41-2.01B Definitions

Reserved

### 41-2.01C Submittals

Submit shipping invoices with packaged or bulk fly ash and cement.

Before grouting activities begin, submit a proposal for the materials to be used. Include authorized laboratory test data for the grout indicating:

1. Time of initial setting under ASTM C266.
2. Compressive strength results at 1, 3, and 7 days for 10, 12, and 14-second grout efflux times.

If requesting a substitution of grout materials, submit a proposal that includes test data.

### 41-2.01D Quality Control and Assurance

Reserved

## 41-2.02 MATERIALS

### 41-2.02A General

Reserved

### 41-2.02B Grout

Grout must consist of Type II portland cement, fly ash, and water. Use from 2.4 to 2.7 parts fly ash to 1 part portland cement by weight. Use enough water to produce the following grout efflux times determined under California Test 541, Part D:

1. From 10 to 16 seconds for subsealing
2. From 10 to 26 seconds for jacking

Cement for grout must comply with the specifications for Type II portland cement in section 90-1.02B(2).

Fly ash must comply with AASHTO M 295, Class C or Class F. Fly ash sources must be on the Authorized Material List.

You may use chemical admixtures and calcium chloride. Chemical admixtures must comply with section 90-1.02E(2). Calcium chloride must comply with ASTM D98.

Test grout compressive strength under California Test 551, Part 1 at 7-days with 12 seconds efflux time. Follow the procedures for moist cure. The 7-day compressive strength must be at least 750 psi.

### 41-2.02C Mortar

Mortar must be a prepackaged fast-setting mortar that complies with ASTM C928.

### 41-2.02D Reserved

## 41-2.03 CONSTRUCTION

### 41-2.03A General

Drill holes in the pavement, inject grout, plug the holes, and finish the holes with mortar.

Drill holes through the pavement and underlying base to a depth from 15 to 18 inches below the pavement surface. The hole diameter must match the fitting for the grout injecting equipment.

### 41-2.03B Injecting Grout

#### 41-2.03B(1) General

Inject grout within 2 days of drilling holes.

Immediately before injecting grout, clean the drilled holes with water at a minimum pressure of 40 psi. The cleaning device must have at least 4 jets that direct water horizontally at the slab-base interface.

Do not inject grout if the atmospheric or subgrade temperature is below 40 degrees F. Do not inject grout in inclement weather. If water is present in the holes, obtain the Engineer's authorization before injecting grout.

Do not inject grout until at least 2 consecutive slabs requiring subsealing are drilled ahead of the grouting activities.

The grout plant must have a positive displacement cement injection pump and a high-speed colloidal mixer capable of operating from 800 to 2,000 rpm. The injection pump must sustain 150 psi if pumping grout with a 12-second efflux time. A pressure gauge must be located immediately adjacent to the supply valve of the grout hose supply valve and positioned for easy monitoring.

Before mixing, weigh dry cement and fly ash if delivered in bulk. If the materials are packaged, each container must weigh the same.

Introduce water to the mixer through a meter or scale.

Inject grout under pressure until the voids under the pavement slab are filled. The injection nozzle must not leak. Do not inject grout if the nozzle is below the bottom of the slab. Inject grout 1 hole at a time.

Stop injecting grout in a hole if either:

1. Grout does not flow under a sustained pump gauge pressure of 150 psi after 7 seconds and there is no indication the slab is moving.
2. Injected grout rises to the surface at any joint or crack, or flows into an adjacent hole.

Dispose of unused grout within 1 hour of mixing.

### 41-2.03B(2) Subsealing

If a slab raises more than 1/16 inch due to grout injection, stop injecting grout in that hole.

### 41-2.03B(3) Jacking

The positive displacement pump used for grout injection must be able to provide a sustained gauge pressure of 200 psi. Gauge pressures may be from 200 to 600 psi for brief periods to start slab movement.

You may add additional water to initiate pressure injection of grout. Do not reduce the grout efflux time below 10 seconds.

Raise the slabs uniformly. Use string lines to monitor the pavement movement.

Do not move adjacent slabs not specified for pavement jacking. If you move adjacent slabs, correct the grade within the tolerances for final pavement elevation.

### 41-2.03B(4) Finishing

Immediately after removing the injection nozzle, plug the hole with a round, tapered wooden plug. Do not remove plugs until adjacent holes are injected with grout and no grout surfaces through previously injected holes.

After grouting, remove grout from drilled holes at least 4 inches below the pavement surface. Clean holes and fill with mortar. Finish filled holes flush with the pavement surface.

### 41-2.03B(5) Tolerances

The final pavement elevation must be within 0.01 foot of the required grade. If the final pavement elevation is between 0.01 and 0.10 foot higher than the required grade, grind the noncompliant pavement surface under section 42 to within 0.01 foot of the required grade.

If the final pavement elevation is higher than 0.10 foot from the required grade, remove and replace the noncompliant pavement under section 41-9.

## 41-2.04 PAYMENT

The payment quantity for subsealing is calculated by adding the dry weight of cement and fly ash used for the placed grout. The payment quantity for jacking is calculated by adding the dry weight of cement and fly ash used for the placed grout.

The Department does not pay for wasted grout.

The Department does not adjust the unit price for an increase or decrease in the subsealing quantity.

The Department does not adjust the unit price for an increase or decrease in the jacking quantity.

## 41-3 CRACK TREATMENT

### 41-3.01 GENERAL

#### 41-3.01A Summary

Section 41-3 includes specifications for applying high-molecular-weight methacrylate (HMWM) to concrete pavement surface cracks that do not extend the full slab depth.

#### 41-3.01B Definitions

Reserved

#### 41-3.01C Submittals

#### 41-3.01C(1) General

Submit HMWM samples 20 days before use.

If sealant is to be removed, submit the proposed removal method at least 7 days before sealant removal. Do not remove sealant until the proposed sealant removal method is authorized.

#### 41-3.01C(2) Public Safety and Placement Plans

Before starting crack treatment, submit a public safety plan for HMWM and a placement plan for construction activity as shop drawings.

The public safety and placement plans must identify the materials, equipment, and methods to be used.

In the public safety plan, include the MSDS for each component of HMWM and details for:

1. Shipping
2. Storage
3. Handling
4. Disposal of residual HMWM and containers

If the project is in an urban area adjacent to a school or residence, the public safety plan must also include an airborne emissions monitoring plan prepared by a CIH certified in comprehensive practice by the American Board of Industrial Hygiene. Submit a copy of the CIH's certification. The CIH must monitor the emissions at a minimum of 4 points including the mixing point, the application point, and the point of nearest public contact. At work completion, submit a report by the industrial hygienist with results of the airborne emissions monitoring plan.

The placement plan must include:

1. Crack treatment schedule including coefficient of friction testing
2. Methods and materials including:
    - 2.1. Description of equipment for applying HMWM
    - 2.2. Description of equipment for applying sand
    - 2.3. Gel time range and final cure time for resin

Revise rejected plans and resubmit. With each plan rejection, the Engineer gives revision directions including detailed comments in writing. The Engineer notifies you of a plan's acceptance or rejection within 2 weeks of receiving that plan.

#### 41-3.01C(3) Reserved

#### 41-3.01D Quality Control and Assurance

#### 41-3.01D(1) General

Use test tiles to evaluate the HMWM cure time. Coat at least one 4 by 4 inch smooth glazed tile for each batch of HMWM. Place the coated tile adjacent to the area being treated. Do not apply sand to the test tiles.

Use the same type of crack treatment equipment for testing and production.

### 41-3.01D(2) Test Area

Before starting crack treatment, treat a test area of at least 500 square feet within the project limits at a location accepted by the Engineer. Use test areas outside the traveled way if available.

Treat the test area under weather and pavement conditions similar to those expected during crack treatment production.

The Engineer evaluates the test area based on the acceptance criteria. Do not begin crack treatment until the Engineer accepts the test area.

### 41-3.01D(3) Reserved

### 41-3.01D(4) Acceptance Criteria

The Engineer accepts a treated area if:

1. Corresponding test tiles are dry to the touch
2. Treated surface is tack-free and not oily
3. Sand cover adheres enough to resist hand brushing
4. Excess sand is removed
5. Coefficient of friction is at least 0.30 when tested under California Test 342

## 41-3.02 MATERIALS

HMWM consists of compatible resin, promoter, and initiator. HMWM resin may be prepromoted by mixing promoter and resin together before filling containers. Identify prepromoted resin on the container label.

Adjust the gel time to compensate for temperature changes throughout the application.

HMWM resin properties must have the following values:

| Property | Test method | Value |
|---|---|---|
| Viscosity [a] (cP, max, Brookfield RVT with UL adapter, 50 RPM at 77 °F) | ASTM D2196 | 25 |
| Specific gravity[a] (min, at 77 °F) | ASTM D1475 | 0.90 |
| Flash point [a] (°F, min) | ASTM D3278 | 180 |
| Vapor pressure[a] (mm Hg, max, at 77 °F) | ASTM D323 | 1.0 |
| Tack-free time (minutes, max, at 77 °F) | Specimen prepared under California Test 551 | 400 |
| Volatile content[a] (%, max) | ASTM D2369 | 30 |
| PCC saturated surface-dry bond strength (psi, min, at 24 hours and 77 ± 2 °F) | California Test 551 | 500 |

[a]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

#### 41-4.01A Summary

Section 41-4 includes specifications for repairing spalls in concrete pavement.

#### 41-4.01B Definitions

Reserved

#### 41-4.01C Submittals

Reserved

#### 41-4.01D Quality Control and Assurance

The Engineer accepts spall repairs based on authorized dimensions and visual inspection.

### 41-4.02 MATERIALS

Bonding agent must comply with the requirements for HMWM in section 41-3.02 except the tack-free time requirements do not apply and the HMWM must not contain wax.

Caulk must be at least 50 percent silicone, designated as a concrete sealant, and comply with ASTM C834.

Form board must be single-wall, double-face corrugated cardboard or paperboard covered with a bond breaker on each face. For existing joints or cracks less than 45 mils wide, use paperboard.

## 41-4.03 CONSTRUCTION

### 41-4.03A General

Prepare spall areas by removing concrete and cleaning. Provide compression relief at joints and cracks by using a form board or saw cutting.

Repair spalls using polyester concrete with a bonding agent.

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 Compression Relief at Joints and Cracks

#### 41-4.03D(1) Form Board Installation

Before placing concrete, place the form board to match the existing joint or crack alignment and width. Extend the form board at least 3 inches beyond each end of the repair and at least 1 inch deeper than the repair.

After placing concrete, remove the form board before sealing joints or cracks.

#### 41-4.03D(2) Saw Cut Method

After cleaning, seal the existing joint or crack and any other exposed cracks with caulk at the bottom and sides of the repair area. Any surface receiving caulk must be clean and dry. Place caulk a minimum of 1/2 inch beyond the edges of the repair area into the existing joint or crack.

Saw cut the polyester concrete to the full depth along the existing joint or crack alignment within 2 hours from time of final setting. Use a power-driven saw with a diamond blade.

### 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 General

Reserved

#### 41-6.03B 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.

#### 41-6.03C 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.
2. Vibratory pad-foot roller exerting a dynamic centrifugal force of at least 10 tons.

A pass is 1 movement of a roller in either direction at 5 mph or less.

After all segments have been seated, clean loose debris from joints and cracks using compressed air free of moisture and oil.

Reseat any segment of cracked pavement that has not been overlaid within 24 hours of seating.

#### 41-6.03D 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.
2. Remove all loose debris and sweep the pavement.

#### 41-6.03E Reserved

### 41-6.04 PAYMENT

Crack and seat existing concrete pavement is measured from the area of pavement cracked and seated. No deduction is made for existing cracked segments. The Department does not pay for HMA used to fill joints, cracks, and spalls.

## 41-7 TRANSITION TAPER

### 41-7.01 GENERAL

Section 41-7 includes specifications for constructing transition tapers in existing pavement.

### 41-7.02 MATERIALS

Not Used

### 41-7.03 CONSTRUCTION

Construct transition tapers by either grinding or removing and replacing the existing concrete. Do not allow flying debris during the construction of tapers.

Grinding must comply with section 42.

Replacement concrete must comply with section 41-9 except place concrete to the taper level shown and finish the surface with a coarse broom.

If the transition taper will be overlaid with HMA that is not placed before opening to traffic and there is a grade difference of more than 0.04 foot, construct a temporary taper by placing minor HMA that complies with section 39. Remove the temporary HMA taper before constructing the transition taper.

### 41-7.04 PAYMENT

Pavement transition tapers are measured using the dimensions shown. The Department does not pay for temporary HMA tapers.

## 41-8 DOWEL BAR RETROFIT

Reserved

## 41-9 INDIVIDUAL SLAB REPLACEMENT WITH RAPID STRENGTH CONCRETE

### 41-9.01 GENERAL

#### 41-9.01A Summary

Section 41-9 includes specifications for removing existing concrete pavement and constructing individual slab replacement with rapid strength concrete (ISR—RSC).

#### 41-9.01B Definitions

**concrete raveling:** Disintegration of the concrete surface layer from aggregate loss.

**early age:** Any age less than 10 times the time of final setting for concrete determined under ASTM C403/C403M.

**full-depth crack:** Crack that runs from one edge of the concrete slab to the opposite or adjacent side of the slab.

**opening age:** Age when the minimum modulus of rupture specified for opening to traffic and equipment is attained.

**time of final setting:** Elapsed time required to develop a concrete penetration resistance that is at least 4,000 psi under ASTM C403/C403M.

#### 41-9.01C Submittals

##### 41-9.01C(1) General

At least 15 days before delivery to the job site, submit manufacturer's recommendations, MSDS and instructions for storage and installation of joint filler material.

At least 45 days before starting ISR—RSC work submit a sample of cement from each proposed lot and samples of proposed admixtures in the quantities ordered by the Engineer.

During ISR—RSC placement operations, submit uniformity reports for hydraulic cement at least once every 30 days to the Engineer and METS, attention Cement Laboratory. Uniformity reports must comply with ASTM C917 except testing age and water content may be modified to suit the particular material.

Except for modulus of rupture tests, submit QC test result forms within 48 hours of the paving shift. Submit modulus of rupture results within:

1. 15 minutes of opening age test completion
2. 24 hours of 3-day test completion

##### 41-9.01C(2) Quality Control Plan

If the quantity of ISR—RSC is at least 300 cu yd, submit a QC plan at least 20 days before placing trial slabs. If the quantity of ISR—RSC is less than 300 cu yd, submit proposed forms for RSC inspection, sampling, and testing.

##### 41-9.01C(3) Mix Design

At least 10 days before use in a trial slab, submit a mix design. The maximum ambient temperature range for a mix design is 18 degrees F. Submit more than 1 mix design based on ambient temperature variations anticipated during RSC placement. Each mix design must include:

1. Mix design identification number

2. Aggregate source
3. Opening age
4. Aggregate gradation
5. Types of cement and chemical admixtures
6. Mix proportions
7. Maximum time allowed between batching and placing
8. Range of effective ambient temperatures
9. Time of final setting
10. Modulus of rupture development data from laboratory-prepared samples, including tests at:
    10.1. 1 hour before opening age
    10.2. Opening age
    10.3. 1 hour after opening age
    10.4. 1 day
    10.5. 3 days
    10.6. 7 days
    10.7. 28 days
11. Shrinkage test data
12. Any special instructions or conditions such as water temperature requirements

### 41-9.01C(4) Reserved

### 41-9.01D Quality Control and Assurance

### 41-9.01D(1) General

Designate a QC manager and assistant QC managers to administer the QC plan. The QC managers must hold current American Concrete Institute (ACI) certification as a Concrete Field Testing Technician-Grade I and a Concrete Laboratory Testing Technician-Grade II, except the assistant QC managers may hold Concrete Laboratory Testing Technician-Grade I instead of Grade II.

The QC manager responsible for the production period involved must review and sign the sampling, inspection, and test reports before submitting them. The QC manager must be present for:

1. Each stage of mix design
2. Trial slab construction
3. Production and construction of RSC
4. Meetings with the Engineer relating to production, placement, or testing

The QC manager must not be a member of this project's production or paving crews, an inspector, or a tester. The QC manager must have no duties during the production and placement of RSC except those specified.

Testing laboratories and equipment must comply with the Department's Independent Assurance Program. At the time of the QC plan submittal, the Department evaluates the quality control samplers and testers.

### 41-9.01D(2) Just-in-time Training

Reserved

### 41-9.01D(3) Quality Control Plan

Establish, implement, and maintain a QC plan for pavement. The QC plan must describe the organization and procedures used to:

1. Control the production process
2. Determine if a change to the production process is needed
3. Implement a change

The QC plan must include:

1. Names, qualifications, and certifications of QC personnel, including:
    1.1. QC manager
    1.2. Assistant QC managers
    1.3. Samplers and testers
2. Outline of procedure for the production, transportation, placement, and finishing of RSC

3. Outline of procedure and forms for concrete QC, sampling, and testing to be performed during and after RSC construction, including testing frequencies for modulus of rupture
4. Contingency plan for identifying and correcting problems in production, transportation, placement, or finishing RSC including:
    - 4.1. Action limits
    - 4.2. Suspension limits that do not exceed specified material requirements
    - 4.3. Detailed corrective action if limits are exceeded
    - 4.4. Temporary pavement structure provisions, including:
        - 4.4.1. The quantity and location of standby material
        - 4.4.2. Determination of need
5. Location of your quality control testing laboratory and testing equipment during and after paving operations
6. List of the testing equipment to be used, including the date of last calibration
7. Production target values for material properties that impact concrete quality or strength including cleanness value and sand equivalent
8. Outline procedure for placing and testing trial slabs, including:
    - 8.1. Locations and times
    - 8.2. Production procedures
    - 8.3. Placing and finishing methods
    - 8.4. Sampling methods, sample curing, and sample transportation
    - 8.5. Testing and test result reporting
9. Name of source plant with approved Material Plant Quality Program (MPQP)
10. Procedures or methods for controlling pavement quality including:
    - 10.1. Materials quality
    - 10.2. Contraction and construction joints
    - 10.3. Protecting pavement before opening to traffic

**41-9.01D(4) Prepaving Conference**

Schedule a prepaving conference and provide a facility to meet with the Engineer.

Prepaving conference attendees must sign an attendance sheet provided by the Engineer. The prepaving conference must be attended by your:

1. Project superintendent
2. Project manager
3. QC manager
4. Workers and your subcontractor's workers, including:
    - 4.1. Foremen
    - 4.2. Concrete plant manager
    - 4.3. Concrete plant operator
    - 4.4. Concrete plant inspectors
    - 4.5. Personnel performing saw cutting and joint sealing
    - 4.6. Paving machine operators
    - 4.7. Inspectors
    - 4.8. Samplers
    - 4.9. Testers

The purpose of the prepaving conference is to familiarize personnel with the project's specifications. Discuss the QC plan and processes for constructing each item of work, including:

1. Production
2. Transportation
3. Trial slabs
4. Pavement structure removal
5. Placement
6. Contingency plan
7. Sampling
8. Testing
9. Acceptance

Do not start trial slabs or paving activities until the listed personnel have attended the prepaving conference.

### 41-9.01D(5) Trial Slabs

Before starting individual slab replacement work, complete 1 trial slab for each mix design.

Place trial slabs near the job site at a mutually-agreed location that is neither on the roadway nor within the project limits. Trial slabs must be 10 by 20 feet and at least 10 inches thick.

During trial slab construction, sample and split the aggregate for grading, cleanness value, and sand equivalent testing.

Fabricate and test beams under California Test 524 to determine the modulus of rupture values.

Cure beams fabricated for early age testing such that the monitored temperatures in the beams and the slab are always within 5 degrees F of each other.

Monitor and record the internal temperatures of trial slabs and early age beams at intervals of at least 5 minutes. Install thermocouples or thermistors connected to strip-chart recorders or digital data loggers to monitor the temperatures. Temperature recording devices must be accurate to within 2 degrees F. Measure internal temperatures at 1 inch from the top, 1 inch from the bottom, and no closer than 3 inches from any edge until early age testing is completed.

Cure beams fabricated for 3-day testing under California Test 524 except place them into sand at a time that is from 5 to 10 times the time of final setting measured under ASTM C403/403M or 24 hours, whichever is earlier.

Trial slabs must have an opening age modulus of rupture of not less than 400 psi and a 3-day modulus of rupture of not less than 600 psi.

After authorization, remove and dispose of trial slabs and testing materials.

### 41-9.01D(6) Quality Control Testing

#### 41-9.01D(6)(a) General

Provide continuous process control and quality control sampling and testing throughout RSC production and placement. Notify the Engineer at least 2 business days notice before any sampling and testing. Establish a testing facility at the job site or at an authorized location.

Sample under California Test 125.

During ISR—RSC placement, sample and fabricate beams for modulus of rupture testing within the first 30 cubic yards, at least once every 130 cu yd, and within the final truckload. Submit split samples and fabricate test beams for the Department’s testing unless the Engineer informs you otherwise.

Determine the modulus of rupture at opening age under California Test 524, except beam specimens may be fabricated using an internal vibrator under ASTM C31. Cure beams under the same conditions as the pavement until 1 hour before testing. Test 3 beam specimens in the presence of the Engineer and average the results. A single test represents no more than that day's production or 130 cu yd, whichever is less.

Determine the modulus of rupture at other ages using beams cured and tested under California Test 524 except place them in sand from 5 to 10 times the time of final setting under ASTM C403/C403M or 24 hours, whichever is earlier.

#### 41-9.01D(6)(b) Rapid Strength Concrete

Your quality control must include testing RSC for the properties at the frequencies shown in the following table:

**RSC Minimum Quality Control**

| Property | Test method | Minimum testing frequency[a] |
|---|---|---|
| Cleanness value | California Test 227 | 650 cu yd or 1 per shift |
| Sand equivalent | California Test 217 | 650 cu yd or 1 per shift |
| Aggregate gradation | California Test 202 | 650 cu yd or 1 per shift |
| Air content | California Test 504 | 130 cu yd or 2 per shift |
| Yield | California Test 518 | 2 per shift |
| Slump or penetration | ASTM C143 or California Test 533 | 1 per 2 hours of paving |
| Unit weight | California Test 518 | 650 cubic yards or 2 per shift |
| Aggregate Moisture Meter Calibration[b] | California Test 223 or California Test 226 | 1 per shift |
| Modulus of rupture | California Test 524 | Comply with section 41-9.01D(6)(a) |

[a]Test at the most frequent interval.
[b]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 ±1.0 percent and the suspension limit is ±1.5 percent of the specified values. If no value is specified, apply the air content value used in the approved mix design.

As a minimum, a process is out of control if any of the following occurs:

1. For fine and coarse aggregate gradation, 2 consecutive running averages of 4 tests are outside the specification limits
2. For individual penetration or air content measurements:
   2.1. One point falls outside the suspension limit line
   2.2. Two points in a row fall outside the action limit line

Stop production and take corrective action for out of control processes or the Engineer rejects subsequent RSC.

Before each day's concrete pavement placement and at intervals not to exceed 4 hours of production, use a tachometer to test and record vibration frequency for concrete consolidation vibrators.

### 41-9.01D(6)(c) Reserved

### 41-9.01D(7) Acceptance Criteria

### 41-9.01D(7)(a) General

The final texture of ISR—RSC must pass visual inspection and have a coefficient of friction of at least 0.30 determined under California Test 342.

Allow at least 25 days for the Department to schedule testing for coefficient of friction. Notify the Engineer when the pavement is scheduled to be opened to traffic.

### 41-9.01D(7)(b) Modulus of Rupture

ISR—RSC is accepted based on your testing for modulus of rupture at opening age and the Department's testing for modulus of rupture at 3 days.

ISR—RSC must have a modulus of rupture at opening age that is at least 400 psi and a modulus of rupture at 3 days that is at least 600 psi.

Calculate the test result as the average from testing 3 beams for each sample. The test result represents 1 paving shift or 130 cu yd, whichever is less.

### 41-9.01D(7)(c) Concrete Pavement Smoothness

The Department tests for concrete pavement smoothness using a 12-foot straightedge. Straightedge smoothness specifications do not apply to the pavement surface placed within 12 inches of existing concrete pavement except parallel to the centerline at the midpoint of a transverse construction joint.

The concrete pavement surface must not vary from the lower edge of a 12-foot straightedge by more than:

1. 0.01 feet when parallel to the centerline
2. 0.02 feet when perpendicular to the centerline extending from edge to edge of a traffic lane

### 41-9.01D(7)(d) Cracking and Raveling

The Engineer rejects an ISR—RSC slab under section 6-3.06 if within 1 year of contract acceptance there is either:

1. Partial or full-depth cracking
2. Concrete raveling consisting of either:
   - 2.1. Combined raveled areas more than 5 percent of each ISR—RSC slab area
   - 2.2. Any single raveled area of more than 4 sq ft

### 41-9.01D(8) Reserved

## 41-9.02 MATERIALS

### 41-9.02A General

Reserved

### 41-9.02B Rapid Strength Concrete

RSC for ISR—RSC must comply with section 90-3.

Use either the 1-1/2 inch maximum or the 1-inch maximum combined grading specified in section 90-1.02C(4)(d).

Air content must comply with the minimum requirements in section 40-1.02B(4).

### 41-9.02C–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 Placing 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 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.

### 41-9.03E Joints

#### 41-9.03E(1) General

Joints must be vertical.

#### 41-9.03E(2) Construction Joints

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.

#### 41-9.03E(3) Contraction Joints

Saw contraction joints before cracking occurs and after the RSC is hard enough to saw without spalling, raveling, or tearing. Cut contraction joints to a minimum of 1/3 the slab depth. Use a power-driven saw with a diamond blade.

Match transverse contraction joints with existing joint spacing and skew unless otherwise described. Where the existing transverse joint spacing in an adjacent lane exceeds 15 feet, construct an additional transverse contraction joint midway between the existing joints.

Cut transverse contraction joints across the full slab replacement width. After cutting, immediately wash slurry from the joint with water at less than 100 psi pressure.

Longitudinal contraction joints must be parallel with the concrete pavement centerline, except when lanes converge or diverge. Transverse and longitudinal contraction joints must not deviate by more than 0.1 foot from either side of a 12-foot straight line. For longitudinal joints parallel to a curved centerline radius less than 7000 feet, compensate for curvature.

Keep joints free from foreign material including soil, gravel, concrete, and asphalt.

### 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–41-9.03K Reserved

## 41-9.04 PAYMENT

Replace base is not included in the payment for individual slab replacement (RSC).

Drill and bond dowel bars are not included in payment for individual slab replacement (RSC).

For individual slab replacement (RSC) with a modulus of rupture at opening age that is at least 400 psi and a modulus of rupture at 3 days that is greater than or equal to 500 psi but less than 550 psi, the Department deducts 10 percent of the payment for individual slab replacement (RSC).

For individual slab replacement (RSC) with a modulus of rupture at opening age that is at least 400 psi and a modulus of rupture at 3 days that is greater than or equal to 550 psi but less than 600 psi, the Department deducts 5 percent of the payment for individual slab replacement (RSC).

## 41-10 DRILL AND BOND BARS

### 41-10.01 GENERAL

#### 41-10.01A Summary

Section 41-10 includes specifications for drilling, installing, and bonding tie bars and dowel bars in concrete pavement.

#### 41-10.01B Definitions

Reserved

#### 41-10.01C Submittals

Submit a certificate of compliance for:

1. Tie bars
2. Dowel bars
3. Dowel bar lubricant
4. Chemical adhesive
5. Epoxy powder coating

At least 15 days before delivery to the job site, submit the manufacturer's recommendations and instructions for storage, handling, and use of chemical adhesive.

#### 41-10.01D Quality Control and Assurance

##### 41-10.01D(1) General

Drill and bond bar is accepted based on inspection before concrete placement.

##### 41-10.01D(2) Reserved

### 41-10.02 MATERIALS

#### 41-10.02A General

Dowel bar lubricant must comply with section 40-1.02D.

Chemical adhesive for drilling and bonding bars must be on the Authorized Material List. The Authorized Material List indicates the appropriate chemical adhesive system for concrete temperature and installation conditions.

Each chemical adhesive system container must clearly and permanently show the following:

1. Manufacturer's name
2. Model number of the system
3. Manufacture date
4. Batch number
5. Expiration date
6. Current International Conference of Building Officials Evaluation Report number
7. Directions for use
8. Storage requirement
9. Warnings or precautions required by state and federal laws and regulations

#### 41-10.02B Reserved

### 41-10.03 CONSTRUCTION

#### 41-10.03A General

Drill holes for bars. Clean drilled holes in compliance with the chemical adhesive manufacturer’s instructions. Holes must be dry at the time of placing the chemical adhesive and bars. Use a grout

retention ring when drilling and bonding dowel bars. Immediately after inserting the bar into the chemical adhesive, support the bar to prevent movement until chemical adhesive has cured the minimum time recommended by the manufacturer.

Apply dowel bar lubricant to the entire exposed portion of the dowel bar.

If the Engineer rejects a bar installation stop paving, drilling, and bonding activities. Adjust your procedures and obtain the Engineer's verbal authorization before resuming paving, drilling, and bonding.

Cut the rejected bar flush with the pavement joint surface and coat the exposed end of the bar with chemical adhesive. Offset the new hole 3 inches horizontally from the rejected hole's center.

**41-10.03B Tie Bar Tolerance**

Place tie bars within the tolerances shown in the following table:

**Tie Bar Tolerances**

| Dimension | Tolerance |
|---|---|
| Horizontal skew (horizontal skew: bar length) | 1:6 |
| Vertical skew (vertical skew: bar length) | 1:6 |
| Longitudinal translation (inch) | ±1 |
| Horizontal offset (embedment, inch) | ±1 |
| Height relative to the adjacent bar | ±1 |
| Vertical Depth (clearance from the pavement surface or bottom, inches, min) | 3 |

**41-10.03C Dowel Bar Tolerance**

Place dowel bars within the tolerances specified in section 40-1.01D(7)(b)(v).

**41-10.03D Reserved**

**41-10.04 PAYMENT**

Not Used

**41-11–41-15 RESERVED**

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## 42 GROOVE AND GRIND CONCRETE

07-19-13

**Replace the paragraph of section 42-1.01A with:**

07-19-13

Section 42-1 includes general specifications for grooving and grinding concrete.

**Replace the headings and paragraphs in section 42-3 with:**

07-19-13

**42-3.01 GENERAL**

**42-3.01A Summary**

Section 42-3 includes specifications for grinding the surfaces of pavement, bridge decks, and approach slabs.

**42-3.01B Definitions**

Reserved

### 42-3.01C Submittals

Reserved

### 42-3.01D Quality Control and Assurance

Reserved

## 42-3.02 MATERIALS

Not Used

## 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.

**Add to section 42:**

07-19-13

**42-4–42-9 RESERVED**

^^^

**Add to section 46-1.02:**

07-19-13

**46-1.02C Grout**

Grout must consist of cement and water and may contain an admixture if authorized. Cement must comply with section 90-1.02B(2). Water must comply with section 90-1.02D. Admixtures must comply with section 90, except they must not contain chloride ions in excess of 0.25 percent by weight. Do not exceed 5 gallons of water per 94 lb of cement.

Mix the grout as follows:

1. Add water to the mixer followed by cement and any admixtures or fine aggregate.
2. Mix the grout with mechanical mixing equipment that produces a uniform and thoroughly mixed grout.
3. Agitate the grout continuously until the grout is pumped.
4. Do not add water after the initial mixing.

**Add to section 46-1.03B:**

04-20-12

Dispose of drill cuttings under section 19-2.03B.

**Add to the end of section 46-1.03C:**

07-19-13

Grouting equipment must be:

1. Capable of grouting at a pressure of at least 100 psi
2. Equipped with a pressure gage having a full-scale reading of not more than 300 psi

07-19-13

**Delete the 3rd paragraph of section 46-2.01A.**

**Add to the beginning of section 46-2.01C:**

07-19-13

Submittals for strand tendons, bar tendons, bar couplers, and anchorage assemblies must comply with section 50-1.01C.

**Replace the 1st sentence of the 1st paragraph in section 46-2.01D(2)(a) with:**

10-30-15

Performance test ground anchors as described.

**Replace the 1st sentence of the 1st paragraph in section 46-2.01D(2)(c) with:**

10-30-15

Ground anchors that are performance- or proof-tested must comply with the following:

**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 3rd paragraph in section 46-2.03A with:**

10-30-15

Sheathe the tendons in the unbonded length with smooth plastic sheathing that extends into the steel tube of the permanent anchorage assembly. Sheathe the tendons full length with corrugated plastic sheathing.

**Replace the 7th paragraph in section 46-2.03A with:**

10-30-15

Drill the holes for ground anchors in the foundation material deep enough to provide the necessary bonded length beyond the minimum unbonded length shown.

**Add between the 13th and 14th paragraphs of section 46-2.03A:**

07-19-13

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.

**Add between the 1st and 2nd paragraphs of section 46-2.03D:**

07-19-13

Secure the ends of strand tendons with a permanent type anchorage system that:

1. Holds the prestressing steel at a force producing a stress of at least 95 percent of the specified ultimate tensile strength of the steel
2. Permanently secures the ends of the prestressing steel

**Replace the 2nd sentence of the 1st paragraph of section 46-3.02A with:**

07-19-13

The epoxy-coated prefabricated reinforcing bar must comply with section 52-2.03, except the epoxy thickness must be from 10 to 12 mils.

**Replace the 2nd paragraph of section 46-3.02B with:**

07-19-13

Concrete anchors on bearing plates must comply with the specifications for studs in clause 7 of AWS D1.1.

07-19-13

**Delete the 1st paragraph of section 46-3.02E.**

^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

# 47 EARTH RETAINING SYSTEMS

07-18-14

**Replace the 2nd paragraph of section 47-2.01D with:**

02-17-12

Coupler test samples must comply with minimum tensile specifications for steel wire in ASTM A 82/A 82M. Total wire slip must be at most 3/16 inch when tested under the specifications for tension testing of round wire test samples in ASTM A 370.

**Replace "78-80" in the 1st table in the 2nd paragraph of section 47-2.02C with:**

10-19-12

78-100

**Replace the value for the sand equivalent requirement in the 2nd table in the 3rd paragraph of section 47-2.02C with:**

01-20-12

12 minimum

**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).

External vibration resulting in adequate consolidation may be used.

If the Engineer determines that rock pockets are of the extent or character as to affect the strength of the member or to endanger the life of the steel reinforcement, replace the member.

Finish concrete-to-concrete bearing surfaces to a smooth plane. Section 51-1.03F does not apply to concrete crib members.

### 47-3.03 Construction

Place reinforced concrete crib walls to the lines and grades established by the Engineer. The foundation must be accepted by the Engineer before any crib members are placed.

The gap between bearing surfaces must not exceed 1/8 inch.

Where a gap of 1/16 inch to 1/8 inch exists or where shown, place a 1/16-inch pad of asphalt felt or sheet neoprene between the bearing surfaces.

### 47-3.04 Payment

The area of reinforced concrete crib wall is measured on the batter at the outer face for the height from the bottom of the bottom stretcher to the top of the top stretcher and for a length measured from end to end of each section of wall.

**Add between the 3rd and 4th paragraphs of section 47-5.01:**

10-19-12

Reinforcement must comply with section 52.

**Add to section 47-6.01A:**

10-19-12

The alternative earth retaining system must comply with the specifications for the type of wall being constructed.

**Replace "sets" at each occurrence in the 1st paragraph of section 47-6.01C with:**

04-19-13

copies

^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

## 48 TEMPORARY STRUCTURES

07-19-13

**Replace "previously welded splice" and its definition in section 48-2.01B with:**

04-19-13

**previously welded splice:** Splice made in a falsework member in compliance with AWS D1.1 or other recognized welding standard before contract award.

**Add to section 48-2.01B:**

07-19-13

**independent support system:** Support system that is in addition to the falsework removal system employing methods of holding falsework from above by winches, hydraulic jacks with prestressing steel, HS rods, or cranes.

04-19-13

**Delete "field" in the 1st sentence of the 5th paragraph of section 48-2.01C(1).**

**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.

**Add to section 48-2.01D(3)(a):**

07-19-13

Falsework removal system employing methods of holding falsework from above and members of the independent support system must support the sum of the actual vertical and horizontal loads due to falsework materials, equipment, construction sequence or other causes, and wind loading. Identifiable mechanical devices used in the falsework removal plan must meet applicable industry standards and manufacturer instructions for safe load carrying capacity. Unidentifiable winches must be capable of carrying twice the design load.

The load used for the analysis of overturning moment and sliding of the winch system must be 150 percent of the design load.

**Add to section 48-2.03D:**

07-19-13

Falsework removal employing methods of holding falsework by winches, hydraulic jacks with prestressing steel, HS rods, or cranes must also be supported by an independent support system when the system is not actively lowering the falsework at vehicular, pedestrian, or railroad traffic openings.

Bridge deck openings used to facilitate falsework removal activities must be formed and located away from the wheel path. The formed openings must be wedge shaped with a 5-inch maximum diameter at the top and a 3-inch maximum diameter at the bottom.

Anchor 10-inch-square aluminum or galvanized steel wire, 1/4-inch-mesh hardware cloth with a 0.025-inch minimum wire diameter firmly to the inside of the soffit openings. Construct a 1/2-inch drip groove to the outside of soffit openings.

Clean and roughen openings made in the bridge deck. Fill the deck openings with rapid setting concrete complying with section 15-5.02.

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# 49 PILING

01-15-16

**Replace "sets" in the 1st paragraph of section 49-1.01C(2) with:**

04-19-13

copies

**Replace "set" in the 2nd paragraph of section 49-1.01C(2) with:**

04-19-13

copy

**Replace "Load Applied to Pile by Hydraulic Jack(s) Acting at One End of Test Beam(s) Anchored to the Pile" in the 5th paragraph of section 49-1.01D(2) with:**

07-20-12

"Tensile Load Applied by Hydraulic Jack(s) Acting Upward at One End of Test Beam(s)"

**Add to section 49-1.03:**

04-20-12

Dispose of drill cuttings under section 19-2.03B.

**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.

01-15-16

**Delete the 4th paragraph of section 49-2.01C(5).**

**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.

07-19-13

**Delete the 5th paragraph of section 49-2.02B(1)(b).**

**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

07-19-13

**Delete the 3rd paragraph of section 49-2.02C(2).**

**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

07-19-13

**Delete the 1st paragraph of section 49-2.04A(4).**

**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

**Replace section 49-3.02C(6) with:**

07-19-13

**49-3.02C(6) Construction Joint**

Section 49-3.02C(6) applies to CIDH concrete piles where a construction joint is shown.

If a permanent steel casing is not shown, you must furnish and install a permanent casing. The permanent casing must:

1. Be watertight and of sufficient strength to prevent damage and to withstand the loads from installation procedures, drilling and tooling equipment, lateral concrete pressures, and earth pressures.
2. Extend at least 5 feet below the construction joint. If placing casing into rock, the casing must extend at least 2 feet below the construction joint.
3. Not extend above the top of the drilled hole or final grade whichever is lower.
4. Not increase the diameter of the CIDH concrete pile more than 2 feet.
5. Be installed by impact or vibratory hammers, oscillators, rotators, or by placing in a drilled hole. Casings placed in a drilled hole must comply with section 49-3.02C(5).

Section 49-2.01A(4)(b) does not apply to permanent casings specified in this section.

**Replace item 3 in the list in the 11th paragraph of section 49-3.02C(8) with:**

07-18-14

3. Maintain the slurry level at least10 feet above the piezometric head

**Add to section 49-3.03A(3):**

01-15-16

Submit a *Pile and Driving Data Form* under section 49-2.01A(3)(a) if specified in the special provisions.

**Add to section 49-4.01:**

07-19-13

Steel soldier piles must comply with section 49-2.03.

**Replace the headings and paragraphs in section 49-4.02 with:**

07-19-13

Concrete anchors must comply with the specifications for studs in clause 7 of AWS D1.1.

**Replace section 49-4.03 with:**

01-15-16

**49-4.03 CONSTRUCTION**

**49-4.03A General**

Reserved

**49-4.03B Drilled Holes**

Drill holes for steel soldier piles into natural foundation material. Drilled holes must be accurately located, straight, and true.

Furnish and place temporary casings or tremie seals where necessary to control water or to prevent caving of the hole.

Before placing the steel soldier pile, remove loose materials existing at the bottom of the hole after drilling activities have been completed.

Do not allow surface water to enter the hole. Remove all water in the hole before placing concrete.

If temporary casings are used, they must comply with section 49-3.02C(3).

**49-4.03C Steel Soldier Piles**

Plumb and align the pile before placing concrete backfill and lean concrete backfill. The pile must be at least 2 inches clear of the sides of the hole for the full length of the hole to be filled with concrete backfill and lean concrete backfill. Ream or enlarge holes that do not provide the clearance around steel piles.

Maintain alignment of the pile in the hole while placing backfill material.

Clean and prepare piles in anticipated heat affected areas before splicing steel piles or welding concrete anchors.

^^^

# 50 PRESTRESSING CONCRETE

07-19-13

**Replace "sets" at each occurrence in the 2nd and 3rd paragraphs of section 50-1.01C(3) with:**

04-19-13

copies

**Add to section 50-1.01C(3):**

07-19-13

Include a grouting plan with your shop drawing submittal. The grouting plan must include:

1. Detailed grouting procedures
2. Type, quantity, and brand of materials to be used
3. Type of equipment to be used including provisions for backup equipment
4. Types and locations of grout inlets, outlets, and vents
5. Methods to clean ducts before grouting
6. Methods to control the rate of flow within ducts
7. Theoretical grout volume calculations for each duct
8. Duct repair procedures due to an air pressure test failure
9. Mixing and pumping procedures
10. Direction of grouting
11. Sequence of use of inlets and outlets
12. Procedure for handling blockages
13. Proposed forms for recording grouting information
14. Procedure for secondary grouting
15. Names of people who will perform grouting activities including their relevant experience and certifications

**Add to section 50-1.01C:**

07-19-13

**50-1.01C(5) Grout**

Submit a daily grouting report for each day grouting is performed. Submit the report within 3 days after grouting. The report must be signed by the technician supervising the grouting activity. The report must include:

1. Identification of each tendon
2. Date grouting occurred
3. Time the grouting started and ended
4. Date of placing the prestressing steel in the ducts
5. Date of stressing
6. Type of grout used
7. Injection end and applied grouting pressure
8. Actual and theoretical quantity of grout used to fill duct
9. Ratio of actual to theoretical grout quantity
10. Records of air, grout, and structure surface temperatures during grouting.
11. Summary of tests performed and results, except submit compressive strength and chloride ion test results within 48 hours of test completion
12. Names of personnel performing the grouting activity
13. Summary of problems encountered and corrective actions taken
14. Summary of void investigations and repairs made

**Replace the introductory clause in the 1st paragraph of section 50-1.01C(4) with:**

07-19-13

Submit test samples for the materials shown in the following table to be used in the work:

**Add between "the" and "test samples" in the 1st paragraph of section 50-1.01D(2):**

07-19-13

prestressing steel

**Replace the 3rd paragraph of section 50-1.01D(2) with:**

10-19-12

The Department may verify the prestressing force using the Department's load cells.

**Replace the 3rd paragraph in section 50-1.01D(3) with:**

07-19-13

Each pressure gage must be fully functional and have an accurately reading, clearly visible dial or display. The dial must be at least 6 inches in diameter and graduated in 100 psi increments or less.

**Add between the 5th and 6th paragraphs of section 50-1.01D(3):**

07-19-13

Each jack and its gages must be calibrated as a unit.

**Replace the 6th paragraph in section 50-1.01D(3) with:**

07-19-13

Each jack used to tension prestressing steel permanently anchored at 25 percent or more of its specified minimum ultimate tensile strength must be calibrated by METS within 1 year of use and after each repair. You must:

1. Schedule the calibration of the jacking equipment with METS
2. Mechanically calibrate the gages with a dead weight tester or other authorized means before calibration of the jacking equipment by METS
3. Verify that the jack and supporting systems are complete, with proper components, and are in good operating condition
4. Provide labor, equipment, and material to (1) install and support the jacking and calibration equipment and (2) remove the equipment after the calibration is complete
5. Plot the calibration results

Each jack used to tension prestressing steel permanently anchored at less than 25 percent of its specified minimum ultimate tensile strength must be calibrated by an authorized laboratory within 6 months of use and after each repair.

**Add to section 50-1.01D:**

07-19-13

**50-1.01D(4) Pressure Testing Ducts**

For post-tensioned concrete bridges, pressure test each duct with compressed air after stressing. To pressure test the ducts:

1. Seal all inlets, outlets, and grout caps.
2. Open all inlets and outlets on adjacent ducts.
3. Attach an air compressor to an inlet at 1 end of the duct. The attachment must include a valve that separates the duct from the air source.
4. Attach a pressure gage to the inlet at the end of the duct.
5. Pressurize the duct to 50 psi.
6. Lock-off the air source.

7. Record the pressure loss after 1 minute.
8. If there is a pressure loss exceeding 25 psi, repair the leaks with authorized methods and retest.

Compressed air used to clear and test the ducts must be clean, dry, and free of oil or contaminants.

**50-1.01D(5) Duct Demonstration of Post-Tensioned Members**

Before placing forms for deck slabs of box girder bridges, demonstrate that any prestressing steel placed in the ducts is free and unbonded. If no prestressing steel is in the ducts, demonstrate that the ducts are unobstructed.

If prestressing steel is installed after the concrete is placed, demonstrate that the ducts are free of water and debris immediately before installing the steel.

Before post-tensioning any member, demonstrate that the prestressing steel is free and unbonded in the duct.

The Engineer must witness all demonstrations.

**50-1.01D(6) Void Investigation**

In the presence of the Engineer, investigate the ducts for voids between 24 hours and 72 hours after grouting completion. As a minimum, inspect the inlet and outlet ports at the anchorages and at high points in the tendons for voids after removal. Completely fill any voids found with secondary grout.

**50-1.01D(7) Personnel Qualifications**

Perform post-tensioning field activities, including grouting, under the direct supervision of a technician certified as a level 2 Bonded PT Field Specialist through the Post-Tensioning Institute. Grouting activities may be performed under the direct supervision of a technician certified as a Grouting Technician through the American Segmental Bridge Institute.

**Replace the 6th paragraph of section 50-1.02B with:**

07-19-13

Package the prestressing steel in containers or shipping forms that protect the steel against physical damage and corrosion during shipping and storage.

**Replace the 13th paragraph of section 50-1.02B with:**

07-19-13

Prestressing steel is rejected if surface rust either:

1. Cannot be removed by hand-cleaning with a fine steel wool pad
2. Leaves pits visible to the unaided eye after cleaning

**Replace the 4th paragraph of section 50-1.02C with:**

07-19-13

Admixtures must comply with section 90, except admixtures must not contain chloride ions in excess of 0.25 percent by weight.

07-19-13

**Delete the 5th paragraphs of section 50-1.02C.**

**Add to section 50-1.02C:**

07-19-13

Secondary grout must:

1. Comply with ASTM C 1107
2. Not have a deleterious effect on the steel, concrete, or bond strength of the steel to concrete

**Replace item 9 including items 9.1 and 9.2 in the list in the 1st paragraph of section 50-1.02D with:**

07-19-13

9. Have an inside cross-sectional area of at least 2.5 times the net area of the prestressing steel for multistrand tendons

**Replace "3/8" in item 10 in the list in the 1st paragraph of section 50-1.02D with:**

07-19-13

1/2

07-19-13

**Delete the 2nd sentences in the 1st paragraph of section 50-1.02E.**

**Replace section 50-1.02F with:**

07-19-13

**50-1.02F Permanent Grout Caps**

Permanent grout caps for anchorage systems of post-tensioned tendons must:

1. Be glass-fiber-reinforced plastic with antioxidant additives. The environmental stress-cracking failure time must be at least 192 hours under ASTM D 1693, Condition C.
2. Completely cover and seal the wedge plate or anchorage head and all exposed metal parts of the anchorage against the bearing plate using neoprene O-ring seals.
3. Have a grout vent at the top of the cap.
4. Be bolted to the anchorage with stainless steel complying with ASTM F 593, alloy 316. All fasteners, including nuts and washers, must be alloy 316.
5. Be pressure rated at or above 150 psi.

**Add to section 50-1.02:**

09-16-11

**50-1.02G Sheathing**

Sheathing for debonding prestressing strand must:

1. Be split or un-split flexible polymer plastic tubing
2. Have a minimum wall thickness of 0.025 inch
3. Have an inside diameter exceeding the maximum outside diameter of the strand by 0.025 to 0.14 inch

Split sheathing must overlap at least 3/8 inch.

Waterproofing tape used to seal the ends of the sheathing must be flexible adhesive tape.

The sheathing and waterproof tape must not react with the concrete, coating, or steel.

**Replace the 2nd paragraph of section 50-1.03A(3) with:**

07-19-13

After installation, cover the duct ends and vents to prevent water or debris from entering.

**Add to section 50-1.03A(3):**

07-19-13

Support ducts vertically and horizontally during concrete placement at a spacing of at most 4 feet.

07-19-13

**Delete "at least" in the 1st paragraph of section 50-1.03B(1).**

**Add to section 50-1.03B(1):**

01-20-12

After seating, the maximum tensile stress in the prestressing steel must not exceed 75 percent of the minimum ultimate tensile strength shown.

07-19-13

**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.

^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

# 51 CONCRETE STRUCTURES

10-30-15

**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 3rd item in the list in the 1st paragraph of section 51-1.01C(4) with:**

10-30-15

3. Proposed aggregate gradation

**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 of section 51-1.01D(4)(b) with:**

10-30-15

Except for POCs, surface smoothness is tested using:

1. 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.
2. 12-foot-long straightedge placed transversely to traffic.

For POCs, surface smoothness is tested using:

1. 12-foot-long straightedge placed parallel to the centerline of the POC
2. 6-foot-long straightedge placed perpendicular to the centerline of the POC

**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.

**Replace the 11th paragraph of section 51-1.03D(1) with:**

10-30-15

If concrete is inaccessible for adequate consolidation by other means, external vibrators must be used and the forms must be sufficiently rigid to resist displacement or damage.

**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.

**Replace the 1st sentence of the 1st paragraph of section 51-1.03F(5)(a) with:**

10-30-15

Construct concrete roadway surfaces of structures, approach slabs, sleeper slabs, and adjoining approach pavement, and concrete decks to be covered with another material, to the grade and cross section 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 the 1st sentence of the 2nd paragraph of section 51-2.02C(3) with:**

10-30-15

Thoroughly clean contact surfaces and the top surface of the seal to within 1/2 inch from either edge immediately before applying the lubricant-adhesive.

**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 the 1st sentence of the 6th paragraph of section 51-2.02E(3) with:**

10-30-15

Install each assembly with a watertight, continuous return 6 inches up into barriers at the low side of the deck.

**Replace "sets" in the 1st and 2nd paragraphs of section 51-2.02F(1)(c) with:**

04-19-13

copies

**Replace the paragraph in section 51-2.04A(3) with:**

10-30-15

Submit a certificate of compliance for waterstop material. The certificate of compliance for PVC waterstop must include a statement that the material complies with Item 6 of Army Corps of Engineers CRD-C 572.

**Add between the 1st and 2nd paragraphs of section 51-4.01A:**

10-19-12

Prestressing concrete members must comply with section 50.

04-20-12

**Delete the 2nd paragraph of section 51-4.01A.**

**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

10-30-15

**Delete the 3rd paragraph of section 51-4.01D.**

10-19-12

**Delete the 1st and 2nd paragraphs of section 51-4.02A.**

**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.

07-19-13

**Delete the 1st paragraph of section 51-5.03B(3).**

07-19-13

**Delete the 2nd paragraph of section 51-5.03D(1).**

**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

10-19-12

**Delete the 4th paragraph of section 51-7.01A.**

**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**

^^^

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.

**Replace the 6th paragraph of section 52-6.01D(4)(a) with:**

01-18-13

Before performing service splice or ultimate butt splice testing, perform total slip testing on the service splice or ultimate butt splice test samples under section 52-6.01D(4)(b).

**Replace section 52-6.02D with:**

10-21-11

**52-6.02D Ultimate Butt Splice Requirements**

When tested under California Test 670, ultimate butt splice test samples must demonstrate necking as either of the following:

1. For "Necking (Option I)," the test sample must rupture in the reinforcing bar outside of the affected zone and show visible necking.
2. For "Necking (Option II)," the largest measured strain must be at least:
   2.1. Six percent for no. 11 and larger bars
   2.2. Nine percent for no. 10 and smaller bars

**Replace the 2nd and 3rd paragraphs of section 52-6.03B with:**

01-18-13

Do not splice the following by lapping:

1. No. 14 bars
2. No. 18 bars
3. Hoops
4. Reinforcing bars where you cannot provide a minimum clear distance of 2 inches between the splice and the nearest adjacent bar

**Replace the 4th paragraph of section 52-6.03B with:**

01-15-16

For uncoated and galvanized reinforcing bars complying with ASTM A 615/A 615M, Grade 60, ASTM A 706/A 706M, or ASTM A 767/A 767M, Class 1, the length of lap splices must be at least:

1. 45 diameters of the smaller bar spliced for reinforcing bars no. 8 or smaller
2. 60 diameters of the smaller bar spliced for reinforcing bars nos. 9, 10, and 11

For epoxy-coated reinforcing bars and alternatives to epoxy-coated reinforcing bars complying with ASTM A 775/A 775M, ASTM A 934/A 934M, ASTM A 1035/A 1035M, or ASTM A 1055/A 1055M, the length of lap splices must be at least:

1. 65 diameters of the smaller bar spliced for reinforcing bars no. 8 or smaller
2. 85 diameters of the smaller bar spliced for reinforcing bars nos. 9, 10, and 11

^^^

# 53 SHOTCRETE

01-15-16

**Replace "632" in item 1 in the list in the 3rd paragraph of section 53-1.02 with:**

01-15-16

675

**Replace item 2 in the list in the 3rd paragraph of section 53-1.02 with:**

01-15-16

2. You may substitute a maximum of 30 percent coarse aggregate for the fine aggregate. Coarse aggregate must comply with section 90-1, except section 90-1.02C(4)(d) does not apply. Grading for the coarse aggregate must comply with the grading specified in section 90-1.02C(4)(b) for the 1/2 inch x No. 4 or the 3/8 inch x No. 8 primary aggregate nominal size.

**Replace "shotcrete" in the 2nd sentence of the 4th paragraph of section 53-1.02 with:**

01-15-16

concrete

**Replace the 2nd and 3rd paragraphs of section 53-2.01D(1) with:**

10-30-15

Obtain cores for compressive strength testing under ASTM C1604/C1604M. Discard cores that contain bar reinforcement or other obstructions or show evidence of improper coring. Test cores for compressive strength at 28 days under ASTM C1604/C1604M at an authorized laboratory. The compressive strength is the average strength of at least 3 cores that are free from bar reinforcement or other obstructions.

Shotcrete must have a minimum compressive strength of 3,600 psi, unless otherwise described. The shotcrete must attain the minimum compressive strength at 28 days, except 42 days are allowed for shotcrete with a described minimum compressive strength greater than 3,600 psi.

**Replace item 2 in the list in the 4th paragraph of section 53-2.01D(3) with:**

10-30-15

2. Obtain 3-inch-diameter cores from the test panel.

**Replace item 4 in the list in the 4th paragraph of section 53-2.01D(3) with:**

10-30-15

4. Test cores for compressive strength. Discard cores that show evidence of improper coring.

**Replace the 1st paragraph of section 53-2.01D(4)(a) with:**

10-30-15

Obtain at least four 3-inch-diameter test cores from each 50 cu yd, or portion thereof, of shotcrete placed each day. Three cores must be free from reinforcement or obstructions. One core must include reinforcement. The Engineer determines each core location.

**Replace the 1st paragraph of section 53-2.01D(4)(b) with:**

10-30-15

Each core must be dense and be free of laminations and sand pockets. Any core with reinforcement must show reinforcement or other obstructions completely encased.

10-30-15

**Delete the 1st paragraph of section 53-2.01D(4)(c).**

**Replace "ASTM C42/C42M" in the 5th paragraph of section 53-2.01D(4)(c) with:**

10-30-15

ASTM C1604/C1604M

^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

# 54 WATERPROOFING

10-30-15

**Add between "be" and "3/8 inch" in the 3rd paragraph of section 54-4.02C:**

04-20-12

at least

**Replace the 2nd paragraph of section 54-4.03A with:**

10-30-15

Sweep or air blow the concrete surfaces to receive the seal to clean them of dirt, dust, gravel, loose concrete particles, and other extraneous materials. Remove projections and fill depressions that could damage the membrane.

04-18-14

**Delete the 3rd paragraph of section 54-5.01A.**

04-18-14

**Delete "and HMA" in the 2nd paragraph of section 54-5.03.**

**Replace the last paragraph of section 54-5.03 with:**

04-18-14

Do not allow traffic on the seal until HMA is placed over it.

**Add to section 54:**

07-19-13

**54-7 SILANE WATERPROOFING TREATMENT**

Reserved

**54-8–54-10 RESERVED**

^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

# 55 STEEL STRUCTURES

10-30-15

07-19-13

**Delete the 3rd paragraph in section 55-1.01C(1).**

**Replace the 3rd sentence of the 4th paragraph in section 55-1.01C(1) with:**

07-19-13

For ASTM F 1554 anchor bolts, include chemical composition and carbon equivalence for each heat of steel.

**Add to section 55-1.01C(1):**

07-19-13

For HS connections, submit a record of which lots are used in each joint as an informational submittal.

**Replace "sets" at each occurrence in the 1st paragraph of section 55-1.01C(2) with:**

04-19-13

copies

**Replace the list in the 2nd paragraph of section 55-1.01C(2) with:**

07-19-13

1. Sequence of shop and field assembly and erection. For continuous members, include proposed steel erection procedures with calculations that show girder capacity and geometry will be correct.
2. Welding sequences and procedures.
3. Layout drawing of the entire structure with locations of butt welded splices.
4. Locations of temporary supports and welds.
5. Vertical alignment of girders at each stage of erection.
6. Match-marking diagrams.
7. Details for connections not shown or dimensioned on the plans.
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:**

07-19-13

2. Tension flanges and webs of horizontally curved girders
3. Hanger plates

**Replace the 2nd paragraph of section 55-1.01C(3) with:**

07-19-13

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).**

**Replace the 4th paragraph of section 55-1.01C(3) with:**

07-19-13

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.

**Replace the 1st sentence of the 6th paragraph in section 55-1.01C(3) with:**

07-19-13

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).**

**Replace the 2nd sentence of the 4th paragraph in section 55-1.01D(1) with:**

07-19-13

The calibration must be performed by an authorized repair and calibration center approved by the tool manufacturer.

**Add to section 55-1.01D(1):**

07-19-13

For bolts installed as snug tight, rotational capacity testing and installation tension testing are not required.

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).**

10-30-15

**Delete the 7th paragraph of section 55-1.01D(3)(b)(i).**

**Replace item 5 in the list in the 3rd paragraph of section 55-1.01D(3)(b)(ii) with:**

10-30-15

5. Assembly must not seize before the final rotation in step 9 is attained.

**Replace section 55-1.01D(4)(b) with:**

07-19-13

Perform rotational capacity testing on each rotational capacity lot under section 55-1.01D(3)(b) at the job site before installation.

**Replace the 1st sentence of the 2nd paragraph in section 55-1.01D(4)(c) with:**

07-19-13

Test 3 representative HS fastener assemblies under section 8 of *Specification for Structural Joints Using High-Strength Bolts* of the RCSC.

**Replace the 1st paragraph in section 55-1.01D(4)(d) with:**

07-19-13

Perform fastener tension testing to verify minimum tension in HS bolted connections no later than 48 hours after all fasteners in a connection have been tensioned.

**Replace the 3rd paragraph in section 55-1.01D(4)(d) with:**

07-19-13

Test 10 percent of each type of fastener assembly in each HS bolted connection for minimum tension using the procedure described in section 10 of *Specification for Structural Joints Using High-Strength Bolts* of the RCSC. Check at least 2 assemblies per connection. For short bolts, determine the inspection torque using steps 1 through 7 of "Arbitration of Disputes, Torque Method-Short Bolts" in *Structural Bolting Handbook* of the Steel Structures Technology Center.

**Replace the 1st table in the 1st paragraph of section 55-1.02A(1) with:**

07-19-13

**Structural Steel**

| Material | Specification |
|---|---|
| Carbon steel | ASTM A 709/A 709M, Grade 36 or {ASTM A36/A36M}[a] |
| HS low alloy columbium vanadium steel | ASTM A 709/A 709M, Grade 50 or {ASTM A 992/A 992M or ASTM A 572/A 572M, Grade 50}[a] |
| HS low alloy structural steel | ASTM A 709/A 709M, Grade 50W or Grade HPS 50W, or {ASTM A 588/A 588M}[a] |
| HS low alloy structural steel plate | ASTM A 709/A 709M, Grade HPS 70W |
| High-yield strength quenched and tempered alloy steel plate suitable for welding | ASTM A 709/A 709M, Grade 100, Grade 100W, or Grade HPS 100W, or {ASTM A 514/A 514M}[a] |

[a]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[a] |
| HS bolts and studs | ASTM A 449, Type 1[a] |
| HS threaded rods | ASTM A 449, Type 1 [a] |
| HS nonheaded anchor bolts | ASTM F 1554, Grade 105, Class 2A[a] |
| Nuts | ASTM A 563, including appendix X1[b] |
| Washers | ASTM F 844 |
| Hardened Washers | ASTM F 436, Type 1, including S1 supplementary requirements |
| Components of HS steel fastener assemblies for use in structural steel joints: | |
| Bolts | ASTM A 325, Type 1 |
| Tension control bolts | ASTM F 1852, Type 1 |
| Nuts | ASTM A 563, including appendix X1[b] |
| Hardened washers | ASTM F 436, Type 1, Circular, including S1 supplementary requirements |
| Direct tension indicators | ASTM F 959, Type 325, zinc-coated |

[a]Use hardened washers.
[b]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 or ASTM A 563, including appendix X1[a] |
| Carbon-steel castings | ASTM A 27/A 27M, Grade 65-35, Class 1 |
| Malleable iron castings | ASTM A 47/A 47M, Grade 32510 |
| Gray iron castings | ASTM A 48, Class 30B |
| Carbon steel structural tubing | ASTM A 500/A 500M, Grade B, ASTM A 501, ASTM A 847/A 847M, or ASTM A 1085 |
| Steel pipe[b] | ASTM A 53, Type E or S, Grade B; ASTM A 106, Grade B; or ASTM A 139, Grade B |
| Stud connectors | ASTM A 108 |

[a]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.
[b]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 ºF |
| Grade 50[a] (Thickness up to 2 inches) | 15 at 40 ºF |
| Grade 50W[a] (Thickness up to 2 inches) | 15 at 40 ºF |
| Grade 50[a] (Thickness over 2 inches up to 4 inches ) | 20 at 40 ºF |
| Grade 50W[a] (Thickness over 2 inches up to 4 inches) | 20 at 40 ºF |
| Grade HPS 50W[a] (Thickness up to 4 inches) | 20 at 10 ºF |
| Grade HPS 70W (Thickness up to 4 inches) | 25 at -10 ºF |
| Grade 100 (Thickness of 2-1/2 inches or less) | 25 at 0 ºF |
| Grade 100W (Thickness over 2-1/2 inches up to 4 inches) | 35 at 0 ºF |
| Grade HPS 100W (Thickness of 2-1/2 inches or less) | 25 at -30 ºF |
| Grade HPS 100W (Thickness over 2-1/2 inches up to 4 inches) | 35 at -30 ºF |

[a]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.

07-19-13

**Delete the 3rd and 4th sentences in the 2nd paragraph in section 55-1.02A(5).**

**Replace the 1st paragraph of section 55-1.02B(1) with:**

07-19-13

Section 55-1.02B(1) applies to work performed at the source and at the job site.

**Replace the 4th paragraph in section 55-1.02B(1) with:**

07-19-13

Ends of girder stiffeners shown as tight-fit must bear on the girder flange with at least point bearing. Local clearances between the end of the stiffener and the girder flange must be at most 1/16 inch.

**Replace the 1st sentence of the 5th paragraph in section 55-1.02B(1) with:**

07-19-13

Fabricate floor beams, stringers, and girders having end connection angles to exact length back to back of connection angles.

**Add to the 7th paragraph in section 55-1.02B(1):**

07-19-13

Use low-stress stamps for fracture critical members and tension members.

**Replace the 2nd sentence of the 9th paragraph in section 55-1.02B(1) with:**

07-19-13

Slightly round edges and sharp corners, including edges marred, cut, or roughened during handling or erection.

**Replace the 3rd paragraph of section 55-1.02B(2) with:**

10-30-15

Instead of machining, you may heat straighten steel slabs not in contact with other metal bearing surfaces if the above tolerances are met.

**Replace item 2 in the list in the 1st paragraph of section 55-1.02B(3) with:**

07-19-13

2. Radius of bend measured to the concave face must comply with *Manual of Steel Construction* of the AISC

**Replace the 1st sentence of the 2nd paragraph in section 55-1.02B(3) with:**

07-19-13

Plates to be bent to a smaller radius than specified in *Manual of Steel Construction* of the AISC must be bent hot.

**Replace the introductory clause of the 2nd paragraph of section 55-1.02B(4) with:**

07-19-13

Threads for pin ends and pin nuts 1-1/2 inches or more in diameter must comply with the following:

**Replace the 1st paragraph of section 55-1.02B(5) with:**

10-30-15

Pins must:

1. Be turned to the dimensions shown
2. Be straight, smooth, and free from flaws
3. Have the final surface produced by a finishing cut

**Replace the 3rd paragraph in section 55-1.02B(5) with:**

07-19-13

Holes for pins must be:

1. True to the diameter specified.
2. At right angles to the member axis.
3. Parallel with each other except for pins where nonparallel holes are required.
4. Smooth and straight with the final surface produced by a finishing cut.

**Replace the 1st paragraph in section 55-1.02B(6)(c) with:**

07-19-13

Bolted connections using HS fastener assemblies must comply with *Specification for Structural Joints Using High-Strength Bolts* of the RCSC.

**Replace the 7th paragraph in section 55-1.02B(6)(c) with:**

07-19-13

For all bolts, thread stickout after tensioning must be at least flush with the outer nut face. At least 3 full threads must be located within the grip of the connection.

07-19-13

**Delete the 3rd paragraph in section 55-1.02B(7)(a).**

**Add to section 55-1.02B(7)(a):**

07-19-13

For welds indicated to be subject to tensile forces that are to receive RT, grind smooth and flush on both sides of welds before testing.

For groove weld surface profiles that interfere with NDT procedures, grind welds smooth and blend with the adjacent material.

For fillet weld surface profiles that interfere with NDT procedures, grind welds and blend the toes smoothly with the adjacent base metal.

**Add to section 55-1.02B(7):**

07-19-13

**55-1.02B(7)(c) Steel Pedestrian Bridges**

Reserved

**Replace the 1st paragraph in section 55-1.02B(9) with:**

07-19-13

Prepare and paint contact surfaces of HS bolted connections before assembly. Thoroughly clean all other surfaces of metal in contact to bare metal before assembly. Remove all rust, mill scale, and foreign material.

**Replace the 1st sentence of the 4th paragraph in section 55-1.02B(9) with:**

07-19-13

Preassemble truss work in lengths of at least 3 abutting panels and adjust members for line and camber.

**Replace the 1st sentence of the 5th paragraph in section 55-1.02B(9) with:**

07-19-13

Preassemble bolted splice joints for plate girders in lengths of at least 3 abutting sections and adjust abutting sections for line and camber.

**Replace the 6th paragraph in section 55-1.02B(9) with:**

07-19-13

Preassemble prepared splice joints for welded girders with abutting members and adjust for line and camber.

**Replace the paragraphs in section 55-1.03C(1) with:**

07-19-13

Reserved

**Replace the 3rd sentence of the 1st paragraph in section 55-1.03C(2) with:**

07-19-13

Attain full bearing on the concrete under bearing assemblies.

**Replace the 3rd paragraph in section 55-1.03C(2) with:**

07-19-13

During welding, protect bearings and bearing surfaces using authorized methods.

**Replace section 55-1.03C(4) with:**

07-19-13

**55-1.03C(4) Continuous Members**

Unless otherwise shown, structural steel girders are designed for continuity in supporting girder dead load. If erection procedures provide girder continuity for dead load, preassemble members with field joints in a no-load condition in a horizontal or an upright condition.

You may erect structural steel girders such that dead load girder continuity is not provided. If erection procedures do not provide girder continuity for dead load:

1. You may increase cross-sectional areas or change grades of steel to provide the specified capacity if authorized.
2. After erection, the erected structure must have a load-carrying capacity at least equal to the structure shown.

^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

# 56 SIGNS

10-30-15

**Replace the 4th paragraph of section 56-3.01A with:**

07-19-13

The types of sign structures include:

1. Truss
2. Bridge mounted
3. Tubular

**Replace the subheadings and paragraphs in section 56-3.01C with:**

10-30-15

**56-3.01C(1) General**

Allow 30 days for the Department's review.

**56-3.01C(2) Shop Drawings**

Submit 2 copies of shop drawings for sign structures. Include:

1. Sign panel dimensions
2. Span lengths

3. Post heights
4. Anchorage layouts
5. Proposed splice locations
6. Snugging and tensioning pattern for anchor bolts and HS bolted connections
7. Details for permanent steel anchor bolt templates
8. Details of clips, eyes, or removable devices for preventing damage to the finished galvanized or painted surfaces used for:
   8.1 Securing the sign during shipping
   8.2 Lifting and moving during erection

**56-3.01C(3) Quality Control Program**

Submit a QC program for sign structures. Include methods, equipment, and personnel to be used during fabrication and installation.

Submit the QC program with the shop drawing submittal.

**Replace "sets" in the 1st paragraph of section 56-3.01C(2) with:**

04-19-13

copies

**Replace the 1st and 2nd paragraphs of section 56-3.01D(2)(b) with:**

10-30-15

For UT of welded joints with any members less than 5/16 inch thick or tubular sections less than 13 inches in diameter, the acceptance and repair criteria must comply with Clause 6.13.3.1 of AWS D1.1.

For UT of other welded joints, the acceptance and repair criteria must comply with Table 6.3 of AWS D1.1 for cyclically loaded nontubular connections.

**Replace the 4th paragraph of section 56-3.02B with:**

10-30-15

Structural tubing and hollow structural sections must be structural steel complying with ASTM A500/A500M, Grade B or ASTM A1085.

07-20-12

**Delete the 7th paragraph of section 56-3.02K(2).**

**Replace the 1st paragraph of section 56-3.02M(1) with:**

07-19-13

Galvanize all ferrous metal parts of the following sign structure types:

1. Truss
2. Bridge mounted
3. Tubular

**Add between the 1st and 2nd paragraphs of section 56-3.02M(1):**

04-19-13

Clean and paint all ferrous metal parts of tubular sign structures after galvanizing, including the areas to be covered by sign panels. Do not paint sign structures other than tubular type unless specified in the special provisions.

**Replace the headings and paragraphs in section 56-3.02M(3) with:**

04-19-13

Where specified, clean and paint sign structures under section 59-5.

^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

# 57 WOOD AND PLASTIC LUMBER STRUCTURES

10-30-15

**Replace the 2nd and 3rd paragraphs of section 57-2.01B(2) with:**

10-30-15

Structural timber and lumber must be inspected and grade marked under the rules and specifications shown in the following table:

**Replace the 9th paragraph of section 57-2.01B(2) with:**

10-30-15

Glued laminated timbers must comply with ANSI/AITC A190.1 and AITC 117, published by the American Institute of Timber Construction.

10-30-15

**Delete the 2nd and 4th paragraphs of section 57-2.01B(3).**

**Replace "51-2.01C(3)" in the 1st paragraph of section 57-2.01C(3)(a) with:**

10-19-12

57-2.01C(3)

**Add to section 57-2.01C(3)(a):**

10-30-15

Treated timber must be preservative-treated Douglas fir or Hem-fir. Chromated copper arsenate must not be used for preservative treatment.

**Add to section 57-2.02B:**

10-30-15

Chromated copper arsenate must not be used for preservative treatment.

**Replace the 2nd sentence of the 1st paragraph of section 57-2.03B(3) with:**

10-30-15

The wire rope must be furnished with Class A weight zinc-coated wire under ASTM A603.

**Replace "sets" at each occurrence in the 1st paragraph of section 57-3.01C with:**

04-19-13

copies

^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

# 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

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# 59 PAINTING

02-12-16

**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 "Type S" in the 2nd paragraph of section 59-1.02A with:**

01-15-16

Type M or Type S

**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:**

02-12-16

Clean and paint all exposed structural steel and other metal surfaces.

Cleaning and painting of new structural steel must be performed in an Enclosed Shop as defined in AISC-420-10/SSPC-QP 3.

**Add to section 59-2.03B:**

07-19-13

**59-2.03B(3) Containment Systems**

**59-2.03B(3)(a) General**

Construct containment systems when disturbing existing paint systems during bridge rehabilitation.

The containment system must be one of the following:

1. Ventilated containment system
2. Vacuum-shrouded surface preparation equipment and drapes and ground covers
3. Equivalent containment system if authorized

The containment system must contain all water, resulting debris, and visible dust produced when the existing paint system is disturbed.

Properly maintain the containment system while work is in progress and do not change the containment system unless authorized.

Containment systems over railroad property must provide the minimum clearances as specified in section 5-1.20C for the passage of railroad traffic.

**59-2.03B(3)(b) Ventilated Containment Systems**

**59-2.03B(3)(b)(i) General**

If flexible framing is used, support and fasten it to (1) prevent the escape of abrasive and blast materials due to whipping from traffic or wind and (2) maintain clearances.

If the wind speed reaches 50 mph or greater, relieve the wind pressure on the containment system using an authorized method.

**59-2.03B(3)(b)(ii) Design Criteria**

Scaffolding or supports for the ventilated containment system must not extend below the vertical clearance level nor to the ground line at locations within the roadbed.

For truss-type bridges, all connections of the ventilated containment system to the existing structure must be made through the deck, girder, stringer, or floor beam system. No connections are allowed that will cause bending stresses in a truss member.

The ventilated containment system must comply with section 7-1.02K(6)(e).

The minimum total design load for the ventilated containment system must consist of the sum of the dead and live vertical loads.

Dead and live loads are as follows:

1. Dead load must consist of the actual load of the ventilated containment system
2. Live loads for bridges with only spot blast cleaning work must consist of:
   2.1. Uniform load of at least 25 psf applied over the supported area
   2.2. Moving concentrated load of 1000 lb to produce maximum stress in the main supporting elements of the ventilated containment system
3. Live loads for bridges with 100 percent blast cleaning to bare metal must consist of:
   3.1. Uniform load of at least 45 psf, which includes 20 psf of sand load, applied over the supported area
   3.2. Moving concentrated load of 1000 lb to produce maximum stress in the main supporting elements of the ventilated containment system

Assumed horizontal loads do not need to be included in the design of the ventilated containment system.

Maximum allowable stresses must comply with section 48-2.01D(3)(c).

**59-2.03B(3)(b)(iii) Ventilation**

The ventilation system in the ventilated containment system must be of the forced input airflow type with fans or blowers.

Negative air pressure must be employed within the ventilated containment system and will be verified by visual methods by observing the concave nature of the ventilated containment system while taking into account wind effects or by using smoke or other visible means to observe airflow. The input airflow must be properly balanced with the exhaust capacity throughout the range of operations.

The exhaust airflow of the ventilation system in the ventilated containment system must be forced into wet or dry dust collectors or bag houses.

**Replace item 1 in the list in the 2nd paragraph of section 59-2.03C(1) with:**

10-19-12

1. Apply a stripe coat of undercoat paint on all edges, corners, seams, crevices, interior angles, junctions of joining members, weld lines, and similar surface irregularities. The stripe coat must completely hide the surface being covered. If spot blast cleaning portions of the bridge, apply the stripe coat of undercoat paint before each undercoat and follow with the undercoat as soon as practical. If removing all existing paint from the bridge, apply the undercoat first as soon as practical and follow with the stripe coat of undercoat paint for each undercoat.

**Replace the heading of section 59-2.03C(2) with:**

04-19-13

**Zinc Coating System**

**Add to section 59-2.03C(2)(a):**

04-19-13

Coatings for new structural steel and connections between new and existing structural steel must comply with the requirements shown in the following table:

**Zinc Coating System**

| Description | Coating | Dry film thickness (mils) |
|---|---|---|
| All new surfaces: | | |
| Undercoat | Inorganic zinc primer, AASHTO M 300 Type I or II | 4–8 |
| Finish coat[a] | Exterior grade latex[b], 2 coats | 2 minimum each coat, 4–8 total |
| Total thickness, all coats | | 8–14 |
| Connections to existing structural steel:[c] | | |
| Undercoat | Inorganic zinc primer, AASHTO M 300 Type I or II | 4–8 |
| Finish coat[a] | Exterior grade latex[b], 2 coats | 2 minimum each coat, 4–8 total |
| Total thickness, all coats | | 8–14 |

[a]If no finish coats are described, a final coat of inorganic zinc primer is required.
[b]Exterior grade latex must comply with section 91-2.02 unless otherwise specified.
[c]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:**

07-19-13

*Specification for Structural Joints Using High-Strength Bolts*

**Add to section 59-2.03C:**

04-19-13

**59-2.03C(3) Moisture-Cured Polyurethane Coating System**

Reserved

**59-2.03C(4) State Specification Paint Waterborne Coating System**

**59-2.03C(4)(a) General**

The State Specification PWB coating system for existing structural steel must comply with the requirements shown in the following table:

**State Specification PWB Coating System**

| Surface | Description | State Specification PWB Coating | Dry film thickness (mils) |
|---|---|---|---|
| Surfaces cleaned to bare metal[a]: | 1st undercoat | 145 | 2–3 |
| | 2nd undercoat | 146 | 2–3 |
| | 1st finish coat | 171 | 1.5–3 |
| | 2nd finish coat | 172 | 1.5–3 |
| | Total thickness, all coats | -- | 7–12 |
| Existing painted surfaces to be topcoated: | Undercoat | 146 | 2–3 |
| | 1st finish coat | 171 | 1.5–3 |
| | 2nd finish coat | 172 | 1.5–3 |
| | Total thickness, new coats | -- | 5–9 |

[a]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:**

04-19-13

soldier

**Replace section 59-11 with:**

07-19-13

**59-11 STAINING GALVANIZED SURFACES**

Reserved

**Replace section 59-12 with:**

07-19-13

# 59-12 ROCK STAINING

## 59-12.01 GENERAL

### 59-12.01A Summary

Section 59-12 includes specifications for applying stain to the exterior surface of landscape boulders, native rock that has been damaged or scarred, rock energy dissipaters, rock slope protection and gabion surfaces.

### 59-12.01B Submittals

Submit the following:

1. Work plan showing methods to control overspray and spillage, and to protect adjacent surfaces
2. Product data including the manufacturer's product sheet and the instructions for the application of the stain

### 59-12.01C Quality Control and Assurance

#### 59-12.01C(1) General

Reserved

#### 59-12.01C(2) Test Plot

Apply the stain to a test plot rock area of at least 3 by 3 feet at a location designated by the Engineer. Notify the Engineer at least 7 days before staining the test plot. Prepare and stain the test plot with the same materials, tools, equipment, and methods to be used in staining the final surfaces. Separate test plots are required for staining rock slope protection and native rock.

If ordered, prepare additional test plots. Additional test plots are change order work.

Obtain authorization of the test plot before starting the staining work. Use the authorized test plot as the standard for comparison in determining acceptability of staining. If the test plot is not incorporated into the work and the Engineer determines it is no longer needed, dispose of it.

## 59-12.02 MATERIALS

### 59-12.02A General

Reserved

### 59-12.02B Stain

Reserved

## 59-12.03 CONSTRUCTION

### 59-12.03A General

Reserved

### 59-12.03B Preparation

Before applying the stain:

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.

**59-12.04 PAYMENT**

Rock stain areas are measured along the slope face.

^^^

# 65 CONCRETE PIPE

07-19-13

**Replace the 2nd paragraph of section 65-1.01 with:**

10-19-12

Concrete pipe includes all necessary elbows, wyes, tees, other branches, concrete collars or tees, and reinforcement.

**Replace section 65-2.02D with:**

07-19-13

**65-2.02D Reserved**

^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

# 68 SUBSURFACE DRAINS

04-18-14

**Replace the 5th paragraph of section 68-4.02E with:**

04-18-14

HMA for backfilling trenches must comply with HMA for miscellaneous areas as specified in section 39.

^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

# 70 MISCELLANEOUS DRAINAGE FACILITIES

07-19-13

**Replace section 70-5.02A(2) with:**

01-20-12

**70-5.02A(2) Plastic Flared End Sections**

Plastic flared end sections must comply with ASTM D 3350.

**Replace "40-1.03N" in item 2.4 of the 1st paragraph of section 70-5.06C with:**

07-19-13

40-1.03K

**Replace the 2nd, 3rd, and 4th paragraphs of section 70-7.02B with:**

01-18-13

Before shipping, the exterior surfaces of the casing must be cleaned, primed, and coated to comply with ANSI/AWWA C213 or ANSI/AWWA C214.

Wrapping tape for repairing damaged coating and wrapping field joints and fittings must be a pressure-sensitive PVC or polyethylene tape with a minimum thickness of 50 mils, 2 inches wide.

**Add to section 70-7.03:**

01-18-13

Repair damaged coating on the casing and wrap field joints and fittings with wrapping tape as follows:

1. Before wrapping, thoroughly clean and prime the pipe casing, joints, and fittings under the tape manufacturer's instructions.

2. Wrap the tape tightly with 1/2 uniform lap, free from wrinkles and voids to provide not less than a 100-mil thickness.
3. Wrapping at joints must extend at least 6 inches over adjacent pipe casing coverings. Apply tension such that the tape will conform closely to contours of the joint.

**Add to section 70:**

07-19-13

**70-8–70-15 RESERVED**

^^^

**Replace the row under "Rock class" in the table in the 2nd paragraph of section 72-3.03E with:**

01-20-12

| | | | | |
|---|---|---|---|---|
| 1/2 T | 1/4 T | Light | Facing | Cobble |

07-19-13

**Delete the 5th and 6th paragraphs of section 72-11.01B.**

**Add to section 72-11.01B:**

01-18-13

Expanded polystyrene and premolded expansion joint filler must comply with section 51-2.

07-19-13

**Delete the 2nd paragraph of section 72-11.01C(1).**

07-19-13

**Delete the 7th paragraph of section 72-11.01C(1).**

**Add between the 7th and 8th paragraphs of section 72-11.01C(1):**

07-19-13

Schedule the construction of the slope paving such that the work, including placing and finishing concrete and applying curing compound, is completed on the same day that the work is started.

**Replace the 8th paragraph of section 72-11.01C(1) with:**

07-19-13

If the Engineer determines that the size of the slope paving is too large to be constructed without an intermediate construction joint, place a joint at an authorized location. Complete a section of concrete bounded by permissible construction joints within the same day.

**Replace the 1st paragraph of section 72-11.01C(2) with:**

01-18-13

Construct and finish minor concrete slope paving under section 51-1.

**Replace the 3rd paragraph of section 72-11.01C(2) with:**

07-19-13

After striking-off to grade, hand float the concrete with floats that are at least 4 inches wide and 30 inches long. Broom the entire surface with a stiff-bristled broom to produce a uniform surface. Brooming must be done when the surface is sufficiently set to prevent deep scarring and must be accomplished by drawing the broom down the slope, leaving marks parallel to the slope. The Engineer may order you to apply a fine spray of water to the surface immediately before brooming.

07-19-13

**Delete the 3rd paragraph of section 72-11.01D.**

^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

## 73 CONCRETE CURBS AND SIDEWALKS

07-19-13

**Replace the paragraph in section 73-1.01A with:**

07-19-13

Section 73-1 includes general specifications for constructing minor concrete items including concrete curbs, sidewalks, gutter depressions, driveways, island paving, and curb ramps; for installing detectable warning surfaces and precast parking bumpers; and for texturing and coloring concrete surfaces.

^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

## 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.

^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

## 75 MISCELLANEOUS METAL

10-30-15

**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 the 7th paragraph of section 75-1.03F with:**

10-30-15

Before applying any nonskid material, demonstrate the method of application to the Engineer by preparing a 1-sq ft test sample applied on hardboard at least 1/4 inch thick. The nonskid surface must have a total thickness from 1/8–3/16 inch.

**Replace "metal beam guard railing" in the table in the 1st paragraph of section 75-1.05 with:**

07-19-13

guardrail

^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

**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

^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

# 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.**

**Add between "coating" and "unless" in the 1st sentence of section 80-3.02C:**

07-18-14

or ASTM F1345, Class 2,

^^^

**Add between "splices at" and "posts" in the 5th paragraph of section 83-1.02B:**

07-19-13

midspan between

**Replace the 7th paragraph of section 83-1.02B with:**

10-30-15

Construct midwest guardrail system using:

1. Wood or steel line posts.
2. Wood blocks for line posts. You may use plastic blocks for steel line posts where shown.
3. Only 1 type of post and block for any 1 continuous length of guardrail.

**Replace the 9th paragraph of section 83-1.02B with:**

10-30-15

Submit 2 certified copies of mill test reports as an informational submittal for each heat of steel from which the steel posts are formed or fabricated.

10-30-15

**Delete "chromated copper arsenate," in the 1st sentence of the 14th paragraph of section 83-1.02B.**

**Replace "7th paragraph in section 57-2.01B(3)" in the 16th paragraph of section 83-1.02B with:**

10-30-15

1st and 2nd paragraphs in section 57-2.01C(3)(b)

**Replace "Metal rail posts, box spacers, and" in item 1 in the list in the 25th paragraph of section 83-1.02B with:**

07-19-13

Metal box spacers and

**Replace item 4 in the list in the 25th paragraph of section 83-1.02B with:**

07-18-14

4. For the connection of guard railing to new bridge railing or barriers, anchor bolt holes must be drilled in the concrete parapet or formed using metal or PVC sleeves.

07-19-13

**Delete items 6 and 7 in the list in the 25th paragraph of section 83-1.02B.**

10-30-15

**Delete "A 441," in item 5 in the list in the 26th paragraph of section 83-1.02B:**

**Add between "mixture" and "specified" in the 27th paragraph of section 83-1.02B:**

10-30-15

for load bearing applications

**Replace "Type WB" at each occurrence in section 83-1.02B(2) with:**

07-19-13

Type WB-31

**Replace "metal" at each occurrence in the 2nd paragraph of section 83-1.02B(2) with:**

10-30-15

rail

**Replace the heading of section 83-1.02B(3) with:**

07-19-13

**Temporary Midwest Guardrail System**

**Replace the 2nd sentence of the 9th paragraph of section 83-1.02D(1) with:**

07-18-14

Posts and balusters must be normal to the profile grade. Transverse to the profile grade, railings must be plumb within a tolerance not to exceed 0.02 foot in 10 feet.

**Replace "80-2.02" in the 2nd paragraph of section 83-1.02E with:**

10-19-12

80-3.02B

**Replace the 3rd paragraph of section 83-1.02G(2) with:**

07-18-14

Stud bolts must comply with the specifications for studs in clause 7 of AWS D1.1.

**Replace the 7th paragraph of section 83-1.02G(2) with:**

10-30-15

For tubular hand railing and tubular lower rail mounted on Type 80SW concrete barrier:

1. Resin capsule anchors and threaded rods must comply with section 75-1.03
2. Drilling and bonding threaded rods must comply with the specifications for drilling and bonding dowels in section 51-1

**Replace "horizontal" in the 8th paragraph of section 83-1.02G(2) with:**

07-18-14

vertical

**Replace the 10th paragraph of section 83-1.02G(2) with:**

10-30-15

For tubular handrailings on Type 80SW concrete barriers, submit 2 copies of threaded rod layouts before placing barrier reinforcement.

10-30-15

**Delete the 15th paragraph of section 83-1.02I.**

**Replace the 1st sentence of the 1st paragraph of section 83-1.03 with:**

11-15-13

Except for guardrail within the pay limits of a terminal system, a transition railing (Type WB-31), an end anchor assembly, or a rail tensioning assembly, midwest guardrail system is measured along the face of the rail element from end post to end post of the completed railing.

**Add between the 1st and 2nd paragraphs of section 83-2.01:**

10-30-15

Concrete barrier work includes:

1. Bar reinforcing steel, including the length that extends from the barrier into decks, walls, and footings
2. Constructing steel plate barriers at overhead sign foundations, electroliers, drainage structures, and other locations shown

10-30-15

**Delete the 2nd paragraph of section 83-2.01.**

**Replace "Reserved" in section 83-2.02A with:**

10-30-15

Markers must comply with section 82.

**Replace the 4th paragraph of section 83-2.02B with:**

10-30-15

Use wood blocks with wood and steel posts. You may use plastic blocks with steel posts where shown.

**Replace the 7th paragraph of section 83-2.02B with:**

10-30-15

Threaded rods must comply with ASTM A 307. Anchor bolts must comply with ASTM F 1554, Grade 55.

**Add between the 8th and 9th paragraphs of section 83-2.02B:**

10-30-15

Trim existing median plantings to clear the work area for thrie beam barrier construction. Dispose of trimmings.

**Replace "metal" at each occurrence in the 3rd paragraph of section 83-2.02B(2) with:**

10-30-15

rail

**Add between "roadway" and ", except" in the 4th paragraph of section 83-2.02B(2):**

10-30-15

at authorized locations

**Replace the 15th paragraph of section 83-2.02D(1) with:**

10-30-15

The tubular handrailing and tubular lower rail for Type 80SW concrete barrier must comply with the specifications for tubular handrailing in section 83-1.02G(2).

**Add to section 83-2.02D(1):**

10-21-11

For a concrete barrier transition:

1. Remove portions of the existing concrete barrier where shown under section 15-3
2. Roughen the contact surface of the existing concrete barrier
3. Drill and bond dowels into the existing concrete barrier under section 51-1

**Replace the 1st paragraph of section 83-2.02D(2) with:**

10-30-15

Construct Type 50 and 60 series concrete barriers of minor concrete, except as follows:

1. Concrete must contain not less than 550 pounds of cementitious material per cubic yard.
2. Maximum size of aggregate used for extruded or slip formed concrete barrier must be no larger than 1-1/2 inches and no smaller than 3/8 inch.
3. If the 3/8-inch maximum size aggregate grading is used to construct extruded or slip formed concrete barrier, the concrete must contain not less than 675 pounds of cementitious material per cubic yard.

**Replace the 2nd paragraph of section 83-2.02D(2) with:**

10-30-15

In non-freeze-thaw areas, concrete for concrete barriers other than Type 50 and 60 series must contain not less than 590 pounds of cementitious material per cubic yard.

**Add to section 83-2.02:**

10-19-12

**83-2.02H–83-2.02M Reserved**

**Add between the 2nd and 3rd paragraphs of section 83-2.03:**

10-30-15

The payment quantity for single thrie beam barrier is the length measured from end post to end post along the face of the rail element of the installed barrier. The quantity does not include any portion of single thrie beam barrier within the pay limits of transition railing (Type STB).

**Add to the end of the 4th paragraph of section 83-2.03:**

10-30-15

The quantity does not include any portion of double thrie beam barrier within the pay limits of transition railing (Type DTB).

**Replace the 10th paragraph of section 83-2.03 with:**

10-30-15

The payment quantity for concrete barriers includes the length of gaps in the concrete barrier where steel plate barrier is attached to the concrete barrier.

^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

# 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 $mcd \cdot m^{-2} \cdot lx^{-1}$ for white and 125 $mcd \cdot m^{-2} \cdot lx^{-1}$ 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

^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

# 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.

07-19-13

**Delete item 15.3 in the list in the 1st paragraph of section 86-2.04B(3).**

**Add between "Exposed" and "conduit" in the 2nd paragraph of section 86-2.05B:**

07-19-13

Type 1

**Replace the 1st sentence of the 10th paragraph of section 86-2.05C with:**

07-19-13

After installing conduit, install the pull tape.

**Replace the 1st sentence of the 15th paragraph of section 86-2.05C with:**

11-15-13

Conduit runs shown to be located behind curbs may be installed in the street within 3 feet of and parallel to the face of the curb by the trenching in pavement method.

**Replace the 1st and 2nd sentences of the 2nd paragraph of section 86-2.05D with:**

07-19-13

Install an expansion-deflection fitting for expansion joints with a 1-1/2-inch movement rating. The fitting must be watertight and include a molded neoprene sleeve, a bonding jumper, and 2 silicon bronze or zinc-plated iron hubs.

**Replace section 86-2.06 with:**

07-19-13

**86-2.06 PULL BOXES**

**86-2.06A General**

**86-2.06A(1) Cover Marking**

The cover marking must be clearly defined, uniform in depth, and parallel to either the long or short sides of the cover.

Marking letters must be 1 to 3 inches high.

Before galvanizing steel or cast iron cover, apply marking by one of the following methods:

1. Use cast iron strip at least 1/4 inch thick with letters raised a minimum of 1/16 inch. Fasten strip to cover with 1/4-inch flathead stainless steel machine bolts and nuts. Peen bolts after tightening.
2. Use sheet steel strip at least 0.027 inch thick with letters raised a minimum of 1/16 inch. Fasten strip to cover by spot welding, tack welding, or brazing, with 1/4-inch stainless steel rivets or 1/4-inch roundhead stainless steel machine bolts and nuts. Peen bolts after tightening.
3. Bead weld the letters on cover such that the letters are raised a minimum of 3/32 inch.

### 86-2.06A(2) Installation and Use

Space pull boxes no more than 200 feet apart. You may install additional pull boxes to facilitate the work.

You may use a larger standard size pull box than that shown on the plans or specified.

A pull box in ground or sidewalk area must be installed as follows:

1. Embed bottom of the pull box in crushed rock.
2. Place a layer of roofing paper on the crushed rock.
3. Place grout over the layer of roofing paper. Grout must be 0.50 to 1 inch thick and sloped toward the drain hole.
4. Make a 1-inch drain hole in the center of the pull box through the grout and roofing paper.
5. Place grout between the pull box and the pull box extension, and around conduits.

The top of the pull box must be flush with the surrounding grade or the top of an adjacent curb, except in unpaved areas where the pull box is not immediately adjacent to and protected by a concrete foundation, pole, or other protective construction. Place the pull box 1-1/4 inches above the surrounding grade. Where practical, place a pull box shown in the vicinity of curbs or adjacent to a standard on the side of the foundation facing away from traffic. If a pull box is installed in a sidewalk area, adjust the depth of the pull box so that the top of the pull box is flush with the sidewalk.

Reconstruct the sump of an existing pull box if disturbed by your activities. Remove old grout and replace with new if the sump was grouted.

### 86-2.06B Non–Traffic Pull Boxes

Reserved

### 86-2.06C Traffic Pull Boxes

The traffic pull box and cover must comply with ASTM C857, "Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures," for HS20 loading. You must be able to place the load anywhere on the box and cover for 1 minute without causing cracks or permanent deformations.

Frame must be anchored to the box with 1/4 by 2-1/4 inch concrete anchors. Four concrete anchors must be included for No. 3-1/2(T) pull box; one placed in each corner. Six concrete anchors must be included for No. 5(T) and No. 6(T) pull boxes; one placed in each corner and one near the middle of each of the longer sides.

Nuts must be zinc-plated carbon steel, vibration resistant, and have a wedge ramp at the root of the thread.

After installation of traffic pull box, install the steel cover and keep it bolted down when your activities are not in progress at the pull box. When the steel cover is placed for the final time, the cover and Z bar frame must be cleaned of debris and tightened securely.

Steel cover must be countersunk approximately 1/4 inch to accommodate the bolt head. When tightened, the bolt head must not exceed more than 1/8 inch above the top of the cover.

Concrete placed around and under traffic pull boxes must be minor concrete.

**Replace the 11th row in the table in the 1st paragraph of section 86-2.08B with:**

07-19-13

| | | | | | |
|---|---|---|---|---|---|
| Grounded circuit conductor | Pedestrian push buttons | Wht | Blk | NBR | 14 |
| | Signals and multiple lighting | Wht | None | NBR | 10 |
| | Flashing beacons and sign lighting | Wht | None | NBR | 12 |
| | Lighting control | Wht | None | C-3 | 14 |
| | Service | Wht | None | NBR | 14 |

**Replace the 1st sentence of the 1st paragraph of section 86-2.08C with:**

07-19-13

Circuit conductors, connectors, and terminals must be UL or NRTL listed and rated for 600 V(ac) operation.

**Add to the beginning of section 86-2.09A:**

07-19-13

Provide enough traffic signal light conductors for functional operation of the signal. Provide 3 spare conductors in all conduits containing traffic signal light conductors.

**Replace the paragraphs in section 86-2.09C with:**

07-19-13

Connectors must be crimp type. Use a manufacturer-recommended tool for connectors and terminals to join conductors. Comply with SAE-AS7928.

Terminate stranded conductors smaller than no. 14 in crimp style terminal lugs.

Terminate field conductors no. 12 and smaller with spade type terminals. Terminate field conductors no. 10 and larger with spade type or ring type terminals.

**Replace the value for resistivity in the table in the 6th paragraph of section 86-2.09E with:**

07-19-13

$25 \times 10^{13}$ Ω 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

07-19-13

**Delete the 12th paragraph of section 86-2.11A.**

**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

07-19-13

**Delete item 1.3 in the list in the 7th paragraph of section 86-3.04A.**

**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.

07-19-13

**Delete item 1 in the list in section 86-4.01D(1)(b).**

**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.

07-19-13

**Delete items 1 and 4 in the list in section 86-4.03I(1)(b).**

**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<br>Y: not greater than 0.390 or less than 0.331<br>Y= 0.990-X |
| Walking person | X: not greater than 0.440 or less than 0.280<br>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:**

10-17-14

Reserved

**Add between "beacon" and "must" in the 1st sentence of section 86-4.05:**

07-19-13

signal face

07-19-13

**Delete "face" in item 1 in the list in the 1st paragraph of section 86-4.05.**

**Replace the row for viscosity in the table in the 2nd paragraph of section 86-5.01A(3)(c) with:**

07-19-13

| | | |
|---|---|---|
| Viscosity, Brookfield Thermosel, no. 27 Spindle, 20 rpm, 190 °C | D 4402 | 2.5–3.5 Pa·s |

**Replace the paragraph in section 86-5.01A(3)(d) with:**

07-19-13

Use epoxy sealant for repair work in and around sawcuts housing inductive loops.

**Replace "all loop conductors" in the 3rd paragraph of section 86-5.01A(4) with:**

07-19-13

the detector lead-in cable

**Replace "Encase the loop wires" in the 1st sentence of the 3rd paragraph of section 86-5.01A(5) with:**

07-19-13

The loop wires must be encased

**Replace section 86-5.02 with:**

07-19-13

**86-5.02 PUSH 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.

Where a push button is mounted on top of a 2-1/2-inch-diameter post, fit the housing with a slip fitter and use screws to rigidly secure it to the post.

Install the push button and the sign on the crosswalk side of the pole.

Attach the sign on a Type B push button assembly.

For a Type C push button assembly, mount the instruction sign on the same standard as the assembly using 2 straps and saddle brackets.

**Add to section 86-5:**

07-19-13

**86-5.03 ACCESSIBLE PEDESTRIAN SIGNAL**

Reserved

**Replace "lthe amp" in item 2 in the list in the 1st paragraph of section 86-6.01A(2) with:**

07-19-13

the lamp

^^^

**Replace the value for permittivity of woven fabric in the table in the 1st paragraph of section 88-1.02E with:**

01-20-12

0.05

**Replace the value for apparent size opening of nonwoven fabric in the table in the 1st paragraph of section 88-1.02E with:**

01-20-12

0.012

**Replace the table in the 1st paragraph of section 88-1.02G with:**

01-20-12

**Sediment Filter Bag**

| Property | Test | Values | |
|---|---|---|---|
| | | Woven | Nonwoven |
| Grab breaking load, lb, 1-inch grip min, in each direction | ASTM D 4632 | 200 | 250 |
| Apparent elongation, percent min, in each direction | ASTM D 4632 | 10 | 50 |
| Water flow rate, gal per minute/sq ft min and max average roll value | ASTM D 4491 | 100-200 | 75-200 |
| Permittivity, $sec^{-1}$ min | ASTM D 4491 | 1.0 | 1.0 |
| Apparent opening size, inches max average roll value | ASTM D 4751 | 0.023 | 0.012 |
| Ultraviolet resistance, % min retained grab breaking load, 500 hr. | ASTM D 4355 | 70 | 70 |

**Replace the table in the 1st paragraph of section 88-1.02H with:**

01-20-12

**Temporary Cover**

| Property | Test | Values | |
|---|---|---|---|
| | | Woven | Nonwoven |
| Grab breaking load, lb, 1-inch grip min, in each direction | ASTM D 4632 | 200 | 200 |
| Apparent elongation, percent min, in each direction | ASTM D 4632 | 15 | 50 |
| Water flow rate, gal per minute/sq ft min and max average roll value | ASTM D 4491 | 4-10 | 80-120 |
| Permittivity, $sec^{-1}$ min | ASTM D 4491 | 0.05 | 1.0 |
| Apparent opening size, inches max average roll value | ASTM D 4751 | 0.023 | 0.012 |
| Ultraviolet resistance, % min retained grab breaking load, 500 hr. | ASTM D 4355 | 70 | 70 |

**Replace section 88-1.02P with:**

01-18-13

### 88-1.02P Biaxial Geogrid

Geosynthetics used for biaxial geogrid must be a punched and drawn polypropylene material formed into an integrally formed biaxial grid. When tested under the referenced test methods, properties of biaxial geogrid must have the values shown in the following table:

**Biaxial Geogrid**

| Property | Test | Value |
|---|---|---|
| Aperture size, inch[a]<br>min and max | Calipered | 0.8-1.3 x 1.0-1.6 |
| Rib thickness, inch<br>min | Calipered | 0.04 |
| Junction thickness, inch<br>min | Calipered | 0.150 |
| Tensile strength, 2% strain, lb/ft[a]<br>min | ASTM D 6637 | 410 x 620 |
| Tensile strength at ultimate, lb/ft[a]<br>min | ASTM D 6637 | 1,310 x 1,970 |
| Ultraviolet resistance, percent<br>min retained tensile strength, 500 hours | ASTM D 4355 | 100 |
| Junction strength, lb/ft[a]<br>min | ASTM D 7737 | 1,220 x 1,830 |
| Overall flexural rigidity, mg-cm<br>min | ASTM D 7748 | 750,000 |
| Torsional rigidity at 20 cm-kg, mm-kg/deg[b]<br>min | GRI:GG9 | 0.65 |

[a]Machine direction x cross direction
[b]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<br>min | ASTM D 5261 | 14.7 |
| Thickness at 29 psi, mm<br>min | ASTM D 5199 | 1.0 |
| Tensile strength at ultimate, lbs/ft<br>min | ASTM D 4595 | 685 |
| Elongation, percent<br>max | ASTM D 4595 | 130 |
| Permittivity at 2.9 psi, m/s<br>min | ASTM D 5493 | 0.0001 |
| Hydraulic transmissivity at 29 psi, m/s<br>min | ASTM D 6574 | 0.0002 |
| Ultraviolet resistance, percent<br>min retained grab breaking load, 500 hours | ASTM D 4355 | 60 |

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# 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[a] | ASTM C117 | |
| Moisture content of fine aggregate | ASTM C566, or electronically actuated moisture meter[b] | 1–2 times per each day of pour, depending on conditions |

[a]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.
[b]Electronically actuated moisture meter must be calibrated once per week per ASTM C566.

**Concrete QC Tests**

| Property | Test method | Minimum testing frequency |
|---|---|---|
| Compressive strengthb | ASTM C172/C172M, ASTM C31/C31M, and ASTM C39/C39M | Once per 100 cu yd of concrete cast, or every day of casting, whichever is more frequent |
| Slump | ASTM C143/C143M | |
| Temperature | ASTM C1064/C1064M | |
| Density | ASTM C138 | Once per 600 cu yd of concrete cast or each week of batching, whichever is more frequent |
| Air content | ASTM C231/C231M or ASTM C173/C173M[a] | If concrete is air entrained, once for each set of cylinders, and when conditions warrant |

[a]ASTM C173/C173M must be used for lightweight concrete.
[b]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.

For PC concrete that is steam cured, concrete designated by compressive strength is acceptable if its compressive strength reaches the described 28-day compressive strength in no more than the maximum number of days specified or allowed after the concrete is cast.

**90-4.01D(3) Quality Assurance**

For PC concrete that is steam cured, the Engineer evaluates the compressive strength based on individual tests representing specific portions of production.

**Add between the 1st and 2nd paragraphs of section 90-4.02:**

07-19-13

PC portland cement based repair material must be on the Authorized Material List.

If municipally supplied potable water is used for PC concrete, the testing specified in section 90-1.02D is waived unless requested.

**Add to section 90-4.03:**

07-19-13

For dimensional tolerances of PC concrete members, comply with the Precast/Prestressed Concrete Institute Concrete Institute's *Tolerance Manual for Precast and Prestressed Concrete Construction, MNL 135-00*.

For tier 1 and tier 2 PC concrete members, apply curing compound using power-operated spraying equipment. You may request application by hand spraying for small quantities of PC concrete members. For tier 3 and tier 4 PC concrete members, the application of curing compound may be hand sprayed.

**Replace the item 2 in the list in the 2nd paragraph of section 90-4.03 with:**

07-19-13

2. To prevent moisture loss on the exposed surfaces during the presteaming period, cover the concrete as soon as possible after casting or keep the exposed surfaces wet by fog spray, curing compound, or wet blankets.

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# 91 PAINT

10-19-12

**Add to section 91-2:**

10-19-12

**91-2.03 MOISTURE-CURED POLYURETHANE COATING**

Reserved

**Replace "saint" in the 1st paragraph of section 91-4.05 with:**

10-19-12

paint

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# 92 ASPHALTS

07-19-13

**Replace "Reserved" in section 92-1.01B with:**

07-19-13

**modified asphalt binder:** Asphalt binder modified with polymers, crumb rubber, or both.

**Replace the row for dynamic shear for original binder in the table in the 1st paragraph of section 92-1.02B with:**

01-20-12

| | | | | | | |
|---|---|---|---|---|---|---|
| Dynamic shear, | | | | | | |
| Test temperature at 10 rad/s, °C | T 315 | 58 | 64 | 64 | 64 | 70 |
| min G*/sin(delta), kPa | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| max G*/sin(delta), kPa | | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 |

**Replace 2nd paragraph of section 92-1.02B with:**

07-19-13

PG modified asphalt binder must comply with the requirements shown in the following table:

**PG Modified Asphalt Binder**

| Property | AASHTO Test Method | Grade | | |
|---|---|---|---|---|
| | | PG 58–34 M | PG 64–28 M | PG 76–22 M |
| Original Binder | | | | |
| Flash point, min °C | T 48 | 230 | 230 | 230 |
| Solubility, min % | T 44[a] | 97.5 | 97.5 | 97.5[b] |
| Viscosity at 135 °C[c], max, Pa·s | T 316 | 3.0 | 3.0 | 3.0 |
| Dynamic shear, Test temperature at 10 rad/s, °C<br>min G*/sin(delta), kPa | T 315 | 58<br>1.00 | 64<br>1.00 | 76<br>1.00 |
| RTFO test[d], Mass loss, max, % | T 240 | 1.00 | 1.00 | 1.00 |
| RTFO Test Aged Binder | | | | |
| Dynamic shear, Test temperature at 10 rad/s, °C<br>min G*/sin(delta), kPa | T 315 | 58<br>2.20 | 64<br>2.20 | 76<br>2.20 |
| Dynamic shear, Test temperature at 10 rad/s, °C<br>max (delta), degree | T 315 | 80[e] | 80[e] | 80[e] |
| Elastic recovery[f], Test temperature °C<br>min recovery, % | T 301 | 25<br>75 | 25<br>75 | 25<br>65 |
| PAV[g], temperature, °C | R 28 | 100 | 100 | 110 |
| RTFO Test and PAV Aged Binder | | | | |
| Dynamic shear, Test temperature at 10 rad/s, °C<br>max G*sin(delta), kPa | T 315 | 16<br>5000 | 22<br>5000 | 31<br>5000 |
| Creep stiffness, Test temperature, °C<br>max S-value, MPa<br>min M-value | T 313 | -24<br>300<br>0.300 | -18<br>300<br>0.300 | -12<br>300<br>0.300 |

[a]The Department allows ASTM D 5546 or ASTM D 7753 instead of AASHTO T 44. Particles recovered from ASTM D 5546 or ASTM D 7753 or AASHTO T 44 must be less than 250 µm.
[b]Report only for spray application.
[c]The Engineer waives this specification if the supplier provides written certification the asphalt can be adequately pumped and mixed at temperatures meeting applicable safety standards.
[d]"RTFO Test" means the asphaltic residue obtained using the Rolling Thin Film Oven Test, AASHTO Test Method T 240 or ASTM D 2872. The residue from mass change determination may be used for other tests.
[e]Test temperature is the temperature at which G*/sin(delta) is 2.2 kPa. A graph of log G*/sin(delta) plotted against temperature may be used to determine the test temperature when G*/sin(delta) is 2.2 kPa. A graph of (delta) versus temperature may be used to determine delta at the temperature when G*/sin(delta) is 2.2 kPa. The graph must have at least two points that envelope G*/sin(delta) of 2.2 kPa and the test temperature must not be more than 6 degree C apart. The Engineer also accepts direct measurement of (delta) at the temperature when G*/sin(delta) is 2.2 kPa.
[f]Tests without a force ductility clamp may be performed.
[g]"PAV" means "Pressure Aging Vessel."

Do not modify PG modified asphalt binder using polyphosphoric acid.

Crumb rubber must be from automobile and truck tires and must be free from contaminants including fabric, metal, minerals, and other nonrubber substances.

PG modified asphalt binder modified with crumb rubber must be homogeneous and must not contain visible particles of crumb rubber.

The supplier of PG modified asphalt binder modified with crumb rubber must:

1. Report the amount of crumb rubber by weight of asphalt binder
2. Certify a minimum of 10 percent of crumb rubber by weight of asphalt binder

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## 93 LIQUID ASPHALTS

07-19-13

**Replace "Celsius" the 1st row in the table in the 8th paragraph of section 93-1.04 with:**

07-19-13

Fahrenheit

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## 94 ASPHALTIC EMULSIONS

03-21-14

**Replace the 1st paragraph of section 94-1.04 with:**

03-21-14

Asphaltic emulsion is measured by weight under the specifications requiring its use. If water is added to the asphaltic emulsion, the quantity of asphaltic emulsion is determined before the addition of water.