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STATE OF CALIFORNIA

DEPARTMENT OF TRANSPORTATION

NOTICE TO CONTRACTORS

AND

SPECIAL PROVISIONS

FOR CONSTRUCTION ON STATE HIGHWAY IN

SAN FRANCISCO COUNTY IN SAN FRANCISCO

FROM 0.6 KM TO 1.3 KM EAST OF THE YERBA BUENA TUNNEL EAST PORTAL

DISTRICT 04, ROUTE 80

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

CONTRACT NO. 04-0120F4

04-SF-80-13.2/13.9

Bids Open: February 1, 2006
Dated: August 1, 2005

OSD

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IMPORTANT
SPECIAL NOTICES

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The bidder's attention is directed to Section 2-1.03, "DVBE Goal for This Project," of these special provisions. The Department is evaluating opportunities for potential DVBE participation to establish an appropriate goal for this project.

The Department is also evaluating opportunities for potential Small Business participation to establish appropriate provisions and participation level for this project.

The bidder's attention is directed to Section 2-1.07, "Pre-Award Information/Questionnaire," Section 3, "Award and Execution of Contract," and Section 8-4.01, "Audits," of these special provisions.

Attention is directed to "**Pre-Bid Manufacturing/Fabrication Facility Audit Review Request Guidelines**" available to interested bidders and subcontractors on the Internet at http://www.dot.ca.gov/hq/esc/tollbridge/SFOBB/Sfobb.html#04-0120F4. Requests for the pre-bid audit review shall be submitted in writing with a completed Manufacturing and Fabrication Self Qualification Audit (MFSQA) form to the Duty Senior at the District 4 Office, 111 Grand Avenue, Oakland, California 94612, telephone: (510) 286-5209.

Responses to the **"Pre-Award Information/Questionnaire"** and **"Manufacturing and Fabrication Self-Qualification Audit"** included in the Proposal must be **submitted with the bid**.

The anticipated period of time within which the contract may be awarded has been extended for this project. See Section 3, "Award and Execution of Contract," of these Special Provisions.

Attention is directed to the pre-award qualifications meeting in Section 3-1.01A "Pre-Award Qualifications Meeting" of these special provisions.

Establishing to the satisfaction of the Department, the bidder's qualifications and ability to complete the bridge construction work in a safe and timely manner is a condition for being eligible for award of the contract.

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- The definition of a working day has been re-defined for this project. (See Section 4 of these special provisions.)

- The time limit specified in the special provisions for the completion of work contemplated herein is considered insufficient to permit completion of the work by the Contractor working a normal number of hours per day or week on a single shift basis. It is expected that additional shifts will be required throughout the life of the contract to the extent deemed necessary to ensure that the work will be completed within the time limit specified. (See Section 4 of these special provisions.)

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STANDARD PLANS LIST

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

A10A	Abbreviations
A10B	Symbols
A20A	Pavement Markers and Traffic Lines, Typical Details
A20B	Pavement Markers and Traffic Lines, Typical Details
A20D	Pavement Markers and Traffic Lines, Typical Details
A24C	Pavement Markings - Symbols and Numerals
A24D	Pavement Markings – Words
A24E	Pavement Markings - Words and Crosswalks
A85	Chain Link Fence
A86	Barbed Wire and Wire Mesh Fences
T10	Traffic Control System for Lane Closure On Freeways and Expressways
T14	Traffic Control System for Ramp Closure
B0-1	Bridge Details
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B0-13	Bridge Details
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B7-11	Utility Details
B11-47	Cable Railing
RS4	Roadside Signs, Typical Installation Details No. 4
RSP S2	Overhead Signs - Truss, Single Post Type - Post Types II Thru VII
RSP S3	Overhead Signs - Truss, Two Post Type - Post Types I-S Thru VII-S
RSP S8A	Overhead Signs - Steel Frames - Removable Sign Panel Frames
S8B	Overhead Signs - Removable Sign Panel Frames – Overhead Formed Panel Mounting Details
S8D	Overhead Signs - Truss, Removable Sign Panel Frames - 2794 mm and 3048 mm Sign Panels
S9	Overhead Signs - Walkway Details No. 1
S10	Overhead Signs - Walkway Details No. 2
RSP S11	Overhead Signs - Walkway Safety Railing Details
S40N	Overhead Signs- Tubular, Instructions and Examples
S40R	Overhead Signs - Tubular, Structural Frame Details No. 1
RSP S40S	Overhead Signs - Tubular, Structural Frame Details No. 2
RSP S40T	Overhead Signs - Tubular, Base Plate and Anchorage Details
RSP S40U	Overhead Signs - Tubular, Foundation Details
ES-1A	Signal, Lighting and Electrical Systems - Symbols and Abbreviations
ES-1B	Signal, Lighting and Electrical Systems - Symbols and Abbreviations
ES-3A	Signal, Lighting and Electrical Systems - Controller Cabinet Details
ES-3B	Signal, Lighting and Electrical Systems - Controller Cabinet Details
RSP ES-6A	Lighting Standards - Types 15, 21 and 22
RSP ES-6B	Lighting Standards - Types 15 AND 21, Barrier Rail Mounted Details
RSP ES-6A	Lighting Standards – Types 15, 21, and 22
RSP ES 6B	Lighting Standards – Types 15 AND 21, Barrier Rail Mounted Details
ES-8	Signal, Lighting and Electrical Systems - Pull Box Details
ES-9B	Signal, Lighting and Electrical Systems - Electrical Details, Structure Installations
ES-9C	Signal, Lighting and Electrical Systems - Electrical Details, Structure Installations
ES-9D	Signal, Lighting and Electrical Systems - Electrical Details, Structure Installations
ES-9E	Signal, Lighting and Electrical Systems - Electrical Details, Structure Installations
ES-9F	Signal, Lighting and Electrical Systems - Flush Soffit Luminaire Modification Details, Structure Installations
ES-11	Signal, Lighting and Electrical Systems - Foundation Installations
ES-13A	Signal, Lighting and Electrical Systems - Splicing Details
ES-13B	Signal, Lighting and Electrical Systems - Wiring Details and Fuse Ratings
ES-15A	Sign Illumination - Mercury Vapor Sign Illumination Equipment
ES-15C	Sign Illumination - Sign Illumination Equipment
ES-15D	Sign Illumination - Sign Illumination Control
ES-16A	Closed Circuit Television Pole Details

DEPARTMENT OF TRANSPORTATION

NOTICE TO CONTRACTORS

CONTRACT NO. 04-0120F4

04-SF-80-13.2/13.9

Sealed proposals for the work shown on the plans entitled:

STATE OF CALIFORNIA; DEPARTMENT OF TRANSPORTATION; PROJECT PLANS FOR CONSTRUCTION ON STATE HIGHWAY IN SAN FRANCISCO COUNTY IN SAN FRANCISCO FROM 0.6 KM TO 1.3 KM EAST OF THE YERBA BUENA TUNNEL EAST PORTAL

will be received at the Department of Transportation, 1120 N Street, Room 0200, MS #26, Sacramento, CA 95814, until 2 o'clock p.m. on February 1, 2006, at which time they will be publicly opened and read in Room 0100 at the same address.

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

STATE OF CALIFORNIA; DEPARTMENT OF TRANSPORTATION; PROPOSAL AND CONTRACT FOR CONSTRUCTION ON STATE HIGHWAY IN SAN FRANCISCO COUNTY IN SAN FRANCISCO FROM 0.6 KM TO 1.3 KM EAST OF THE YERBA BUENA TUNNEL EAST PORTAL

General work description: Construct self-anchored suspension bridge with cable tower upon existing piers and footing.

This project has a goal of __ percent disabled veteran business enterprise (DVBE) participation.

Bidder inquiries may be made as follows:

Submit Bidder Inquiries to the Duty Senior at the District 4 Office, 111 Grand Avenue, Oakland, California 94612, Fax number: (510) 622-1805, e-mail address: duty_senior_district04@dot.ca.gov, telephone: (510) 286-5209.To the extent feasible and at the discretion of the Department, completed Bidder Inquiries submitted for consideration will be investigated, and responses will be posted on the Internet at http://www.dot.ca.gov/dist4/construction/Inquiries/04-0120F4_inquiry.html.Responses to Bidder inquiries are provided to designate the contract requirements that address the inquiries. Revisions and additions to the contract requirements will only be issued as contract addenda. Attention is directed to the provisions of Section 2-1.03, "Examination of Plans, Specifications, Contract, and Site of Work," of the Standard Specifications. The responses may be considered along with other information furnished to prospective bidders. The questions and answers posted may represent summaries of questions submitted and responses to them. Bidders are cautioned that subsequent responses and contract addenda may be issued and should be taken into consideration when submitting a bid.

The following meetings are planned:

1. Technical outreach meeting will be held on August 16, 2005 at 8:30a.m. (Pacific Time) at the Waterfront Plaza Hotel, Jack London Square, 10 Washington Street, Oakland, California, USA.
2. Disadvantaged Business Enterprise (DBE), Small Business, and Disabled Veteran Business Enterprise (DVBE) outreach meeting will be held on August 31, 2005 at 8:30 a.m. (Pacific Time) at the Waterfront Plaza Hotel, Jack London Square, 10 Washington Street, Oakland, California, USA.
3. Technical outreach meeting will be held on September 23, 2005 at 8:30 a.m. (Pacific Time) at the Waterfront Plaza Hotel, Jack London Square, 10 Washington Street, Oakland, California, USA.

Prospective bidders unable to attend in person may dial the teleconference call-in number (800) 444 - 9007 from the United States and Canada, or (213) 596-1389 from outside the United States and Canada. Callers will need to use the guest code: 91641356.

The purpose of the technical outreach meetings is for participants to ask questions and discuss constructibility issues.

The purpose of the business enterprise meeting is to discuss business opportunities for DBEs, Small Businesses, and DVBEs for contracts in Caltrans, District 4 including the Self-Anchored Suspension Span contract.

Bidders who are participating in this meeting may submit their questions in writing to the Duty Senior at the District 4 Office, 111 Grand Avenue, Oakland, California 94612, Fax number: (510) 622-1805, e-mail address: duty_senior_district04@dot.ca.gov, telephone: (510) 286-5209, no later than 4:00 p.m. (Pacific Time) one week in advance. The written inquiry should clearly identify the bidder's identity and the contract specification(s) or drawing(s) that form the basis for the question. Each question should be separately numbered.

To the extent feasible and at the discretion of the Department, an oral response will be provided to each written question. The Department's final written response to each question will be made available to all bidders in accordance with the bidder inquiry provisions of the Notice to Contractors. Bidders are cautioned that oral responses and instructions given at the meeting are not binding on the Department.

No prebid meeting is scheduled for this project.

Bids are required for the entire work described herein.

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

The Contractor must also be properly licensed at the time the bid is submitted, except that on a joint venture bid a joint venture license may be obtained by a combination of licenses after bid opening but before award in conformance with Business and Professions Code, Section 7029.1.

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

Project plans, special provisions, and proposal forms for bidding this project can only be obtained at the Department of Transportation, Plans and Bid Documents, Room 0200, MS #26, Transportation Building, 1120 N Street, Sacramento, California 95814, FAX No. (916) 654-7028, Telephone No. (916) 654-4490. Use FAX orders to expedite orders for project plans, special provisions and proposal forms. FAX orders must include credit card charge number, card expiration date and authorizing signature. Project plans, special provisions, and proposal forms may be seen at the above Department of Transportation office and at the offices of the District Directors of Transportation at Irvine, Oakland, and the district in which the work is situated. Standard Specifications and Standard Plans are available through the State of California, Department of Transportation, Publications Unit, 1900 Royal Oaks Drive, Sacramento, CA 95815, Telephone No. (916) 445-3520.

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

Preference will be granted to bidders properly certified as a "Small Business" as determined by the Department of General Services, Office of Small Business and Disabled Veteran Business Enterprise Certification (OSDC), at the time of bid opening in conformance with the provisions in Section 2-1.05, "Small Business Preference," of the special provisions, and Section 1896 et seq, Title 2, California Code of Regulations. A form for requesting a "Small Business" preference is included with the bid documents. Applications for status as a "Small Business" must be submitted to the Department of General Services, Office of Small Business and Disabled Veteran Business Enterprise Certification, 707 Third Street, West Sacramento, CA 95605, Telephone Nos. (800) 559-5529 or (916) 375-4940.

A reciprocal preference will be granted to "California company" bidders in conformance with Section 6107 of the Public Contract Code. (See Sections 2 and 3 of the special provisions.) A form for indicating whether bidders are or are not a "California company" is included in the bid documents and is to be filled in and signed by all bidders.

Pursuant to Section 1773 of the Labor Code, the general prevailing wage rates in the county, or counties, in which the work is to be done have been determined by the Director of the California Department of Industrial Relations. These wages are set forth in the General Prevailing Wage Rates for this project, available at the Labor Compliance Office at the offices of the District Director of Transportation for the district in which the work is situated, and available from the California Department of Industrial Relations' internet web site at: http://www.dir.ca.gov. Future effective general prevailing wage rates which have been predetermined and are on file with the California Department of Industrial Relations are referenced but not printed in the general prevailing wage rates.

DEPARTMENT OF TRANSPORTATION

Deputy Director Transportation Engineering

Dated August 1, 2005

RWR

COPY OF ENGINEER'S ESTIMATE
(NOT TO BE USED FOR BIDDING PURPOSES)

04-0120F4

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
1	030748	WORKING DRAWING CAMPUS	LS	LUMP SUM
2	030702	ELECTRONIC MOBILE DAILY DIARY COMPUTER SYSTEM DATA DELIVERY	LS	LUMP SUM
3	030704	EROSION CONTROL (TYPE B)	M2	1570
4	070010	PROGRESS SCHEDULE (CRITICAL PATH)	LS	LUMP SUM
5	070018	TIME-RELATED OVERHEAD	WDAY	2130
6	071322	TEMPORARY FENCE (TYPE CL-1.8)	M	205
7	030705	3.66 M TEMPORARY GATE (TYPE CL-1.8)	EA	1
8	049281	FURNISH TEMPORARY TOWERS	LS	LUMP SUM
9	049816	REMOVE TEMPORARY TOWERS	LS	LUMP SUM
10	049297	REMOVE SKYWAY TEMPORARY TOWER (AE)	LS	LUMP SUM
11	049298	REMOVE SKYWAY TEMPORARY TOWER (AW)	LS	LUMP SUM
12	074019	PREPARE STORM WATER POLLUTION PREVENTION PLAN	LS	LUMP SUM
13	074020	WATER POLLUTION CONTROL	LS	LUMP SUM
14	030706	NON-STORM WATER DISCHARGES	LS	LUMP SUM
15	030707	TURBIDITY CONTROL	LS	LUMP SUM
16	074032	TEMPORARY CONCRETE WASHOUT FACILITY	LS	LUMP SUM
17	074034	TEMPORARY COVER	M2	1350
18	030708	ACCELERATED WORKING DRAWINGS SUBMITTAL	LS	LUMP SUM
19	120100	TRAFFIC CONTROL SYSTEM	LS	LUMP SUM
20	150605	REMOVE FENCE	M	90

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
21	150620	REMOVE GATE	EA	2
22	030709	RECONSTRUCT CHAIN LINK FENCE (TYPE CL-2.4, BLACK VINYL-CLAD) W/BARBED WIRE EXTENSION ARMS	M	150
23	030710	RECONSTRUCT 3.66 M CHAIN LINK GATE (TYPE CL-2.4, BLACK VINYL-CLAD) W/BARBED WIRE EXTENSION ARMS	EA	2
24	032138	STABILIZING EMULSION	KG	35
25	203014	FIBER (EROSION CONTROL)	KG	155
26	203021	FIBER ROLLS	M	252
27	203024	COMPOST (EROSION CONTROL)	KG	470
28	030711	MOVE IN/MOVE OUT (EROSION CONTROL)	EA	4
29	203045	PURE LIVE SEED (EROSION CONTROL)	KG	30
30 (S)	049299	EPOXY ASPHALT CONCRETE AGGREGATE	TONN	3670
31 (S)	049300	EPOXY ASPHALT BOND COAT AND BINDER	KG	268 000
32 (S)	049301	APPLY EPOXY ASPHALT BOND COAT	M2	32 800
33 (S)	049302	PLACE EPOXY ASPHALT CONCRETE SURFACING	M2	32 800
34 (S)	049303	PRESTRESSING CAST-IN-PLACE CONCRETE (PIER W2)	LS	LUMP SUM
35 (S)	049304	PRESTRESSING CAST-IN-PLACE CONCRETE (PIER E2)	LS	LUMP SUM
36 (S)	049305	HIGH STRENGTH PRESTRESSING ROD (75MM)	LS	LUMP SUM
37 (S)	049306	CABLE TIEDOWN	LS	LUMP SUM
38 (F)	510053	STRUCTURAL CONCRETE, BRIDGE	M3	8200
39 (F)	049307	STRUCTURAL CONCRETE, FENDER	M3	370
40	049817	FURNISH PRECAST CONCRETE FENDER MODULES	M3	880

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
41	049818	ERECT PRECAST CONCRETE FENDER MODULES	EA	8
42 (F)	049308	MINOR CONCRETE (COUNTERWEIGHT)	M3	430
43 (S-F)	049309	FURNISH POLYESTER CONCRETE OVERLAY (13 MM)	M3	40
44 (S-F)	049310	PLACE POLYESTER CONCRETE OVERLAY (13MM)	M2	3050
45 (S)	049311	FURNISH AND INSTALL SPHERICAL BUSHING BEARING (PIER E2)	EA	4
46 (S)	049312	FURNISH SPHERICAL BUSHING RING BEARING (HINGE K)	EA	4
47 (S)	049313	INSTALL CIRCULAR SEGMENTED BEARING (HINGE A)	EA	16
48 (S-F)	520102	BAR REINFORCING STEEL (BRIDGE)	KG	1 410 000
49 (S-F)	520110	BAR REINFORCING STEEL (EPOXY COATED) (BRIDGE)	KG	48 500
50 (F)	550203	FURNISH STRUCTURAL STEEL (BRIDGE)	KG	183 000
51 (F)	550204	ERECT STRUCTURAL STEEL (BRIDGE)	KG	183 000
52 (F)	049314	FURNISH STRUCTURAL STEEL (BRIDGE) (TOWER)	KG	13 095 000
53 (F)	049315	ERECT STRUCTURAL STEEL (BRIDGE) (TOWER)	KG	13 095 000
54 (F)	049316	FURNISH STRUCTURAL STEEL (BRIDGE) (TOWER STRUT)	EA	68
55 (F)	049317	FURNISH STRUCTURAL STEEL (BRIDGE) (BOX GIRDER)	KG	29 065 000
56 (F)	049318	ERECT STRUCTURAL STEEL (BRIDGE) (BOX GIRDER)	KG	29 065 000
57 (F)	049319	FURNISH STRUCTURAL STEEL (BRIDGE) (BIKEPATH)	KG	1 273 000
58 (F)	049320	ERECT STRUCTURAL STEEL (BRIDGE) (BIKEPATH)	KG	1 222 000
59 (S-F)	049321	FURNISH STRUCTURAL STEEL (BRIDGE) (SADDLE)	KG	1 130 000
60 (F)	049322	ERECT STRUCTURAL STEEL (BRIDGE) (SADDLE)	KG	1 130 000

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
61 (S-F)	049323	FURNISH AND INSTALL SHEAR KEY (PIER E2)	EA	2
62 (F)	049324	FURNISH STRUCTURAL STEEL (BRIDGE) (PIPE BEAM)	KG	260 000
63 (F)	049325	ERECT STRUCTURAL STEEL (BRIDGE) (PIPE BEAM)	KG	260 000
64 (F)	049326	INSTALL STRUCTURAL STEEL (BRIDGE) (PIPE BEAM) (HINGE AW & AE)	EA	4
65	049327	FURNISH STRUCTURAL STEEL (BRIDGE) (PIPE BEAM FUSE)	EA	4
66 (S-F)	049328	FURNISH PWS CABLE SYSTEM	KG	4 800 000
67 (S-F)	049329	ERECT PWS CABLE SYSTEM	KG	4 800 000
68 (S-F)	049330	FURNISH SUSPENDER SYSTEM	KG	650 000
69 (S-F)	049331	ERECT SUSPENDER SYSTEM	KG	650 000
70 (S)	049332	TOWER SUSPENDER ASSEMBLIES	LS	LUMP SUM
71	030712	SERVICE PLATFORM	EA	5
72 (F)	560218	FURNISH SIGN STRUCTURE (TRUSS)	KG	9200
73 (F)	560219	INSTALL SIGN STRUCTURE (TRUSS)	KG	9200
74	562002	METAL (BARRIER MOUNTED SIGN)	KG	1020
75 (S-F)	049333	PLASTIC LUMBER	M3	99
76 (S-F)	049334	UHMW POLYETHYLENE PANEL (50MM)	M2	637
77 (S)	590115	CLEAN AND PAINT STRUCTURAL STEEL	LS	LUMP SUM
78 (S)	049335	CLEAN AND PAINT STRUCTURAL STEEL (TOWER)	LS	LUMP SUM
79 (S)	049336	CLEAN AND PAINT STRUCTURAL STEEL (BOX GIRDER)	LS	LUMP SUM
80 (S)	049337	CLEAN AND PAINT STRUCTURAL STEEL (BIKEPATH)	LS	LUMP SUM

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
81 (S)	049338	CLEAN AND PAINT CABLE SYSTEM	LS	LUMP SUM
82 (S-F)	750501	MISCELLANEOUS METAL (BRIDGE)	KG	250 000
83	030713	PERIMETER FENCE (TYPE WM 1.8)	M	410
84 (S-F)	833020	CHAIN LINK RAILING	M	130
85 (S-F)	049339	STEEL BARRIER (TYPE 732 MODIFIED)	M	2490
86 (S-F)	049340	BIKEPATH RAILING	M	1246
87 (F)	839527	CABLE RAILING (MODIFIED)	M	3000
88 (F)	839717	CONCRETE BARRIER (TYPE 732 MODIFIED)	M	7
89	840515	THERMOPLASTIC PAVEMENT MARKING	M2	18
90	840561	100 MM THERMOPLASTIC TRAFFIC STRIPE	M	7500
91	030715	75 MM PAINT TRAFFIC STRIPE (BLACK, 1-COAT)	M	2500
92	840656	PAINT TRAFFIC STRIPE (2-COAT)	M	590
93	840666	PAINT PAVEMENT MARKING (2-COAT)	M2	8
94	850101	PAVEMENT MARKER (NON-REFLECTIVE)	EA	1390
95	850111	PAVEMENT MARKER (RETROREFLECTIVE)	EA	440
96	030716	UNDERGROUND	LS	LUMP SUM
97	049341	ELECTRICAL UTILITIES REMOVAL	LS	LUMP SUM
98 (S)	049342	ELEVATOR	LS	LUMP SUM
99 (F)	049343	MAINTENANCE TRAVELER	LS	LUMP SUM
100 (S-F)	049344	MAINTENANCE TRAVELER (BIKEPATH)	LS	LUMP SUM

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
101 (S-F)	049345	TRAVELER SUPPORT RAIL	KG	398 570
102 (S-F)	049346	WIND VORTEX GENERATOR PLATES	EA	82
103	030717	SAS SUPERSTRUCTURE GIRDER WESTBOUND	LS	LUMP SUM
104	030718	SAS SUPERSTRUCTURE ROADWAY EASTBOUND	LS	LUMP SUM
105	030719	SAS SUPERSTRUCTURE GIRDER EASTBOUND	LS	LUMP SUM
106	030720	TOWER AND SUSPENSION CABLE	LS	LUMP SUM
107	030721	NAVIGATION AND AVIATION WARNING SYSTEMS	LS	LUMP SUM
108	030722	SCADA REMOTE TERMINAL UNIT SYSTEM	LS	LUMP SUM
109	030723	CALL BOX SYSTEM	LS	LUMP SUM
110	030724	TRAFFIC OPERATION SYSTEM	LS	LUMP SUM
111	030725	CAMERA WITH HOUSING ENCLOSURE	EA	2
112 (S)	030726	PAN/TILT UNIT	EA	2
113 (S)	030727	CAMERA CONTROL UNIT	EA	2
114 (S)	030728	VIDEO TRANSMITTER DUPLEX DATA	EA	2
115 (S)	030729	MICROWAVE VEHICLE DETECTION SENSOR SYSTEM	EA	6
116 (S)	030730	FIBER OPTIC DATA MODEMS	EA	6
117 (S)	030731	FIBER OPTIC CABLE (72-FIBER INDOOR/OUTDOOR)	M	2300
118 (S)	030732	FIBER OPTIC CABLE (12-FIBER INDOOR/OUTDOOR)	M	150
119 (S)	867130	FIBER OPTIC SPLICE CLOSURE	EA	8
120	030733	STRONG MOTION DETECTION SYSTEM	LS	LUMP SUM

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
121	030734	CCSF RECLAIM WATER (6 NPS)	M	640
122	030735	CCSF SEWER FORCE MAIN (10 NPS)	M	640
123	030736	CCSF WATER MAIN (12 NPS)	M	640
124	030737	DOMESTIC WATER (2NPS) (T1 TOWER)	M	152
125	030738	DOMESTIC WATER (2 1/2 NPS)	M	2560
126	030739	COMPRESS AIR (4 NPS)	M	2560
127	030740	COMPRESS AIR (3 NPS) (T1 TOWER)	M	152
128	030745	DEHUMIDIFIER SYSTEM	LS	LUMP SUM
129	030747	BOOSTER PUMP STATION	EA	1
130	031195	TRANSPORTATION FOR THE ENGINEER	LS	LUMP SUM
131	031196	PHOTO SURVEY OF EXISTING FACILITIES	LS	LUMP SUM
132	031197	VIBRATION MONITORING	LS	LUMP SUM
133	031198	CONSTRUCTION SURVEYING	LS	LUMP SUM
134	031199	ESTABLISH MARINE ACCESS	LS	LUMP SUM
135	031526	SAS SUPERSTRUCTURE ROADWAY WESTBOUND	LS	LUMP SUM
136 (S)	049349	SEISMIC JOINT (HINGE AW)	LS	LUMP SUM
137 (S)	049350	SEISMIC JOINT (HINGE AE)	LS	LUMP SUM
138	032980	CLEAN AND PAINT STRUCTURAL STEEL (DACROMET)	LS	LUMP SUM
139	032992	DOCUMENT MANAGEMENT SYSTEM	LS	LUMP SUM
140	999999	MOBILIZATION	LS	LUMP SUM

STATE OF CALIFORNIA

DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISIONS

Annexed to Contract No. 04-0120F4

SECTION 1. SPECIFICATIONS AND PLANS

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

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

AMENDMENTS TO JULY 1999 STANDARD SPECIFICATIONS

UPDATED JANUARY 31, 2005

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

SECTION 1: DEFINITIONS AND TERMS

Issue Date: January 31, 2005

Section 1-1.265, "Manual of Traffic Controls," of the Standard Specifications is amended to read:

1-1.265 MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES

- The Manual on Uniform Traffic Control Devices for Streets and Highways, 2003 Edition (MUTCD) is administered by the Federal Highway Administration.

Section 1, "Definitions and Terms," of the Standard Specifications is amended by adding the following section:

1-1.266 MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES CALIFORNIA SUPPLEMENT

- The MUTCD 2003 California Supplement (MUTCD California Supplement) is issued by the Department of Transportation to provide amendments to the MUTCD. The MUTCD and MUTCD California Supplement supersede the Department's Manual of Traffic Controls.

SECTION 2: PROPOSAL REQUIREMENTS AND CONDITIONS

Issue Date: June 19, 2003

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

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

- The bidder shall examine carefully the site of the work contemplated, the plans and specifications, and the proposal and contract forms therefor. The submission of a bid shall be conclusive evidence that the bidder has investigated and is satisfied as to the general and local conditions to be encountered, as to the character, quality and scope of work to be performed, the quantities of materials to be furnished and as to the requirements of the proposal, plans, specifications and the contract.
- The submission of a bid shall also be conclusive evidence that the bidder is satisfied as to the character, quality and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information was reasonably ascertainable from an inspection of the site and the records of exploratory work done by the Department as shown in the bid documents, as well as from the plans and specifications made a part of the contract.
- Where the Department has made investigations of site conditions including subsurface conditions in areas where work is to be performed under the contract, or in other areas, some of which may constitute possible local material sources, bidders or contractors may, upon written request, inspect the records of the Department as to those investigations subject to and upon the conditions hereinafter set forth.
- Where there has been prior construction by the Department or other public agencies within the project limits, records of the prior construction that are currently in the possession of the Department and which have been used by, or are known to, the designers and administrators of the project will be made available for inspection by bidders or contractors, upon written request, subject to the conditions hereinafter set forth. The records may include, but are not limited to, as-built drawings, design calculations, foundation and site studies, project reports and other data assembled in connection with the investigation, design, construction and maintenance of the prior projects.
- Inspection of the records of investigations and project records may be made at the office of the district in which the work is situated, or in the case of records of investigations related to structure work, at the Transportation Laboratory in Sacramento, California.
- When a log of test borings or other record of geotechnical data obtained by the Department's investigation of surface and subsurface conditions is included with the contract plans, it is furnished for the bidders' or Contractor's information and its use shall be subject to the conditions and limitations set forth in this Section 2-1.03.
- In some instances, information considered by the Department to be of possible interest to bidders or contractors has been compiled as "Materials Information." The use of the "Materials Information" shall be subject to the conditions and limitations set forth in this Section 2-1.03 and Section 6-2, "Local Materials."
- When cross sections are not included with the plans, but are available, bidders or contractors may inspect the cross sections and obtain copies for their use, at their expense.
- When cross sections are included with the contract plans, it is expressly understood and agreed that the cross sections do not constitute part of the contract, do not necessarily represent actual site conditions or show location, character, dimensions and details of work to be performed, and are included in the plans only for the convenience of bidders and their use is subject to the conditions and limitations set forth in this Section 2-1.03.
- When contour maps were used in the design of the project, the bidders may inspect those maps, and if available, they may obtain copies for their use.
- The availability or use of information described in this Section 2-1.03 is not to be construed in any way as a waiver of the provisions of the first paragraph in this Section 2-1.03 and bidders and contractors are cautioned to make independent investigations and examinations as they deem necessary to be satisfied as to conditions to be encountered in the performance of the work and, with respect to possible local material sources, the quality and quantity of material available from the property and the type and extent of processing that may be required in order to produce material conforming to the requirements of the specifications.
- The Department assumes no responsibility for conclusions or interpretations made by a bidder or contractor based on the information or data made available by the Department. The Department does not assume responsibility for representation made by its officers or agents before the execution of the contract concerning surface or subsurface conditions, unless that representation is expressly stated in the contract.
- No conclusions or interpretations made by a bidder or contractor from the information and data made available by the Department will relieve a bidder or contractor from properly fulfilling the terms of the contract.

SECTION 5: CONTROL OF WORK

Issue Date: December 31, 2001

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

5-1.02A Excavation Safety Plans

- The Construction Safety Orders of the Division of Occupational Safety and Health shall apply to all excavations. For all excavations 1.5 m or more in depth, the Contractor shall submit to the Engineer a detailed plan showing the design and details of the protective systems to be provided for worker protection from the hazard of caving ground during excavation. The detailed plan shall include any tabulated data and any design calculations used in the preparation of the plan. Excavation shall not begin until the detailed plan has been reviewed and approved by the Engineer.
- Detailed plans of protective systems for which the Construction Safety Orders require design by a registered professional engineer shall be prepared and signed by an engineer who is registered as a Civil Engineer in the State of California, and shall include the soil classification, soil properties, soil design calculations that demonstrate adequate stability of the protective system, and any other design calculations used in the preparation of the plan.
- No plan shall allow the use of a protective system less effective than that required by the Construction Safety Orders.
- If the detailed plan includes designs of protective systems developed only from the allowable configurations and slopes, or Appendices, contained in the Construction Safety Orders, the plan shall be submitted at least 5 days before the Contractor intends to begin excavation. If the detailed plan includes designs of protective systems developed from tabulated data, or designs for which design by a registered professional engineer is required, the plan shall be submitted at least 3 weeks before the Contractor intends to begin excavation.
- Attention is directed to Section 7-1.01E, "Trench Safety."

SECTION 7: LEGAL RELATIONS AND RESPONSIBILITY

Issue Date: January 31, 2005

The eighth paragraph of Section 7-1.09, "Public Safety" of the Standard Specifications is amended to read:

- Signs, lights, flags, and other warning and safety devices and their use shall conform to the requirements set forth in Part 6 of the MUTCD and of the MUTCD California Supplement. Signs or other protective devices furnished and erected by the Contractor, at the Contractor's expense, as above provided, shall not obscure the visibility of, nor conflict in intent, meaning and function of either existing signs, lights and traffic control devices or any construction area signs and traffic control devices for which furnishing of, or payment for, is provided elsewhere in the specifications. Signs furnished and erected by the Contractor, at the Contractor's expense, shall be approved by the Engineer as to size, wording and location.

The fourteenth paragraph of Section 7-1.09, "Public Safety," of the Standard Specifications is amended to read:

- The Contractor shall notify the Engineer not less than 18 days and no more than 90 days prior to the anticipated start of an operation that will change the vertical or horizontal clearance available to public traffic (including shoulders).

The sixteenth paragraph of Section 7-1.09, "Public Safety," of the Standard Specifications is amended to read:

- When vertical clearance is temporarily reduced to 4.72 m or less, low clearance warning signs shall be placed in accordance with Part 2 of the MUTCD and the MUTCD California Supplement, and as directed by the Engineer. Signs shall conform to the dimensions, color, and legend requirements of the MUTCD, the MUTCD California Supplement, and these specifications except that the signs shall have black letters and numbers on an orange retroreflective background. W12-2P signs shall be illuminated so that the signs are clearly visible.

SECTION 9: MEASUREMENT AND PAYMENT

Issue Date: November 17, 2004

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

9-1.04 NOTICE OF POTENTIAL CLAIM

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

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

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

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

- The information provided in items A and B above shall provide the Contractor's complete reasoning for additional compensation or adjustments.
- The supplemental notice of potential claim shall be submitted on Form CEM-6201B furnished by the Department and shall be certified with reference to the California False Claims Act, Government Code Sections 12650-12655. The Engineer will evaluate the information presented in the supplemental notice of potential claim and provide a written response to the Contractor within 20 days of its receipt. If the estimated cost or effect on the scheduled completion date changes, the Contractor shall update information in items C and D above as soon as the change is recognized and submit this information to the Engineer.
- Within 30 days of the completion of work related to the potential claim, the Contractor shall provide the full and final documentation of potential claim to the Engineer that provides the following information:

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

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

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

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

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

• The full and final documentation of the potential claim shall be submitted on Form CEM-6201C furnished by the Department and shall be certified with reference to the California False Claims Act, Government Code Sections 12650-12655.

• Pertinent information, references, arguments, and data to support the potential claim shall be included in the full and final documentation of potential claim. Information submitted subsequent to the full and final documentation submittal will not be considered. Information required in the full and final documentation of potential claim, as listed in items A to E above, that is not applicable to the dispute may be exempted as determined by the Engineer. No full and final documentation of potential claim will be considered that does not have the same nature and circumstances, and basis of claim as those specified on the initial and supplemental notices of potential claim.

• The Engineer will evaluate the information presented in the full and final documentation of potential claim and provide a written response to the Contractor within 30 days of its receipt unless otherwise specified. The Engineer's receipt of the full and final documentation of potential claim shall be evidenced by postal receipt or the Engineer's written receipt if delivered by hand. If the full and final documentation of potential claim is submitted by the Contractor after acceptance of the work by the Director, the Engineer need not provide a written response.

• Provisions in this section shall not apply to those claims for overhead costs and administrative disputes that occur after issuance of the proposed final estimate. Administrative disputes are disputes of administrative deductions or retentions, contract item quantities, contract item adjustments, interest payments, protests of contract change orders as provided in Section 4-1.03A, "Procedure and Protest," and protests of the weekly statement of working days as provided in Section 8-1.06, "Time of Completion." Administrative disputes that occur prior to issuance of the proposed final estimate shall follow applicable requirements of this section. Information listed in the supplemental notice and full and final documentation of potential claim that is not applicable to the administrative dispute may be exempted as determined by the Engineer.

• Unless otherwise specified in the special provisions, the Contractor may pursue the administrative claim process pursuant to Section 9-1.07B, "Final Payment and Claims," for any potential claim found by the Engineer to be without merit.

• Failure of the Contractor to conform to specified dispute procedures shall constitute a failure to pursue diligently and exhaust the administrative procedures in the contract, and is deemed as the Contractor's waiver of the potential claim and a waiver of the right to a corresponding claim for the disputed work in the administrative claim process in conformance with Section 9-1.07B, "Final Payment of Claims," and shall operate as a bar to arbitration pursuant to Section 10240.2 of the California Public Contract Code.

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

9-1.07B Final Payment and Claims

• After acceptance by the Director, the Engineer will make a proposed final estimate in writing of the total amount payable to the Contractor, including an itemization of the total amount, segregated by contract item quantities, extra work and other bases for payment, and shall also show each deduction made or to be made for prior payments and amounts to be kept

or retained under the provisions of the contract. Prior estimates and payments shall be subject to correction in the proposed final estimate. The Contractor shall submit written approval of the proposed final estimate or a written statement of claims arising under or by virtue of the contract so that the Engineer receives the written approval or statement of claims no later than close of business of the thirtieth day after receiving the proposed final estimate. If the thirtieth day falls on a Saturday, Sunday or legal holiday, then receipt of the written approval or statement of claims by the Engineer shall not be later than close of business of the next business day. The Contractor's receipt of the proposed final estimate shall be evidenced by postal receipt. The Engineer's receipt of the Contractor's written approval or statement of claims shall be evidenced by postal receipt or the Engineer's written receipt if delivered by hand.

- On the Contractor's approval, or if the Contractor files no claim within the specified period of 30 days, the Engineer will issue a final estimate in writing in conformance with the proposed final estimate submitted to the Contractor, and within 30 days thereafter the State will pay the entire sum so found to be due. That final estimate and payment thereon shall be conclusive and binding against both parties to the contract on all questions relating to the amount of work done and the compensation payable therefor, except as otherwise provided in Sections 9-1.03C, "Records," and 9-1.09, "Clerical Errors."
- If the Contractor within the specified period of 30 days files claims, the Engineer will issue a semifinal estimate in conformance with the proposed final estimate submitted to the Contractor and within 30 days thereafter the State will pay the sum found to be due. The semifinal estimate and corresponding payment shall be conclusive and binding against both parties to the contract on each question relating to the amount of work done and the compensation payable therefor, except insofar as affected by the claims filed within the time and in the manner required hereunder and except as otherwise provided in Sections 9-1.03C, "Records," and 9-1.09, "Clerical Errors."
- Except for claims for overhead costs and administrative disputes that occur after issuance of the proposed final estimate, the Contractor shall only provide the following two items of information for each claim:

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

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

A. The claim does not have the same nature, circumstances, and basis as the corresponding full and final documentation of potential claim.
B. The claim does not have a corresponding full and final documentation of potential claim.
C. The claim was not included in the written statement of claims.
D. The Contractor did not comply with applicable notice or protest requirements of Sections 4-1.03, "Changes," 5-1.116, "Differing Site Condition," 8-1.06, "Time of Completion," 8-1.07, "Liquidated Damages," 8-1.10, "Utility and Non-Highway Facilities," and 9-1.04, "Notice of Potential Claim."

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

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

_____ .
(name)

_____ *of*
(title)

_____ .
(company)

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

Dated _____

/s/ _____

Subscribed and sworn before me this _____ day

of _____ .

_____
(Notary Public)
My Commission
Expires _____

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

A. Allowable in conformance with the requirements in Title 48 of the Federal Acquisition Regulations, Chapter 1, Part 31.
B. Adequately supported by reliable documentation.
C. Related solely to the project under examination.

- Costs or expenses incurred by the State in reviewing or auditing claims that are not supported by the Contractor's cost accounting or other records shall be deemed to be damages incurred by the State within the meaning of the California False Claims Act.
- If the Engineer determines that a claim requires additional analysis, the Engineer will schedule a board of review meeting. The Contractor shall meet with the review board or person and make a presentation in support of the claim. Attendance by the Contractor at the board of review meeting shall be mandatory.
- The District Director of the District that administered the contract will make the final determination of any claims which remain in dispute after completion of claim review by the Engineer or board of review meeting.

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

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

SECTION 12: CONSTRUCTION AREA TRAFFIC CONTROL DEVICES

Issue Date: November 2, 2004

The second paragraph of Section 12-1.01, "Description," of the Standard Specifications is amended to read:

• Attention is directed to Part 6 of the MUTCD and of the MUTCD California Supplement. Nothing in this Section 12 is to be construed as to reduce the minimum standards in these manuals.

Section 12-2.01, "Flaggers," of the Standard Specifications is amended to read:

• Flaggers while on duty and assigned to traffic control or to give warning to the public that the highway is under construction and of any dangerous conditions to be encountered as a result thereof, shall perform their duties and shall be provided with the necessary equipment in conformance with Part 6 of the MUTCD and of the MUTCD California Supplement. The equipment shall be furnished and kept clean and in good repair by the Contractor at the Contractor's expense.

The first paragraph of Section 12-3.01, "General," of the Standard Specifications is amended to read:

• In addition to the requirements in Part 6 of the MUTCD and of the MUTCD California Supplement, all devices used by the Contractor in the performance of the work shall conform to the provisions in this Section 12-3.

The first paragraph of Section 12-3.06, "Construction Area Signs," of the Standard Specifications is amended to read:

• The term "Construction Area Signs" shall include all temporary signs required for the direction of public traffic through or around the work during construction. Construction area signs are shown in or referred to in Part 6 of the MUTCD and of the MUTCD California Supplement.

The fourth paragraph of Section 12-3.06, "Construction Area Signs," of the Standard Specifications is amended to read:

• All construction area signs shall conform to the dimensions, color and legend requirements of the plans, Part 6 of the MUTCD, Part 6 of the MUTCD California Supplement, and these specifications. All sign panels shall be the product of a commercial sign manufacturer, and shall be as specified in these specifications.

The eighth paragraph of Section 12-3.06, "Construction Area Signs," of the Standard Specifications is amended to read:

• Used signs with the specified sheeting material will be considered satisfactory if they conform to the requirements for visibility and legibility and the colors conform to the requirements in Part 6 of the MUTCD and of the MUTCD California Supplement. A significant difference between day and nighttime retroreflective color will be grounds for rejecting signs.

Section 12-3.06A, "Stationary Mounted Signs," of the Standard Specifications is amended by deleting the third, fourth, fifth, and sixth paragraphs.

SECTION 19: EARTHWORK

Issue Date: December 31, 2001

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

• In addition to the provisions in Sections 5-1.02, "Plans and Working Drawings," and 5-1.02A, "Excavation Safety Plans," detailed plans of the protective systems for excavations on or affecting railroad property will be reviewed for adequacy of protection provided for railroad facilities, property, and traffic. These plans shall be submitted at least 9 weeks

before the Contractor intends to begin excavation requiring the protective systems. Approval by the Engineer of the detailed plans for the protective systems will be contingent upon the plans being satisfactory to the railroad company involved.

SECTION 42: GROOVE AND GRIND PAVEMENT

Issue Date: December 31, 2001

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

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

SECTION 49: PILING

Issue Date: November 2, 2004

The first paragraph in Section 49-1.03, "Determination of Length," of the Standard Specifications is amended to read:

- Foundation piles of any material shall be of such length as is required to obtain the specified penetration, and to extend into the cap or footing block as shown on the plans, or specified in the special provisions.

The fourth paragraph in Section 49-1.03, "Determination of Length," of the Standard Specifications is amended to read:

- Modification to the specified installation methods and specified pile tip elevation will not be considered at locations where tension or lateral load demands control design pile tip elevations or when the plans state that specified pile tip elevation shall not be revised.

The sixth and seventh paragraphs in Section 49-1.03, "Determination of Length," of the Standard Specifications are amended to read:

- Indicator compression pile load testing shall conform to the requirements in ASTM Designation: D 1143. The pile shall sustain the first compression test load applied which is equal to the nominal resistance in compression, as shown on the plans, with no more than 13 mm total vertical movement at the top of the pile measured relative to the top of the pile prior to the start of compression load testing.
- Indicator tension pile load testing shall conform to the requirements in ASTM Designation: D 3689. The loading apparatus described as "Load Applied to Pile by Hydraulic Jack(s) Acting at One End of Test Beam(s) Anchored to the Pile" shall not be used. The pile shall sustain the first tension test load applied which is equal to the nominal resistance in tension, as shown on the plans, with no more than 13 mm total vertical movement at the top of the pile measured relative to the top of the pile prior to the start of tension load testing.

The ninth paragraph in Section 49-1.03, "Determination of Length," of the Standard Specifications is amended to read:

- For driven piling, the Contractor shall furnish piling of sufficient length to obtain the specified tip elevation shown on the plans or specified in the special provisions. For cast-in-drilled-hole concrete piling, the Contractor shall construct piling of such length to develop the nominal resistance in compression and to obtain the specified tip elevation shown on the plans or specified in the special provisions.

The tenth paragraph in Section 49-1.03, "Determination of Length," of the Standard Specifications is deleted.

The fourth paragraph in Section 49-1.04, "Load Test Piles," of the Standard Specifications is amended to read:

- Load test piles and anchor piles which are not to be incorporated in the completed structure shall be removed in conformance with the provisions in Section 15-4.02, "Removal Methods," and the remaining holes shall be backfilled with earth or other suitable material approved by the Engineer.

The fifth paragraph in Section 49-1.04, "Load Test Piles," of the Standard Specifications is amended to read:

- Load test anchorages in piles used as anchor piles shall conform to the following requirements:

A. High strength threaded steel rods shall conform to the provisions for bars in Section 50-1.05, "Prestressing Steel," except Type II bars shall be used.
B. High strength steel plates shall conform to the requirements in ASTM Designation: A 709/A 709M, Grade 345.
C. Anchor nuts shall conform to the provisions in the second paragraph in Section 50-1.06, "Anchorages and Distribution."

The first paragraph in Section 49-1.05, "Driving Equipment," of the Standard Specifications is amended to read:

- Driven piles shall be installed with impact hammers that are approved in writing by the Engineer. Impact hammers shall be steam, hydraulic, air or diesel hammers. Impact hammers shall develop sufficient energy to drive the piles at a penetration rate of not less than 3 mm per blow at the specified nominal resistance.

The seventh paragraph in Section 49-1.05, "Driving Equipment," of the Standard Specifications is amended to read:

- When necessary to obtain the specified penetration and when authorized by the Engineer, the Contractor may supply and operate one or more water jets and pumps, or furnish the necessary drilling apparatus and drill holes not greater than the least dimension of the pile to the proper depth and drive the piles therein. Jets shall not be used at locations where the stability of embankments or other improvements would be endangered. In addition, for steel piles, steel shells, or steel casings, when necessary to obtain the specified penetration or to prevent damage to the pile during installation, the Contractor shall provide special driving tips or heavier pile sections or take other measures as approved by the Engineer.

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

The second paragraph in Section 49-1.07, "Driving," of the Standard Specifications is amended to read:

- Timber piles shall be fresh-headed and square and when permitted by the Engineer, the heads of the piles may be protected by means of heavy steel or wrought iron rings. During driving operations timber piling shall be restrained from lateral movement at intervals not to exceed 6 m over the length between the driving head and the ground surface. During driving operations, the timber pile shall be kept moving by continuous operation of the hammer. When the blow count exceeds either 2 times the blow count required in 300 mm, or 3 times the blow count required in 75 mm for the nominal resistance as shown on the plans, computed in conformance with the provisions in Section 49-1.08, "Pile Driving Acceptance Criteria," additional aids shall be used to obtain the specified penetration. These aids may include the use of water jets or drilling, where permitted, or the use of a larger hammer employing a heavy ram striking with a low velocity.

Section 49-1.08, "Bearing Value and Penetration," of the Standard Specifications is amended to read:

49-1.08 PILE DRIVING ACCEPTANCE CRITERIA

- Except for piles to be load tested, driven piles shall be driven to a value of not less than the nominal resistance shown on the plans unless otherwise specified in the special provisions or permitted in writing by the Engineer. In addition, when a pile tip elevation is specified, driven piles shall penetrate at least to the specified tip elevation, unless otherwise permitted in writing by the Engineer. Piles to be load tested shall be driven to the specified tip elevation.
- When the pile nominal resistance is omitted from the plans or the special provisions, timber piles shall be driven to a nominal resistance of 800 kN, and steel and concrete piles shall be driven to a nominal resistance of 1250 kN.
- The nominal resistance for driven piles shall be determined from the following formula in which "R_u" is the nominal resistance in kilonewtons, "E_r" is the manufacturer's rating for joules of energy developed by the hammer at the observed field drop height, and "N" is the number of hammer blows in the last 300 millimeters. (maximum value to be used for N is 100):

$$R_u = (7 * (E_r)^{1/2} * \log_{10} (0.83 * N)) - 550$$

The first paragraph in Section 49-2.03, "Requirements," of the Standard Specifications is amended to read:

• When preservative treatment of timber piles is required by the plans or specified in the special provisions, the treatment shall conform to the provisions in Section 58, "Preservative Treatment of Lumber, Timber and Piling," and the applicable AWPA Use Category.

The first paragraph in Section 49-2.04, "Treatment of Pile Heads," of the Standard Specifications is amended to read:

A. An application of wood preservative conforming to the provisions in Section 58-1.04, "Wood Preservative for Manual Treatment," shall first be applied to the head of the pile and a protective cap shall then be built up by applying alternate layers of loosely woven fabric and hot asphalt or tar similar to membrane waterproofing, using 3 layers of asphalt or tar and 2 layers of fabric. The fabric shall measure at least 150 mm more in each direction than the diameter of the pile and shall be turned down over the pile and the edges secured by binding with 2 turns of No. 10 galvanized wire. The fabric shall be wired in advance of the application of the final layer of asphalt or tar, which shall extend down over the wiring.
B. The sawed surface shall be covered with 3 applications of a hot mixture of 60 percent creosote and 40 percent roofing pitch, or thoroughly brushcoated with 3 applications of hot creosote and covered with hot roofing pitch. A covering of 3.50-mm nominal thickness galvanized steel sheet shall be placed over the coating and bent down over the sides of each pile to shed water.

Section 49-3.01, "Description," of the Standard Specifications is amended by deleting the fifth paragraph.

The sixth and seventh paragraphs in Section 49-3.01, "Description," of the Standard Specifications are amended to read:

• Except for precast prestressed concrete piles in a corrosive environment, lifting anchors used in precast prestressed concrete piles shall be removed, and the holes filled in conformance with the provisions in Section 51-1.18A, "Ordinary Surface Finish."
• Lifting anchors used in precast prestressed concrete piles in a corrosive environment shall be removed to a depth of at least 25 mm below the surface of the concrete, and the resulting hole shall be filled with epoxy adhesive before the piles are delivered to the job site. The epoxy adhesive shall conform to the provisions in Sections 95-1, "General," and 95-2.01, "Binder (Adhesive), Epoxy Resin Base (State Specification 8040-03)."

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

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

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

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

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

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

The first and second paragraphs in Section 49-4.04, "Steel Shells," of the Standard Specifications are amended to read:

• Steel shells shall be sufficiently watertight to exclude water during the placing of concrete. The shells may be cylindrical or tapered, step-tapered, or a combination of either, with cylindrical sections.

The first paragraph in Section 49-4.05, "Inspection," of the Standard Specifications is amended to read:

• After being driven and prior to placing reinforcement and concrete therein, the steel shells shall be examined for collapse or reduced diameter at any point. Any shell which is improperly driven or broken or shows partial collapse to such an extent as to materially decrease its nominal resistance will be rejected. Rejected shells shall be removed and replaced, or a new shell shall be driven adjacent to the rejected shell. Rejected shells which cannot be removed shall be filled with concrete by the Contractor at the Contractor's expense. When a new shell is driven to replace a rejected shell, the Contractor, at the Contractor's expense, shall enlarge the footing as determined necessary by the Engineer.

The third paragraph in Section 49-5.01, "Description," of the Standard Specifications is amended to read:

• Steel pipe piles shall conform to the following requirements:

1. Steel pipe piles less than 360 mm in diameter shall conform to the requirements in ASTM Designation: A 252, Grade 2 or 3.
2. Steel pipe piles 360 mm and greater in diameter shall conform to the requirements in ASTM Designation: A 252, Grade 3.
3. Steel pipe piles shall be of the nominal diameter and nominal wall thickness shown on the plans or specified in the special provisions.
4. The carbon equivalency (CE) of steel for steel pipe piles, as defined in AWS D 1.1, Section XI5.1, shall not exceed 0.45.
5. The sulfur content of steel for steel pipe piles shall not exceed 0.05-percent.
6. Seams in steel pipe piles shall be complete penetration welds.

The first paragraph in Section 49-6.01, "Measurement," of the Standard Specifications is amended to read:

• The length of timber, steel, and precast prestressed concrete piles, and of cast-in-place concrete piles consisting of driven shells filled with concrete, shall be the greater of the following:

A. The total length in place in the completed work, measured along the longest side, from the tip of the pile to the plane of pile cut-off.
B. The length measured along the longest side, from the tip elevation shown on the plans or the tip elevation ordered by the Engineer, to the plane of pile cut-off.

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

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

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

• The contract unit price paid for drive pile shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in driving timber, concrete and steel piles, driving steel shells for cast-in-place concrete piles, placing filling materials for cast-in-place concrete piles and cutting off piles, all complete in place to the required nominal resistance and penetration as shown on the plans and as specified in these specifications and the special provisions, and as directed by the Engineer.

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

• Full compensation for all jetting, drilling, providing special driving tips or heavier sections for steel piles or shells, or other work necessary to obtain the specified penetration and nominal resistance of the piles, for predrilling holes through embankment and filling the space remaining around the pile with sand or pea gravel, for disposing of material resulting from jetting, drilling or predrilling holes, and for all excavation and backfill involved in constructing concrete extensions as shown on the plans, and as specified in these specifications and the special provisions, and as directed by the Engineer shall be considered as included in the contract unit price paid for drive pile or in the contract price paid per meter for cast-in-drilled-hole concrete piling, and no additional compensation will be allowed therefor.

Section 49-6.02, "Payment," of the Standard Specifications is amended by adding the following paragraphs:

Full compensation for furnishing and placing additional testing reinforcement, for load test anchorages, and for cutting off test piles, shall be considered as included in the contract price paid for piling of the type or class shown in the Engineer's Estimate, and no additional compensation will be allowed.

No additional compensation or extension of time will be made for additional foundation investigation, installation and testing of indicator piling, cutting off piling and restoring the foundation investigation and indicator pile sites, and review of request by the Engineer

SECTION 50: PRESTRESSING CONCRETE

Issue Date: November 18, 2002

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

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

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

- Prestressing steel shall be high-tensile wire conforming to the requirements in ASTM Designation: A 421, including Supplement I; high-tensile seven-wire strand conforming to the requirements in ASTM Designation: A 416; or uncoated high-strength steel bars conforming to the requirements in ASTM Designation: A 722, including all supplementary requirements. The maximum mass requirement of ASTM Designation: A 722 will not apply.
- In addition to the requirements of ASTM Designation: A 722, for deformed bars, the reduction of area shall be determined from a bar from which the deformations have been removed. The bar shall be machined no more than necessary to remove the deformations over a length of 300 mm, and reduction will be based on the area of the machined portion.
- In addition to the requirements specified herein, epoxy-coated seven-wire prestressing steel strand shall be grit impregnated and filled in conformance with the requirements in ASTM Designation: A 882/A 882M, including Supplement I, and the following:

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

- All bars in any individual member shall be of the same grade, unless otherwise permitted by the Engineer.
- When bars are to be extended by the use of couplers, the assembled units shall have a tensile strength of not less than the manufacturer's minimum guaranteed ultimate tensile strength of the bars. Failure of any one sample to meet this requirement will be cause for rejection of the heat of bars and lot of couplers. The location of couplers in the member shall be subject to approval by the Engineer.

- Wires shall be straightened if necessary to produce equal stress in all wires or wire groups or parallel lay cables that are to be stressed simultaneously or when necessary to ensure proper positioning in the ducts.
- Where wires are to be button-headed, the buttons shall be cold formed symmetrically about the axes of the wires. The buttons shall develop the minimum guaranteed ultimate tensile strength of the wire. No cold forming process shall be used that causes indentations in the wire. Buttonheads shall not contain wide open splits, more than 2 splits per head, or splits not parallel with the axis of the wire.
- Prestressing steel shall be protected against physical damage and rust or other results of corrosion at all times from manufacture to grouting or encasing in concrete. Prestressing steel that has sustained physical damage at any time shall be rejected. The development of visible rust or other results of corrosion shall be cause for rejection, when ordered by the Engineer.
- Epoxy-coated prestressing steel strand shall be covered with an opaque polyethylene sheeting or other suitable protective material to protect the strand from exposure to sunlight, salt spray, and weather. For stacked coils, the protective covering shall be draped around the perimeter of the stack. The covering shall be adequately secured; however, it should allow for air circulation around the strand to prevent condensation under the covering. Epoxy-coated strand shall not be stored within 300 m of ocean or tidal water for more than 2 months.
- Prestressing steel shall be packaged in containers or shipping forms for the protection of the steel against physical damage and corrosion during shipping and storage. Except for epoxy-coated strand, a corrosion inhibitor which prevents rust or other results of corrosion, shall be placed in the package or form, or shall be incorporated in a corrosion inhibitor carrier type packaging material, or when permitted by the Engineer, may be applied directly to the steel. The corrosion inhibitor shall have no deleterious effect on the steel or concrete or bond strength of steel to concrete. Packaging or forms damaged from any cause shall be immediately replaced or restored to original condition.
- The shipping package or form shall be clearly marked with a statement that the package contains high-strength prestressing steel, and the type of corrosion inhibitor used, including the date packaged.
- Prestressing steel for post-tensioning which is installed in members prior to placing and curing of the concrete, and which is not epoxy-coated, shall be continuously protected against rust or other results of corrosion, until grouted, by means of a corrosion inhibitor placed in the ducts or applied to the steel in the duct. The corrosion inhibitor shall conform to the provisions specified herein.
- When steam curing is used, prestressing steel for post-tensioning shall not be installed until the steam curing is completed.
- Water used for flushing ducts shall contain either quick lime (calcium oxide) or slaked lime (calcium hydroxide) in the amount of 0.01-kg/L. Compressed air used to blow out ducts shall be oil free.
- When prestressing steel for post-tensioning is installed in the ducts after completion of concrete curing, and if stressing and grouting are completed within 10 days after the installation of the prestressing steel, rust which may form during those 10 days will not be cause for rejection of the steel. Prestressing steel installed, tensioned, and grouted in this manner, all within 10 days, will not require the use of a corrosion inhibitor in the duct following installation of the prestressing steel. Prestressing steel installed as above but not grouted within 10 days shall be subject to all the requirements in this section pertaining to corrosion protection and rejection because of rust. The requirements in this section pertaining to tensioning and grouting within 10 days shall not apply to epoxy-coated prestressing steel strand.
- Any time prestressing steel for pretensioning is placed in the stressing bed and is exposed to the elements for more than 36 hours prior to encasement in concrete, adequate measures shall be taken by the Contractor, as approved by the Engineer, to protect the steel from contamination or corrosion.
- After final fabrication of the seven-wire prestressing steel strand, no electric welding of any form shall be performed on the prestressing steel. Whenever electric welding is performed on or near members containing prestressing steel, the welding ground shall be attached directly to the steel being welded.
- Pretensioned prestressing steel shall be cut off flush with the end of the member. For epoxy-coated prestressing steel, only abrasive saws shall be used to cut the steel. The exposed ends of the prestressing steel and a 25-mm strip of adjoining concrete shall be cleaned and painted. Cleaning shall be by wire brushing or abrasive blast cleaning to remove all dirt and residue on the metal or concrete surfaces. Immediately after cleaning, the surfaces shall be covered with one application of unthinned zinc-rich primer (organic vehicle type) conforming to the provisions in Section 91, "Paint," except that 2 applications shall be applied to surfaces which will not be covered by concrete or mortar. Aerosol cans shall not be used. The paint shall be thoroughly mixed at the time of application and shall be worked into any voids in the prestressing tendons.

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

- Prestressing steel in pretensioned members shall not be cut or released until the concrete in the member has attained a compressive strength of not less than the value shown on the plans or 28 MPa, whichever is greater. In addition to these

concrete strength requirements, when epoxy-coated prestressing steel strand is used, the steel shall not be cut or released until the temperature of the concrete surrounding the strand is less than 65°C, and falling.

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

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

A. For wire or bars, one 2-m long sample and for strand, one 1.5-m long sample, of each size shall be furnished for each heat or reel.
B. For epoxy-coated strand, one 1.5-m long sample of uncoated strand of each size shall be furnished for each reel.
C. If the prestressing tendon is a bar, one 2-m long sample shall be furnished and in addition, if couplers are to be used with the bar, two 1.25-m long samples of bar, equipped with one coupler and fabricated to fit the coupler, shall be furnished.

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

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

SECTION 51: CONCRETE STRUCTURES

Issue Date: January 31, 2005

The eleventh paragraph in Section 51-1.05, "Forms," of the Standard Specifications is amended to read:

• Form panels for exposed surfaces shall be furnished and placed in uniform widths of not less than 0.9-m and in uniform lengths of not less than 1.8 m, except at the end of continuously formed surfaces where the final panel length required is less than 1.8 m. Where the width of the member formed is less than 0.9-m, the width of the panels shall be not less than the width of the member. Panels shall be arranged in symmetrical patterns conforming to the general lines of the structure. Except when otherwise provided herein or shown on the plans, panels for vertical surfaces shall be placed with the long dimension horizontal and with horizontal joints level and continuous. Form panels for curved surfaces of columns shall be continuous for a minimum of one quarter of the circumference, or 1.8 m. For walls with sloping footings which do not abut other walls, panels may be placed with the long dimension parallel to the footing. Form panels on each side of the panel joint shall be precisely aligned, by means of supports or fasteners common to both panels, to result in a continuous unbroken concrete plane surface. When prefabricated soffit panels are used, form filler panels joining prefabricated panels shall have a uniform minimum width of 0.3-m and shall produce a smooth uniform surface with consistent longitudinal joint lines between the prefabricated panels.

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

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

• The falsework drawings shall include details of the falsework erection and removal operations showing the methods and sequences of erection and removal and the equipment to be used. The details of the falsework erection and removal operations shall demonstrate the stability of all or any portions of the falsework during all stages of the erection and removal operations.

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

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

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

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

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

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

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

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

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

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

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

- For falsework piles with a calculated nominal resistance greater than 1800 kN, the Contractor shall conduct dynamic monitoring of pile driving and generate field acceptance criteria based on a wave equation analysis. These analyses shall be signed by an engineer who is registered as a Civil Engineer in the State of California and submitted to the Engineer prior to completion of falsework erection.

- Prior to the placement of falsework members above the stringers, the final bracing system for the falsework shall be installed.

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

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

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

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

The third sentence of the fourth paragraph in Section 51-1.12D, "Sheet Packing, Preformed Pads and Board Fillers," of the Standard Specifications is amended to read:

Surfaces of expanded polystyrene against which concrete is placed shall be faced with hardboard.

Section 51-1.12F, "Sealed Joints," of the Standard Specifications is amended by adding the following paragraph:

• The opening of the joints at the time of placing shall be that shown on the plans adjusted for temperature. Care shall be taken to avoid impairment of the clearance in any manner.

The first paragraph in Section 51-1.12F, "Sealed Joints," of the Standard Specifications is amended to read:

• Where shown on the plans, joints in structures shall be sealed with joint seals, joint seal assemblies, or seismic joints in conformance with the details shown on the plans, the provisions in these specifications, and the special provisions.

The fourth paragraph in Section 51-1.12F, "Sealed Joints," of the Standard Specifications is amended to read:

• Joint seal assemblies and seismic joints shall consist of metal or metal and elastomeric assemblies which are anchored or cast into a recess in the concrete over the joint. Strip seal joint seal assemblies consist of only one joint cell. Modular unit joint seal assemblies consist of more than one joint cell.

The fifth paragraph in Section 51-1.12F, "Sealed Joints," of the Standard Specifications is amended to read:

• The Movement Rating (MR) shall be measured normal to the longitudinal axis of the joint. The type of seal to be used for the MR shown on the plans shall be as follows:

Movement Rating (MR)	Seal Type
MR ≤ 15 mm	Type A or Type B
15 mm < MR ≤ 30 mm	Type A (silicone only) or Type B
30 mm < MR ≤ 50 mm	Type B
50 mm < MR ≤ 100 mm	Joint Seal Assembly (Strip Seal)
MR > 100 mm	Joint Seal Assembly (Modular Unit) or Seismic Joint

The second paragraph in Section 51-1.12F(3)(b), "Type B Seal," of the Standard Specifications is amended to read:

• The preformed elastomeric joint seal shall conform to the requirements in ASTM Designation: D 2628 and the following:

A. The seal shall consist of a multi-channel, nonporous, homogeneous material furnished in a finished extruded form.
B. The minimum depth of the seal, measured at the contact surface, shall be at least 95 percent of the minimum uncompressed width of the seal as designated by the manufacturer.
C. When tested in conformance with the requirements in California Test 673 for Type B seals, joint seals shall provide a Movement Rating (MR) of not less than that shown on the plans.
D. The top and bottom edges of the joint seal shall maintain continuous contact with the sides of the groove over the entire range of joint movement.
E. The seal shall be furnished full length for each joint with no more than one shop splice in any 18-m length of seal.
F. The Contractor shall demonstrate the adequacy of the procedures to be used in the work before installing seals in the joints.
G. Shop splices and field splices shall have no visible offset of exterior surfaces, and shall show no evidence of bond failure.
H. At all open ends of the seal that would admit water or debris, each cell shall be filled to a depth of 80 mm with commercial quality open cell polyurethane foam, or closed by other means subject to approval by the Engineer.

Section 51-1.12F(3)(c), "Joint Seal Assemblies," of the Standard Specifications is amended to read:

(c) Joint Seal Assemblies and Seismic Joints

- Joint seal assemblies and seismic joints shall be furnished and installed in joints in bridge decks as shown on the plans and as specified in the special provisions.

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

- The elastomer, as determined from test specimens, shall conform to the following:

Test	ASTM Designation	Requirement
Tensile strength, MPa	D 412	15.5 Min.
Elongation at break, percent	D 412	350 Min.
Compression set, 22 h at 70°C, percent	D 395 (Method B)	25 Max.
Tear strength, kN/m	D 624 (Die C)	31.5 Min.
Hardness (Type A)	D 2240 with 2 kg. mass	55 ±5
Ozone resistance 20% strain, 100 h at 40°C ±2°C	D 1149 (except 100 ±20 parts per 100 000 000)	No cracks
Instantaneous thermal stiffening at -40°C	D 1043	Shall not exceed 4 times the stiffness measured at 23°C
Low temperature brittleness at -40°C	D 746 (Procedure B)	Pass

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

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

The first paragraph in Section 51-1.12H(2), "Steel Reinforced Elastomeric Bearings," of the Standard Specifications is amended to read:

- Steel reinforced elastomeric bearings shall conform to the requirements for steel-laminated elastomeric bearings in ASTM Designation: D 4014 and the following:

A. The bearings shall consist of alternating steel laminates and internal elastomer laminates with top and bottom elastomer covers. Steel laminates shall have a nominal thickness of 1.9 mm (14 gage). Internal elastomer laminates shall have a thickness of 12 mm, and top and bottom elastomer covers shall each have a thickness of 6 mm. The combined thickness of internal elastomer laminates and top and bottom elastomer covers shall be equal to the bearing pad thickness shown on the plans. The elastomer cover to the steel laminates at the sides of the bearing shall be 3 mm. If guide pins or other devices are used to control the side cover over the steel laminates, any exposed portions of the steel laminates shall be sealed by vulcanized patching. The length, width, or diameter of the bearings shall be as shown on the plans.
B. The total thickness of the bearings shall be equal to the thickness of elastomer laminates and covers plus the thickness of the steel laminates.
C. Elastomer for steel reinforced elastomeric bearings shall conform to the provisions for elastomer in Section 51-1.12H(1), "Plain and Fabric Reinforced Elastomeric Bearing Pads."
D. A Certificate of Compliance conforming to the provisions in Section 6-1.07, "Certificates of Compliance," shall be furnished to the Engineer certifying that the bearings to be furnished conform to all of the above provisions. The Certificate of Compliance shall be supported by a certified copy of the results of tests performed by the manufacturer on the bearings.

E. One sample bearing shall be furnished to the Engineer from each lot of bearings to be furnished for the contract. Samples shall be available at least 3 weeks in advance of intended use. The sample bearing shall be one of the following:

Bearing Pad Thickness as Shown on the Plans	Sample Bearing
≤ 50 mm	Smallest complete bearing shown on the plans
> 50 mm	* 57 ± 3 mm thick sample not less than 200 mm x 305 mm in plan and cut by the manufacturer from the center of one of the thickest complete bearings

* The sample bearing plus remnant parts of the complete bearing shall be furnished to the Engineer.

F. A test specimen taken from the sample furnished to the Engineer will be tested in conformance with the requirements in California Test 663. Specimens tested shall show no indication of loss of bond between the elastomer and steel laminates.

The fourth paragraph in Section 51-1.14, "Waterstops," of the Standard Specifications is amended to read:

• Neoprene shall be manufactured from a vulcanized elastomeric compound containing neoprene as the sole elastomer and shall conform to the following:

Test	ASTM Designation	Requirement
Tensile strength, MPa	D 412	13.8 Min.
Elongation at break, percent	D 412	300 Min.
Compression set, 22 h at 70°C, percent	D 395 (Method B)	30 Max.
Tear strength, kN/m	D 624 (Die C)	26.3 Min.
Hardness (Type A)	D 2240	55±5
Ozone resistance 20% strain, 100 h at 38°C ±1°C	D 1149 (except 100± 20 parts per 100 000 000)	No cracks
Low temperature brittleness at -40°C	D 746 (Procedure B)	Pass
Flame resistance	C 542	Must not propagate flame
Oil Swell, ASTM Oil #3, 70 h at 100°C, volume change, percent	D 471	80 Max.
Water absorption, immersed 7 days at 70°C, change in mass, percent	D 471	15 Max.

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

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

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

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

SECTION 52: REINFORCEMENT

Issue Date: November 2, 2004

The first paragraph in Section 52-1.02A, "Bar Reinforcement," of the Standard Specifications is amended to read:

• Reinforcing bars shall be low-alloy steel deformed bars conforming to the requirements in ASTM Designation: A 706/A 706M, except that deformed or plain billet-steel bars conforming to the requirements in ASTM Designation: A 615/A 615M, Grade 280 or 420, may be used as reinforcement in the following 5 categories:

A. Slope and channel paving,
B. Minor structures,
C. Sign and signal foundations (pile and spread footing types),
D. Roadside rest facilities, and
E. Concrete barrier Type 50 and Type 60 series and temporary railing.

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

• A Certificate of Compliance conforming to the provisions in Section 6-1.07, "Certificates of Compliance," shall also be furnished for each shipment of epoxy-coated bar reinforcement or wire reinforcement certifying that the coated reinforcement conforms to the requirements in ASTM Designation: A 775/A 775M or A 884/A 884M respectively, and the provisions in Section 52-1.02B, "Epoxy-coated Reinforcement." The Certificate of Compliance shall include all of the certifications specified in ASTM Designation: A 775/A 775M or A 884/A 884M respectively.

Section 52-1.07 "Placing," of the Standard Specifications is amended by deleting item C of the third paragraph.

The eleventh paragraph in Section 52-1.07, "Placing," of the Standard Specifications is amended to read:

• Attention is directed to the provisions in Section 7-1.09, "Public Safety." Whenever a portion of an assemblage of bar reinforcing steel that is not encased in concrete exceeds 6 m in height, the Contractor shall submit to the Engineer for approval, in accordance with the provisions in Section 5-1.02, "Plans and Working Drawings," working drawings and design calculations for the temporary support system to be used. The working drawings and design calculations shall be signed by an engineer who is registered as a Civil Engineer in the State of California. The temporary support system shall be designed to resist all expected loads and shall be adequate to prevent collapse or overturning of the assemblage. If the installation of forms or other work requires revisions to or temporary release of any portion of the temporary support system, the working drawings shall show the support system to be used during each phase of construction. The minimum horizontal wind load to be applied to the bar reinforcing steel assemblage, or to a combined assemblage of reinforcing steel and forms, shall be the sum of the products of the wind impact area and the applicable wind pressure value for each height zone. The wind impact area is the total projected area of the cage normal to the direction of the applied wind. Wind pressure values shall be determined from the following table:

Height Zone (Meters above ground)	Wind Pressure Value (Pa)
0-9.0	960
9.1-15.0	1200
15.1-30.0	1440
Over 30	1675

Section 52-1.08 "Splicing," of the Standard Specifications is amended to read:

52-1.08 SPLICING

• Splices of reinforcing bars shall consist of lap splices, service splices, or ultimate butt splices.

• Splicing of reinforcing bars will not be permitted at a location designated on the plans as a "No-Splice Zone." At the option of the Contractor, reinforcing bars may be continuous at locations where splices are shown on the plans. The location of splices, except where shown on the plans, shall be determined by the Contractor using available commercial lengths where practicable.

• Unless otherwise shown on the plans, splices in adjacent reinforcing bars at any particular section shall be staggered. The minimum distance between staggered lap splices or mechanical lap splices shall be the same as the length required for a lap splice in the largest bar. The minimum distance between staggered butt splices shall be 600 mm, measured between the midpoints of the splices along a line which is centered between the axes of the adjacent bars.

52-1.08A Lap Splicing Requirements

• Splices made by lapping shall consist of placing reinforcing bars in contact and wiring them together, maintaining the alignment of the bars and the minimum clearances. Should the Contractor elect to use a butt welded or mechanical splice at a location not designated on the plans as requiring a service or ultimate butt splice, this splice shall conform to the testing requirements for service splice.

• Reinforcing bars shall not be spliced by lapping at locations where the concrete section is not sufficient to provide a minimum clear distance of 50 mm between the splice and the nearest adjacent bar. The clearance to the surface of the concrete specified in Section 52-1.07, "Placing," shall not be reduced.

• Reinforcing bars Nos. 43 and 57 shall not be spliced by lapping.

• Where ASTM Designations: A 615/A 615M, Grade 420 or A 706/A 706M reinforcing bars are required, the length of lap splices shall be as follows: Reinforcing bars No. 25 or smaller shall be lapped at least 45 diameters of the smaller bar joined; and reinforcing bars Nos. 29, 32, and 36 shall be lapped at least 60 diameters of the smaller bar joined, except when otherwise shown on the plans.

• Where ASTM Designation: A 615/A 615M, Grade 280 reinforcing bars are permitted, the length of lap splices shall be as follows: Reinforcing bars No. 25 or smaller shall be lapped at least 30 diameters of the smaller bar joined; and reinforcing bars Nos. 29, 32, and 36 shall be lapped at least 45 diameters of the smaller bar joined, except when otherwise shown on the plans.

• Splices in bundled bars shall conform to the following:

A In bundles of 2 bars, the length of the lap splice shall be the same as the length of a single bar lap splice.
B. In bundles of 3 bars, the length of the lap splice shall be 1.2 times the length of a single bar lap splice.

• Welded wire fabric shall be lapped such that the overlap between the outermost cross wires is not less than the larger of:

A. 150 mm,
B. The spacing of the cross wires plus 50 mm, or
C. The numerical value of the longitudinal wire size (MW-Size Number) times 370 divided by the spacing of the longitudinal wires in millimeters.

52-1.08B Service Splicing and Ultimate Butt Splicing Requirements

• Service splices and ultimate butt splices shall be either butt welded or mechanical splices, shall be used at the locations shown on the plans, and shall conform to the requirements of these specifications and the special provisions.

52-1.08B(1) Mechanical Splices

• Mechanical splices to be used in the work shall be on the Department's current prequalified list before use. The prequalified list can be obtained from the Department's internet site listed in the special provisions or by contacting the Transportation Laboratory directly.

• When tested in conformance with the requirements in California Test 670, the total slip shall not exceed the values listed in the following table:

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

- Slip requirements shall not apply to mechanical lap splices, splices that are welded, or splices that are used on hoops.
- Splicing procedures shall be in conformance with the manufacturer's recommendations, except as modified in this section. Splices shall be made using the manufacturer's standard equipment, jigs, clamps, and other required accessories.
- Splice devices shall have a clear coverage of not less than 40 mm measured from the surface of the concrete to the outside of the splice device. Stirrups, ties, and other reinforcement shall be adjusted or relocated, and additional reinforcement shall be placed, if necessary, to provide the specified clear coverage to reinforcement.
- The Contractor shall furnish the following information for each shipment of splice material in conformance with the provisions in Section 6-1.07, "Certificates of Compliance:"

A. The type or series identification of the splice material including tracking information for traceability.
B. The bar grade and size number to be spliced.
C. A copy of the manufacturer's product literature giving complete data on the splice material and installation procedures.
D. A statement that the splicing systems and materials used in conformance with the manufacturer's installation procedures will develop the required tensile strengths, based on the nominal bar area, and will conform to the total slip requirements and the other requirements in these specifications.
E. A statement that the splice material conforms to the type of mechanical splice in the Department's current prequalified list.

52-1.08B(2) Butt Welded Splices

- Except for resistance butt welds, butt welded splices of reinforcing bars shall be complete joint penetration butt welds conforming to the requirements in AWS D 1.4, and these specifications.
- Welders and welding procedures shall be qualified in conformance with the requirements in AWS D 1.4.
- Only the joint details and dimensions as shown in Figure 3.2, "Direct Butt Joints," of AWS D 1.4, shall be used for making complete joint penetration butt welds of bar reinforcement. Split pipe backing shall not be used.
- Butt welds shall be made with multiple weld passes using a stringer bead without an appreciable weaving motion. The maximum stringer bead width shall be 2.5 times the diameter of the electrode and slagging shall be performed between each weld pass. Weld reinforcement shall not exceed 4 mm in convexity.
- Electrodes used for welding shall meet the minimum Charpy V-notch impact requirement of 27°J at –20°C.
- For welding of bars conforming to the requirements of ASTM Designation: A 615/A 615M, Grade 280 or Grade 420, the requirements of Table 5.2, "Minimum Preheat and Interpass Temperatures," of AWS D 1.4 are superseded by the following:

The minimum preheat and interpass temperatures shall be 200°C for Grade 280 bars and 300°C for Grade 420 bars. Immediately after completing the welding, at least 150 mm of the bar on each side of the splice shall be covered by an insulated wrapping to control the rate of cooling. The insulated wrapping shall remain in place until the bar has cooled below 90°C.

- When welding different grades of reinforcing bars, the electrode shall conform to Grade 280 bar requirements and the preheat shall conform to the Grade 420 bar requirements.
- In the event that any of the specified preheat, interpass, and post weld cooling temperatures are not met, all weld and heat affected zone metal shall be removed and the splice rewelded.
- Welding shall be protected from air currents, drafts, and precipitation to prevent loss of heat or loss of arc shielding. The method of protecting the welding area from loss of heat or loss of arc shielding shall be subject to approval by the Engineer.

- Reinforcing bars shall not be direct butt spliced by thermite welding.
- Procedures to be used in making welded splices in reinforcing bars, and welders employed to make splices in reinforcing bars, shall be qualified by tests performed by the Contractor on sample splices of the type to be used, before making splices to be used in the work.

52-1.08B(3) Resistance Butt Welds

- Shop produced resistance butt welds shall be produced by a fabricator who is approved by the Transportation Laboratory. The list of approved fabricators can be obtained from the Department's internet site or by contacting the Transportation Laboratory directly.
- Before manufacturing hoops using resistance butt welding, the Contractor shall submit to the Engineer the manufacturer's Quality Control (QC) manual for the fabrication of hoops. As a minimum, the QC manual shall include the following:

A. The pre-production procedures for the qualification of material and equipment.
B. The methods and frequencies for performing QC procedures during production.
C. The calibration procedures and calibration frequency for all equipment.
D. The welding procedure specification (WPS) for resistance welding.
E. The method for identifying and tracking lots.

52-1.08C Service Splice and Ultimate Butt Splice Testing Requirements

- The Contractor shall designate in writing a splicing Quality Control Manager (QCM). The QCM shall be responsible directly to the Contractor for 1) the quality of all service and ultimate butt splicing including the inspection of materials and workmanship performed by the Contractor and all subcontractors; and 2) submitting, receiving, and approving all correspondence, required submittals, and reports regarding service and ultimate splicing to and from the Engineer.
- The QCM shall not be employed or compensated by any subcontractor, or by other persons or entities hired by subcontractors, who will provide other services or materials for the project. The QCM may be an employee of the Contractor.
- Testing on prequalification and production sample splices shall be performed at the Contractor's expense, at an independent qualified testing laboratory. The laboratory shall not be employed or compensated by any subcontractor, or by other persons or entities hired by subcontractors who will provide other services or materials for the project, and shall have the following:

A. Proper facilities, including a tensile testing machine capable of breaking the largest size of reinforcing bar to be tested with minimum lengths as shown in this section.
B. A device for measuring the total slip of the reinforcing bars across the splice to the nearest 25 µm, that, when placed parallel to the longitudinal axis of the bar is able to simultaneously measure movement across the splice at 2 locations 180 degrees apart.
C. Operators who have received formal training for performing the testing requirements of ASTM Designation: A 370 and California Test 670.
D. A record of annual calibration of testing equipment performed by an independent third party that has 1) standards that are traceable to the National Institute of Standards and Technology, and 2) a formal reporting procedure, including published test forms.

- The Contractor shall provide samples for quality assurance testing in conformance with the provisions in these specifications and the special provisions.
- Prequalification and production sample splices shall be 1) a minimum length of 1.5 meters for reinforcing bars No. 25 or smaller, and 2 meters for reinforcing bars No. 29 or larger, with the splice located at mid-point; and 2) suitably identified before shipment with weatherproof markings that do not interfere with the Engineer's tamper-proof markings or seals. Splices that show signs of tampering will be rejected.
- Shorter length sample splice bars may be furnished if approved in writing by the Engineer.
- The Contractor shall ensure that sample splices are properly secured and transported to the testing laboratory in such a manner that no alterations to the physical conditions occur during transportation. Sample splices shall be tested in the same condition as received. No modifications to the sample splices shall be made before testing.
- Each set or sample splice, as defined herein, shall be identified as representing either a prequalification or production test sample splice.
- For the purpose of production testing, a lot of either service splices or ultimate butt splices is defined as 1) 150, or fraction thereof, of the same type of mechanical splices used for each bar size and each bar deformation pattern that is used in the work, or 2) 150, or fraction thereof, of complete joint penetration butt welded splices or resistance butt welded splices for

each bar size used in the work. If different diameters of hoop reinforcement are shown on the plans, separate lots shall be used for each different hoop diameter.

• Whenever a lot of splices is rejected, the rejected lot and subsequent lots of splices shall not be used in the work until 1) the QCM performs a complete review of the Contractor's quality control process for these splices, 2) a written report is submitted to the Engineer describing the cause of failure for the splices in this lot and provisions for preventing similar failures in future lots, and 3) the Engineer has provided the Contractor with written notification that the report is acceptable. The Engineer shall have 3 working days after receipt of the report to provide notification to the Contractor. In the event the Engineer fails to provide notification within the time allowed, and if, in the opinion of the Engineer, completion of the work is delayed or interfered with by reason of the Engineer's delay in providing notification, the Contractor will be compensated for any resulting loss, and an extension of time will be granted in the same manner as provided for in Section 8-1.09, "Right of Way Delays."

52-1.08C(1) Splice Prequalification Report

• Before using any service splices or ultimate butt splices in the work, the Contractor shall submit a Splice Prequalification Report. The report shall include splice material information, names of the operators who will be performing the splicing, and descriptions of the positions, locations, equipment, and procedures that will be used in the work.

• The Splice Prequalification Report shall also include certifications from the fabricator for prequalifications of operators and procedures based on sample tests performed no more than 2 years before submitting the report. Each operator shall be certified by performing 2 sample splices for each bar size of each splice type that the operator will be performing in the work. For deformation-dependent types of splice devices, each operator shall be certified by performing 2 additional samples for each bar size and deformation pattern that will be used in the work.

• Prequalification sample splices shall be tested by an independent qualified testing laboratory and shall conform to the appropriate production test criteria and slip requirements specified herein. When epoxy-coated reinforcement is required, resistance butt welded sample splices shall have the weld flash removed by the same procedure as will be used in the work, before coating and testing. The Splice Prequalification Report shall include the certified test results for all prequalification sample splices.

• The QCM shall review and approve the Splice Prequalification Report before submitting it to the Engineer for approval. The Contractor shall allow 2 weeks for the review and approval of a complete report before performing any service splicing or ultimate butt splicing in the work. In the event the Engineer fails to complete the review within the time allowed, and in the opinion of the Engineer, completion of the work is delayed or interfered with by reason of the Engineer's delay in completing the review, the Contractor will be compensated for any resulting loss, and an extension of time will be granted, in the same manner as provided for in Section 8-1.09, "Right of Way Delays."

52-1.08C(2) Service Splice Test Criteria

• Service production and quality assurance sample splices shall be tensile tested in conformance with the requirements in ASTM Designation: A 370 and California Test 670 and shall develop a minimum tensile strength of not less than 550 MPa.

52-1.08C(2)(a) Production Test Requirements for Service Splices

• Production tests shall be performed by the Contractor's independent laboratory for all service splices used in the work. A production test shall consist of testing 4 sample splices prepared for each lot of completed splices. The samples shall be prepared by the Contractor using the same splice material, position, operators, location, and equipment, and following the same procedure as used in the work.

• At least one week before testing, the Contractor shall notify the Engineer in writing of the date when and the location where the testing of the samples will be performed.

• The 4 samples from each production test shall be securely bundled together and identified with a completed sample identification card before shipment to the independent laboratory. The card will be furnished by the Engineer. Bundles of samples containing fewer than 4 samples of splices shall not be tested.

• Before performing any tensile tests on production test sample splices, one of the 4 samples shall be tested for, and shall conform to, the requirements for total slip. Should this sample not meet the total slip requirements, one retest, in which the 3 remaining samples are tested for total slip, will be allowed. Should any of the 3 remaining samples not conform to the total slip requirements, all splices in the lot represented by this production test will be rejected.

• If 3 or more sample splices from a production test conform to the provisions in this Section 52-1.08C(2),"Service Splice Test Criteria," all splices in the lot represented by this production test will be considered acceptable, provided each of the 4 samples develop a minimum tensile strength of not less than 420 MPa.

• Should only 2 sample splices from a production test conform to the provisions in this Section 52-1.08C(2), "Service Splice Test Criteria," one additional production test shall be performed on the same lot of splices. This additional production test shall consist of testing 4 samples splices that have been randomly selected by the Engineer and removed by the

Contractor from the actual completed lot of splices. Should any of the 4 splices from this additional test fail to conform to these provisions, all splices in the lot represented by these production tests will be rejected.

- If only one sample splice from a production test conforms to the provisions in this Section 52-1.08C(2), "Service Splice Test Criteria," all splices in the lot represented by this production test will be rejected.
- If a production test for a lot fails, the Contractor shall repair or replace all reinforcing bars from which sample splices were removed before the Engineer selects additional splices from this lot for further testing.

52-1.08C(2)(b) Quality Assurance Test Requirements for Service Splices

- For the first production test performed, and for at least one, randomly selected by the Engineer, of every 5 subsequent production tests, or portion thereof, the Contractor shall concurrently prepare 4 additional service quality assurance sample splices. These service quality assurance sample splices shall be prepared in the same manner as specified herein for service production sample splices.
- These 4 additional quality assurance sample splices shall be shipped to the Transportation Laboratory for quality assurance testing. The 4 sample splices shall be securely bundled together and identified by location and contract number with weatherproof markings before shipment. Bundles containing fewer than 4 samples of splices will not be tested. Sample splices not accompanied by the supporting documentation required in Section 52-1.08B(1), for mechanical splices, or in Section 52-1.08B(3), for resistance butt welds, will not be tested.
- Quality assurance testing will be performed in conformance with the requirements for service production sample splices in Section 52-1.08C(2)(a), "Production Test Requirements for Service Splices."

52-1.08C(3) Ultimate Butt Splice Test Criteria

- Ultimate production and quality assurance sample splices shall be tensile tested in conformance with the requirements described in ASTM Designation: A 370 and California Test 670.
- A minimum of one control bar shall be removed from the same bar as, and adjacent to, all ultimate production, and quality assurance sample splices. Control bars shall be 1) a minimum length of one meter for reinforcing bars No. 25 or smaller and 1.5 meters for reinforcing bars No. 29 or larger, and 2) suitably identified before shipment with weatherproof markings that do not interfere with the Engineer's tamper-proof markings or seals. The portion of adjacent bar remaining in the work shall also be identified with weatherproof markings that correspond to its adjacent control bar.
- Each sample splice and its associated control bar shall be identified and marked as a set. Each set shall be identified as representing a prequalification, production, or quality assurance sample splice.
- The portion of hoop reinforcing bar, removed to obtain a sample splice and control bar, shall be replaced using a prequalified ultimate mechanical butt splice, or the hoop shall be replaced in kind.
- Reinforcing bars, other than hoops, from which sample splices are removed, shall be repaired using ultimate mechanical butt splices conforming to the provisions in Section 52-1.08C(1), "Splice Prequalification Report," or the bars shall be replaced in kind. These bars shall be repaired or replaced such that no splices are located in any "No Splice Zone" shown on the plans.
- Ultimate production and quality assurance sample splices shall rupture in the reinforcing bar either: 1) outside of the affected zone or 2) within the affected zone, provided that the sample splice has achieved at least 95 percent of the ultimate tensile strength of the control bar associated with the sample splice. In addition, necking of the bar, as defined in California Test 670, shall be evident at rupture regardless of whether the bar breaks inside or outside the affected zone.
- The affected zone is the portion of the reinforcing bar where any properties of the bar, including the physical, metallurgical, or material characteristics, have been altered by fabrication or installation of the splice.
- The ultimate tensile strength shall be determined for all control bars by tensile testing the bars to rupture, regardless of where each sample splice ruptures. If 2 control bars are tested for one sample splice, the bar with the lower ultimate tensile strength shall be considered the control bar.

52-1.08C(3)(a) Production Test Requirements for Ultimate Butt Splices

- Production tests shall be performed for all ultimate butt splices used in the work. A production test shall consist of testing 4 sets of sample splices and control bars removed from each lot of completed splices, except when quality assurance tests are performed.
- After the splices in a lot have been completed, and the bars have been epoxy-coated when required, the QCM shall notify the Engineer in writing that the splices in this lot conform to the specifications and are ready for testing. Except for hoops, sample splices will be selected by the Engineer at the job site. Sample splices for hoops will be selected by the Engineer either at the job site or a fabrication facility.
- After notification has been received, the Engineer will randomly select the 4 sample splices to be removed from the lot and place tamper-proof markings or seals on them. The Contractor shall select the adjacent control bar for each sample splice bar, and the Engineer will place tamper-proof markings or seals on them. These ultimate production sample splices and control bars shall be removed by the Contractor, and tested by an independent qualified testing laboratory.

- At least one week before testing, the Contractor shall notify the Engineer in writing of the date when and the location where the testing of the samples will be performed.
- A sample splice or control bar from any set will be rejected if a tamper-proof marking or seal is disturbed before testing.
- The 4 sets from each production test shall be securely bundled together and identified with a completed sample identification card before shipment to the independent laboratory. The card will be furnished by the Engineer. Bundles of samples containing fewer than 4 sets of splices shall not be tested.
- Before performing any tensile tests on production test sample splices, one of the 4 sample splices shall be tested for, and shall conform to, the requirements for total slip. Should this sample splice not meet these requirements, one retest, in which the 3 remaining sample splices are tested for total slip, will be allowed. Should any of the 3 remaining sample splices not conform to these requirements, all splices in the lot represented by this production test will be rejected.
- If 3 or more sample splices from a production test conform to the provisions in Section 52-1.08C(3), "Ultimate Butt Splice Test Criteria," all splices in the lot represented by this production test will be considered acceptable.
- Should only 2 sample splices from a production test conform to the provisions in Section 52-1.08C(3), "Ultimate Butt Splice Test Criteria," one additional production test shall be performed on the same lot of splices. Should any of the 4 sample splices from this additional test fail to conform to these provisions, all splices in the lot represented by these production tests will be rejected.
- If only one sample splice from a production test conforms to the provisions in Section 52-1.08C(3), "Ultimate Butt Splice Test Criteria," all splices in the lot represented by this production test will be rejected.
- If a production test for a lot fails, the Contractor shall repair or replace all reinforcing bars from which sample splices were removed, complete in place, before the Engineer selects additional splices from this lot for further testing.
- Production tests will not be required on repaired splices from a lot, regardless of the type of prequalified ultimate mechanical butt splice used to make the repair. However, should an additional production test be required, the Engineer may select any repaired splice for the additional production test.

52-1.08C(3)(b) Quality Assurance Test Requirements for Ultimate Butt Splices

- For the first production test performed, and for at least one, randomly selected by the Engineer, of every 5 subsequent production tests, or portion thereof, the Contractor shall concurrently prepare 4 additional ultimate quality assurance sample splices along with associated control bars.
- Each time 4 additional ultimate quality assurance sample splices are prepared, 2 of these quality assurance sample splice and associated control bar sets and 2 of the production sample splice and associated control bar sets, together, shall conform to the requirements for ultimate production sample splices in Section 52-1.08C(3)(a),"Production Test Requirements for Ultimate Butt Splices."
- The 2 remaining quality assurance sample splice and associated control bar sets, along with the 2 remaining production sample splice and associated control bar sets shall be shipped to the Transportation Laboratory for quality assurance testing. The 4 sets shall be securely bundled together and identified by location and contract number with weatherproof markings before shipment. Bundles containing fewer than 4 sets will not be tested.
- Quality assurance testing will be performed in conformance with the requirements for ultimate production sample splices in Section 52-1.08C(3)(a), "Production Test Requirements for Ultimate Butt Splices."

52-1.08C(3)(c) Nondestructive Splice Tests

- When the specifications allow for welded sample splices to be taken from other than the completed lot of splices, the Contractor shall meet the following additional requirements.
- Except for resistance butt welded splices, radiographic examinations shall be performed on 25 percent of all complete joint penetration butt welded splices from a production lot. The size of a production lot will be a maximum of 150 splices. The Engineer will select the splices which will compose the production lot and also the splices within each production lot to be radiographically examined.
- All required radiographic examinations of complete joint penetration butt welded splices shall be performed by the Contractor in conformance with the requirements in AWS D 1.4 and these specifications.
- Before radiographic examination, welds shall conform to the requirements in Section 4.4, "Quality of Welds," of AWS D 1.4.
- Should more than 12 percent of the splices which have been radiographically examined in any production lot be defective, an additional 25 percent of the splices, selected by the Engineer from the same production lot, shall be radiographically examined. Should more than 12 percent of the cumulative total of splices tested from the same production lot be defective, all remaining splices in the lot shall be radiographically examined.
- Additional radiographic examinations performed due to the identification of defective splices shall be at the Contractor's expense.
- All defects shall be repaired in conformance with the requirements in AWS D 1.4.
- The Contractor shall notify the Engineer in writing 48 hours before performing any radiographic examinations.

- The radiographic procedure used shall conform to the requirements in AWS D1.1, AWS D1.4, and the following:

Two exposures shall be made for each complete joint penetration butt welded splice. For each of the 2 exposures, the radiation source shall be centered on each bar to be radiographed. The first exposure shall be made with the radiation source placed at zero degrees from the top of the weld and perpendicular to the weld root and identified with a station mark of "0." The second exposure shall be at 90 degrees to the "0" station mark and shall be identified with a station mark of "90." When obstructions prevent a 90 degree placement of the radiation source for the second exposure, and when approved in writing by the Engineer, the source may be rotated, around the centerline of the reinforcing bar, a maximum of 25 degrees.

For field produced complete joint penetration butt welds, no more than one weld shall be radiographed during one exposure. For shop produced complete joint penetration butt welds, if more than one weld is to be radiographed during one exposure, the angle between the root line of each weld and the direction to the radiation source shall be not less than 65 degrees.

Radiographs shall be made by either X-ray or gamma ray. Radiographs made by X-ray or gamma rays shall have densities of not less than 2.3 nor more than 3.5 in the area of interest. A tolerance of 0.05 in density is allowed for densitometer variations. Gamma rays shall be from the iridium 192 isotope and the emitting specimen shall not exceed 4.45 mm in the greatest diagonal dimension.

The radiographic film shall be placed perpendicular to the radiation source at all times; parallel to the root line of the weld unless source placement determines that the film must be turned; and as close to the root of the weld as possible.

The minimum source to film distance shall be maintained so as to ensure that all radiographs maintain a maximum geometric unsharpness of 0.020 at all times, regardless of the size of the reinforcing bars.

Penetrameters shall be placed on the source side of the bar and perpendicular to the radiation source at all times. One penetrameter shall be placed in the center of each bar to be radiographed, perpendicular to the weld root, and adjacent to the weld. Penetrameter images shall not appear in the weld area.

When radiography of more than one weld is being performed per exposure, each exposure shall have a minimum of one penetrameter per bar, or 3 penetrameters per exposure. When 3 penetrameters per exposure are used, one penetrameter shall be placed on each of the 2 outermost bars of the exposure, and the remaining penetrameter shall be placed on a centrally located bar.

An allowable weld buildup of 4 mm may be added to the total material thickness when determining the proper penetrameter selection. No image quality indicator equivalency will be accepted. Wire penetrameters or penetrameter blocks shall not be used.

Penetrameters shall be sufficiently shimmed using a radiographically identical material. Penetrameter image densities shall be a minimum of 2.0 and a maximum of 3.6.

Radiographic film shall be Class 1, regardless of the size of reinforcing bars.

Radiographs shall be free of film artifacts and processing defects, including, but not limited to, streaks, scratches, pressure marks or marks made for the purpose of identifying film or welding indications.

Each splice shall be clearly identified on each radiograph and the radiograph identification and marking system shall be established between the Contractor and the Engineer before radiographic inspection begins. Film shall be identified by lead numbers only; etching, flashing or writing in identifications of any type will not be permitted. Each piece of film identification information shall be legible and shall include, as a minimum, the following information: Contractor's name, date, name of nondestructive testing firm, initials of radiographer, contract number, part number and weld number. The letter "R" and repair number shall be placed directly after the weld number to designate a radiograph of a repaired weld.

Radiographic film shall be developed within a time range of one minute less to one minute more than the film manufacturer's recommended maximum development time. Sight development will not be allowed.

Processing chemistry shall be done with a consistent mixture and quality, and processing rinses and tanks shall be clean to ensure proper results. Records of all developing processes and any chemical changes to the developing processes shall be kept and furnished to the Engineer upon request. The Engineer may request, at any time, that a sheet of unexposed film be processed in the presence of the Engineer to verify processing chemical and rinse quality.

The results of all radiographic interpretations shall be recorded on a signed certification and a copy kept with the film packet.

Technique sheets prepared in conformance with the requirements in ASME Boiler and Pressure Vessels Code, Section V, Article 2 Section T-291 shall also contain the developer temperature, developing time, fixing duration and all rinse times.

52-1.08D Reporting Test Results

- A Production Test Report for all testing performed on each lot shall be prepared by the independent testing laboratory performing the testing and submitted to the QCM for review and approval. The report shall be signed by an

engineer who represents the laboratory and is registered as a Civil Engineer in the State of California. The report shall include, as a minimum, the following information for each test: contract number, bridge number, lot number and location, bar size, type of splice, length of mechanical splice, length of test specimen, physical condition of test sample splice and any associated control bar, any notable defects, total measured slip, ultimate tensile strength of each splice, and for ultimate butt splices, limits of affected zone, location of visible necking area, ultimate tensile strength and 95 percent of this ultimate tensile strength for each control bar, and a comparison between 95 percent of the ultimate tensile strength of each control bar and the ultimate tensile strength of its associated splice.

- The QCM must review, approve, and forward each Production Test Report to the Engineer for review before the splices represented by the report are encased in concrete. The Engineer will have 3 working days to review each Production Test Report and respond in writing after a complete report has been received. Should the Contractor elect to encase any splices before receiving notification from the Engineer, it is expressly understood that the Contractor will not be relieved of the responsibility for incorporating material in the work that conforms to the requirements of the plans and specifications. Material not conforming to these requirements will be subject to rejection. Should the Contractor elect to wait to encase splices pending notification by the Engineer, and in the event the Engineer fails to complete the review and provide notification within the time allowed, and if, in the opinion of the Engineer, the work is delayed or interfered with by reason of the Engineer's delay in completing the review, the Contractor will be compensated for any resulting loss, and an extension of time will be granted, in the same manner as provided for in Section 8-1.09, "Right of Way Delays."
- Quality assurance test results for each bundle of 4 sets or 4 samples of splices will be reported in writing to the Contractor within 3 working days after receipt of the bundle by the Transportation Laboratory. In the event that more than one bundle is received on the same day, 2 additional working days shall be allowed for providing test results for each additional bundle received. A test report will be made for each bundle received. Should the Contractor elect to encase splices before receiving notification from the Engineer, it is expressly understood that the Contractor will not be relieved of the responsibility for incorporating material in the work that conforms to the requirements of the plans and specifications. Material not conforming to these requirements will be subject to rejection. Should the Contractor elect to wait to encase splices pending notification by the Engineer, and in the event the Engineer fails to complete the review within the time allowed, and in the opinion of the Engineer, completion of the work is delayed or interfered with by reason of the Engineer's delay in completing the review, the Contractor will be compensated for any resulting loss, and an extension of time will be granted, in the same manner as provided for in Section 8-1.09, "Right of Way Delays."

Section 52-1.11, "Payment," of the Standard Specifications is amended by adding the following paragraph after the seventh paragraph:

- If a portion or all of the reinforcing steel is epoxy-coated more than 480 air line kilometers from both Sacramento and Los Angeles, additional shop inspection expenses will be sustained by the State. Whereas it is and will be impracticable and extremely difficult to ascertain and determine the actual increase in these expenses, it is agreed that payment to the Contractor for furnishing the epoxy-coated reinforcement will be reduced $5000 for each epoxy-coating facility located more than 480 air line kilometers from both Sacramento and Los Angeles and an additional $3000 ($8000 total) for each epoxy-coating facility located more than 4800 air line kilometers from both Sacramento and Los Angeles.

SECTION 55: STEEL STRUCTURES

Issue Date: December 31, 2001

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

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

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

- If a portion or all of the structural steel is fabricated more than 480 air line kilometers from both Sacramento and Los Angeles, additional shop inspection expenses will be sustained by the State. Whereas it is and will be impracticable and

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

SECTION 56: SIGNS

Issue Date: November 2, 2004

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

Section 56-1.02A, "Bars, Plates and Shapes," of the Standard Specifications is amended to read:

56-1.02A Bars, Plates, Shapes, and Structural Tubing

• Bars, plates, and shapes shall be structural steel conforming to the requirements in ASTM Designation: A 36/A 36M, except, at the option of the Contractor, the light fixture mounting channel shall be continuous-slot steel channel conforming to the requirements in ASTM Designation: A 1011/A 1011M, Designation SS, Grade 33[230], or aluminum Alloy 6063-T6 extruded aluminum conforming to the requirements in ASTM Designation: B 221 or B 221M.

• Structural tubing shall be structural steel conforming to the requirements in ASTM Designation: A 500, Grade B.

• Removable sign panel frames shall be constructed of structural steel conforming to the requirements in ASTM Designation: A 36/A 36M.

Section 56-1.02B, "Sheets," of the Standard Specifications is amended to read:

56-1.02B Sheets

• Sheets shall be carbon-steel sheets conforming to the requirements in ASTM Designation: A 1011/A 1011M, Designation SS, Grade 33[230].

• Ribbed sheet metal for box beam-closed truss sign structures shall be fabricated from galvanized sheet steel conforming to the requirements in ASTM Designation: A 653/A 653M, Designation SS, Grade 33[230]. Sheet metal panels shall be G 165 coating designation in conformance with the requirements in ASTM Designation: A 653/A 653M.

Section 56-1.02F, "Steel Walkway Gratings," of the Standard Specifications is amended to read:

56-1.02F Steel Walkway Gratings

• Steel walkway gratings shall be furnished and installed in conformance with the details shown on the plans and the following provisions:

A. Gratings shall be the standard product of an established grating manufacturer.
B. Material for gratings shall be structural steel conforming to the requirements in ASTM Designation: A 1011/A 1011M, Designation CS, Type B.
C. For welded type gratings, each joint shall be full resistance welded under pressure, to provide a sound, completely beaded joint.
D. For mechanically locked gratings, the method of fabrication and interlocking of the members shall be approved by the Engineer, and the fabricated grating shall be equal in strength to the welded type.
E. Gratings shall be accurately fabricated and free from warps, twists, or other defects affecting their appearance or serviceability. Ends of all rectangular panels shall be square. The tops of the bearing bars and cross members shall be in the same plane. Gratings distorted by the galvanizing process shall be straightened.

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

• High-strength bolted connections, where shown on the plans, shall conform to the provisions in Section 55-3.14, "Bolted Connections," except that only fastener assemblies consisting of a high-strength bolt, nut, hardened washer, and direct tension indicator shall be used.

• High-strength fastener assemblies, and any other bolts, nuts, and washers attached to sign structures shall be zinc-coated by the mechanical deposition process.

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

The fifth paragraph of Section 56-2.02B, "Wood Posts," of the Standard Specifications is amended to read:

- Douglas fir and Hem-Fir posts shall be treated in conformance with the provisions in Section 58, "Preservative Treatment of Lumber, Timber and Piling," and in conformance with AWPA Use Category System: UC4A, Commodity Specification A. Posts shall be incised and the minimum retention of preservative shall be as specified in AWPA Standards.

SECTION 57: TIMBER STRUCTURES

Issue Date: October 12, 2004

The second paragraph of Section 57-1.02A, "Structural Timber and Lumber," of the Standard Specifications is amended to read:

- When preservative treatment of timber and lumber is required, the treatment shall conform to the provisions in Section 58, "Preservative Treatment of Lumber, Timber and Piling," and AWPA's Use Category 4B. The type of treatment to be used will be shown on the plans or specified in the special provisions.

SECTION 58: PRESERVATIVE TREATMENT OF LUMBER, TIMBER AND PILING

Issue Date: November 2, 2004

The first paragraph of Section 58-1.02, "Treatment and Retention," of the Standard Specifications is amended to read:

- Unless otherwise permitted by the Engineer or otherwise specified in the special provisions, the timber, lumber and piling shall be pressure treated after all millwork is completed. The preservatives, treatment and results of treatment shall be in conformance with AWPA Standards U1-03, "User Specification for Treated Wood," and T1-03, "Processing and Treatment." Except as provided below, treatment of lumber and timber shall conform to the specified AWPA Use Category. The type of treatment to be used shall be one of those named in the special provisions, on the plans, or elsewhere in these specifications.

The second paragraph of Section 58-1.02, "Treatment and Retention," of the Standard Specifications is deleted.

SECTION 59: PAINTING

Issue Date: December 31, 2001

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

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

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

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

• Exposed steel or other metal surfaces to be blast cleaned shall be cleaned in conformance with the requirements in Surface Preparation Specification No. 6, "Commercial Blast Cleaning," of the "SSPC: The Society for Protective Coatings." Blast cleaning shall leave all surfaces with a dense, uniform, angular anchor pattern of not less than 35 µm as measured in conformance with the requirements in ASTM Designation: D 4417.

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

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

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

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

SECTION 75: MISCELLANEOUS METAL

Issue Date: November 2, 2004

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

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

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

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

• Miscellaneous bridge metal shall consist of the following, except as further provided in Section 51-1.19, "Utility Facilities," and in the special provisions:

A. Bearing assemblies, equalizing bolts and expansion joint armor in concrete structures.
B. Expansion joint armor in steel structures.
C. Manhole frames and covers, frames and grates, ladder rungs, guard posts and access door assemblies.
D. Deck drains, area drains, retaining wall drains, and drainage piping, except drainage items identified as "Bridge Deck Drainage System" in the special provisions.

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

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

* Maximum stud diameter permitted for mechanical expansion anchors.

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

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

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

Installation Torque Values, (newton meters)

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

The third paragraph in Section 75-1.035, "Bridge Joint Restrainer Units," of the Standard Specifications is amended to read:

- Cables shall be 19 mm preformed, 6 x 19, wire strand core or independent wire rope core (IWRC), galvanized, and in conformance with the requirements in Federal Specification RR-W-410D, right regular lay, manufactured of improved plow steel with a minimum breaking strength of 200 kN. Two certified copies of mill test reports of each manufactured length of cable used shall be furnished to the Engineer.

The second paragraph in Section 75-1.05, "Galvanizing," of the Standard Specifications is amended to read:

At the option of the Contractor, material thinner than 3.2 mm shall be galvanized either before fabrication in conformance with the requirements of ASTM Designation: A 653/A 653M, Coating Designation Z600, or after fabrication in conformance with the requirements of ASTM Designation: A 123, except that the weight of zinc coating shall average not less than 365 g per square meter of actual surface area with no individual specimen having a coating weight of less than 305 g per square meter.

SECTION 80: FENCES

Issue Date: October 12, 2004

The second paragraph of Section 80-3.01B(2), "Treated Wood Posts and Braces," of the Standard Specifications is amended to read:

- Posts and braces to be treated shall be pressure treated in conformance with the provisions in Section 58, "Preservative Treatment of Lumber, Timber and Piling," and AWPA Use Category System: UC4A, Commodity Specification A or B.

SECTION 83: RAILINGS AND BARRIERS

Issue Date: January 31, 2005

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

- The grades and species of wood posts and blocks shall be No. 1 timbers (also known as No. 1 structural) Douglas fir or No. 1 timbers Southern yellow pine. Wood posts and blocks shall be graded in conformance with the provisions in Section 57-2, "Structural Timber," of the Standard Specifications, except allowances for shrinkage after mill cutting shall in no case exceed 5 percent of the American Lumber Standards minimum sizes, at the time of installation.

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

- After fabrication, wood posts and blocks shall be pressure treated in conformance with Section 58, "Preservative Treatment of Lumber, Timber and Piling," and AWPA Use Category System: UC4A, Commodity Specification A.

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

- If copper naphthenate, ammoniacal copper arsenate, chromated copper arsenate, ammoniacal copper zinc arsenate, ammoniacal copper quat or copper azole is used to treat the wood posts and blocks, the bolt holes shall be treated as follows:

A. Before the bolts are inserted, bolt holes shall be filled with a grease, recommended by the manufacturer for corrosion protection, which will not melt or run at a temperature of 65°C.

The second paragraph in Section 83-1.02D, "Steel Bridge Railing," of the Standard Specifications is amended to read:

- Structural shapes, tubing, plates, bars, bolts, nuts, and washers shall be structural steel conforming to the provisions in Section 55-2, "Materials." Other fittings shall be commercial quality.

The second and third paragraphs in Section 83-1.02E, "Cable Railing," of the Standard Specifications are replaced with the following paragraph:

- Pipe for posts and braces shall be standard steel pipe or pipe that conforms to the provisions in Section 80-4.01A, "Posts and Braces."

The fourteenth paragraph in Section 83-1.02I, "Chain Link Railing," of the Standard Specifications is amended to read:

- Chain link fabric shall be either 11-gage Type I zinc coated fabric conforming to the requirements in AASHTO Designation: M 181 or 11-gage Type IV polyvinyl chloride (PVC) coated fabric conforming to the requirements in Federal Specification RR-F-191/1D.

The first paragraph in Section 83-2.02D(2), "Materials," of the Standard Specifications is amended to read:

- Type 50 and 60 series concrete barriers shall be constructed of minor concrete conforming to the provisions in Section 90-10, "Minor Concrete," except as follows:

a. The maximum size of aggregate used for extruded or slip-formed concrete barriers shall be at the option of the Contractor, but in no case shall the maximum size be larger than 37.5-mm or smaller than 9.5-mm.
b. If the 9.5-mm maximum size aggregate grading is used to construct extruded or slip-formed concrete barriers, the cementitious material content of the minor concrete shall be not less than 400 kg/m^3.

The third paragraph in Section 83-2.02D(2), "Materials," of the Standard Specifications is amended to read:

- The concrete paving between the tops of the 2 walls of concrete barrier (Types 50E, 60E, 60GE, and 60SE) and the optional concrete slab at the base between the 2 walls of concrete barrier (Types 50E, 60E, 60GE, and 60SE) shall be constructed of minor concrete conforming to the provisions of Section 90-10, except that the minor concrete shall contain not less than 300 kg of cementitious material per cubic meter.

The fourth paragraph in Section 83-2.04, "Payments," of the Standard Specifications is amended to read:

- Steel plate barrier attached to concrete barrier at overhead sign foundations, electroliers, drainage structures, and other locations shown on the plans will be measured and paid for as the type of concrete barrier attached thereto.

SECTION 85: PAVEMENT MARKERS

Issue Date: May 16, 2003

The second through fifth paragraphs in Section 85-1.03, "Sampling, Tolerances and Packaging," of the Standard Specifications are amended to read:

Sampling

- Twenty markers selected at random will constitute a representative sample for each lot of markers.
- The lot size shall not exceed 25000 markers.

Tolerances

- Three test specimens will be randomly selected from the sample for each test and tested in conformance with these specifications. Should any one of the 3 specimens fail to conform with the requirements in these specifications, 6 additional specimens will be tested. The failure of any one of these 6 specimens shall be cause for rejection of the entire lot or shipment represented by the sample.
- The entire sample of retroreflective pavement markers will be tested for reflectance. The failure of 10 percent or more of the original sampling shall be cause for rejection.

Section 85-1.04, "Non-Reflective Pavement Markers," of the Standard Specifications is amended to read:

85-1.04 Non-Reflective Pavement Markers

- Non-reflective pavement markers (Types A and AY) shall be, at the option of the Contractor, either ceramic or plastic conforming to these specifications.
- The top surface of the marker shall be convex with a gradual change in curvature. The top, bottom and sides shall be free of objectionable marks or discoloration that will affect adhesion or appearance.
- The bottom of markers shall have areas of integrally formed protrusions or indentations, which will increase the effective bonding surface area of adhesive. The bottom surface of the marker shall not deviate more than 1.5 mm from a flat surface. The areas of protrusion shall have faces parallel to the bottom of the marker and shall project approximately one mm from the bottom.

The second through fourth paragraphs of Section 85-1.04A, "Non-Reflective Pavement Markers (Ceramic)," of the Standard Specifications are deleted.

The table in the fifth paragraph in Section 85-1.04A, "Non-Reflective Pavement Markers (Ceramic)," of the Standard Specifications is amended to read:

Testing

- Tests shall be performed in conformance with the requirements in California Test 669.

Test	Test Description	Requirement
a	Bond strength	4.8 MPa, min.
b	Glaze thickness	180 µm, min.
c	Hardness	6 Moh, min.
d	Luminance factor, Type A, white markers only, glazed surface	75, min.
e	Yellowness index, Type A, white markers only, glazed surface	7, max.
f	Color-yellow, Type AY, yellow markers only. The chromaticity coordinates shall be within a color box defined in CTM 669	Pass
g	Compressive strength	6700 N, min.
h	Water absorption	2.0 %, max.
i	Artificial weathering, 500 hours exposure, yellowness index	20, max.

Section 85-1.04B, "Non-Reflective Pavement Markers (Plastic)," of the Standard Specifications is amended to read:

85-1.04B Non-Reflective Pavement Markers (Plastic)

- Plastic non-reflective pavement markers Types A and AY shall be, at the option of the Contractor, either polypropylene or acrylonitrile-butadiene-styrene (ABS) plastic type.
- Plastic markers shall conform to the testing requirements specified in Section 85-1.04A, "Non-Reflective Pavement Markers (Ceramic)," except that Tests a, b, c, and h shall not apply. The plastic markers shall not be coated with substances that interfere with the ability of the adhesive bonding to the marker.

The sixth and seventh paragraphs in Section 85-1.05, "Retroreflective Pavement Markers," of the Standard Specifications are amended to read:

Testing

- Tests shall be performed in conformance with the requirements in California Test 669.

Test Description	Requirement		
Bond strength[a]	3.4 MPa, min.		
Compressive strength[b]	8900 N, min.		
Abrasion resistance, marker must meet the respective specific intensity minimum requirements after abrasion.	Pass		
Water Soak Resistance	No delamination of the body or lens system of the marker nor loss of reflectance		
	Specific Intensity		
Reflectance	Clear	Yellow	Red
0° Incidence Angle, min.	3.0	1.5	0.75
20° Incidence Angle, min.	1.2	0.60	0.30
After one year field evaluation	0.30	0.15	0.08

a Failure of the marker body or filler material prior to reaching 3.4 MPa shall constitute a failing bond strength test.

b Deformation of the marker of more than 3 mm at a load of less than 8900 N or delamination of the shell and the filler material of more than 3 mm regardless of the load required to break the marker shall be cause for rejection of the markers as specified in Section 85-1.03, "Sampling, Tolerances and Packaging."

- Pavement markers to be placed in pavement recesses shall conform to the above requirements for retroreflective pavement markers except that the minimum compressive strength requirement shall be 5338 N.

The eighth paragraph of Section 85-1.05, "Retroreflective Pavement Markers" of the Standard Specifications is deleted.

The eighth paragraph in Section 85-1.06, "Replacement," of the Standard Specifications is amended to read:

- Epoxy adhesive shall not be used to apply non-reflective plastic pavement markers.

SECTION 86: SIGNALS, LIGHTING AND ELECTRICAL SYSTEMS

Issue Date: January 31, 2005

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

- Except for concrete for cast-in-drilled-hole concrete pile foundations, portland cement concrete shall conform to Section 90-10, "Minor Concrete."

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

- Reinforced cast-in-drilled-hole concrete pile foundations for traffic signal and lighting standards shall conform to the provisions in Section 49, "Piling," with the following exceptions: 1) Material resulting from drilling holes shall be disposed of in conformance with the provisions in Section 86-2.01, "Excavating and Backfilling," and 2) Concrete filling for cast-in-drilled-hole concrete piles will not be considered as designated by compressive strength.

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

- Forms shall be true to line and grade. Tops of foundations for posts and standards, except special foundations, shall be finished to curb or sidewalk grade or as directed by the Engineer. Forms shall be rigid and securely braced in place. Conduit ends and anchor bolts shall be placed in proper position and to proper height, and anchor bolts shall be held in place by means of rigid top and bottom templates. The bottom template shall be made of steel. The bottom template shall provide proper spacing and alignment of the anchor bolts near their bottom embedded end. The bottom template shall be installed before placing footing concrete. Anchor bolts shall not be installed more than 1:40 from vertical.

Section 86-2.03, "Foundations," of the Standard Specifications is amended by deleting the eighth paragraph.

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

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

The first paragraph of Section 86-2.04, "Standards, Steel Pedestals and Posts," of the Standard Specifications is amended to read:

86-2.04 STANDARDS, STEEL PEDESTALS, AND POSTS

• Standards for traffic signals and lighting, and steel pedestals for cabinets and other similar equipment, shall be located as shown on the plans. Bolts, nuts and washers, and anchor bolts for use in signal and lighting support structures shall conform to the provisions in Section 55-2, "Materials." Except when bearing-type connections or slipbases are specified, high-strength bolted connections shall conform to the provisions in Section 55-3.14, "Bolted Connections." Welding, nondestructive testing (NDT) of welds, and acceptance and repair criteria for NDT of steel members shall conform to the requirements of AWS D1.1 and the contract special provisions.

The second paragraph of Section 86-2.04, "Standards, Steel Pedestals and Posts," of the Standard Specifications is amended to read:

• On each lighting standard except Type 1, one rectangular corrosion resistant metal identification tag shall be permanently attached above the hand hole, near the base of the standard, using stainless steel rivets. On each signal pole support, two corrosion resistant metal identification tags shall be attached, one above the hand hole near the base of the vertical standard and one on the underside of the signal mast arm near the arm plate. As a minimum, the information on each identification tag shall include the name of the manufacturer, the date of manufacture, the identification number as shown on the plans, the contract number, and a unique identification code assigned by the fabricator. This number shall be traceable to a particular contract and the welds on that component, and shall be readable after the support structure is coated and installed. The lettering shall be a minimum of 7 mm high. The information may be either depressed or raised, and shall be legible.

The fourth paragraph of Section 86-2.04, "Standards, Steel Pedestals and Posts," of the Standard Specifications is amended to read:

• Ferrous metal parts of standards, with shaft length of 4.6 m and longer, shall conform to the details shown on the plans, the provisions in Section 55-2, "Materials," except as otherwise noted, and the following requirements:

Except as otherwise specified, standards shall be fabricated from sheet steel of weldable grade having a minimum yield strength, after fabrication, of 276 MPa.

Certified test reports which verify conformance to the minimum yield strength requirements shall be submitted to the Engineer. The test reports may be the mill test reports for the as-received steel or, when the as-received steel has a lower yield strength than required, the Contractor shall provide supportive test data which provides assurance that the Contractor's method of cold forming will consistently increase the tensile properties of the steel to meet the specified minimum yield strength. The supportive test data shall include tensile properties of the steel after cold forming for specific heats and thicknesses.

When a single-ply 8-mm thick pole is specified, a 2-ply pole with equivalent section modulus may be substituted.

Standards may be fabricated of full-length sheets or shorter sections. Each section shall be fabricated from not more than 2 pieces of sheet steel. Where 2 pieces are used, the longitudinal welded seams shall be directly opposite one another. When the sections are butt-welded together, the longitudinal welded seams on adjacent sections shall be placed to form continuous straight seams from base to top of standard.

Butt-welded circumferential joints of tubular sections requiring CJP groove welds shall be made using a metal sleeve backing ring inside each joint. The sleeve shall be 3-mm nominal thickness, or thicker, and manufactured from steel having the same chemical composition as the steel in the tubular sections to be joined. When the sections to be joined have different specified minimum yield strengths, the steel in the sleeve shall have the same chemical composition as the tubular section having the higher minimum yield strength. The width of the metal sleeve shall be consistent with the type of NDT chosen and shall be a minimum width of 25 mm. The sleeve shall be centered at the joint and be in contact with the tubular section at the point of the weld at time of fit-up.

Welds shall be continuous.

The weld metal at the transverse joint shall extend to the sleeve, making the sleeve an integral part of the joint.

During fabrication, longitudinal seams on vertical tubular members of cantilevered support structures shall be centered on and along the side of the pole that the pole plate is located. Longitudinal seams on horizontal tubular members, including signal and luminaire arms, shall be within +/-45 degrees of the bottom of the arm.

The longitudinal seam welds in steel tubular sections may be made by the electric resistance welding process.

Longitudinal seam welds shall have 60 percent minimum penetration, except that within 150 mm of circumferential welds, longitudinal seam welds shall be CJP groove welds. In addition, longitudinal seam welds on lighting support structures having telescopic pole segment splices shall be CJP groove welds on the female end for a length on each end equal to the designated slip fit splice length plus 150 mm.

Exposed circumferential welds, except fillet and fatigue-resistant welds, shall be ground flush (-0, +2mm) with the base metal prior to galvanizing or painting.

Circumferential welds and base plate-to-pole welds may be repaired only one time without written permission from the Engineer.

Exposed edges of the plates that make up the base assembly shall be finished smooth and exposed corners of the plates shall be broken unless otherwise shown on the plans. Shafts shall be provided with slip-fitter shaft caps.

Flatness of surfaces of 1) base plates that are to come in contact with concrete, grout, or washers and leveling nuts; 2) plates in high-strength bolted connections; 3) plates in joints where cap screws are used to secure luminaire and signal arms; and 4) plates used for breakaway slip base assemblies shall conform to the requirements in ASTM A6.

Standards shall be straight, with a permissive variation not to exceed 25 mm measured at the midpoint of a 9-m or 11-m standard and not to exceed 20 mm measured at the midpoint of a 5-m through 6-m standard. Variation shall not exceed 25 mm at a point 4.5 m above the base plate for Type 35 and Type 36 standards.

Zinc-coated nuts used on fastener assemblies having a specified preload (obtained by specifying a prescribed tension, torque value, or degree of turn) shall be provided with a colored lubricant that is clean and dry to the touch. The color of the lubricant shall be in contrast to the zinc coating on the nut so that the presence of the lubricant is visually obvious. In addition, either the lubricant shall be insoluble in water, or fastener components shall be shipped to the job site in a sealed container.

No holes shall be made in structural members unless the holes are shown on the plans or are approved in writing by the Engineer.

Standards with an outside diameter of 300 mm or less shall be round. Standards with an outside diameter greater than 300 mm shall be round or multisided. Multisided standards shall have a minimum of 12 sides which shall be convex and shall have a minimum bend radius of 100 mm.

Mast arms for standards shall be fabricated from material as specified for standards, and shall conform to the dimensions shown on the plans.

The cast steel option for slip bases shall be fabricated from material conforming to the requirements in ASTM Designation: A 27/A 27M, Grade 70-40. Other comparable material may be used if written permission is given by the Engineer. The casting tolerances shall be in conformance with the Steel Founder's Society of America recommendations (green sand molding).

One casting from each lot of 50 castings or less shall be subject to radiographic inspection, in conformance with the requirements in ASTM Designation: E 94. The castings shall comply with the acceptance criteria severity level 3 or better for the types and categories of discontinuities in conformance with the requirements in ASTM Designations: E 186 and E 446. If the one casting fails to pass the inspection, 2 additional castings shall be radiographed. Both of these castings shall pass the inspection, or the entire lot of 50 will be rejected.

Material certifications, consisting of physical and chemical properties, and radiographic films of the castings shall be filed at the manufacturer's office. These certifications and films shall be available for inspection upon request.

High-strength bolts, nuts, and flat washers used to connect slip base plates shall conform to the requirements in ASTM Designation: A 325 or A 325M and shall be galvanized in conformance with the provisions in Section 75-1.05, "Galvanizing."

Plate washers shall be fabricated by saw cutting and drilling steel plate conforming to the requirements in AISI Designation: 1018, and be galvanized in conformance with the provisions in Section 75-1.05, "Galvanizing." Prior to galvanizing, burrs and sharp edges shall be removed and holes shall be chamfered sufficiently on each side to allow the bolt head to make full contact with the washer without tension on the bolt.

High-strength cap screws shown on the plans for attaching arms to standards shall conform to the requirements in ASTM Designation: A 325, A 325M, or A 449, and shall comply with the mechanical requirements in ASTM Designation: A 325 or A 325M after galvanizing. The cap screws shall be galvanized in conformance with the provisions in Section 75-1.05, "Galvanizing." The threads of the cap screws shall be coated with a colored lubricant that is clean and dry to the touch. The color of the lubricant shall be in contrast to the color of the zinc coating on the cap screw so that presence of the lubricant is visually obvious. In addition, either the lubricant shall be insoluble in water, or fastener components shall be shipped to the job site in a sealed container.

Unless otherwise specified, bolted connections attaching signal or luminaire arms to poles shall be considered slip critical. Galvanized faying surfaces on plates on luminaire and signal arms and matching plate surfaces on poles shall be

roughened by hand using a wire brush prior to assembly and shall conform to the requirements for Class C surface conditions for slip-critical connections in "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts," a specification approved by the Research Council on Structural Connections (RCSC) of the Engineering Foundation. For faying surfaces required to be painted, the paint shall be an approved type, brand, and thickness that has been tested and approved according to the RCSC Specification as a Class B coating.

Samples of fastener components will be randomly taken from each production lot by the Engineer and submitted, along with test reports required by appropriate ASTM fastener specifications, for QA testing and evaluation. Sample sizes for each fastener component shall be as determined by the Engineer.

The seventh paragraph of Section 86-2.04, "Standards, Steel Pedestals and Posts," of the Standard Specifications is amended to read:

• To avoid interference of arm plate-to-tube welds with cap screw heads, and to ensure cap screw heads can be turned using conventional installation tools, fabricators shall make necessary adjustments to details prior to fabrication and properly locate the position of arm tubes on arm plates during fabrication.

The sixth and seventh paragraphs of 86-2.12, "Wood Poles," of the Standard Specifications are amended to read:

• After fabrication, wood poles shall be pressure treated in conformance with the provisions in Section 58, "Preservative Treatment of Lumber, Timber and Piling," and AWPA Use Category System: UC4B, Commodity Specification D.

• Wood poles, when specified in the special provisions to be painted, shall be treated with waterborne wood preservatives.

The first paragraph of Section 86-2.15, "Galvanizing," of the Standard Specifications is amended to read:

• Galvanizing shall be in conformance with the provisions in Section 75-1.05, "Galvanizing," except that cabinets may be constructed of material galvanized prior to fabrication in conformance with the requirements in ASTM Designation: A 653/653M, Coating Designation G 90, in which case all cut or damaged edges shall be painted with at least 2 applications of approved unthinned zinc-rich primer (organic vehicle type) conforming to the provisions in Section 91, "Paint." Aerosol cans shall not be used. Other types of protective coating must be approved by the Engineer prior to installation.

The first paragraph of Section 86-4.06, "Pedestrian Signal Faces" of the Standard Specifications is amended to read:

• Message symbols for pedestrian signal faces shall be white WALKING PERSON and Portland orange UPRAISED HAND conforming to the requirements in the Institute of Transportation Engineers Standards: "Pedestrian Traffic Control Signal Indications," "Manual on Uniform Traffic Control Devices," and "MUTCD California Supplement." The height of each symbol shall be not less than 250 mm and the width of each symbol shall be not less than 165 mm.

The tenth paragraph of Section 86-4.07, "Light Emitting Diode Pedestrian Signal Face 'Upraised Hand' Module" of the Standard Specifications is amended to read:

• The luminance of the "UPRAISED HAND" symbol shall be 3750 cd/m^2 minimum. The color of "UPRAISED HAND" shall be Portland orange conforming to the requirements of the Institute of Transportation Engineers Standards: "Pedestrian Traffic Control Signal Indications," "Manual on Uniform Traffic Control Devices," and "MUTCD California Supplement." The height of each symbol shall be not less than 250 mm and the width of each symbol shall be not less than 165 mm.

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

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

SECTION 88: ENGINEERING FABRIC

Issue Date: January 15, 2002

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

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

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

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

SECTION 90: PORTLAND CEMENT CONCRETE

Issue Date: November 2, 2004

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

SECTION 90: PORTLAND CEMENT CONCRETE
90-1 GENERAL

90-1.01 DESCRIPTION

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

• The Contractor shall determine the mix proportions for concrete in conformance with these specifications. Unless otherwise specified, cementitious material shall be a combination of cement and mineral admixture. Cementitious material shall be either:

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

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

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

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

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

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

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

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

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

- Whenever the 28-day compressive strength shown on the plans is greater than 25 MPa, the concrete shall be designated by compressive strength. If the plans show a 28-day compressive strength that is 28 MPa or greater, an additional 14 days will be allowed to obtain the specified strength. The 28-day compressive strengths shown on the plans that are 25 MPa or less are shown for design information only and are not a requirement for acceptance of the concrete.
- Concrete designated by compressive strength shall be proportioned such that the concrete will attain the strength shown on the plans or specified in the special provisions.
- Before using concrete for which the mix proportions have been determined by the Contractor, or in advance of revising those mix proportions, the Contractor shall submit in writing to the Engineer a copy of the mix design.
- Compliance with cementitious material content requirements will be verified in conformance with procedures described in California Test 518 for cement content. For testing purposes, mineral admixture shall be considered to be cement. Batch proportions shall be adjusted as necessary to produce concrete having the specified cementitious material content.
- If any concrete has a cementitious material, portland cement, or mineral admixture content that is less than the minimum required, the concrete shall be removed. However, if the Engineer determines that the concrete is structurally adequate, the concrete may remain in place and the Contractor shall pay to the State $0.55 for each kilogram of cementitious material, portland cement, or mineral admixture that is less than the minimum required. The Department may deduct the amount from any moneys due, or that may become due, the Contractor under the contract. The deductions will not be made unless the difference between the contents required and those actually provided exceeds the batching tolerances permitted by Section 90-5, "Proportioning." No deductions will be made based on the results of California Test 518.
- The requirements of the preceding paragraph shall not apply to minor concrete or commercial quality concrete.

90-2 MATERIALS

90-2.01 CEMENT

- Unless otherwise specified, cement shall be either "Type IP (MS) Modified" cement, "Type II Modified" portland cement or Type V portland cement.
- "Type IP (MS) Modified" cement shall conform to the requirements for Type IP (MS) cement in ASTM Designation: C 595, and shall be comprised of an intimate and uniform blend of Type II cement and not more than 35 percent by mass of mineral admixture. The type and minimum amount of mineral admixture used in the manufacture of "Type IP (MS) Modified" cement shall be in conformance with the provisions in Section 90-4.08, "Required Use of Mineral Admixtures."
- "Type II Modified" portland cement shall conform to the requirements for Type II portland cement in ASTM Designation: C 150-02a.
- In addition, "Type IP (MS) Modified" cement and "Type II Modified" portland cement shall conform to the following requirements:

A. The cement shall not contain more than 0.60-percent by mass of alkalies, calculated as the percentage of Na_2O plus 0.658 times the percentage of K_2O, when determined by either direct intensity flame photometry or by the atomic absorption method. The instrument and procedure used shall be qualified as to precision and accuracy in conformance with the requirements in ASTM Designation: C 114;
B. The autoclave expansion shall not exceed 0.50-percent; and
C. Mortar, containing the cement to be used and Ottawa sand, when tested in conformance with California Test 527, shall not expand in water more than 0.010 percent and shall not contract in air more than 0.048 percent, except that

when cement is to be used for precast prestressed concrete piling, precast prestressed concrete members, or steam cured concrete products, the mortar shall not contract in air more than 0.053 percent.

- Type III and Type V portland cements shall conform to the requirements in ASTM Designation: C 150-02a and the additional requirements listed above for "Type II Modified" portland cement, except that when tested in conformance with California Test 527, mortar containing Type III portland cement shall not contract in air more than 0.075 percent.
- Cement used in the manufacture of cast-in-place concrete for exposed surfaces of like elements of a structure shall be from the same cement mill.
- Cement shall be protected from exposure to moisture until used. Sacked cement shall be piled to permit access for tally, inspection, and identification of each shipment.
- Adequate facilities shall be provided to assure that cement meeting the provisions specified in this Section 90-2.01 shall be kept separate from other cement in order to prevent any but the specified cement from entering the work. Safe and suitable facilities for sampling cement shall be provided at the weigh hopper or in the feed line immediately in advance of the hopper, in conformance with California Test 125.
- If cement is used prior to sampling and testing as provided in Section 6-1.07, "Certificates of Compliance," and the cement is delivered directly to the site of the work, the Certificate of Compliance shall be signed by the cement manufacturer or supplier of the cement. If the cement is used in ready-mixed concrete or in precast concrete products purchased as such by the Contractor, the Certificate of Compliance shall be signed by the manufacturer of the concrete or product.
- Cement furnished without a Certificate of Compliance shall not be used in the work until the Engineer has had sufficient time to make appropriate tests and has approved the cement for use.

90-2.02 AGGREGATES

- Aggregates shall be free from deleterious coatings, clay balls, roots, bark, sticks, rags, and other extraneous material.
- Natural aggregates shall be thoroughly and uniformly washed before use.
- The Contractor, at the Contractor's expense, shall provide safe and suitable facilities, including necessary splitting devices for obtaining samples of aggregates, in conformance with California Test 125.
- Aggregates shall be of such character that it will be possible to produce workable concrete within the limits of water content provided in Section 90-6.06, "Amount of Water and Penetration."
- Aggregates shall have not more than 10 percent loss when tested for soundness in conformance with the requirements in California Test 214. The soundness requirement for fine aggregate will be waived, provided that the durability index, D_f, of the fine aggregate is 60, or greater, when tested for durability in conformance with California Test 229.
- If the results of any one or more of the Cleanness Value, Sand Equivalent, or aggregate grading tests do not meet the requirements specified for "Operating Range" but all meet the "Contract Compliance" requirements, the placement of concrete shall be suspended at the completion of the current pour until tests or other information indicate that the next material to be used in the work will comply with the requirements specified for "Operating Range."
- If the results of either or both the Cleanness Value and coarse aggregate grading tests do not meet the requirements specified for "Contract Compliance," the concrete that is represented by the tests shall be removed. However, if the Engineer determines that the concrete is structurally adequate, the concrete may remain in place, and the Contractor shall pay to the State $4.60 per cubic meter for paving concrete and $7.20 per cubic meter for all other concrete for the concrete represented by these tests and left in place. The Department may deduct the amount from any moneys due, or that may become due, the Contractor under the contract.
- If the results of either or both the Sand Equivalent and fine aggregate grading tests do not meet the requirements specified for "Contract Compliance," the concrete which is represented by the tests shall be removed. However, if the Engineer determines that the concrete is structurally adequate, the concrete may remain in place, and the Contractor shall pay to the State $4.60 per cubic meter for paving concrete and $7.20 per cubic meter for all other concrete for the concrete represented by these tests and left in place. The Department may deduct the amount from any moneys due, or that may become due, the Contractor under the contract.
- The 2 preceding paragraphs apply individually to the "Contract Compliance" requirements for coarse aggregate and fine aggregate. When both coarse aggregate and fine aggregate do not conform to the "Contract Compliance" requirements, both paragraphs shall apply. The payments specified in those paragraphs shall be in addition to any payments made in conformance with the provisions in Section 90-1.01, "Description."
- No single Cleanness Value, Sand Equivalent or aggregate grading test shall represent more than 250 m^3 of concrete or one day's pour, whichever is smaller.
- When the source of an aggregate is changed, the Contractor shall adjust the mix proportions and submit in writing to the Engineer a copy of the mix design before using the aggregates.

90-2.02A Coarse Aggregate

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

• Coarse aggregate shall conform to the following quality requirements:

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

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

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

90-2.02B Fine Aggregate

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

• Fine aggregate shall conform to the following quality requirements:

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

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

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

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

90-2.03 WATER

• In conventionally reinforced concrete work, the water for curing, for washing aggregates, and for mixing shall be free from oil and shall not contain more than 1000 parts per million of chlorides as Cl, when tested in conformance with California Test 422, nor more than 1300 parts per million of sulfates as SO_4, when tested in conformance with California Test 417. In prestressed concrete work, the water for curing, for washing aggregates, and for mixing shall be free from oil

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

- In non-reinforced concrete work, the water for curing, for washing aggregates and for mixing shall be free from oil and shall not contain more than 2000 parts per million of chlorides as Cl, when tested in conformance with California Test 422, or more than 1500 parts per million of sulfates as SO_4, when tested in conformance with California Test 417.
- In addition to the above provisions, water for curing concrete shall not contain impurities in a sufficient amount to cause discoloration of the concrete or produce etching of the surface.
- Water reclaimed from mixer wash-out operations may be used in mixing concrete. The water shall not contain coloring agents or more than 300 parts per million of alkalis (Na_2O + 0.658 K_2O) as determined on the filtrate. The specific gravity of the water shall not exceed 1.03 and shall not vary more than ±0.010 during a day's operations.

90-2.04 ADMIXTURE MATERIALS

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

A. Chemical Admixtures—ASTM Designation: C 494.
B. Air-entraining Admixtures—ASTM Designation: C 260.
C. Calcium Chloride—ASTM Designation: D 98.
D. Mineral Admixtures—Coal fly ash; raw or calcined natural pozzolan as specified in ASTM Designation: C 618; silica fume conforming to the requirements in ASTM Designation: C 1240, with reduction of mortar expansion of 80 percent, minimum, using the cement from the proposed mix design.

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

90-3 AGGREGATE GRADINGS

90-3.01 GENERAL

- Before beginning concrete work, the Contractor shall submit in writing to the Engineer the gradation of the primary aggregate nominal sizes that the Contractor proposes to furnish. If a primary coarse aggregate or the fine aggregate is separated into 2 or more sizes, the proposed gradation shall consist of the gradation for each individual size, and the proposed proportions of each individual size, combined mathematically to indicate one proposed gradation. The proposed gradation shall meet the grading requirements shown in the table in this section, and shall show the percentage passing each of the sieve sizes used in determining the end result.
- The Engineer may waive, in writing, the gradation requirements in this Section 90-3.01 and in Sections 90-3.02, "Coarse Aggregate Grading," 90-3.03, "Fine Aggregate Grading," and 90-3.04, "Combined Aggregate Gradings," if, in the Engineer's opinion, furnishing the gradation is not necessary for the type or amount of concrete work to be constructed.
- Gradations proposed by the Contractor shall be within the following percentage passing limits:

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

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

90-3.02 COARSE AGGREGATE GRADING

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

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

- In the above table, the symbol X is the gradation that the Contractor proposes to furnish for the specific sieve size as provided in Section 90-3.01, "General."
- Coarse aggregate for the 37.5-mm, maximum, combined aggregate grading as provided in Section 90-3.04, "Combined Aggregate Gradings," shall be furnished in 2 or more primary aggregate nominal sizes. Each primary aggregate nominal size may be separated into 2 sizes and stored separately, provided that the combined material conforms to the grading requirements for that particular primary aggregate nominal size.
- When the 25-mm, maximum, combined aggregate grading as provided in Section 90-3.04, "Combined Aggregate Gradings," is to be used, the coarse aggregate may be separated into 2 sizes and stored separately, provided that the combined material shall conform to the grading requirements for the 25-mm x 4.75-mm primary aggregate nominal size.

90-3.03 FINE AGGREGATE GRADING

- Fine aggregate shall be graded within the following limits:

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

- In the above table, the symbol X is the gradation that the Contractor proposes to furnish for the specific sieve size as provided in Section 90-3.01, "General."
- In addition to the above required grading analysis, the distribution of the fine aggregate sizes shall be such that the difference between the total percentage passing the 1.18-mm sieve and the total percentage passing the 600-µm sieve shall be between 10 and 40, and the difference between the percentage passing the 600-µm and 300-µm sieves shall be between 10 and 40.
- Fine aggregate may be separated into 2 or more sizes and stored separately, provided that the combined material conforms to the grading requirements specified in this Section 90-3.03.

90-3.04 COMBINED AGGREGATE GRADINGS

- Combined aggregate grading limits shall be used only for the design of concrete mixes. Concrete mixes shall be designed so that aggregates are combined in proportions that shall produce a mixture within the grading limits for combined aggregates as specified herein.
- The combined aggregate grading, except when otherwise specified in these specifications or the special provisions, shall be either the 37.5-mm, maximum grading, or the 25-mm, maximum grading, at the option of the Contractor.

Grading Limits of Combined Aggregates

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

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

90-4 ADMIXTURES

90-4.01 GENERAL

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

90-4.02 MATERIALS

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

90-4.03 ADMIXTURE APPROVAL

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

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

90-4.04 REQUIRED USE OF CHEMICAL ADMIXTURES AND CALCIUM CHLORIDE

• When the use of a chemical admixture or calcium chloride is specified, the admixture shall be used at the dosage specified, except that if no dosage is specified, the admixture shall be used at the dosage normally recommended by the manufacturer of the admixture.

• Calcium chloride shall be dispensed in liquid, flake, or pellet form. Calcium chloride dispensed in liquid form shall conform to the provisions for dispensing liquid admixtures in Section 90-4.10, "Proportioning and Dispensing Liquid Admixtures."

90-4.05 OPTIONAL USE OF CHEMICAL ADMIXTURES

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

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

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

90-4.06 REQUIRED USE OF AIR-ENTRAINING ADMIXTURES

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

90-4.07 OPTIONAL USE OF AIR-ENTRAINING ADMIXTURES

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

90-4.08 REQUIRED USE OF MINERAL ADMIXTURES

• Unless otherwise specified, mineral admixture shall be combined with cement to make cementitious material.

• The calcium oxide content shall not exceed 10 percent when determined in conformance with the requirements in ASTM Designation: C 114. The available alkali content (as sodium oxide equivalent) shall not exceed 1.5 percent when determined in conformance with the requirements in ASTM Designation: C 311, or the total alkali content (as sodium oxide equivalent) shall not exceed 5.0 percent when determined in conformance with the requirements in ASTM Designation: D 4326.

• The amounts of cement and mineral admixture used in cementitious material shall be sufficient to satisfy the minimum cementitious material content requirements specified in Section 90-1.01, "Description," or Section 90-4.05, "Optional Use of Chemical Admixtures," and shall conform to the following:

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

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

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

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

90-4.09 BLANK

90-4.10 PROPORTIONING AND DISPENSING LIQUID ADMIXTURES

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

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

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

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

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

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

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

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

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

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

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

• When concrete is completely mixed in stationary paving mixers, the mineral admixture shall be weighed in a separate weigh hopper conforming to the provisions for cement weigh hoppers and charging and discharging mechanisms in Section 90-5.03A, "Proportioning for Pavement," and the mineral admixture and cement shall be introduced simultaneously into the mixer proportionately with the aggregate. If the mineral admixture is not weighed in a separate weigh hopper, the Contractor shall provide certification that the stationary mixer is capable of mixing the cement, admixture, aggregates and water uniformly prior to discharge. Certification shall contain the following:

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

90-5 PROPORTIONING

90-5.01 STORAGE OF AGGREGATES

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

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

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

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

90-5.02 PROPORTIONING DEVICES

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

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

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

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

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

A. Aggregate weighed cumulatively shall be within 1.0 percent of the designated total batch mass of the aggregate. Aggregates weighed individually shall be within 1.5 percent of their respective designated batch masses; and

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

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

90-5.03 PROPORTIONING

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

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

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

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

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

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

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

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

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

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

90-5.03A Proportioning for Pavement

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

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

• The batching of cement, mineral admixture, or cement plus mineral admixture and aggregate shall be interlocked so that a new batch cannot be started until all weigh hoppers are empty, the proportioning devices are within zero tolerance, and the discharge gates are closed. The interlock shall permit no part of the batch to be discharged until all aggregate hoppers and the cement and mineral admixture hoppers or the cement plus mineral admixture hopper are charged with masses that are within the tolerances specified in Section 90-5.02, "Proportioning Devices."

• When interlocks are required for cement and mineral admixture charging mechanisms and cement and mineral admixtures are weighed cumulatively, their charging mechanisms shall be interlocked to prevent the introduction of mineral

admixture until the mass of cement in the cement weigh hopper is within the tolerances specified in Section 90-5.02, "Proportioning Devices."

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

90-6 MIXING AND TRANSPORTING

90-6.01 GENERAL

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

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

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

90-6.02 MACHINE MIXING

- Concrete mixers may be of the revolving drum or the revolving blade type, and the mixing drum or blades shall be operated uniformly at the mixing speed recommended by the manufacturer. Mixers and agitators that have an accumulation of hard concrete or mortar shall not be used.
- The temperature of mixed concrete, immediately before placing, shall be not less than 10°C or more than 32°C. Aggregates and water shall be heated or cooled as necessary to produce concrete within these temperature limits. Neither aggregates nor mixing water shall be heated to exceed 65°C. If ice is used to cool the concrete, discharge of the mixer will not be permitted until all ice is melted.
- The batch shall be so charged into the mixer that some water will enter in advance of cementitious materials and aggregates. All water shall be in the drum by the end of the first one-fourth of the specified mixing time.
- Cementitious materials shall be batched and charged into the mixer by means that will not result either in loss of cementitious materials due to the effect of wind, in accumulation of cementitious materials on surfaces of conveyors or hoppers, or in other conditions that reduce or vary the required quantity of cementitious material in the concrete mixture.

- Paving and stationary mixers shall be operated with an automatic timing device. The timing device and discharge mechanism shall be interlocked so that during normal operation no part of the batch will be discharged until the specified mixing time has elapsed.
- The total elapsed time between the intermingling of damp aggregates and all cementitious materials and the start of mixing shall not exceed 30 minutes.
- The size of batch shall not exceed the manufacturer's guaranteed capacity.
- When producing concrete for pavement or base, suitable batch counters shall be installed and maintained in good operating condition at jobsite batching plants and stationary mixers. The batch counters shall indicate the exact number of batches proportioned and mixed.
- Concrete shall be mixed and delivered to the jobsite by means of one of the following combinations of operations:

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

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

90-6.03 TRANSPORTING MIXED CONCRETE

- Mixed concrete may be transported to the delivery point in truck agitators or truck mixers operating at the speed designated by the manufacturer of the equipment as agitating speed, or in non-agitating hauling equipment, provided the consistency and workability of the mixed concrete upon discharge at the delivery point is suitable for adequate placement and consolidation in place, and provided the mixed concrete after hauling to the delivery point conforms to the provisions in Section 90-6.01, "General."
- Truck agitators shall be loaded not to exceed the manufacturer's guaranteed capacity and shall maintain the mixed concrete in a thoroughly mixed and uniform mass during hauling.
- Bodies of non-agitating hauling equipment shall be constructed so that leakage of the concrete mix, or any part thereof, will not occur at any time.
- Concrete hauled in open-top vehicles shall be protected during hauling against rain or against exposure to the sun for more than 20 minutes when the ambient temperature exceeds 24°C.
- No additional mixing water shall be incorporated into the concrete during hauling or after arrival at the delivery point, unless authorized by the Engineer. If the Engineer authorizes additional water to be incorporated into the concrete, the drum shall be revolved not less than 30 revolutions at mixing speed after the water is added and before discharge is commenced.
- The rate of discharge of mixed concrete from truck mixer-agitators shall be controlled by the speed of rotation of the drum in the discharge direction with the discharge gate fully open.
- When a truck mixer or agitator is used for transporting concrete to the delivery point, discharge shall be completed within 1.5 hours or before 250 revolutions of the drum or blades, whichever occurs first, after the introduction of the cement to the aggregates. Under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 30°C or above, the time allowed may be less than 1.5 hours.
- When non-agitating hauling equipment is used for transporting concrete to the delivery point, discharge shall be completed within one hour after the addition of the cement to the aggregates. Under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 30°C or above, the time between the introduction of cement to the aggregates and discharge shall not exceed 45 minutes.
- Each load of concrete delivered at the jobsite shall be accompanied by a weighmaster certificate showing the mix identification number, non-repeating load number, date and time at which the materials were batched, the total amount of water added to the load, and for transit-mixed concrete, the reading of the revolution counter at the time the truck mixer is charged with cement. This weighmaster certificate shall also show the actual scale masses (kilograms) for the ingredients batched. Theoretical or target batch masses shall not be used as a substitute for actual scale masses.

• Weighmaster certificates shall be provided in printed form, or if approved by the Engineer, the data may be submitted in electronic media. Electronic media shall be presented in a tab-delimited format on a 90 mm diskette with a capacity of at least 1.4 megabytes. Captured data, for the ingredients represented by each batch shall be "line feed, carriage return" (LFCR) and "one line, separate record" with allowances for sufficient fields to satisfy the amount of data required by these specifications.

• The Contractor may furnish a weighmaster certificate accompanied by a separate certificate that lists the actual batch masses or measurements for a load of concrete provided that both certificates are imprinted with the same non-repeating load number that is unique to the contract and delivered to the jobsite with the load.

• Weighmaster certificates furnished by the Contractor shall conform to the provisions in Section 9-1.01, "Measurement of Quantities."

90-6.04 TIME OR AMOUNT OF MIXING

• Mixing of concrete in paving or stationary mixers shall continue for the required mixing time after all ingredients, except water and admixture, if added with the water, are in the mixing compartment of the mixer before any part of the batch is released. Transfer time in multiple drum mixers shall not be counted as part of the required mixing time.

• The required mixing time, in paving or stationary mixers, of concrete used for concrete structures, except minor structures, shall be not less than 90 seconds or more than 5 minutes, except that when directed by the Engineer in writing, the requirements of the following paragraph shall apply.

• The required mixing time, in paving or stationary mixers, except as provided in the preceding paragraph, shall be not less than 50 seconds or more than 5 minutes.

• The minimum required revolutions at the mixing speed for transit-mixed concrete shall not be less than that recommended by the mixer manufacturer, but in no case shall the number of revolutions be less than that required to consistently produce concrete conforming to the provisions for uniformity in Section 90-6.01, "General."

90-6.05 HAND-MIXING

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

90-6.06 AMOUNT OF WATER AND PENETRATION

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

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

• The amount of free water used in concrete shall not exceed 183 kg/m^3, plus 20 kg for each required 100 kg of cementitious material in excess of 325 kg/m^3.

• The term free water is defined as the total water in the mixture minus the water absorbed by the aggregates in reaching a saturated surface-dry condition.

• Where there are adverse or difficult conditions that affect the placing of concrete, the above specified penetration and free water content limitations may be exceeded providing the Contractor is granted permission by the Engineer in writing to increase the cementitious material content per cubic meter of concrete. The increase in water and cementitious material shall be at a ratio not to exceed 30 kg of water per added 100 kg of cementitious material per cubic meter. The cost of additional cementitious material and water added under these conditions shall be at the Contractor's expense and no additional compensation will be allowed therefor.

• The equipment for supplying water to the mixer shall be constructed and arranged so that the amount of water added can be measured accurately. Any method of discharging water into the mixer for a batch shall be accurate within 1.5 percent of the quantity of water required to be added to the mix for any position of the mixer. Tanks used to measure water shall be designed so that water cannot enter while water is being discharged into the mixer and discharge into the mixer shall be made rapidly in one operation without dribbling. All equipment shall be arranged so as to permit checking the amount of water delivered by discharging into measured containers.

90-7 CURING CONCRETE

90-7.01 METHODS OF CURING

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

90-7.01A Water Method

• The concrete shall be kept continuously wet by the application of water for a minimum curing period of 7 days after the concrete has been placed.

• When a curing medium consisting of cotton mats, rugs, carpets, or earth or sand blankets is to be used to retain the moisture, the entire surface of the concrete shall be kept damp by applying water with a nozzle that so atomizes the flow that a mist and not a spray is formed, until the surface of the concrete is covered with the curing medium. The moisture from the nozzle shall not be applied under pressure directly upon the concrete and shall not be allowed to accumulate on the concrete in a quantity sufficient to cause a flow or wash the surface. At the expiration of the curing period, the concrete surfaces shall be cleared of all curing mediums.

• At the option of the Contractor, a curing medium consisting of white opaque polyethylene sheeting extruded onto burlap may be used to cure concrete structures. The polyethylene sheeting shall have a minimum thickness of 100 µm, and shall be extruded onto 283.5 gram burlap.

• At the option of the Contractor, a curing medium consisting of polyethylene sheeting may be used to cure concrete columns. The polyethylene sheeting shall have a minimum thickness of 250 µm achieved in a single layer of material.

• If the Contractor chooses to use polyethylene sheeting or polyethylene sheeting on burlap as a curing medium as specified above, these mediums and any joints therein shall be secured as necessary to provide moisture retention and shall be within 75 mm of the concrete at all points along the surface being cured. When these mediums are used, the temperature of the concrete shall be monitored during curing. If the temperature of the concrete cannot be maintained below 60°C, this method of curing shall be discontinued, and one of the other curing methods allowed for the concrete shall be used.

• When concrete bridge decks and flat slabs are to be cured without the use of a curing medium, the entire surface of the bridge deck or slab shall be kept damp by the application of water with an atomizing nozzle as specified in the preceding paragraph, until the concrete has set, after which the entire surface of the concrete shall be sprinkled continuously with water for a period of not less than 7 days.

90-7.01B Curing Compound Method

• Surfaces of the concrete that are exposed to the air shall be sprayed uniformly with a curing compound.

• Curing compounds to be used shall be as follows:

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

• The infrared scan for the dried vehicle from curing compound (1) shall match the infrared scan on file at the Transportation Laboratory.

- The loss of water for each type of curing compound, when tested in conformance with the requirements in California Test 534, shall not be more than 0.15-kg/m^2 in 24 hours.
- The curing compound to be used will be specified elsewhere in these specifications or in the special provisions.
- When the use of curing compound is required or permitted elsewhere in these specifications or in the special provisions and no specific kind is specified, any of the curing compounds listed above may be used.
- Curing compound shall be applied at a nominal rate of 3.7 m^2/L, unless otherwise specified.
- At any point, the application rate shall be within ±1.2 m^2/L of the nominal rate specified, and the average application rate shall be within ±0.5 m^2/L of the nominal rate specified when tested in conformance with the requirements in California Test 535. Runs, sags, thin areas, skips, or holidays in the applied curing compound shall be evidence that the application is not satisfactory.
- Curing compounds shall be applied using power operated spray equipment. The power operated spraying equipment shall be equipped with an operational pressure gage and a means of controlling the pressure. Hand spraying of small and irregular areas that are not reasonably accessible to mechanical spraying equipment, in the opinion of the Engineer, may be permitted.
- The curing compound shall be applied to the concrete following the surface finishing operation, immediately before the moisture sheen disappears from the surface, but before any drying shrinkage or craze cracks begin to appear. In the event of any drying or cracking of the surface, application of water with an atomizing nozzle as specified in Section 90-7.01A, "Water Method," shall be started immediately and shall be continued until application of the compound is resumed or started; however, the compound shall not be applied over any resulting freestanding water. Should the film of compound be damaged from any cause before the expiration of 7 days after the concrete is placed in the case of structures and 72 hours in the case of pavement, the damaged portion shall be repaired immediately with additional compound.
- At the time of use, compounds containing pigments shall be in a thoroughly mixed condition with the pigment uniformly dispersed throughout the vehicle. A paddle shall be used to loosen all settled pigment from the bottom of the container, and a power driven agitator shall be used to disperse the pigment uniformly throughout the vehicle.
- Agitation shall not introduce air or other foreign substance into the curing compound.
- The manufacturer shall include in the curing compound the necessary additives for control of sagging, pigment settling, leveling, de-emulsification, or other requisite qualities of a satisfactory working material. Pigmented curing compounds shall be manufactured so that the pigment does not settle badly, does not cake or thicken in the container, and does not become granular or curdled. Settlement of pigment shall be a thoroughly wetted, soft, mushy mass permitting the complete and easy vertical penetration of a paddle. Settled pigment shall be easily redispersed, with minimum resistance to the sideways manual motion of the paddle across the bottom of the container, to form a smooth uniform product of the proper consistency.
- Curing compounds shall remain sprayable at temperatures above 4°C and shall not be diluted or altered after manufacture.
- The curing compound shall be packaged in clean 1040-L totes, 210-L barrels

or 19-L pails shall be supplied from a suitable storage tank located at the jobsite. The containers shall comply with "Title 49, Code of Federal Regulations, Hazardous Materials Regulations." The 1040-L totes and the 210-L barrels shall have removable lids and airtight fasteners. The 19-L pails shall be round and have standard full open head and bail. Lids with bungholes shall not be permitted. Settling or separation of solids in containers, except tanks, must be completely redispersed with low speed mixing prior to use, in conformance with these specifications and the manufacturer's recommendations. Mixing shall be accomplished either manually by use of a paddle or by use of a mixing blade driven by a drill motor, at low speed. Mixing blades shall be the type used for mixing paint. On site storage tanks shall be kept clean and free of contaminants. Each tank shall have a permanent system designed to completely redisperse settled material without introducing air or other foreign substances.

- Steel containers and lids shall be lined with a coating that will prevent destructive action by the compound or chemical agents in the air space above the compound. The coating shall not come off the container or lid as skins. Containers shall be filled in a manner that will prevent skinning. Plastic containers shall not react with the compound.
- Each container shall be labeled with the manufacturer's name, kind of curing compound, batch number, volume, date of manufacture, and volatile organic compound (VOC) content. The label shall also warn that the curing compound containing pigment shall be well stirred before use. Precautions concerning the handling and the application of curing compound shall be shown on the label of the curing compound containers in conformance with the Construction Safety Orders and General Industry Safety Orders of the State of California.
- Containers of curing compound shall be labeled to indicate that the contents fully comply with the rules and regulations concerning air pollution control in the State of California.
- When the curing compound is shipped in tanks or tank trucks, a shipping invoice shall accompany each load. The invoice shall contain the same information as that required herein for container labels.
- Curing compound will be sampled by the Engineer at the source of supply or at the jobsite or at both locations.

• Curing compound shall be formulated so as to maintain the specified properties for a minimum of one year. The Engineer may require additional testing before use to determine compliance with these specifications if the compound has not been used within one year or whenever the Engineer has reason to believe the compound is no longer satisfactory.

• Tests will be conducted in conformance with the latest ASTM test methods and methods in use by the Transportation Laboratory.

90-7.01C Waterproof Membrane Method

• The exposed finished surfaces of concrete shall be sprayed with water, using a nozzle that so atomizes the flow that a mist and not a spray is formed, until the concrete has set, after which the curing membrane shall be placed. The curing membrane shall remain in place for a period of not less than 72 hours.

• Sheeting material for curing concrete shall conform to the requirements in AASHTO Designation: M 171 for white reflective materials.

• The sheeting material shall be fabricated into sheets of such width as to provide a complete cover for the entire concrete surface. Joints in the sheets shall be securely cemented together in such a manner as to provide a waterproof joint. The joint seams shall have a minimum lap of 100 mm.

• The sheets shall be securely weighted down by placing a bank of earth on the edges of the sheets or by other means satisfactory to the Engineer.

• Should any portion of the sheets be broken or damaged before the expiration of 72 hours after being placed, the broken or damaged portions shall be immediately repaired with new sheets properly cemented into place.

• Sections of membrane that have lost their waterproof qualities or have been damaged to such an extent as to render them unfit for curing the concrete shall not be used.

90-7.01D Forms-In-Place Method

• Formed surfaces of concrete may be cured by retaining the forms in place. The forms shall remain in place for a minimum period of 7 days after the concrete has been placed, except that for members over 0.5-m in least dimension the forms shall remain in place for a minimum period of 5 days.

• Joints in the forms and the joints between the end of forms and concrete shall be kept moisture tight during the curing period. Cracks in the forms and cracks between the forms and the concrete shall be resealed by methods subject to the approval of the Engineer.

90-7.02 CURING PAVEMENT

• The entire exposed area of the pavement, including edges, shall be cured by the waterproof membrane method, or curing compound method using curing compound (1) or (2) as the Contractor may elect. Should the side forms be removed before the expiration of 72 hours following the start of curing, the exposed pavement edges shall also be cured. If the pavement is cured by means of the curing compound method, the sawcut and all portions of the curing compound that have been disturbed by sawing operations shall be restored by spraying with additional curing compound.

• Curing shall commence as soon as the finishing process provided in Section 40-1.10, "Final Finishing," has been completed. The method selected shall conform to the provisions in Section 90-7.01, "Methods of Curing."

• When the curing compound method is used, the compound shall be applied to the entire pavement surface by mechanical sprayers. Spraying equipment shall be of the fully atomizing type equipped with a tank agitator that provides for continual agitation of the curing compound during the time of application. The spray shall be adequately protected against wind, and the nozzles shall be so oriented or moved mechanically transversely as to result in the minimum specified rate of coverage being applied uniformly on exposed faces. Hand spraying of small and irregular areas, and areas inaccessible to mechanical spraying equipment, in the opinion of the Engineer, will be permitted. When the ambient air temperature is above 15°C, the Contractor shall fog the surface of the concrete with a fine spray of water as specified in Section 90-7.01A, "Water Method." The surface of the pavement shall be kept moist between the hours of 10:00 a.m. and 4:30 p.m. on the day the concrete is placed. However, the fogging done after the curing compound has been applied shall not begin until the compound has set sufficiently to prevent displacement. Fogging shall be discontinued if ordered in writing by the Engineer.

90-7.03 CURING STRUCTURES

• Newly placed concrete for cast-in-place structures, other than highway bridge decks, shall be cured by the water method, the forms-in-place method, or, as permitted herein, by the curing compound method, in conformance with the provisions in Section 90-7.01, "Methods of Curing."

• The curing compound method using a pigmented curing compound may be used on concrete surfaces of construction joints, surfaces that are to be buried underground, and surfaces where only Ordinary Surface Finish is to be applied and on which a uniform color is not required and that will not be visible from a public traveled way. If the Contractor elects to use the curing compound method on the bottom slab of box girder spans, the curing compound shall be curing compound (1).

• The top surface of highway bridge decks shall be cured by both the curing compound method and the water method. The curing compound shall be curing compound (1).

• Concrete surfaces of minor structures, as defined in Section 51-1.02, "Minor Structures," shall be cured by the water method, the forms-in-place method or the curing compound method.

• When deemed necessary by the Engineer during periods of hot weather, water shall be applied to concrete surfaces being cured by the curing compound method or by the forms-in-place method, until the Engineer determines that a cooling effect is no longer required. Application of water for this purpose will be paid for as extra work as provided in Section 4-1.03D, "Extra Work."

90-7.04 CURING PRECAST CONCRETE MEMBERS

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

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

90-7.05 CURING PRECAST PRESTRESSED CONCRETE PILES

• Newly placed concrete for precast prestressed concrete piles shall be cured in conformance with the provisions in Section 90-7.04, "Curing Precast Concrete Members," except that piles in a corrosive environment shall be cured as follows:

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

90-7.06 CURING SLOPE PROTECTION

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

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

90-7.07 CURING MISCELLANEOUS CONCRETE WORK

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

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

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

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

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

90-8 PROTECTING CONCRETE

90-8.01 GENERAL

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

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

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

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

90-8.02 PROTECTING CONCRETE STRUCTURES

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

90-8.03 PROTECTING CONCRETE PAVEMENT

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

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

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

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

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

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

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

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

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

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

90-9 COMPRESSIVE STRENGTH

90-9.01 GENERAL

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

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

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

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

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

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

• When a precast concrete member is steam cured, the compressive strength of the concrete will be determined from test cylinders that have been handled and stored in conformance with Method 3 of California Test 540. The compressive strength of steam cured concrete will be evaluated on the basis of individual tests representing specific portions of production. When the concrete is designated by 28-day compressive strength rather than by cementitious material content, the concrete shall be considered to be acceptable whenever its compressive strength reaches the specified 28-day compressive strength provided that strength is reached in not more than the maximum number of days specified or allowed after the member is cast.

• When concrete is specified by compressive strength, prequalification of materials, mix proportions, mixing equipment, and procedures proposed for use will be required prior to placement of the concrete. Prequalification shall be

accomplished by the submission of acceptable certified test data or trial batch reports by the Contractor. Prequalification data shall be based on the use of materials, mix proportions, mixing equipment, procedures, and size of batch proposed for use in the work.

- Certified test data, in order to be acceptable, shall indicate that not less than 90 percent of at least 20 consecutive tests exceed the specified strength at the maximum number of cure days specified or allowed, and none of those tests are less than 95 percent of specified strength. Strength tests included in the data shall be the most recent tests made on concrete of the proposed mix design and all shall have been made within one year of the proposed use of the concrete.
- Trial batch test reports, in order to be acceptable, shall indicate that the average compressive strength of 5 consecutive concrete cylinders, taken from a single batch, at not more than 28 days (or the maximum age allowed) after molding shall be at least 4 MPa greater than the specified 28-day compressive strength, and no individual cylinder shall have a strength less than the specified strength at the maximum age specified or allowed. Data contained in the report shall be from trial batches that were produced within one year of the proposed use of specified strength concrete in the project. Whenever air-entrainment is required, the air content of trial batches shall be equal to or greater than the air content specified for the concrete without reduction due to tolerances.
- Tests shall be performed in conformance with either the appropriate California Test methods or the comparable ASTM test methods. Equipment employed in testing shall be in good condition and shall be properly calibrated. If the tests are performed during the life of the contract, the Engineer shall be notified sufficiently in advance of performing the tests in order to witness the test procedures.
- The certified test data and trial batch test reports shall include the following information:

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

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

90-10 MINOR CONCRETE

90-10.01 GENERAL

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

90-10.02 MATERIALS

- Minor concrete shall conform to the following requirements:

90-10.02A Cementitious Material

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

90-10.02B Aggregate

- Aggregate shall be clean and free from deleterious coatings, clay balls, roots, and other extraneous materials.

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

90-10.02C Water

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

90-10.02D Admixtures

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

90-10.03 PRODUCTION

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

90-10.04 CURING MINOR CONCRETE

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

90-10.05 PROTECTING MINOR CONCRETE

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

90-10.06 MEASUREMENT AND PAYMENT

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

90-11 MEASUREMENT AND PAYMENT

90-11.01 MEASUREMENT

- Portland cement concrete will be measured in conformance with the provisions specified in the various sections of these specifications covering construction requiring concrete.
- When it is provided that concrete will be measured at the mixer, the volume in cubic meters shall be computed as the total mass of the batch in kilograms divided by the density of the concrete in kilograms per cubic meter. The total mass of the batch shall be calculated as the sum of all materials, including water, entering the batch. The density of the concrete will be determined in conformance with the requirements in California Test 518.

90-11.02 PAYMENT

- Portland cement concrete will be paid for in conformance with the provisions specified in the various sections of these specifications covering construction requiring concrete.
- Full compensation for furnishing and incorporating admixtures required by these specifications or the special provisions will be considered as included in the contract prices paid for the concrete involved and no additional compensation will be allowed therefor.
- Should the Engineer order the Contractor to incorporate any admixtures in the concrete when their use is not required by these specifications or the special provisions, furnishing the admixtures and adding them to the concrete will be paid for as extra work as provided in Section 4-1.03D, "Extra Work."
- Should the Contractor use admixtures in conformance with the provisions in Section 90-4.05, "Optional Use of Chemical Admixtures," or Section 90-4.07, "Optional Use of Air-entraining Admixtures," or should the Contractor request and obtain permission to use other admixtures for the Contractor's benefit, the Contractor shall furnish those admixtures and incorporate them into the concrete at the Contractor's expense and no additional compensation will be allowed therefor.

END OF AMENDMENTS

SECTION 2. PROPOSAL REQUIREMENTS AND CONDITIONS

2-1.01 GENERAL

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

In addition to the subcontractors required to be listed in conformance with Section 2-1.054, "Required Listing of Proposed Subcontractors," of the Standard Specifications, each proposal shall have listed therein the name and address of each DVBE subcontractor to be used for credit in meeting the goal, and to whom the bidder proposes to directly subcontract portions of the work. The list of subcontractors shall also set forth the portion of work that will be performed by each subcontractor listed. A sheet for listing the subcontractors is included in the Proposal.

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

Submit request for substitution of an "or equal" item, and the data substantiating the request to the Department of Transportation, Division Of Construction - Duty Senior, Mail Station: 3 - B, 111 Grand Avenue / P. O. Box 23660, Oakland, CA 94623-0660, so that the request is received by the Department by close of business on the fourth day, not including Saturdays, Sundays and legal holidays, following bid opening.

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

Failure of the bidder to fulfill the requirements of the Special Provisions for submittals required to be furnished after bid opening, including but not limited to DBE or DVBE submittals, or escrowed bid documents, where applicable, may subject the bidder to a determination of the bidder's responsibility in the event it is the apparent low bidder on a future public works contracts.

2-1.02 DISABLED VETERAN BUSINESS ENTERPRISE (DVBE)

Section 10115 of the Public Contract Code requires the Department to implement provisions to establish a goal for Disabled Veteran Business Enterprise (DVBE) in contracts.

It is the policy of the Department that Disabled Veteran Business Enterprise (DVBE) shall have the maximum opportunity to participate in the performance of contracts financed solely with state funds. The Contractor shall ensure that DVBEs have the maximum opportunity to participate in the performance of this contract and shall take all necessary and

reasonable steps for this assurance. The Contractor shall not discriminate on the basis of race, color, national origin, or sex in the award and performance of subcontracts. Failure to carry out the requirements of this paragraph shall constitute a breach of contract and may result in termination of this contract or other remedy the Department may deem appropriate.

Bidder's attention is directed to the following:

A. "Disabled Veteran Business Enterprise" (DVBE) means a business concern certified as a DVBE by the Office of Small Business and Disabled Veteran Business Enterprise Certification, Department of General Services.
B. A DVBE may participate as a prime contractor, subcontractor, joint venture partner with a prime or subcontractor, or vendor of material or supplies.
C. Credit for DVBE prime contractors will be 100 percent.
D. A DVBE joint venture partner must be responsible for specific contract items of work, or portions thereof. Responsibility means actually performing, managing and supervising the work with its own forces. The DVBE joint venture partner must share in the ownership, control, management responsibilities, risks and profits of the joint venture. The DVBE joint venturer must submit the joint venture agreement with the Caltrans Bidder DVBE Information form required in Section 2-1.04, "Submission of DVBE Information," elsewhere in these special provisions.
E. A DVBE must perform a commercially useful function, i.e., must be responsible for the execution of a distinct element of the work and must carry out its responsibility by actually performing, managing and supervising the work.
F. Credit for DVBE vendors of materials or supplies is limited to 60 percent of the amount to be paid to the vendor for the material unless the vendor manufactures or substantially alters the goods.
G. Credit for trucking by DVBEs will be as follows:

    1. One hundred percent of the amount to be paid when a DVBE trucker will perform the trucking with his/her own trucks, tractors and employees.
    2. Twenty percent of the amount to be paid to DVBE trucking brokers who do not have a "certified roster."
    3. One hundred percent of the amount to be paid to DVBE trucking brokers who have signed agreements that all trucking will be performed by DVBE truckers if credit is toward the DVBE goal, a "certified roster" showing that all trucks are owned by DVBEs, and a signed statement on the "certified roster" that indicates that 100 percent of revenue paid by the broker will be paid to the DVBEs listed on the "certified roster."
    4. Twenty percent of the amount to be paid to trucking brokers who are not a DVBE but who have signed agreements with DVBE truckers assuring that at least 20 percent of the trucking will be performed by DVBE truckers if credit is toward the DVBE goal, a "certified roster" showing that at least 20 percent of the number of trucks are owned by DVBE truckers, and a signed statement on the "certified roster" that indicates that at least 20 percent of the revenue paid by the broker will be paid to the DVBEs listed on the "certified roster."

    The "certified roster" referred to herein shall conform to the requirements in Section 2-1.04, "Submission Of DVBE Information," elsewhere in these special provisions.
H. DVBEs and DVBE joint venture partners must be certified DVBEs as determined by the Department of General Services, Office of Small Business and Disabled Veteran Business Enterprise Certification, 707 Third Street, West Sacramento, CA 95605, on the date bids for the project are opened before credit may be allowed toward the DVBE goal. It is the Contractor's responsibility to verify that DVBEs are certified.
I. Noncompliance by the Contractor with these requirements constitutes a breach of this contract and may result in termination of the contract or other appropriate remedy for a breach of this contract.

2-1.03 DVBE GOAL FOR THIS PROJECT

The Department has established the following goal for Disabled Veteran Business Enterprise (DVBE) participation for this project:

Disabled Veteran Business Enterprise (DVBE): __ percent.

It is the bidder's responsibility to make a sufficient portion of the work available to subcontractors and suppliers and to select those portions of the work or material needs consistent with the available DVBE subcontractors and suppliers, so as to assure meeting the goal for DVBE participation.

The Office of Small Business and Disabled Veteran Business Enterprise Certification, Department of General Services, may be contacted at (800) 559-5529 or (916) 375-4940 or visit their internet web site at http://www.pd.dgs.ca.gov/smbus/default.htm for program information and certification status. The Department's Business

Enterprise Program may also be contacted through their internet web site at http://www.dot.ca.gov/hq/bep/ or at (866) 810-6346 or (916) 324-1700.

2-1.04 SUBMISSION OF DVBE INFORMATION

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

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

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

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

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

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

If credit for trucking by a DVBE trucking broker is shown on the bidder's information as 100 percent of the revenue to be paid by the broker is to be paid to DVBE truckers, a "certified roster" of the broker's trucks to be used must be included. The "certified roster" must indicate that all the trucks are owned by certified DVBEs and must show the DVBE truck numbers, owner's name, Public Utilities Commission Cal-T numbers, and the DVBE certification numbers. The roster must indicate that all revenue paid by the broker will be paid to DVBEs listed on the "certified roster".

If credit for trucking by a trucking broker who is not a DVBE is shown in the bidder's information, a "certified roster" of the broker's trucks to be used must be included. The "certified roster" must indicate that at least 20 percent of the broker's trucks are owned by certified DVBEs and must show the DVBE truck numbers, owner's name, Public Utilities Commission Cal-T numbers, and the DVBE certification number. The roster must indicate that at least 20 percent of the revenue paid by the broker will be paid to DVBEs listed on the "certified roster".

A bidder shall be deemed to have made good faith efforts upon submittal, within time limits specified by the Department, of documentary evidence that all of the following actions were taken:

A. Contact was made with the Office of Small Business and Disabled Veteran Business Enterprise Certification (OSDC), Department of General Services or their web site at http://www.pd.dgs.ca.gov/smbus/default.htm to identify Disabled Veteran Business Enterprises.
B. Advertising was published in trade media and media focusing on Disabled Veteran Business Enterprises, unless time limits imposed by the Department do not permit that advertising.
C. Invitations to bid were submitted to potential Disabled Veteran Business Enterprise contractors.
D. Available Disabled Veteran Business Enterprises were considered.

2-1.05 SMALL BUSINESS PREFERENCE

Attention is directed to "Award and Execution of Contract" of these special provisions.

Attention is also directed to the Small Business Procurement and Contract Act, Government Code Section 14835, et seq and Title 2, California Code of Regulations, Section 1896, et seq.

Bidders who wish to be classified as a Small Business under the provisions of those laws and regulations, shall be certified as Small Business by the Department of General Services, Office of Small Business and Disabled Veteran Business Enterprise Certification, 707 Third Street, West Sacramento, CA 95605.

To request Small Business Preference, bidders shall fill out and sign the Request for Small Business Preference form in the Proposal and shall attach a copy of their Office of Small Business and Disabled Veteran Business Enterprise Certification small business certification letter to the form. The bidder's signature on the Request for Small Business Preference certifies, under penalty of perjury, that the bidder is certified as Small Business at the time of bid opening and further certifies, under penalty of perjury, that under the following conditions, at least 50 percent of the subcontractors to be utilized on the project are either certified Small Business or have applied for Small Business certification by bid opening date and are subsequently granted Small Business certification.

The conditions requiring the aforementioned 50 percent level of subcontracting by Small Business subcontractors apply if:

A. The lowest responsible bid for the project exceeds $100,000; and
B. The project work to be performed requires a Class A or a Class B contractor's license; and
C. Two or more subcontractors will be used.

If the above conditions apply and Small Business Preference is granted in the award of the contract, the 50 percent Small Business subcontractor utilization level shall be maintained throughout the life of the contract.

2-1.06 CALIFORNIA COMPANY PREFERENCE

Attention is directed to "Award and Execution of Contract" of these special provisions.

In conformance with the requirements of Section 6107 of the Public Contract Code, a "California company" will be granted a reciprocal preference for bid comparison purposes as against a nonresident contractor from any state that gives or requires a preference to be given contractors from that state on its public entity construction contracts.

A "California company" means a sole proprietorship, partnership, joint venture, corporation, or other business entity that was a licensed California contractor on the date when bids for the public contract were opened and meets one of the following:

A. Has its principal place of business in California.
B. Has its principal place of business in a state in which there is no local contractor preference on construction contracts.
C. Has its principal place of business in a state in which there is a local contractor construction preference and the contractor has paid not less than $5000 in sales or use taxes to California for construction related activity for each of the five years immediately preceding the submission of the bid.

To carry out the "California company" reciprocal preference requirements of Section 6107 of the Public Contract Code, all bidders shall fill out and sign the California Company Preference form in the Proposal. The bidder's signature on the California Company Preference form certifies, under penalty of perjury, that the bidder is or is not a "California company" and if not, the amount of the preference applied by the state of the nonresident Contractor.

A nonresident Contractor shall disclose any and all bid preferences provided to the nonresident Contractor by the state or country in which the nonresident Contractor has its principal place of business.

Proposals without the California Company Preference form filled out and signed may be rejected.

2-1.07 PRE-AWARD INFORMATION/QUESTIONNAIRE

The Department has established that the bidder shall submit information regarding the bidder's qualifications for performing bridge construction work contracts. Bidders shall submit responses to the "Pre-Award Information/Questionnaire" (PAIQ) and the "Manufacturing and Fabrication Self Qualification Audit" (MFSQA), included in the Proposal, and included in "Project Information," of these special provisions. Responses to the PAIQ and MFSQA shall be submitted with the bid along with the shop drawings of these special provisions. The bidder's attention is directed to "Audits," of these special provisions regarding requirements for manufacturers and suppliers solicited and identified subsequent to bid opening and award. For the following items, bidders shall submit a MFSQA of each facility considered for use by the Contractor or any subcontractor, supplier, or fabricator, including those of all lower subcontracted tiers, to prepare materials for incorporation into the project for which a Department audit is required, with the bid. The MFSQA shall comply with the requirements of "Audits," of these special provisions. Manufacturers and suppliers sufficient to perform the work shall be identified prior to bid opening.

FURNISH STRUCTURAL STEEL (BRIDGE) (TOWER)
FURNISH STRUCTURAL STEEL (BRIDGE) (ORTHOTROPIC BOX GIRDER)
FURNISH STRUCTURAL STEEL (BRIDGE) (SADDLE)
FURNISH SUSPENDER SYSTEM
FURNISH PWS CABLE SYSTEM
FURNISH AND INSTALL SHEAR KEY (PIER E2)
CLEAN AND PAINT STRUCTURAL STEEL (TOWER)
CLEAN AND PAINT STRUCTURAL STEEL (ORTHOTROPIC BOX GIRDER)"

In signing the signature page of the Proposal, the bidder certifies that the information and answers in response to the PAIQ and MFSQA are complete and accurate. Failure to completely answer the PAIQ and MFSQA or failure to include responses from all potential subcontractors known or considered at the time of bid may be a contributing factor for considering the bidder non-responsive and a reason for rejection of the bid.

The PAIQ and MFSQA shall be made as part of the Proposal in demonstrating how the shop will meet the Contract requirements. The bidder is responsible for conducting and reviewing the MFSQA of each potential subcontractor, supplier, and fabricator, including those of all lower subcontracted tiers, particularly those identified for participation in the project. Deficiencies in the bidder's MFSQAs noted by the bidder shall be corrected or otherwise satisfactorily addressed prior to submission for bid. Deficiencies noted by the Department prior to Award may be cause for determination that the bidder is not capable of meeting the contract requirements.

The bidder's attention is directed to "Pre-award Qualifications Meeting," and "Audits," of these special provisions for the requirements of acceptance of bid, review timelines, and deductions resulting from inaccuracies in the MFSQA. The Department will perform an audit in conformance with the provisions in "Audits," of these special provisions, to verify the MFSQA.

A Department audit is not required prior to bid, however Department audits may be requested prior to Award following receipt of the Department's written approval of a given facility's MFSQA. Successful completion of a Department audit does not relieve bidders of the responsibility for furnishing materials or producing finished work of the quality specified in these special provisions and shown on the plans.

The contract provisions in this section shall be considered part of the cost of preparing bids and no separate payment will be made therefor.

2-1.08 ESCROW OF BID DOCUMENTATION

Bid documentation shall consist of all documentary and calculated information generated by the Contractor in preparation of the bid. The bid documentation shall conform to the requirements in these special provisions, and shall be submitted to the Department and held in escrow for the duration of the contract.

The escrowed bid documents will be the only documents accepted from the Contractor regarding preparation of the bid.

In signing the proposal, the bidder certifies that the material submitted for escrow constitutes all the documentary information used in preparation of the bid and that he has personally examined the contents of the container and that they are complete.

Nothing in the bid documentation shall be construed to change or modify the terms or conditions of the contract.

Escrowed bid documentation will not be used for pre-award evaluation of the Contractor's anticipated methods of construction, nor to assess the Contractor's qualifications for performing the work.

Bid documentation shall clearly itemize the Contractor's estimated costs of performing the work. The documentation submitted shall be complete and so detailed as to allow for an in-depth analysis of the Contractor's estimate.

The Contractor shall submit its bid documentation which shall include, but not be limited to:

- quantity takeoffs;
- rate schedules for the direct costs and the time- and nontime-related indirect costs for
- labor (by craft),
- plant and equipment ownership and operation,
- permanent and expendable materials,
- insurance and subcontracted work;
- estimated construction schedules, including sequence and duration and development of production rates;
- quotations, terms and limitations of quotes, and subcontracts related to subcontractors, manufacturers and suppliers;
- estimates of field and home office overhead;
- contingency and margin for each contract item of work;

- names of the persons responsible for preparing the bidder's estimate, and other reports, calculations, assumptions and supplemental information used by the bidder to arrive at the estimate submitted with the proposal.
- bid documentation for each subcontractor, manufacturer and supplier whose total subcontract or purchase orders exceeds or is expected to exceed $250,000. Bid documentation for other subcontractors, manufacturers, and suppliers may be submitted, if required by the Contractor or requested by the subcontractor, manufacturer, or supplier.

If required by the Contractor or requested by the subcontractor, manufacturer, or supplier, additional information may be submitted by the subcontractor, manufacturer, or supplier. Subcontractor, manufacturer and supplier bid documentation shall conform to the requirements for the Contractor's documentation and shall be enclosed with the Contractor's submittal, regardless of whether or not subcontracts or purchase orders have been executed or entered into on the date that bid documentation is submitted for escrow. If at the time that bid documentation is submitted for escrow, the subcontractor, manufacturer or supplier does not have a executed subcontract or purchase orders, and a subcontract or purchase orders is subsequently executed, then a copy of the executed subcontract or purchase orders shall be submitted into escrow within 14 days of the execution of the respective subcontract or purchase orders. The examination of subcontractors', manufacturers' and suppliers' bid documentation will be accomplished in the same manner as for the Contractor's bid documentation. If a subcontractor, manufacturer or supplier is replaced, bid documentation for the new subcontractor, manufacturer or supplier shall be submitted for review and escrow before authorization for the substitution will be granted. Upon request of a subcontractor, manufacturer or supplier, the bid documentation from that subcontractor, manufacturer or supplier shall be reviewed only by the subcontractor, manufacturer or supplier and the Department.

If the bidder is a joint venture, the bid documentation shall include the joint venture agreement, the joint venture estimate comparison and final reconciliation of the joint venture estimate.

Copies of the proposals submitted by the first, second and third low bidders will be provided to the respective bidders for inclusion in the bid documentation to be escrowed.

The first, second, and third apparent low bidders shall present the bid documentation for escrow at the District 4 Office, 111 Grand Avenue, Oakland, CA, (510) 286-5209, on the first Tuesday between 1:00 p.m. and 2:00 p.m., following the time indicated in the "Notice to Contractors" for the opening of bids. The fourth and subsequent apparent low bidders shall present the bid documentation for escrow if requested by the Department to do so. Bid documentation shall be submitted as a paper copy in a sealed container, clearly marked with the bidder's name, date of submittal, project contract number and the words, "Bid Documentation for Escrow."

Failure to submit the actual and complete bid documentation as specified herein within the time specified shall be cause for rejection of the proposal.

Upon submittal, the bid documentation of the apparent low bidder will be examined and inventoried by the duly designated representatives of the Contractor and the Department to ensure that the bid documentation is authentic, legible, and in accordance with the terms of this section "Escrow of Bid Documentation." The examination will not include review of, nor will it constitute approval of, proposed construction methods, estimating assumptions or interpretation of the contract. The examination will not alter any conditions or terms of the contract. The acceptance or rejection by the Department that the submitted bid documents are in compliance with this section "Escrow of Bid Documentation" shall be completed within 48 hours of the time the bid documentation is submitted by the Contractor.

At the completion of the examination, the bid documents will be sealed and jointly deposited at an agreed commercial business in Oakland, CA.

Bid documentation submitted by the second and third apparent low bidders will be jointly deposited at agreed commercial businesses. If the apparent low bid is withdrawn or rejected, the bid documentation of the second low bidder will be examined and inventoried in the manner specified above, then sealed and deposited again in escrow. If the second low bid is withdrawn or rejected, the bid documentation of the third low bidder will be examined and inventoried in the manner specified above, then sealed and deposited again in escrow. Bid documentation from subsequent bidders, if requested, will be examined and inventoried in the same manner as specified above, then sealed and deposited in escrow. Upon execution and final approval of the contract or rejection of all bids, the bid documentation will be returned to any remaining unsuccessful bidders.

Any and all components of the escrowed bid documentation may be examined by the designated representatives of both the Department and the Contractor, at any time deemed necessary by either the Department or the Contractor to assist in the negotiation of price adjustments and change orders, or to assist in the potential resolution or in the settlement of claims or disputes. Such a joint review shall be performed within 15 days of receipt of a written request to do so by either party. If the Contractor refuses to participate in the joint examination of any and all components of the escrowed bid documentation as provided herein, such refusal shall be considered as a failure by the Contractor to exhaust administrative claim remedies with respect to the particular protest, notice of potential claim, or claim. In addition, this refusal by the Contractor shall constitute a bar to future arbitration with respect to the protest, potential claim or claim as provided by Section 10240.2 of the California Public Contract Code.

If requested by a Disputes Review Board, the escrowed bid documentation may be utilized to assist the Board in its recommendations.

The bid documentation submitted by the Contractor will be held in escrow until the contract has been completed, the ultimate resolution of all disputes and claims has been achieved and receipt of final payment has been accepted by the Contractor. The escrowed bid documentation will then be released from escrow to the Contractor.

The bid documentation submitted by the bidder is, and shall remain, the property of the bidder, and is subject to only joint review by the Department and the bidder. The Department stipulates and expressly acknowledges that the submitted bid documentation constitutes trade secrets and will not be deemed public records. This acknowledgment is based on the Department's express understanding that the information contained in the bid documentation is not known outside the bidder's business, is known only to a limited extent and only by a limited number of employees of the bidder, is safeguarded while in the bidder's possession, is extremely valuable to the bidder and could be extremely valuable to the bidder's competitors by virtue of it reflecting the bidder's contemplated techniques of construction. The Department acknowledges that the bid documentation includes a compilation of information used in the bidder's business, intended to give the bidder an opportunity to obtain an advantage over competitors who do not know of or use the contents of the documentation. The Department agrees to safeguard the bid documentation, and all information contained therein, against disclosure, including disclosure of subcontractor bid documentation to the Contractor and other subcontractors to the fullest extent permitted by law. However, in the event of arbitration or litigation, the bid documentation shall be subject to discovery, and the Department assumes no responsibility for safeguarding the bid documentation unless the Contractor has obtained an appropriate protective order issued by the arbitrator or the court.

Full compensation for preparing the bid documentation, presenting it for escrow and reviewing it for escrow and upon request of the Engineer shall be considered as included in the contract prices paid for the various items of work, and no additional compensation will be allowed therefor.

The direct cost of depositing the bid documentation in escrow at the agreed commercial business will be paid by the State.

2-1.09 BIDDERS COMPENSATION

The Department recognizes that significant costs are incurred in preparing a bid and performing the advance engineering for a project of this magnitude. To encourage responsible bidders to submit responsive bids, the low, second low, and third low bidders shall each receive $3,000,000 as compensation for a portion of the costs of preparing a responsive bid. Other unsuccessful bidders will not be compensated for their bids.

Bidders whose bids are determined by the Department to be non-responsive, or who fail to submit a reasonable bid, or who fail to execute the contract will not be eligible for bidder compensation.

Payment of the compensation will be made within 90 days after award of the contract. Within 30 days after award of the contract, the Department will notify the Contractor of the identity of the second low and third low bidders for payment of the bidder compensation. The Contractor shall make the necessary arrangements with the recipients and administer the payments. The Contractor shall provide the Department proof of payment by invoices in accordance with the provisions of Section 9-1.03B, "Work Performed by Special Forces or Other Special Services," of the Standard Specifications within 5 days of the payments. The Contractor shall make payment to the designated recipients and provide proof of receipt to the Department within 5 days of receipt of the pass through payment The Department will compensate the Contractor for payment of bidders compensation to the second and third low bidders, in the next monthly progress payment, in conformance with the provisions of Section 9-1.03B, except that no mark up will be added, and the Department will pay the Contractor $3,000,000 as bidder compensation to the low bidder.

Full compensation for the costs of preparing a responsive bid and performing the advance engineering shall be considered as included in the contract prices paid for the various contract items of work and no additional compensation will be allowed therefor.

If the Department rejects all bids and cancels the solicitation the Department will provide bidders compensation to the low, second low, and third low responsible bidders who have submitted responsive bids.

2-1.10 SUBMITTALS WITH BID

In addition to the requirements of "Pre-Award Information/Questionnaire" and "Escrow of Bid Documentation," of these special provisions, a complete bid shall include the following:

- A preliminary working drawing submittal schedule as described in "Working Drawing Submittal Schedule" of these special provisions. At a minimum, the drawings shall provide information for items D, E, and G of the referenced section.
- Preliminary drawings illustrating a general description of the tower and superstructure steel erection procedure. At a minimum, the drawings shall provide preliminary information for items C and D in subsection "Erection Plan" in "Steel Structures," of these special provisions.

- Preliminary drawings illustrating a general description and loading of temporary support towers. At a minimum, the drawings shall provide preliminary information for items A, B, D, E, F, and H in subsection "Working Drawings" in "Temporary Towers," of these special provisions.

Drawings shall be submitted on 11x17 paper and text and details shall be legible and suitable for photocopying. Only one set of the entire submittal package is required.

The schedule and shop drawings are subject to the Engineer's review as part of the Department's assessment of responsibility of bidders in conformance with these special provisions. It is understood that the drawings at bid time are preliminary conceptual versions subject to change, however, the drawings shall be as complete and comprehensive as possible to demonstrate a clear plan for construction. Multiple options and plans may be shown. Review of the bid submittals will only be to assess the responsibility of the Contractor, and does not relieve the Contractor from conforming to plans and specifications. The low bidder to whom the project is awarded will be required to resubmit the finalized schedule and drawings as described in "Working Drawing Submittal Schedule", "Steel Structures", and "Temporary Towers" of these special provisions.

The contract provisions in this section shall be considered part of the cost of preparing bids and no separate payment will be made therefor.

SECTION 3. AWARD AND EXECUTION OF CONTRACT

3-1.01 GENERAL

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

Bid protests are to be delivered to the following address: Department of Transportation, MS 43, Attn: Office Engineer, 1727 30th Street, Sacramento, CA 95816 or by facsimile to the Office Engineer at (916) 227-6282.

3-1.01A PRE-AWARD QUALIFICATIONS MEETING

If the Engineer determines it necessary, a pre-award qualification review meeting will be conducted. The meeting, if held, will be on the second Tuesday after bid opening at 1:00 p.m. **in the third floor conference room 1727 - 30th Street, Sacramento, CA 95816**. The apparent low bidder shall participate in a pre-award qualification review meeting conducted by one or more agents of the Director and the Engineer. Non-attendance to the qualification review meeting by the apparent low bidder shall be just cause for rejection of the bid and forfeiture of the proposal guaranty. At the qualifications review meeting, the low bidder shall be prepared to discuss and answer questions relative to the responses to the "Pre-Award Information/Questionnaire," "Manufacturing and Fabrication Self Qualification Audit" and shop drawings submitted with the bid. Prior to award, the Director’s agent will prepare written findings and recommendations to the Engineer regarding award of the contract to the apparent low bidder based on the bridge construction and steel fabricator information and responses submitted with the bid, and on the information provided at the qualifications review meeting.

The Engineer’s determination on the bidder's qualifications for performing bridge construction work, in a manner that is safe for the workers and the public and of the highest possible quality, will be based on the following:

1. Bidder's experience in structural work of this nature
2. Qualifications of on-site supervisory personnel capable of completing the work in a safe and timely manner
3. Safety history of the bidder and its supervisory personnel
4. Conceptual approach to the bridge construction work
5. Availability of equipment capable of performing the work
6. Ability of the steel suppliers to supply material on schedule
7. Sufficient letters of intent to list and use fabricators/steel shops
8. Sufficient schedule for steel delivery and sufficient planned storage space for delivered steel until it can be incorporated into the work
9. Demonstration through completed self-audits that proposed fabricators for the contract items designated can perform and are competent to do the work. It is expected that designated item fabricators will pass the Department’s audit
10. Adequate shop facility footprint/space requirements
11. Adequate funding capability

Successful completion of the pre-award qualifications process does not relieve the Contractor of the responsibility for furnishing materials or producing finished work of the quality specified in project plans and specifications.

The second and third apparent low bidders shall participate in pre-award qualifications review meetings if requested to do so by the Department. Notification by the Department will be within 7 days after the bid opening, and will be provided at least 48 hours prior to the qualifications review meeting. Non-attendance by the second or third apparent low bidder at any such requested meeting shall be just cause for rejection of bid and forfeiture of the proposal guaranty.

The contract provisions described herein shall be considered part of the cost of preparing bids and no separate payment will be made therefor.

3-1.01B AWARD AND EXECUTION OF CONTRACT

The award of the contract, if it be awarded, will be made within 60 days after the opening of the proposals. This period will be subject to extension for such further period as may be agreed upon in writing between the Department and the bidder concerned. The award, if made, will be to the lowest responsible bidder whose proposal complies with all the requirements prescribed and who has met the goal for DVBE participation or has demonstrated, to the satisfaction of the Department, adequate good faith efforts to do so. Meeting the goal for DVBE participation or demonstrating, to the satisfaction of the Department, adequate good faith efforts to do so is a condition for being eligible for award of contract.

The contract shall be executed by the successful bidder and shall be returned, together with the contract bonds, to the Department so that it is received within 10 days, not including Saturdays, Sundays and legal holidays, after the bidder has received the contract for execution. Failure to do so shall be just cause for forfeiture of the proposal guaranty. The executed contract documents shall be delivered to the following address: Department of Transportation MS 43, Attn: Office Engineer, 1727 30th Street, Sacramento, CA 95816

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

Attention is directed to "California Company Preference" of these special provisions.

The amount of the California company reciprocal preference shall be equal to the amount of the preference applied by the state of the nonresident contractor with the lowest responsive bid, except where the "California company" is eligible for a California Small Business Preference, in which case the preference applied shall be the greater of the two, but not both.

If the bidder submitting the lowest responsive bid is not a "California company" and with the benefit of the reciprocal preference, a "California company's" responsive bid is equal to or less than the original lowest responsive bid, the "California company" will be awarded the contract at its submitted bid price except as provided below.

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

Attention is directed to the provisions in "Order of Work,"of these special provisions, Section 8-1.03, "Beginning of Work," Section 8-1.06, "Time of Completion," and Section 8-1.07, "Liquidated Damages," of the Standard Specifications, and these special provisions.

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

The second through fourth paragraphs, inclusive, and the first sentence of the fifth paragraph of Section 8-1.06, "Time of Completion," of the Standard Specifications shall not apply. A working day is defined as any day, with no exceptions.

The work shall be completed in phases as described in Section 10-1.01 "Order of Work" of these special provisions.

Phase 1 work shall be diligently prosecuted to completion before the expiration of **650 WORKING DAYS** beginning on the fifteenth day after approval of the contract.

The Contractor shall pay to the State of California the sum of $100,000 per day as liquidated damages, for each and every day's delay in completing Phase 1 work in excess of the number of working days prescribed above for Phase 1, not to exceed $18,000,000.

Phase 2 work shall be diligently prosecuted to completion before the expiration of **1770 WORKING DAYS** beginning on the fifteenth day after approval of the contract.

The Contractor shall pay to the State of California the sum of $100,000 per day as liquidated damages, for each and every day's delay in completing Phase 2 work in excess of the number of working days prescribed above for Phase 2.

Phase 3 work shall be diligently prosecuted to completion before the expiration of **1950 WORKING DAYS** beginning on the fifteenth day after approval of the contract.

The Contractor shall pay to the State of California the sum of $100,000 per day as liquidated damages, for each and every day's delay in completing Phase 3 work in excess of the number of working days prescribed above for Phase 3.

Phase 4 work shall be diligently prosecuted to completion before the expiration of **2130 WORKING DAYS** beginning on the fifteenth day after approval of the contract.

The Contractor shall pay to the State of California the sum of $100,000 per day as liquidated damages, for each and every day's delay in completing Phase 4 work in excess of the number of working days prescribed above for Phase 4.

Should two or more liquidated damages accrue concurrently, no more than $100,000 per day will be assessed. Total liquidated damages for the project will not exceed $125,000,000.

Inspection, testing, and review duties performed by the Engineer shall be considered as included in the number of working days for completion of the phases of work and no extensions of time will be allowed for such actions in determining liquidated damages.

The time limit specified for the completion of the work contemplated herein is considered insufficient to permit completion of the work by the Contractor working a normal number of hours per day or week on a single shift basis. Should the Contractor fail to maintain the progress of the work in accordance with the "Progress Schedule (Critical Path Method)" required in these special provisions, additional shifts will be required to the extent necessary to ensure that the progress conforms to the above mentioned schedule and that the work will be completed within the time limit specified.

Full compensation for additional costs occasioned by compliance with the provisions in this section shall be considered as included in the prices paid for the various contract items of work and no additional compensation will be allowed therefor.

SECTION 5. GENERAL

SECTION 5-1. MISCELLANEOUS

5-1.01 WORKING DRAWINGS

Working drawings shall conform to the requirements in Section 5-1.02," Plans and Working Drawings," of the Standard Specifications and these special provisions. Working drawings shall include supplements and calculations that are in addition to drawings.

Working drawings shall be submitted to the following location:

California Department of Transportation
Office of the Resident Engineer, Contract 04-0120F4
333 Burma Rd.
Oakland, CA 94607

Working drawings shall conform to the following:

A. For initial review, 6 sets of the working drawings, shall be submitted. After the Engineer has determined that a submittal is complete, 12 additional sets shall be submitted.
B. Drawings shall be 559 mm x 864 mm or 279 mm x 432 mm in size. Supplements and calculations shall be 215 mm x 280 mm in size.
C. For drawings, text size shall be nominally 2.8 mm high, minimum. For supplement and calculations, font size shall be 12, minimum.
D. Each working drawing sheet and each page of supplement or calculation, shall include the jobsite name of the structure as shown on the contract plans, District-County-Route-Kilometer Post, bridge number and contract number.
E. Text and details shall be legible and suitable for photocopying and reduction.
F. In addition to the paper copies of the working drawings, electronic files shall be submitted. Electronic files shall be portable document format (PDF) and shall be submitted on compact disk (CD) media. Each plan sheet shall be a separate PDF file on the CD. The electronic copy of the calculations and supplement shall be made into separate PDF files so that no more than 50 pages are included in a single file on the CD. The CD shall contain an index consisting of the file names and a description of the corresponding file contents. The files shall be listed in the sequence of: 1) index, 2) drawings, 3) supplement, and 4) calculations. If more than one CD is used for a given working drawing submittal, the index shall be included on each CD.
G. Microfilms are required for approved shop drawings and shall be only a 24x reduction. The edge of the corrected original tracing image shall be clearly visible and visually parallel with the edges of the page. A clear, legible symbol shall be provided on the upper left side of each page to show the amount of reduction, and a horizontal and vertical scale shall be provided on each reduced print to facilitate enlargement to original scale.

H. After review and approval of the working drawings, between 6 and 12 sets, as requested by the Engineer, shall be submitted to the Engineer for final approval. These sets will be the only sets stamped "Approved" and will be distributed for use during construction.
I. At the completion of the contract, one compiled set of all approved working drawings (in electronic form and including all corrections and revisions) shall be furnished to the Engineer. The index shall be the first file on the CD.
J. At the completion of the contract, one set of reduced prints on 75-g/m2 (minimum) bond paper, 279 mm x 432 mm in size, of the corrected original tracings of all approved working drawings, including all corrections and revisions shall be furnished to the Engineer. Reduced prints that are common to more than one structure shall be submitted for each structure. An index prepared specifically for the drawings for each structure containing sheet numbers and titles shall be included on the first reduced print in the set for each structure. Reduced prints for each structure shall be arranged in the order of drawing numbers shown in the index

Working drawings shall be stamped and signed by an engineer who is registered as a Civil Engineer in the State of California. When independently checked calculations are required, these calculations shall be stamped and signed by another engineer who is registered as a Civil Engineer in the State of California.

Working drawings shall be submitted sufficiently in advance of the start of the affected work to allow time for review by the Engineer and correction by the Contractor of the drawings without delaying the work. The time shall be proportional to the complexity of the work, but in no case shall the time be less than the review time as specified for the type of working drawings as required elsewhere in these special provisions.

The Engineer will review a working drawing submittal for completeness. Within 3 days of the receipt of the submittal by the Engineer, the Engineer will notify the Contractor in writing if the submittal is determined to be incomplete. If the submittal is determined to be complete, 20 days from the day of receipt shall be allowed for approval or return for correction of each submittal or resubmittal, unless specified otherwise in the special provisions.

The Contractor shall allow the review times specified in these special provisions after complete working drawings and all supporting data are submitted to the Engineer. The review time for a set of working drawings will be considered as starting when the Engineer has received a complete set of working drawings and all supporting data.

If at any time during the review process, the working drawings are determined to be incomplete or in need of correction, the drawings will be rejected and returned to the Contractor for correction. The review time on a set of returned drawings will be suspended on the date the drawings are date stamped by the Engineer for return. The Contractor shall submit a notice of resubmittal to the Engineer within 5 days after receipt of the rejected set. The notice shall contain the submittal number, revision number, and date the revised set will be returned for review. The revised set shall contain the same work as was originally submitted.

After a revised set of drawings have been received by the Engineer, the new review time for that set of revised drawings will be the original review time, less the time already spent under review before rejection. In no case shall the review time allotted the Engineer upon receipt of a resubmittal be less than 14 days.

Should the Engineer fail to review the complete working drawing submittal within the time specified, and the Contractor's controlling operation on the critical path is delayed (as determined by the Engineer) by the Engineer's failure to review within the time specified, an extension of time will be granted in conformance with the provisions in Section 8-1.07, "Liquidated Damages," of the Standard Specifications and in "Progress Schedule (Critical Path Method)," of these special provisions. Should the Engineer fail to review the complete working drawing submittal within the time specified, compensation, if any, will be made in accordance with Section 8-1.09, "Right of Way Delays," of the Standard Specifications, and "Time Related Overhead," of these special provisions.

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

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

5-1.012 DIFFERING SITE CONDITIONS

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

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

The Contractor will be allowed 15 days from the notification of the Engineer's determination of whether or not an adjustment of the contract is warranted, in which to file a notice of potential claim in conformance with the provisions of

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

5-1.013 LINES AND GRADES

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

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

5-1.015 LABORATORY

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

5-1.017 CONTRACT BONDS

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

The payment bond shall be in a sum equal to three hundred fifty million dollars ($350,000,000).

The performance bond shall be in a sum equal to three hundred fifty million dollars ($350,000,000).

5-1.018 FOREIGN FABRICATION

Attention is directed to Section 6-1.08, "Foreign Materials," of the Standard Specifications and these special provisions.

The second paragraph of Section 6-1.08, "Foreign Materials," in the Standard Specifications, shall not apply.

It shall be the Contractor's responsibility to deliver materials obtained from outside of the United States to the point of entry into the continental United States in sufficient time to permit timely delivery to the job site.

To facilitate discussion between Department and Contractor representatives during materials and fabrication inspections and audits that occur outside the United States, where English is not fluently spoken by onsite representatives, the Contractor shall ensure that a translator is available at the facility at all times when the Department's quality assurance representatives are present.

Full compensation for ensuring that the translator is available shall be considered as included in the contract prices paid for the various contract items of work and no additional compensation will be allowed therefor.

All documents pertaining to the contract, including but not limited to, correspondence, bid documents, working drawings and data shall be written only in the English language and all numerical data shall use the International System of Units (SI) for measurement.

When Department audit, inspection, or test witnessing is requested for facilities outside the United States, the Contractor shall provide 14 days notice to the Department, except when Department representatives are already on site.

5-1.02 LABOR NONDISCRIMINATION

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

NOTICE OF REQUIREMENT FOR NONDISCRIMINATION PROGRAM

(GOV. CODE, SECTION 12990)

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

5-1.022 EXCLUSION OF RETENTION

The retention of proceeds required by Public Contract Code Section 10261 shall not apply. In conformance with Public Contract Code 7200 (b), in subcontracts between the Contractor and a subcontractor and in subcontracts between a subcontractor and any subcontractor thereunder, retention proceeds shall not be withheld, and the exceptions provided in Public Contract Code 7200 (c) shall not apply. At the option of the Contractor, subcontractors may be required to furnish payment and performance bonds issued by an admitted surety insurer.

The third paragraph of Section 9-1.06, "Partial Payments," of the Standard Specifications, and Section 9-1.065, "Payment of Withheld Funds," of the Standard Specifications shall not apply.

5-1.023 UNSATISFACTORY PROGRESS

If the number of working days charged to the contract exceeds 75 percent of the working days in the current time of completion and the percent working days elapsed exceeds the percent work completed by more than 15 percentage points, the Department will withhold 10 percent of the amount due on the current monthly estimate.

The percent working days elapsed will be determined from the number of working days charged to the contract divided by the number of contract working days in the current time of completion, expressed as a percentage. The number of contract working days in the current time of completion shall consist of the original contract working days increased or decreased by time adjustment s approved by the Engineer.

The percent work completed will be determined by the Engineer from the sum of payments made to date plus the amount due on the current monthly estimate, divided by the current total estimated value of the work, expressed as a percentage.

When the percent of working days elapsed minus the percent of work completed is less than or equal to 15 percentage points, the funds withheld shall be returned to the Contractor with the next monthly progress payment.

Funds kept or withheld from payment, due to the failure of the Contractor to comply with the provisions of the contract, will not be subject to the requirements of Public Contract Code 7107 or to the payment of interest pursuant to Public Contract Code Section 10261.5.

5-1.03 INTEREST ON PAYMENTS

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

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

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

5-1.04 PUBLIC SAFETY

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

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

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

    1. Excavations covered with sheet steel or concrete covers of adequate thickness to prevent accidental entry by traffic or the public.
    2. Excavations less than 0.3-m deep.

3. Trenches less than 0.3-m wide for irrigation pipe or electrical conduit, or excavations less than 0.3-m in diameter.
4. Excavations parallel to the lane for the purpose of pavement widening or reconstruction.
5. Excavations in side slopes, where the slope is steeper than 1:4 (vertical:horizontal).
6. Excavations protected by existing barrier or railing.

B. Temporarily Unprotected Permanent Obstacles.—The work includes the installation of a fixed obstacle together with a protective system, such as a sign structure together with protective railing, and the Contractor elects to install the obstacle prior to installing the protective system; or the Contractor, for the Contractor's convenience and with permission of the Engineer, removes a portion of an existing protective railing at an obstacle and does not replace such railing complete in place during the same day.
C. Storage Areas.—Material or equipment is stored within 3.6 m of the lane and the storage is not otherwise prohibited by the provisions of the Standard Specifications and these special provisions.

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

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

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

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

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

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

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

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

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

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

5-1.05 TESTING

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

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

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

5-1.06 REMOVAL OF ASBESTOS AND HAZARDOUS SUBSTANCES

When the presence of asbestos or hazardous substances are not shown on the plans or indicated in the specifications and the Contractor encounters materials which the Contractor reasonably believes to be asbestos or a hazardous substance as defined in Section 25914.1 of the Health and Safety Code, and the asbestos or hazardous substance has not been rendered harmless, the Contractor may continue work in unaffected areas reasonably believed to be safe. The Contractor shall immediately cease work in the affected area and report the condition to the Engineer in writing.

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

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

5-1.07 (BLANK)

5-1.08 SUBCONTRACTOR AND DVBE RECORDS

The Contractor shall maintain records of all subcontracts entered into with certified DVBE subcontractors and records of materials purchased from certified DVBE suppliers. The records shall show the name and business address of each DVBE subcontractor or vendor and the total dollar amount actually paid each DVBE subcontractor or vendor.

Upon completion of the contract, a summary of these records shall be prepared on Form CEM-2402 (S) and certified correct by the Contractor or the Contractor's authorized representative, and shall be furnished to the Engineer.

5-1.086 PERFORMANCE OF DVBE SUBCONTRACTORS AND SUPPLIERS

The DVBEs listed by the Contractor in response to the provisions in Section 2-1.04, "Submission of DVBE Information," and Section 3, "Award and Execution of Contract," of these special provisions, which are determined by the Department to be certified DVBEs, shall perform the work and supply the materials for which they are listed, unless the Contractor has received prior written authorization to perform the work with other forces or to obtain the materials from other sources.

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

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

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

5-1.09 SUBCONTRACTING

Attention is directed to the provisions in Section 8-1.01, "Subcontracting," of the Standard Specifications, Section 2, "Proposal Requirements and Conditions," Section 2-1.04, "Submission of DVBE Information," and Section 3, "Award and Execution of Contract," of these special provisions and these special provisions.

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

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

The DVBE information furnished under Section 2-1.04, "Submission of DVBE Information," of these special provisions is in addition to the subcontractor information required to be furnished in Section 8-1.01, "Subcontracting," and Section 2-1.054, "Required Listing of Proposed Subcontractors," of the Standard Specifications.

Section 10115 of the Public Contract Code requires the Department to implement provisions to establish a goal for Disabled Veteran Business Enterprise (DVBE) participation in highway contracts that are State funded. As a part of this requirement:

A. No substitution of a DVBE subcontractor shall be made at any time without the written consent of the Department, and
B. If a DVBE subcontractor is unable to perform successfully and is to be replaced, the Contractor shall make good faith efforts to replace the original DVBE subcontractor with another DVBE subcontractor.

The provisions in Section 2-1.02, "Disabled Veteran Business Enterprise (DVBE)," of these special provisions that DVBEs shall be certified on the date bids are opened does not apply to DVBE substitutions after award of the contract.

5-1.10 PROMPT PROGRESS PAYMENT TO SUBCONTRACTORS

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

5-1.103 RECORDS

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

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

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

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

5-1.11 PARTNERING

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

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

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

The costs involved in providing the "Training in Partnering Concepts", the trainer and training site will be borne entirely by the State. The costs will be determined in conformance with the provisions in Section 9-1.03B, "Work Performed by

Special Forces or Other Special Services," of the Standard Specifications, and paying to the Contractor the sum of that cost, except no markups will be allowed.

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

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

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

5–1.114 CORRIDOR VALUE ANALYSIS

Attention is directed to Section "Cooperation" of these special provisions.

The Contractor shall attend a "SFOBB Corridor Value Analysis" workshop on a semi-annual basis until project acceptance. It is anticipated that one or more other contractors, pursuant to said Section "Cooperation" will also participate in the workshop. The purpose for having a workshop is to identify value enhancing opportunities and to consider modifications to the plans and specifications of any and all corridor projects that will reduce either the total corridor cost, time of construction or traffic congestion, without impairing, in any manner, the essential functions or characteristics of this contract or any other corridor construction contract including, but not limited to, service life, economy of operation, ease of maintenance, benefits to the travelling public, desired appearance, or design and safety standards. The workshop shall focus on potential enhancing opportunities which would result in any and all corridor construction contractors meeting their respective contractual milestones, early completion of any and all corridor construction contract's designated portions of work and project completion dates, and mitigating delays to any and all corridor construction contracts.

Scheduling of a workshop, selecting the facilitator and workshop site, and other administrative details shall be determined cooperatively by the Contractor and the Engineer. The workshop shall be conducted in conformance with the methodology described in the Department's "Value Analysis Team Guide" available at the Department's web site at:

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

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

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

In addition to the above provisions relative to the semi-annual "SFOBB Corridor Value Analysis" workshop, the Contractor may submit to the Engineer, in writing, a request for a project-specific "Value Analysis" workshop with no other corridor construction contractors in attendance. To maximize the potential benefits of a workshop, the request should be submitted to the Engineer early in the project after approval of the contract.

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

The costs involved in providing the "Value Analysis" facilitator and workshop site for the semi-annual "SFOBB Corridor Value Analysis" workshop shall be borne by the State in conformance with the provisions in Section 9-1.03B, "Work Performed by Special Forces or Other Special Services," of the Standard Specifications, except no markups will be allowed.

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

All other costs including, but not limited to, wages and travel expenses, associated with the semi-annual "SFOBB Corridor Value Analysis" workshop and "Value Analysis" workshop will be borne separately by the party incurring the costs, and no additional compensation will be allowed therefor.

5-1.12 DISPUTE REVIEW BOARD

GENERAL

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

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

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

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

SELECTION PROCESS, DISCLOSURE AND APPOINTMENTS

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

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

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

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

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

The first 2 DRB members shall select a third DRB member subject to mutual approval of the parties or may mutually concur on a list of potentially acceptable third DRB members and submit the list to the parties for final selection and approval

of the third member. The goal in the selection of the third member is to complement the professional experience of the first 2 members and to provide leadership for the DRB's activities.

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

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

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

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

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

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

COMPENSATION

The State and the Contractor shall bear the costs and expenses of the DRB equally. Each DRB member shall be compensated at an agreed rate of $1,200 per day if time spent per meeting, including on-site time plus one hour of travel time, is greater than 4 hours. Each DRB member shall be compensated at an agreed rate of $700 per day if time spent per meeting, including on-site time plus one hour of travel time, is less than or equal to 4 hours. The agreed rates shall be considered full compensation for on-site time, travel expenses, transportation, lodging, time for travel and incidentals for each day, or portion thereof, that the DRB member is at an authorized DRB meeting. No additional compensation will be made for time spent by DRB members in review and research activities outside the official DRB meetings unless that time, (such as time spent evaluating and preparing recommendations on specific issues presented to the DRB), has been specifically agreed to in advance by the State and Contractor. Time away from the project, which has been specifically agreed to in advance by the parties, will be compensated at an agreed rate of $125 per hour. The agreed amount of $125 per hour shall include all incidentals including expenses for telephone, fax, and computer services. Members serving on more than one DRB involving the Department, regardless of the number of meetings per day, shall not be paid more than the all inclusive rate per day or rate per hour for an individual project. The State will provide, at no cost to the Contractor, administrative services such as conference facilities and secretarial services to the DRB. These special provisions and the Dispute Review Board Agreement state the provisions for compensation and expenses of the DRB. DRB members shall be compensated at the same daily and hourly rate. The Contractor shall make direct payments to each DRB member for their participation in authorized meetings and approved hourly rate charges from invoices submitted by each DRB member. The State will reimburse the Contractor for the State's share of the costs. There will be no markups applied to expenses connected with the DRB, either by the DRB members or by the Contractor when requesting payment of the State's share of DRB expenses. Regardless of the DRB recommendation, neither party shall be entitled to reimbursement of DRB costs from the other party.

REPLACEMENT OF DRB MEMBERS

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

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

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

OPERATION

The following procedure shall be used for dispute resolution:

A. If the Contractor objects to any decision, act or order of the Engineer, the Contractor shall give written notice of potential claim in conformance with the provisions in Section 9-1.04, "Notice of Potential Claim," of the Standard Specifications and these special provisions, including the provision of applicable cost documentation; or file written protests or notices in conformance with the provisions in the Standard Specifications and these special provisions.
B. The Engineer will respond, in writing, to the Contractor's written supplemental notice of potential claim within 20 days of receipt of the notice.
C. Within 15 days after receipt of the Engineer's written response, the Contractor shall, if the Contractor still objects, file a written reply with the Engineer, stating clearly and in detail the basis of the objection.
D. Following an objection to the Engineer's written response, the Contractor shall refer the dispute to the DRB if the Contractor wishes to further pursue the objection to the Engineer's decision. The Contractor shall make the referral in writing to the DRB, simultaneously copied to the State, within 21 days after receipt of the written response from the Engineer. The written dispute referral shall describe the disputed matter in individual discrete segments so that it will be clear to both parties and the DRB what discrete elements of the dispute have been resolved, and which remain unresolved, and shall include an estimate of the cost of the affected work and impacts, if any, on project completion.
E. By failing to submit the written notice of referral to the DRB, within 21 days after receipt of the Engineer's written response to the supplemental notice of potential claim, the Contractor waives future claims and arbitration on the matter in contention.
F. The Contractor and the State shall each be afforded an opportunity to be present and to be heard by the DRB, and to offer evidence. Either party furnishing written evidence or documentation to the DRB must furnish copies of such information to the other party a minimum of 15 days prior to the date the DRB is scheduled to convene the meeting for the dispute. Either party shall produce such additional evidence as the DRB may deem necessary to reach an understanding and a determination of the dispute. The party furnishing additional evidence shall furnish copies of such additional evidence to the other party at the same time the evidence is provided to the DRB. The DRB shall not consider evidence not furnished in conformance with the terms specified herein.
G. Upon receipt by the DRB of a written referral of a dispute, the DRB shall convene to review and consider the dispute. The dispute meeting shall be held no earlier than 30 days and no later than 60 days after receipt of the written referral unless otherwise agreed to by all parties. The DRB shall determine the time and location of the DRB dispute meeting, with due consideration for the needs and preferences of the parties while recognizing the paramount importance of a timely hearing of the dispute.
H. There shall be no participation of either party's attorneys at DRB dispute meetings.
I. There shall be no participation of persons who are not directly involved in the contract or who do not have direct knowledge of the dispute, including but not limited to consultants, except for expert testimony allowed at the discretion of the DRB and with approval prior to the dispute meeting by both parties.
J. The DRB shall furnish a report, containing findings and recommendations as described in the Dispute Review Board Agreement, in writing to both the State and the Contractor. The DRB may request clarifying information of either party within 10 days after the DRB dispute meeting. Requested information shall be submitted to the DRB within

10 days of the DRB request. The DRB shall complete its report, including minority opinion, if any, and submit it to the parties within 30 days of the DRB dispute meeting, except that time extensions may be granted at the request of the DRB with the written concurrence of both parties. The report shall include the facts and circumstances related to the matters under consideration, pertinent provisions of the contract, applicable laws and regulations, and actual costs and time incurred as shown on the Contractor's cost accounting records. The DRB shall make recommendations on the merit of the dispute and, if appropriate, recommend guidelines for determining compensation.

K. Within 30 days after receiving the DRB's report, both the State and the Contractor shall respond to the DRB in writing signifying that the dispute is either resolved or remains unresolved. Failure to provide the written response within the time specified, or a written rejection of the DRB's recommendation or response to a request for reconsideration presented in the report by either party, shall conclusively indicate that the party(s) failing to respond accepts the DRB recommendation. Immediately after responses have been received from both parties, the DRB shall provide copies of both responses to the parties simultaneously. Either party may request clarification of elements of the DRB's report from the DRB prior to responding to the report. The DRB shall consider any clarification request only if submitted within 10 days of receipt of the DRB's report, and if submitted simultaneously in writing to both the DRB and the other party. Each party may submit only one request for clarification for any individual DRB report. The DRB shall respond, in writing, to requests for clarification within 10 days of receipt of such requests.

L. The DRB's recommendations, stated in the DRB's reports, are not binding on either party. Either party may seek a reconsideration of a recommendation of the DRB. The DRB shall only grant a reconsideration based upon submission of new evidence and if the request is submitted within the 30-day time limit specified for response to the DRB's written report. Each party may submit only one request for reconsideration regarding an individual DRB recommendation.

M. If the State and the Contractor are able to resolve their dispute with the aid of the DRB's report, the State and Contractor shall promptly accept and implement the recommendations of the DRB. If the parties cannot agree on compensation within 60 days of the acceptance by both parties of the DRB's recommendation, either party may request the DRB to make a recommendation regarding compensation.

N. The State or the Contractor shall not call DRB members who served on the DRB for this contract as witnesses in arbitration proceedings which may arise from this contract, and all documents created by the DRB shall be inadmissible as evidence in subsequent arbitration proceedings, except the DRB's final written reports on each issue brought before it.

O. The State and Contractor shall jointly indemnify and hold harmless the DRB members from and against all claims, damages, losses, and expenses, including but not limited to attorney's fees, arising out of and resulting from the findings and recommendations of the DRB.

P. The DRB members shall have no claim against the State or the Contractor, or both, from claimed harm arising out of the parties' evaluations of the DRB's report.

DISPUTES INVOLVING SUBCONTRACTOR POTENTIAL CLAIMS

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

A. The Contractor shall identify clearly in submissions pursuant to this section, that portion of the dispute that involves a subcontractor potential claim or potential claims.

B. The Contractor shall include, as part of its submission pursuant to Step D above, a certification (False Claims Act Certification) by the subcontractor's or supplier's officer, partner, or authorized representative with authority to bind the subcontractor and with direct knowledge of the facts underlying the subcontractor potential claim. The Contractor shall submit a certification that the subcontractor potential claim is acknowledged and forwarded by the Contractor. The form for these certifications is available from the Engineer.

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

D. Failure by the Contractor to declare a subcontractor potential claim on behalf of its subcontractor (including lower tier subcontractors' and suppliers' pass through potential claims) at the time of submission of the Contractor's

potential claims, as provided hereunder, shall constitute a release of the State by the Contractor of such subcontractor potential claim.

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

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

RETENTION

Failure of the Contractor to nominate and approve DRB members in conformance with the terms and conditions of the Dispute Review Board Agreement and these special provisions shall result in the retention of $150,000 for each estimate period in which the Contractor fails to comply with the requirements of this section as determined by the Engineer. DRB retentions will be released for payment on the next monthly estimate for partial payment following the date that the Contractor has nominated and approved DRB members and no interest will be due the Contractor.

DISPUTE REVIEW BOARD AGREEMENT

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

Form 6202 Rev (09/01/02)

DISPUTE REVIEW BOARD AGREEMENT

_____
(Contract Identification)

Contract No. _____

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

_____ ,
(Contractor Appointee)

_____ ,
(State Appointee)

and _____
(Third Person)

WITNESSETH, that

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

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

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

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

SECTION I DESCRIPTION OF WORK

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

SECTION II SCOPE OF WORK

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

A. OBJECTIVE

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

B. PROCEDURES

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

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

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

C. CONSTRUCTION SITE VISITS, PROGRESS MEETINGS AND FIELD INSPECTIONS

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

1. Meeting opened by the DRB Chairperson.
2. Remarks by the STATE's representative.

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

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

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

D. DRB CONSIDERATION AND HANDLING OF DISPUTES

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

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

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

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

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

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

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

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

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

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

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

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

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

E. DRB MEMBER REPLACEMENT

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

SECTION III CONTRACTOR RESPONSIBILITIES

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

SECTION IV STATE RESPONSIBILITIES

The STATE will furnish the following services and items:

A. CONTRACT RELATED DOCUMENTS

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

B. COORDINATION AND SERVICES

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

SECTION V TIME FOR BEGINNING AND COMPLETION

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

SECTION VI PAYMENT

A. ALL INCLUSIVE RATE PAYMENT

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

B. PAYMENTS

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

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

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

C. INSPECTION OF COSTS RECORDS

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

SECTION VII ASSIGNMENT OF TASKS OF WORK

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

SECTION VIII TERMINATION OF DRB MEMBERS

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

SECTION IX LEGAL RELATIONS

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

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

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

SECTION X CONFIDENTIALITY

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

SECTION XI DISPUTES

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

SECTION XII VENUE, APPLICABLE LAW, AND PERSONAL JURISDICTION

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

SECTION XIII FEDERAL REVIEW AND REQUIREMENTS

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

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

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

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

DRB MEMBER

By: _____

Title: _____

DRB MEMBER

By: _____

Title : _____

DRB MEMBER

By : _____

Title : _____

CONTRACTOR

By: _____

Title: _____

CALIFORNIA STATE DEPARTMENT OF TRANSPORTATION

By: _____

Title: _____

5-1.13 PROJECT INFORMATION

The information in this section has been compiled specifically for this project and is made available for bidders and Contractors. Other information referenced in the Standard Specifications and these special provisions do not appear in this section. The information is subject to the conditions and limitations set forth in Section 2-1.03, "Examination of Plans, Specifications, Contract, and Site of Work," and Section 6-2, "Local Materials," of the Standard Specifications. Bidders and Contractors shall be responsible for knowing the procedures for obtaining information.

Information included in the Information Handout provided to bidders and Contractors is as follows:

STRUCTURE MATERIALS INFORMATION

A. United States Army Corps of Engineers Method CRD-C39-81, "Test Method for Coefficient of Linear Thermal Expansion of Concrete", June 1, 1981
B. Notification of Qualification Requirements for Ultrasonic Testing Personnel, Forms
C. Mass Concrete Report: Skyway Structure, January 25, 2001
D. Appendix to Mass Concrete Report: Measurement of the Curing Temperature in Mass Concrete Pours : Dublin 580/680 Interchange, January 9, 2001
E. Self Anchored Suspension Bridge Design Criteria, July 15, 2002
F. CEB-FIP Model Code1990 for Concrete Structures, recommendation (Comité Euro-international du Béton Fédération International de la Précontrainte)
G. Sample Certificate of Compliance Form, April 2001
H. New Self-Anchored Suspension Span Wind Studies, Final Report, Revision 1, December 2002
I. SAS Suspension System Geometry Based on Contract Plans, September 30, 2003
J. Ship Collision Study, February 14, 2000
K. Hydraulic Modeling and Scour Analysis, October 31, 1999
L. Illustration of Gross Notch identified in Item B.3 of "Steel Structures/Shop Welding/Welding of Closed Ribs to Box Shell Plate" of these special provisions
M. Preliminary Working Drawings for Skyway Temporary Towers (Contract 04-012024)

Preliminary Pipe Beam Temporary Support Working Drawings from Contract 04-012024 (Skyway)

GEOTECHNICAL MATERIALS INFORMATION

A. Pile Installation Demonstration Project (PIDP) Geotechnical Report, March 2001
B. Ground Motion Report, SFOBB East Span Seismic Safety Project, March 2001
C. Demonstration of Blasting and Environmental Effects for Caltrans SFOBB Project, August 2002

D. Final Marine Geophysical Survey Report, Volumes 1 and 2, March 2001
E. Final Marine Geotechnical Site Characterization Report, Volumes 1, 2A through 2H, and Appendices, March 2001
F. Final Yerba Buena Island Geotechnical Site Characterization Report, Volumes 1 through 4, December 2001
G. Geotechnical Foundation Report for the Yerba Buena Island Approach and Self-Anchored Suspension Bridge, June 30, 2002
H. Geotechnical and Material Report for Yerba Buena Island, January 2002Phase I- Subcontractor Reports, Preliminary Geotechnical Site Characterization, Volumes 1 through 4, June 1998
I. Phase II- Subcontractor Reports, Final Geotechnical Site Characterization, Volumes 1 through 3, March 2001

DISTRICT MATERIALS INFORMATION

A. Water Quality, Permits, and Agreements:

1. California Regional Water Quality Control Board (RWQCB)
    a. Order 01-120, October 17, 2001
    b. Order R2-2002-0011, January 23, 2002
2. California Department of Fish and Game (CDFG), Permit No. 2081-2001-021-03, Issued November 19, 2001
3. United States Army Corps of Engineers (ACOE)
    a. Permit No. 023014-0S, December 4, 2001
    b. Permit No. 023014-0S, Letter of Modification, April 2, 2002
4. San Francisco Bay Conservation Development Commission (BCDC), Permit No. 8-01, Issued on November 20, 2001, As Amended through July 13, 2004
5. National Marine Fisheries Service (NMFS)
    a. Biological Opinion and Incidental Take Statement, October 30, 2001
    b. Incidental Harassment Authorization, November 4, 2003
    c. Incidental Harassment Authorization Amendment, June 28, 2004
6. United States Fish and Wildlife Service (USFWS), Biological Opinion, October 29, 2001
7. United States Coast Guard (USCG)
    a. Record of Decision and Bridge Permit 3-01-11, December 11, 2001
    b. Memorandum of Agreement, June 21, 2002
    c. Licenses DTCG-Z71111-03-RP-010L and DTCG-Z71111-03-RP-002L, December 23, 2002
    d. License DTCG-Z71111-03-RP-002L, Amendment No. 1, May 14, 2003
8. Correspondence with Dredged Material Management Office (DMMO) regarding dredging, October 31, 2000, through November 21, 2001.

Updated versions of environmental permits can be found at the following website:
www.biomitigation.org

B. Correspondence with United States Custom Service regarding Jones Act and use of crane/barge, 2002
C. Pre-Award Information/Questionnaire (PAIQ) Form
D. Manufacturing and Fabrication Self Qualification Audit (MFSQA) Form
E. Construction Vibration Monitoring Field Data Form
F. Sample of United States Coast Guard, Private Aids to Navigation Form, April 2001
G. SFOBB East Span Survey Information, Control Diagram, December 30, 2002
H. Archaeological Survey Reports

1. Phase 1- Maritime Archaeology, September 1999
2. Addendum- Maritime Archaeology, December 6, 1999
3. Addendum- Maritime Archaeology, March 2000
4. Addendum- Maritime Archaeology, August 17, 2000

I. SFOBB East Span Underwater Debris Diagram, May 2001
J. Plot Map titled, "Pier 7 – Area for Contractor's Use", and Sample Pier 7 Occupancy Agreement
K. Settlement Agreement regarding Burma Road Easement and Pier 7 Temporary Construction Easement, between City of Oakland and State of California Department of Transportation, dated April 18, 2002
L. California Office of the State Fire Marshal, approved plans and specifications for the Dehumidifier System and Elevator, dated September 15, 2003
M. Sample Advance Payment Bond form for partial payments
N. Sample First Demand Bank Guarantee form for partial payments
O. Yerba Buena Historical Torpedo Building As-Built Plans, November 9, 2004

Information available for inspection, upon written request, at the District Office is as follows:

A. Final Environmental Impact Statement/California Environmental Quality Act (CEQA) Statutory Exemption and Record of Decision;
B. BCDC Permit Application;
C. Application for Water Quality Certification from the RWQCB;
D. ACOE 404 Permit Application;
E. USCG Permit Application;

The District Office in which the work is situated is located at the office of the Duty Senior, 111 Grand Avenue, Oakland, CA 94612, email: duty_senior_district04@dot.ca.gov, telephone number (510) 286-5209.

Cross sections are not available for this project.

5-1.14 INTEGRATED SHOP DRAWINGS

Attention is directed to "Working Drawings" in these special provisions.

Difficult construction is anticipated at the Pier W2 cap beam and Pier E2 cross beam that are highly congested with reinforcing steel, high strength rods, post-tensioning strand tendons, cable tie-down pipe sleeves, anchor bolts, and other concrete embedded items as shown on the plans. It is anticipated that various conflicts will be encountered between embedded items within the concrete. The Contractor shall develop three-dimensional integrated shop drawings (ISD) for the Pier W2 cap beam and Pier E2 cross beam in accordance with the details shown on the plans and the requirements of this section. The ISD shall be of sufficient detail to demonstrate compatibility of the embedded items within the concrete.

Prior to commencing work on the ISD, the Contractor (including any sub-consultants hired to work on the ISD) shall attend a meeting with the Engineer to discuss the ISD work.

The Contractor shall utilize commercially available software that checks for interference in three dimensions. Prior to acquiring the software, the Contractor shall submit to the Engineer the product name and application features of the software for review and approval. The software shall be compatible with the computer-aided drafting (CAD) software used to develop the ISD. Bar reinforcement shall be shown with deformed diameters. The Contractor shall develop CAD files using different layers for each type of embedded item such that the sequence of construction of the member or area being detailed can be shown.

Attention is directed to "Working Drawing Campus" in these special provisions for other equipment and software requirements.

Embedded items that are to be shown on the ISD shall include, but are not limited to, the following:

A. Prestressing ducts, anchorages, and blockouts
B. Bar reinforcing steel and splices including lap, welded, and mechanical splices
C. Anchor bolts
D. Anchor bolt plates
E. Anchorage reinforcement and hardware
F. Grout vents
G. High strength rods
H. Cable tie-down pipe sleeves
I. Seismic joint blockout
J. Drainage pipe
K. Utility conduits and openings
L. Inserts, bolt sleeves and studs
M. Other items, as shown on the plans

The Contractor shall use the ISD to identify and propose resolution of all conflicts and interference between the planned positions of embedded items and to satisfy the concrete cover shown on the plans.

If a conflict is identified, the Contractor shall document the conflict and propose any changes that are needed to the embedded items in the ISD's to resolve the conflict. Proposed changes to the embedded items shall be made by a licensed Engineer practicing Civil Engineering with extensive previous experience developing ISD.

The Contractor’s proposed changes in the ISD shall comply with the following sequence of item adjustments:

A. Pier W2 Cap Beam:

1. Non structural embedded items
2. Bar reinforcing steel
3. Vertical prestressing ducts
4. Transverse prestressing ducts
5. Continuity prestressing ducts
6. High strength anchor rods
7. Cable tie-down cable pipe sleeves

B. Pier E2 Cross Beam:

1. Nonstructural embedded items
2. Bar reinforcing steel
3. Prestressing ducts
4. Shear key anchor bolts
5. Bearing anchor bolts

Through the use of the "Working Drawing Campus," the Contractor shall use the following measures in the order prescribed to resolve interference issues during the preparation of the ISD:

A. Adjust reinforcement spacing.
B. Bundle bars.
C. Relocate splices.
D. Change reinforcement size and number. Reduction of the total reinforcement area will not be permitted, unless otherwise approved by the Engineer.
E. Change reinforcement shape.
F. Move embedded inserts.
G. Cut/trim reinforcement.
H. Combination of all the above.

Attention is directed to "Working Drawing Campus" in these special provisions. The Working Drawing Campus shall be used to facilitate resolution of the ISD.

The ISD to be submitted to the Engineer shall include the following:

A. Three sets of the ISD corresponding to the details as shown on the plans without any modifications. These ISD shall indicate all conflicts including locations of the conflicts and items involved in the conflicts.
B. Three complete lists of conflicts with descriptions and the Contractor's proposed modifications for each conflict.
C. Three sets of the ISD corresponding to the details as shown on the plans with incorporation of the Contractor's proposed modifications. These ISD shall indicate that all previous identified conflicts have been resolved and concrete cover requirements as shown on the plans are met.
D. ISD shall be 559 mm x 864 mm in size and shall use colored ink to differentiate each type of embedded items. For each portion of the structure, ISD shall include a minimum of six isometric views. Any two isometric views shall be 90 degrees apart.
E. Three copies of the ISD in CAD file format on compact discs or tape for use by the Engineer.

An ISD submittal that complies with all of the above requirements, in the opinion of the Engineer, will be defined as a complete ISD submittal. Submittal of isometric drawings made from ISD shall in no way relieve the Contractor from any other working drawing submittal required by these special provisions or the Standard Specifications.

CAD files of the contract drawings will not be made available to the Contractor.

After an ISD submittal is received by the Engineer, the Contractor shall allow the Engineer 7 days to review the ISD submittal for completeness. If determined to be complete, the Engineer shall have 28 days from the day of receipt to review and approve the ISD submittal. For proposed modifications that are not approved by the Engineer, the Engineer will propose alternative modifications to the Contractor. Modifications that result in changes to the plans or specifications, as determined by the Engineer, will be made in accordance with Section 4-1.03 "Changes" of the Standard Specifications. The Contractor shall submit revised ISD incorporating the Engineer's alternative modifications as specified in this section. If more than one

ISD is submitted at one time, the time to be allowed for the review of the ISD shall not be less than the review time specified above plus 14 days for each ISD submittal still under review and the Contractor shall designate the sequence in which the submittals are to be reviewed.

Construction of the Pier W2 Cap Beam and Pier E2 Cross Beam shall not begin until the Engineer has approved the complete ISD submittal with all conflicts resolved.

No extension of time will be permitted for the Contractor's failure to identify all conflicts or to complete the ISD as required by these special provisions.

Full compensation for preparing ISD, including all revisions necessary due to conflict resolution measures described in this section, shall be considered as included in the contract prices paid for the various items of work and no additional compensation will be allowed therefor.

5-1.15 COST REDUCTION INCENTIVE PROPOSALS

Cost Reduction Incentive Proposals (CRIP) shall conform to the provisions in Section 5-1.14, "Cost Reduction Incentive," of the Standard Specifications and these special provisions.

Attention is directed to "Description of Bridge Work" of these special provisions for the description of basic design of the bridge.

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

If a cost reduction proposal submitted by the Contractor, and subsequently approved by the Engineer, provides for a reduction in contract time, 40 percent of that contract time reduction shall be credited to the State by reducing the contract working days. Attention is directed to "Beginning of Work, Time of Completion and Liquidated Damages" of these special provisions regarding the working days.

If a cost reduction proposal submitted by the Contractor, and subsequently approved by the Engineer, provides for more timely and thorough completion of the contract, 60 percent of the estimated net savings in construction costs attributable to the cost reduction proposal will be paid to the Contractor.

The Contractor shall attend facilitated enhanced CRIP workshops. The first workshop will occur within 30 days of contract award and the workshops will continue on a semi-monthly basis until 90 days after contract award, or at a frequency mutually acceptable to both the Contractor and the Engineer. The purpose for having the workshops is to identify and manage value enhancing opportunities, and to consider modifications to the plans and specifications that will reduce the total project cost or time of construction without impairing, in any manner, the essential functions or characteristics of this contract including, but not limited to, service life, economy of operation, ease of maintenance, benefits to the travelling public, desired appearance, or design and safety standards. Scheduling of the workshops, selecting the facilitator and workshop site, and other administrative details shall be determined cooperatively by the Contractor and the Engineer. The Contractor may submit recommendations resulting from an enhanced CRIP workshop for approval by the Engineer as cost reduction incentive proposals in conformance with these special provisions.

The Contractor shall submit the preliminary concept of a proposed CRIP in writing to the Engineer for acceptance prior to proceeding with the complete CRIP and at least 5 days prior to the next scheduled facilitated enhanced CRIP workshop. The preliminary concept will be discussed at the facilitated enhanced CRIP workshop to determine whether it will be accepted by the Department. Items of discussion will include permit issues, impact on other projects, impact on the project schedule, traffic considerations, safety and health issues, design criteria, and review times required by the Department and other agencies. Each preliminary concept submittal shall include:

1. A brief description of both the existing contract requirements for performing the work and the proposed changes.
2. A summary of contract requirements that must be changed if the proposal is adopted.
3. An estimate of the cost savings from the proposed changes.
4. An estimate of the impact on the construction schedule.

With the preliminary CRIP concept submittal, the Contractor shall indicate if the proposal affects the seismic performance of the structure. If the preliminary CRIP concept affects the seismic performance of the structure, as determined by the Engineer, the Contractor, if still interested with pursuing the CRIP, shall present the CRIP and necessary supporting information to the Seismic Safety Peer Review Panel (SSPRP). It is anticipated that this presentation to the SSPRP will require a 2-month notice and 6 meetings (occurring once a month), and compensation to the SSPRP. The meeting locations will be in California, and the meeting location and schedule will be determined by the SSPRP. The Engineer will no longer consider such a CRIP unless it is approved by the SSPRP. Determination by the Engineer that a preliminary CRIP concept will not be considered further will be deemed rejection of the proposal. Acceptance of a preliminary CRIP concept submittal will in no way constitute approval nor guarantee future approval of a Contractor's CRIP.

Attention is directed to Section 10-1.16, "Working Drawing Campus," of the Special Provisions. By mutual agreement, the Contractor and the Engineer may elect to utilize the Working Drawing Campus to facilitate development, submittal, investigation, review and approval of CRIPs in the shortest and most efficient manner possible.

The eighth paragraph of Section 5-1.14, "Cost Reduction Incentive," of the Standard Specifications shall not apply. If, within 90 days of award of the contract, the Contractor submits one or more preliminary CRIP concepts as provided herein, a 30 day non-compensable contract time extension will be granted. The 30 day non-compensable contract time extension will be one-time and non-cumulative, regardless of the actual number of preliminary CRIP concepts submitted. If the Contractor obtains conceptual acceptance of one or more preliminary CRIP concepts that were submitted within 90 days of award of the contract, and both the Contractor and the Engineer mutually concur to further develop such preliminary CRIP concepts, an additional non-compensable contract time extension, not to exceed a cumulative total of 90 non-compensable days for all such accepted preliminary CRIP concepts, will be granted in order to facilitate CRIP development, submittal, investigation, review and approval. The term non-compensable, as used herein, shall mean that the extension of time is made in conformance with Section 8-1.07, "Liquidated Damages," of the Standard Specifications, except that no additional compensation will be permitted in accordance with Section 8-1.09, "Right of Way Delays," of the Standard Specifications, and that no payment including, but not limited to, such costs as direct, indirect, consequential, or time related overhead will be made in association with the non-compensable contract time extension. Non-compensable days shall be applied to the current contract completion date after the expiration of the number of working days measured for payment for time related overhead in accordance with "Time Related Overhead" of these special provisions. Other than as provided herein, no additional contract time extension will be provided for CRIP development; submittal; investigation; review, time associated with the SSPRP; or acceptance of a CRIP and performance of the work thereunder, unless specifically provided for in the contract change order authorizing the use of the CRIP.

The costs involved in providing the enhanced CRIP facilitator and workshop site for the enhanced CRIP workshop will be paid for by the State in conformance with the provisions in Section 9-1.03B, "Work Performed by Special Forces or Other Special Services," of the Standard Specifications, except no markups will be allowed. If, as provided in these special provisions, the Contractor and the Engineer elect to utilize the working drawing campus to facilitate development, submittal, investigation, review and approval of CRIPs, compensation shall be made in accordance with the sixth paragraph of Section 5-1.14, "Cost Reduction Incentive," of the Standard Specifications. The Contractor's cost of the enhanced CRIP workshops, preliminary CRIP concepts, preliminary CRIP concept meetings and the Department's costs of investigating said proposal, presentation, meeting attendance, and compensation to the SSPRP, including any portion thereof paid by the Contractor, shall be excluded from consideration in determining the estimated new savings in construction costs. All other costs associated with these special provisions including, but not limited to, wages and travel expenses, associated with the facilitated enhanced CRIP workshops shall be considered to be included in the various items of work and borne separately by the party incurring the costs, and no additional compensation will be allowed therefor.

5-1.16 TIDAL CONDITIONS AND ELEVATION DATUM

Attention is directed to Section 2-1.03, "Examination of Plans, Specifications, Contract, and Site of Work," of the Standard Specifications.

Tidal conditions may present significant problems in constructing the work as depicted in the contract plans. Tidal fluctuations may be severe and different from those shown in published tidal and current data due to differences in datum, winter runoff and other causes. Strong currents exist over portions of the project site. Limited time periods of slack water may restrict diving and other underwater activities.

The Contractor is responsible for being knowledgeable of such tidal difficulties, and no payment will be made by the State for any costs incurred by the Contractor in connection with the variations in actual tidal or current conditions during the course of this contract. Any reference to Mean Higher High and Mean Lower Low tides shall be understood to be an estimate used for permit purposes, actual mean tide data shall be determined by the Contractor.

All vertical control data are based on the National Geodetic Vertical Datum NGVD of 1929.

5-1.17 ELECTRONIC DAILY EXTRA WORK REPORT

Attention is directed to Sections 5-1.10, "Equipment and Plants," 7-1.01A(3), "Payroll Records," 9-1.03C, "Records," and 9-1.06, "Partial Payments," of the Standard Specifications and these special provisions.

Daily extra work reports shall be furnished to the Engineer using the Department's electronic extra work billing system. The reports shall conform to the requirements set forth in the "Extra Work Billing System User's Guide." The Guide is available from the Department, and is also found on the Internet at http://www.dot.ca.gov/hq/construc/EWB_INSTRUCTION.pdf. The Department will provide electronic extra work billing system accounts to the Contractor's representatives only after they have received training. The Department will provide system training to the Contractor's authorized representatives within 30 days of the Contractor's request for training.

An account, user identification assigned by the Department, and password used by the Contractor's representative are deemed to meet the requirement in Section 9-1.03C of the Standard Specifications that daily extra work reports shall be signed by the Contractor or the Contractor's authorized representative.

Daily extra work reports that include materials shall be substantiated by a valid copy of a vendor's invoice as required in Section 9-1.03C, "Records," of the Standard Specifications. Each invoice shall clearly identify the applicable electronic extra work report and the cost of the materials. In addition to postal service and parcel service, invoices may be sent by FAX or as an electronic-mail attachment, if approved by the Engineer.

The Engineer will compare the Engineer's records with the completed electronic daily extra work report. The Engineer will reject a report that has an error that affects payment, and will indicate the necessary adjustments the Contractor must make prior to sending a corrected electronic extra work report. A daily extra work report that the Contractor's representative sends to the Department using the electronic extra work billing system will be deemed to be signed by the Contractor. A daily extra work report that the Engineer approves using the electronic extra work billing system will be deemed to be signed by the Engineer.

Electronic submittals submitted by the file transfer process shall conform to the Department's specified format. The Contractor is responsible for maintaining the required data file format and requirements in the file transfer process. The Contractor is responsible for maintaining and operating the Contractor's interface with the Department's electronic extra work billing system.

Full compensation for furnishing daily extra work reports using the Department's electronic extra work billing system shall be considered as included in the various contract items involved and no separate payment will be made therefor.

5-1.18 AREAS FOR CONTRACTOR'S USE

Attention is directed to the requirements specified in the project plans "Construction Details - Areas for Contractor Use", Section 7-1.19, "Rights in Land and Improvements," and Section 10-1.08, "Cooperation," of the Standard Specifications, and these special provisions.

The Contractor shall have use of the areas as indicated on the plans and as follows and shall plan his work accordingly:

"Area EF" is primarily available to Contract 04-0120E4 until March 31, 2008, and then to this contract after that date. Prior to March 31, 2008, the Contractor shall coordinate any planned work in "Area EF" with the Engineer and Contract 04-0120E4 contractor. Additionally, footings at tower T1 and footing and piers at Pier E2 to be constructed by others under Contract 04-0120E4 will be substantially complete by March 31, 2008, to allow the Contractor to complete the tower and E2 work specified under the contract.

"Area CE" is designated for use by Contract 04-0120E4 until March 31, 2008. The Contractor shall have access through "Area CE" to the work area at Pier W2. After March 31, 2008, "Area CE" becomes a part of the area provided to the YBI Structures contractor on contract 04-0120P4. The Contractor shall continue to have access through the area to the work area at Pier W2.

"Area FPR" is primarily available to Contract 04-0120R4 until May 1, 2007. Prior to May 1, 2007, the Contractor shall coordinate any planned work in "Area FPR" with the Engineer and Contract 04-0120R4 contractor. After May 1, 2007, "Area FPR" shall be considered a part of "Area FP."

"Area FP" is available for use by this contract until November 30, 2007. "Area FP" shall then be made available to the contractor constructing the YBI transition structures under contract 04-0120P4 until May 1, 2009. After May 1, 2009, "Area FP" is available to this contractor to complete Phase 2 activities as described in Section 10-1.01 "Order of Work" and Section 4 "Beginning of Work, Time of Completion and Liquidated Damages" of these special provisions. After completion of Phase 2 activities, "Area FP" shall be made available to the YBI Structures contractor prosecuting contract 04-0120P4. The Contractor shall coordinate any planned work in "Area FP" with the Engineer and Contract 04-0120P4 contractor.

The western portion of the Skyway constructed by others under Contract 04-012024 will be substantially complete by July 1, 2007, in order to allow the Contractor to complete the Hinge A connection and other work specified under the contract.

The Contractor's access to/from the work area may be limited by closures of the Westbound YBI onramp to I-80 and Southgate Road during the contract period. The Contractor will have access to the work area during these closures via posted detours.

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

No area is available within the contract limits for the exclusive use of the Contractor. However, temporary storage of equipment and materials on State property may be arranged with the Engineer, subject to the prior demands of State maintenance forces and to other contract requirements. Use of the Contractor's work areas and other State-owned property

shall be at the Contractor's own risk. The State shall not be held liable for damage to or loss of materials or equipment located within these areas.

The Contractor shall remove the equipment, materials, and rubbish from the work areas and other State-owned property which the Contractor occupies and shall leave the areas in a presentable condition, in conformance with the provisions in Section 4-1.02, "Final Cleaning Up," of the Standard Specifications.

The Contractor shall secure, at the Contractor's own expense, areas required for storage of plant, equipment, and materials, or for other purposes if sufficient area is not available to the Contractor within the contract limits, except as stated in subsection Port of Oakland Pier 7.

Port of Oakland Pier 7

The Department intends to occupy and make available to contractors Port of Oakland Pier 7 for the life of the contract.

Attention is directed to Section 10-1.16, "Working Drawing Campus," of these special provisions.

Attention is also directed to Section 5-1.13, "Project Information," for reference to plot map titled, "Pier 7 – Area for Contractor's Use, "sample document titled "Sample Pier 7 Occupancy Agreement," and "Settlement Agreement regarding Burma Road Easement and Pier 7 Temporary Construction Easement."

In addition to locating the Working Drawing Campus within the designated area as shown on plot map titled, "Pier 7 – Area for Contractor's Use," the Contractor may also locate their field office for work exclusive to the 04-0120F4 contract. The Department will enter a no-cost occupancy agreement with Contractor to occupy property described in the plot map. The Department will consider a written request from the Contractor for other use of the area, such as for marine access, staging of construction, temporary storage of equipment and materials, or other pertinent use of the area for the construction of the 04-0120F4 contract. The Contractor shall certify that sufficient space exists for the proposed use, including vehicle parking. The Contractor is responsible for all move in and move out costs for Pier 7. Provided that the terms of the occupancy agreement and the settlement agreement are complied with, should the Department order the Contractor to vacate Pier 7 early, the additional relocation costs as directed by the Engineer will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications.

The Contractor shall investigate utility capacity to support the needs of any intended use. The Contractor shall be responsible for all cost related to utility connections, maintenance and operational cost, improvements needed for intended use, and cost related to vacate and restore property to original conditions at the termination of the occupancy agreement. The existing warehouse building shall not be removed or demolished, although it may be modified with approval of the Engineer.

5-1.19 UTILITIES

The Contractor shall make arrangements to obtain electrical power, water or compressed air or other utilities required for the Contractor's operations and shall make and maintain the necessary service connections at the Contractor's own expense.

5-1.20 SANITARY PROVISIONS

State sanitary facilities will not be available for use by the Contractor's employees.

5-1.21 BRIDGE TOLLS

Toll-free passage on the San Francisco-Oakland Bay Bridge will be granted only for cars, trucks and special construction equipment which are clearly marked on the exterior with the Contractor's identification and which are being operated by the Contractor exclusively for the project, and which are used for the purpose of transporting materials and workers directly to and from the project site.

The Contractor shall make application to the Engineer in advance for toll-free passage. The Contractor will be held accountable for the proper use of passes issued, and upon completion of the work, shall return unused passes to the Engineer.

Attention is directed to Section 23302, "Evasion of Toll," of the Vehicle Code.

5-1.22 ACCESS TO PROJECT SITE

Prospective bidders may make arrangements to visit the project site by contacting the Duty Senior, District 04 Office, 111 Grand Avenue, Oakland, CA 94612, email: duty_senior_district04@dot.ca.gov, telephone number (510) 286-5209.

5-1.23 PERMITS AND LICENSES

Attention is directed to Section 7-1.04, "Permits and Licenses," of the Standard Specifications and these special provisions.

The Department has obtained the following permits for this project:

A. California Regional Water Quality Control Board (RWQCB)
B. U.S. Army Corps of Engineers (ACOE)

C. San Francisco Bay Conservation Development Commission (BCDC)
D. United States Coast Guard (USCG)
E. California Department of Fish and Game (CDFG)
F. United States Fish and Wildlife Service (USFWS)
G. National Marine Fisheries Service (NMFS)

Copies of these permits have been made on CD-ROMs as part of the information handout that is available to the Contractor, as specified in "Project Information," of these special provisions, or can be obtained at the Department of Transportation, Plans and Bid Documents Section, MS 26, 1120 N Street, Room 200, Sacramento, CA 95814, Telephone 916-654-4490 or may be seen and are available for inspection at the office of the Duty Senior, District 04 Office, 111 Grand Avenue, Oakland, CA 94612, email: duty_senior_district04@dot.ca.gov, telephone number (510) 286-5209.

For updated versions of environmental permits, the Bidders and Contractor shall visit the website:

www.biomitigation.org

PAYMENT

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

5-1.24 FORCE ACCOUNT PAYMENT

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

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

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

Cost	Percent Markup
Labor	28
Materials	10
Equipment Rental	10

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

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

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

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

5-1.25 PAYMENTS

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

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

A.	Electronic Mobile Daily Diary Computer System Data Delivery	$ 22,540
B.	Working Drawing Campus	$ 5,380,000
C.	Accelerated Working Drawings Submittal	$ 26,900,000
D.	Project Schedule (Critical Path)	$ 6,000,000
E.	Establish Marine Access	$ 38,500,000
F.	Document Management System	$ 1,345,000

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

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

A. Prestressing steel in sealed containers
B. Prestressing ducts and anchorages
C. Bearings
D. Seismic Joint
E. Bar reinforcing steel
F. Bar reinforcing steel (epoxy coated)
G. Structural steel
H Miscellaneous metal
I. Steel barrier
J. Railings
K. Prefabricated parallel wire strand and wire
L. Suspender ropes
M. High Strength Prestressing Rod
N. S-Wire wrapping
O. Precast Concrete Fender Modules

Materials furnished but not incorporated into the work in fenced areas with locked gates or in locked warehouses will be eligible for partial payment if the Contractor furnishes evidence satisfactory to the Engineer that its storage is subject to or under the control of the Department and that it has been designated or fabricated specifically for this project and is of such character that it is not adaptable to any other use. Such materials are not required to be stored within the State of California.

The total amount paid for materials furnished but not incorporated in the work shall not exceed 25 percent of the total contract amount.

To be eligible for these payments for any material stored outside the United States, the Contractor shall furnish an advance payment bond, first demand bank guarantee, or combination of no more than two thereof to secure the value of potential partial payments for material furnished but not incorporated in the work pursuant to these special provisions and Section 9-1.06, "Partial Payments," of the Standard Specifications. The advance payment bond or first demand bank guarantee shall be in a sum not less than the amount requested for payment by the Contractor, and shall, at a minimum, match the terms of the sample advance payment bond or first demand bank guarantee forms identified in "Project Information" in these special provisions. The value of the advance payment bond or first demand bank guarantee shall not be adjusted more than once per year. The Contractor shall certify in writing to the Engineer that the proposed bonding company or bank complies with these special provisions. The bonding company shall be licensed to do business in the State of California, and shall be certified to write a bond equal to 30% of the executed contract price by the United States Department of the Treasury. The bank shall have United States operations with a minimum rating of "A-" by either AM Best or Standard & Poor. All alterations, extensions of time, extra and additional work, and other changes authorized by these special provisions or any part of the contract may be made without securing the consent of the surety of the bond or the bank.

5-1.26 SOUND CONTROL REQUIREMENTS

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

Attention is directed to Section 5-1.13 "Project Information" of these special provisions for reference to the USCG License DTCG-Z71111-03RP-002L, Amendment No. 1, Maintenance and Logistic Command Pacific.

The noise level from the Contractor's operations, between the hours of 7:00 p.m. and 7:00 a.m., shall not exceed 78 dbA when taken on the sidewalk outside of Building 26, adjacent to the breezeway and nearest the barracks room window.

Impact-type mechanical operations, such as pile-driving and jack-hammering shall not be conducted between the hours of 7:00 p.m. and 7:00 a.m. At all times, the Contractor shall be responsible for complying with local ordinances regulating noise levels as well as the sound requirements of this section.

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

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

Noise monitoring activities will be conducted by the Department of Transportation. The Contractor shall coordinate with the Department of Transportation monitors and allow them access to noise monitoring locations.

5-1.27 PHOTO IDENTIFICATION SYSTEM

Photo identification system shall consist of photo identification (ID) cards, production equipment and database. The contractor shall submit a database record of every person contemplated to work on the project jobsite, including the employees of the subcontractors, vendor and suppliers.

All employees, including subcontractor, vendors and suppliers, shall have photo ID cards when reporting to work at the jobsite. Photo ID cards shall consist of a visible badge which shall be worn plainly visible at all times and a wallet-size card which shall be available for inspection as required. The front side of the badge shall contain a visible, identifiable photograph with a minimum size of 25mm x 25mm, the person's last name, first name, employee ID number, issue date, expiration date and employer logo. Wallet-size cards shall contain the last name, first name, middle initial, issue date, expiration date and issuer signature. Any lost badges or cards shall be immediately reported to the Engineer prior to being replaced. Individuals who do not possess the required photo ID cards shall be removed from the work site immediately at the Engineer's request.

Production equipment shall consist of system software, camera and duplex card printer. Equipment shall have the following standard features or equivalent, as determined by the Engineer:

A. **System Software**.--ID works production software will have the following standard features:

1. Microsoft Windows-compatible operation;
2. Full user audit log;
3. Administrator and user security;
4. .BMP, .JPG, .PCX, .PNG, and .PSD image import formats;
5. .BMP, .JPG, .PCX, .TGA, .TIF , and .WMF image export formats;
6. Full character recognition search (alphabets, numbers) in all fields;
7. Automatic update of database after badge production;
8. Simultaneous batch print of multiple card formats;
9. Software license key;
10. Online Help and reference library; and
11. Documentation, installation, training and Help Desk support.

B. **Camera**.-- The camera used for producing employee ID badges shall be USB digital with the following specifications:

1. Compatible with Windows 98, ME, 2000 Professional;
2. External AC power supply (auto-switch);
3. Operating Environment for humidity of 30%-90% and for temperature of 0-40° C;
4. Resolutions of 1600 x 1200, 1024 X768, or 640 x 480 pixels;
5. Lens of 7.1 to 21.3 mm, F/l.8 to F/2.6 (equivalent to 40-120 mm lens on 35mm camera);
6. Flash range appropriate for a subject 6 meters to 1.8 meters from camera; 6.8 MB SmartMedia memory card; and
7. CE Mark, FCC Class B and UL approved.

In addition, the camera shall have the following features and components:

1. Datacard Integrated USB Digital Camera Software with controlled Auto-Crop or Manual ~p;
2. USB cable connection to PC;
3. High, Medium and Low resolution (customer selectable);
4. Built-in flash;
5. Automatic focus and exposure;
6. 3x Optical Zoom;
7. 2.11 Megapixel RGB CCD;
8. Country Specific Power Cords;

9. Power adapter (auto switches for the appropriate voltage);
10. Tripod, backdrop, frame and stand;
11. Installation instruction and manuals; and
12. Optional 3 meter USB Cable.

C. **Duplex Card Printer**.--The duplex card printer shall have the following features and specifications:

1. Windows 95, NT, 98, 2000 printer drivers;
2. CD ROM Tutorial;
3. Operator-replaceable printhead;
4. Audio and visual error prompts;
5. Operator messages displayed on PC screen;
6. Automatic card feed;
7. "True" exception card system;
8. Full-color or monochrome imaging;
9. One-step ribbon cartridge replacement;
10. Hands-free card cleaning system;
11. In-line topcoat application;
12. Portable, desktop design;
13. Input hopper holds 100- .76mm cards;
14. Output hopper holds 25- .76mm cards;
15. One-year depot warranty for printer;
16. One-year printhead warranty -no prorating, no card counting;
17. Continuous-tone, full-color, with alphanumeric text and logos print capability;
18. Background patterns with 300 dots per inch print resolution, In-line ribbon application of single topcoat capability , and dual voltage-auto sensing electrical requirements ;
19. 1 00/120V , 50/60 Hz and 220/240V, 50/60 Hz;
20. Parallel ECP mode or Compatible mode communications; 21. CR80-30 Plastic cards accepted:
21. PVC, with glossy overlaminate laminate surface ID cards, 86mm x 54mm in size and 0.8mm in thickness;
22. Resident memory of2MB; and
23. UL, CSA, FCC Class A (for U.S. and Canada) approved.

A database record shall be furnished to the Engineer at least three days prior to beginning of work. It will be updated for new employees, subcontractors or suppliers daily and submitted weekly to the engineer. This database shall contain the following information:

A. Caltrans contract number;
B. Contractor/Subcontractor/Vendor/Supplier ID number;
C. Employee ID number;
D. Last name;
E. First name;
F. Middle name;
G. Labor classification;
H. Date of hire/employment date;
I. Length of employment;
J. Issue date; and
K. Expiration date.

All data shall be delivered to the Engineer electronically, on Microsoft Windows compatible 90 mm floppy disks or CD ROM.s. The Contractor shall provide an updated personnel information whenever there is a change or at least 5 days after requested by the I Engineer. The file format for all files delivered to the Engineer shall be standard comma delimited c (CSV), plain text files. Characteristics of this type of file are:

A. All data is in the form of plain ASCII characters;
B. Each row of data is delimited by a carriage return character: and
C. Within row, each column (field) of data is delimited by a comma character.

Full compensation for providing photo identification system shall be considered as included in the prices paid for the various items of work involved, and no separate payment will be made therefor.

In addition to photo identification system, access control measures shall be placed as directed by the Engineer. Access control measures will be paid for as extra work as provided for in Section 4-1.03D of the Standard Specifications, and will not be considered a special service as specified in Section 9-1.03D of the Standard Specifications.

5-1.28 GENERAL MIGRATORY BIRD TREATY ACT

Attention is directed to the Federal Migratory Bird Treaty Act (15 USC 703-711) 50 CFR Part 21 and 50 CFR Part 10, and the California Department of Fish and Game Code Sections 3503, 3513, and 3800, that protect migratory birds, their occupied nests, and their eggs from disturbance or destruction.

During bird breeding and nesting season between December 1 and September 30, the Contractor shall notify the Engineer 15 days prior to beginning of work disturbing structures, the ground or vegetation. The Engineer will approve the beginning of work disturbing structures, the ground or vegetation between December 15 and September 30.

The Contractor shall use exclusion techniques directed by the Engineer to prevent migratory birds from nesting on the ground, on structures or in trees, shrubs or other vegetation within the project limits.

Preventing nesting by using appropriate exclusion techniques will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications.

If evidence of bird nesting is discovered, the Contractor shall not disturb the nesting birds or nests until the birds have naturally left the nests. If evidence of migratory bird nesting is discovered after beginning work, the Contractor shall immediately stop work and notify the Engineer.

Attention is directed to Section 8-1.05, "Temporary Suspension of Work," of the Standard Specifications .

If, in the opinion of the Engineer, completion of the work is delayed or interfered with by reason of the Engineer's delay in approving the disturbance structures, ground or vegetation, the Contractor will be compensated for resulting losses, and an extension of time will be granted, in the same manner as provided for in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

If completion of the work is delayed or interfered with due to bird nesting, an extension of time will be granted, in the same manner as provided for in Section 8-1.09, "Right of Way Delays," of the Standard Specifications. No additional compensation will be provided to the Contractor.

5-1.29 ENVIRONMENTAL WORK RESTRICTIONS

The project is located, in the San Francisco Bay, within the jurisdictions of the U.S. Army Corp of Engineers (ACOE), the United States Coast Guard (USCG), the San Francisco Bay Conservation and Development Commission (BCDC), the California Department of Fish and Game (CDFG), the San Francisco Bay Regional Water Control Board (RWQCB), the U.S. Fish and Wildlife Service (USFWS), and the National Marine Fisheries Service (NMFS). The Department has entered into agreements with these agencies regarding mitigation for potential impacts this project may have on biological resources and water quality. The Contractor shall be fully informed of rules, regulations, and conditions that may govern the Contractor's operations in the areas and shall conduct the work accordingly.

Attention is directed to "Project Information," of these special provisions, regarding materials information handout available on CD ROMs for Regulation, Permits, Agreement, Consultation Letter, or Biological Opinion, and materials information available for inspection.

For updated versions of environmental permits, the Bidders and Contractor shall visit the website:

www.biomitigation.org

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

SPECIES OF CONCERN

Attention is directed to the existence of environmental work restrictions that require special precautions to be taken by the Contractor to protect the species of concern in conforming with the provisions in "General Migratory Bird treaty Act," of this special provision and these special provisions.

The Contractor shall comply with the California Endangered Species Act, the Federal Endangered Species Act, the Federal Migratory Bird Treaty Act, and the Marine Mammal Protection act, which govern the protection of the American peregrine falcon, California least tern, California brown pelican, double-crested cormorant, western gull, nesting birds found on Yerba Buena Island, marine mammals, as well as the following fish species: Central California Coast and Central Valley steelhead, Central Valley spring-run Chinook, Sacramento River winter-run Chinook, and Central California Coho salmon.

The Department and qualified bird experts will monitor these birds during construction.

The Contractor shall notify the Engineer immediately if any dead or injured species of concern listed below are encountered.

American Peregrine Falcon

American peregrine falcon movements and behavior will be monitored by USFWS authorized personnel from the Santa Cruz Predatory Bird Research Group during construction . If American peregrine falcon nesting occurs on the falsework structures, the Contractor shall immediately stop work and notify the engineer. If necessary, the Contractor shall provide access to the nesting site as directed by the authorized biologist to monitor the nest site and to remove the falcon eggs and chicks.

Double-Crested Cormorant, Western Gulls, California Least Tern and California Brown Pelican

Where double-crested cormorant or western gull nests are present on the falsework structures, the Contractor shall not perform any activity within the nesting area unless the Contractor implements the following:

A. Remove existing nests from the work areas prior to the nesting season.
B. Prevent the birds from completing nests in the work area by continually washing off nest material during nesting season.

Surveys and monitoring of the activities of the California least tern and California brown pelicans will be conducted by the State and others. The Contractor shall cooperate with the activities of the State monitors. If, through monitoring, it is determined that construction activities result in a taking of a least tern or brown pelican, the State and USFWS will work together to evaluate methods to eliminate further project-related impacts to these species. The Contractor will be informed of any changes in procedure that may affect their operations and may be entitled to compensation to extent provided under Section 8-1.09, "Right of Way Delays," of the Standard Specifications if operations are delayed.

California Sea Lion, Harbor Seal and Gray Whale

Prior to commencement of driving of any in-water, permanent piles, a preliminary 500-meter radius safety zone for pinnipeds (harbor seals and California sea lions) will be established around the pile-driving site. The Department of Transportation will establish and conduct monitoring of the safety zone. Once pile-driving begins, the safety zone radius for pinnipeds will then be enlarged or reduced by the Department of Transportation, depending on monitored sound pressure levels. A safety zone for gray whales will also be established by the Department of Transportation during the gray whale migration season from December 1 through May 31.

The Contractor shall notify the Engineer at least 30 minutes prior to the start of any pile-driving. If marine mammals are found within the safety zone, pile-driving of the segment shall be delayed until they move out of the area. If a marine mammal is seen above water and then dives below, the Contractor shall wait 15 minutes and if no marine mammals are observed in that time it will be assumed that the animal has moved beyond the safety zone. If a marine mammal enters the safety zone after the driving of a pile segment has commenced, the driving of the segment can proceed until it has reached the prescribed tip elevation.

If pile driving of a segment ceases for 30 minutes or more and a marine mammal is sighted within the designated safety zone prior to commencement of pile driving, the observer must notify the Engineer immediately and follow the mitigation requirements as outlined in the above paragraph.

Pacific Herring

Surveys and monitoring of Pacific herring spawning locations will be conducted by the State and others. Open water construction operations will not be allowed between December 1 and March 1 unless approval is granted by BCDC and the Engineer per the follow conditions:

a. The open water construction operation was begun prior to December 1 of any year and could not be completed by the December 1 deadline due to unforeseen delays;
b. A biologist provided by the State will monitor for the presence of herring spawns within 200 meters of construction operations in open water and will be at the project site during open water construction operations which occur between December 1 through March 1; and
c. Open water construction operations within 200 meters of spawn shall cease within eight hours of notification by the Engineer for a minimum of 14 days or until the Engineer notifies the contractor that dredging may be resumed.

Contractor's operations within cofferdams such as pile-driving, which do not place debris into the water or increase water turbidity will not be restricted.

If, in the opinion of the Engineer, completion of the work is delayed or interfered with due to herring spawning, an extension of time will be granted, in the same manner as provided for in Section 8-1.09, "Right of Way Delays," of the Standard Specifications. No additional compensation will be provided to the Contractor.

PAYMENT

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

5-1.30 ENVIRONMENTALLY SENSITIVE AREAS (GENERAL)

Attention is directed to the nine designated Environmentally Sensitive Areas (ESA), shown on the plans:

A. ESA 1, Environmentally Sensitive Area
B. ESA 2, including the Senior Officers' Quarters Historic District and grounds, Quarters 8 and grounds, and Building No. 262.
C. ESA 3, Quarters 10 and grounds.
D. ESA 4, Building No. 267 and grounds.
E. ESA 5, Vegetation, Environmentally Sensitive Areas, including Specific plants and trees, Holly trees, and Live Oak and Pittosporum trees
F. ESA 6, Tidal wetlands and eelgrass beds, located on the north side of YBI
G. ESA 7, Eelgrass beds, located on the south sides of YBI
H. ESA 9a and 9b, historic resources

Water-based ESA boundaries will be marked with USCG-approved buoys, and will be established by others. No construction activities in water within 200 meters of the ESA boundaries shall be allowed until the high visibility USCG-approved delineators have been installed.

Within the boundaries of land-based ESAs 1 through 5 and 9a and 9b, and water-based ESAs 6 and 7, no project related activities shall take place, without the written approval from the Engineer. This specifically prohibits vehicle and barge access, storage or transport of any materials, including hydrocarbon and lead contaminated material, or any other project related activities. The Contractor shall take such measures, including the posting of written notices to his employees and subcontractors, to ensure that ESAs are not entered or disturbed.

No construction activities involving asphalt removal or earth disturbance and/or removal shall be allowed within ESA 1 and ESA 9a and 9b as shown on the plans. All other construction activities are permissible within these ESA, such as heavy equipment movement and storage and stock piling.

In the event that human skeletal material or archaeological resources are uncovered within the contract limits, the Contractor shall immediately notify the Engineer, and the State may conduct an archaeological investigation. The Contractor's construction activities within 10 meters of the find shall be halted immediately and shall not resume until permitted, in writing, by the Engineer. If, in the opinion of the Engineer, the Contractor's operations are delayed or interfered with by reason of such discoveries, the State will compensate the Contractor for the delays to the extent provided in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

RESOURCE REGULATIONS AND MANDATES

In compliance with Section 106 of the National Historic Preservation Act of 1966, any archaeological resource discovered during construction activities must be evaluated by the Department of Transportation Archaeologist.

The California Public Resources Code (PRC) Sections 5097.00 and 5097.8 require protection of Native American remains which might be discovered and outlines procedures for handling any burials found. The California PRC Section 5097 and Health and Safety Code Section 7050 require coordination with the Native American Heritage Commission.

Under California PRC, Chapter 1.7, Section 5097.5, it is a misdemeanor charge for anyone to knowingly disturb a historical feature or steal an archaeological resource. The California Administrative Code, Title 14, Section 4307, mandates that no person shall disfigure any object of historical interest or value. Under California Penal Code, Title 14, Part 1, Section 622-1.2, it is a misdemeanor to destroy anything of historical value within any public place.

All archaeological resources located on Department of Transportation property are property of the State of California. All archaeological resources located on Federal property are property of the Federal government and are governed by federal environmental laws, such as, but not limited to, the Antiquities Act of 1906, the Archaeological Resources Protection Act, and the Native American Graves Protection and Repatriation Act.

PROTECTION OF BUILDING No. 262

Attention is directed to Section 7-1.12, "Preservation of Property," and Section 7-1.12, "Responsibility for Damage," of the Standard Specifications, and the provisions in "Photo Survey of Existing Facilities," and "Vibration Monitoring," of these special provisions, regarding Building No. 262, a historical building that is included in ESA 2.

Attention is directed to "Project Information," of the special provisions, regarding the as-built plans of Building No. 262.

The Contractor shall take measures to protect the building from damage caused by the Contractor's operations. The Contractor shall submit a building protection plan for the Engineer's review at least 30 days prior to the start of adjacent or

overhead construction. The Contractor shall also notify the Engineer at least 48 hours prior to the start of adjacent or overhead construction.

The Contractor shall bear full liability for any damage to Building No. 262 caused by the Contractor's operations.

Should any damage to Building No. 262 occur, the Contractor shall notify the Engineer within 24 hours. The Engineer may order the suspension of construction operations until the Contractor takes all necessary measures to prevent further damage to the building, and until an approved repair is completed. The Contractor shall submit a repair plan to the Engineer for approval prior to the start of such work. The Engineer will review the plan within 90 days. All repairs must follow the Secretary of the Interior's Standards for the Treatment of Historic Properties (http://www2.cr.nps.gov/tps/standguide/index.htm), and must be undertaken by a licensed preservation architect who meets the Secretary of the Interior's Professional Qualifications Standards for Historic Architecture (http://www.cr.nps.gov/local-law/arch_stnds_9.htm). The Department may retain not less than $2,100,000 from moneys due or that may become due the Contractor under the contract, until an approved repair or reconstruction is complete.

PAYMENT

Full compensation for checking, repairing or replacing the ESA markings for the water-based ESA boundaries, and for conforming to the requirements of this section shall be considered as included in the contract prices paid for the various contract items of work and no separate payment will be made therefor.

5-1.31 RELATIONS WITH CALIFORNIA DEPARTMENT OF FISH AND GAME

This project is located within the jurisdiction of the California Department of Fish and Game (CDFG). The Department of Transportation has received a California Endangered Species Act Incidental Take Permit from CDFG. The Contractor shall be fully informed of all rules, regulations and conditions of the permit that may govern the Contractor's operations in said area and shall conduct the Contractor's work accordingly. Said document shall be considered a part of, and shall become, an integral part of the special provisions and contract for this project.

Copies of the permit may be obtained at the Department of Transportaiton, Plans and Bid Documents, Room 0200, Transportation Building, 1120 N Street, P.O. Box 942874, Sacramento, California 94274-0001, Telephone No. (916) 654-4490, and are available for inspection at the office of the Duty Senior at the District 4 Office, 111 Grand Avenue, Oakland, CA 94612, email: duty_senior_district04@dot.ca.gov, telephone number (510) 286-5209.

The Contractor’s attention is directed to "Environmental Work Restrictions" of these special provisions relating to specific protection measures required under this contract.

Any modifications to any agreement between the Department and the CDFG shall be fully binding on the Contractor, and the provisions of this section shall be made a part of every subcontract executed pursuant to this contract. Such modifications will be made in accordance with Section 4-1.03, "Changes" of the Standard Specifications. Full compensation for conforming to the requirements of this section shall be considered as included in the contract prices paid for the various contract items of work and no additional compensation will be allowed therefor.

5-1.32 RELATIONS WITH REGIONAL WATER QUALITY CONTROL BOARD

This project is located within an area controlled by the Regional Water Quality Control Board, San Francisco Bay Region (RWQCB). A RWQCB Order and Waste Discharge Requirements have been issued covering work to be performed under this contract. The Contractor shall be fully informed of all rules, regulations and conditions that may govern the Contractor's operations in said area and shall conduct the Contractor's work accordingly. Said documents shall be considered a part of, and shall become, an integral part of the special provisions and contract for this project.

Copies of the Order and the Waste Discharge Requirements may be obtained at the Department of Transportation, Plans and Bid Documents, Room 200, Transportation Building, 1120 N Street, P.O. Box 942874, Sacramento, California 94274-0001, Telephone No. (916) 654-4490, and will be available for inspection at the office of the Duty Senior at the District 4 Office, 111 Grand Avenue, Oakland, CA 94612, email: duty_senior_district04@dot.ca.gov, telephone number (510) 286-5209.

The Contractor’s attention is directed to Sections 7-1.11, "Preservation of Property," and 7-1.12, "Indemnification and Insurance", of the Standard Specifications.

The Contractor’s attention is also directed to Section 8-1.06, "Time of Completion," of the Standard Specifications. Days during which the Contractor's operations are restricted in the floodway by the requirements of this section, shall be considered to be nonworking days if these restrictions cause a delay in the current controlling operation or operations.

Any modifications to the Order which are proposed by the Contractor shall be submitted in writing to the Engineer for transmittal to the RWQCB for their consideration. No additional time or compensation will be allowed for delays caused by the Contractor’s proposed modifications to the Order.

When the Engineer notifies the Contractor that a modification to the Order is under consideration, no work will be allowed on the proposed modification until the Department of Transportation takes action on the proposed modification.

Any modifications to any agreement between the Department and the RWQCB shall be fully binding on the Contractor, and the provisions of this section shall be made a part of every subcontract executed pursuant to this contract. Such modifications will be made in accordance with Section, 4-1.03 "Changes" of the Standard Specifications

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

5-1.33 RELATIONS WITH U.S. ARMY CORPS OF ENGINEERS

This project is located within the jurisdiction of the United States Army Corps of Engineers (ACOE). A permit has been issued covering work to be performed under this contract. The Contractor shall be fully informed of all rules, regulations and conditions of the permit that may govern the Contractor's operations in said area and shall conduct the Contractor's work accordingly. Said document shall be considered a part of, and shall become, an integral part of the special provisions and contract for this project.

Copies of the permit may be obtained at the Department of Transportation, Plans and Bid Documents, Room 200, Transportation Building, 1120 N Street, P.O. Box 942874, Sacramento, California 94274-0001, telephone number (916) 654-4490, and will be available for inspection at the Duty Senior at the District 4 Office, 111 Grand Avenue, Oakland, CA 94612, email: duty_senior_district04@dot.ca.gov, telephone number (510) 286-5209.

Any modifications to the permit which are proposed by the Contractor shall be submitted in writing to the Engineer for transmittal to the ACOE for their consideration. No additional time or compensation will be allowed for delays by the Contractor's proposed modifications to the agreement between the Department of Transportation and the ACOE.

When the Contractor is notified by the Engineer that a modification to the permit is under consideration, no work will be allowed on the proposed modification until the Department takes action on the proposed modification. Any modifications to any agreement between the Department and the ACOE shall be fully binding on the Contractor, and the provisions of this section shall be made a part of every subcontract executed pursuant to this contract. Such modifications will be made in accordance with Section 4-1.03, "Changes" of the Standard Specifications. Full compensation for conforming to the requirements of this section shall be considered as included in the prices paid for the various contract items of work involved and no additional compensation will be allowed therefor.

5-1.34 RELATIONS WITH SAN FRANCISCO BAY CONSERVATION DEVELOPMENT COMMISSION

This project is located within the jurisdiction of the San Francisco Bay Conservation and Development Commission (BCDC). A permit has been issued covering work to be performed under this contract. The Contractor shall be fully informed of all rules, regulations and conditions of the permit that may govern the Contractor's operations in said areas as shown on the plan and shall conduct the Contractor's work accordingly. Said document shall be considered a part of, and shall become an integral part of the special provisions and contract for this project.

Copies of the permit may be obtained at the Department of Transportation, Plans and Bid Documents, Room 200, Transportation Building, 1120 N Street, P.O. Box 942874, Sacramento, California 94274-0001, telephone number (916) 654-4490, and will be available for inspection at the Duty Senior at the District 4 Office, 111 Grand Avenue, Oakland, CA 94612, email: duty_senior_district04@dot.ca.gov, telephone number (510) 286-5209.

Any modifications to the permit, which are proposed by the Contractor, shall be submitted in writing to the Engineer for transmittal to the BCDC for their consideration. No additional time or compensation will be allowed for delays caused by the Contractor's proposed modifications to the agreement between the Department of Transportation and the BCDC.

When the Contractor is notified by the Engineer that a modification to the permit is under consideration, no work will be allowed on the proposed modification until the Department takes action on the proposed modification. Any modifications to any agreement between the Department and BCDC shall be fully binding on the Contractor, and the provisions of this section shall be made a part of every subcontract executed pursuant to this contract. Such modifications will be made in accordance with Section 4-1.03, "Changes" of the Standard Specifications. For work already authorized in the BCDC permit, the Contractor shall submit to the Engineer a plan for in-Bay docks, trestles, and temporary structures, including temporary towers and falsework within 15 days after the approval of the contract, or six months prior to beginning construction of in-Bay docks, trestles, and temporary structures, including temporary towers and falsework, whichever is later. The plan shall include the area covered by the in-Bay temporary structures, docks, and trestles and volume of water displaced by the in-Bay temporary structures, docks, and trestles to be placed Bayward of the mean-high-water-line. The Engineer will submit to BCDC for final plan review; the Engineer and BCDC will review and the Engineer will provide comments to the Contractor within 50 days. The Contractor will have 10 days to revise and resubmit.

For work not already authorized in the BCDC permit, such as temporary structures or trestles in-bay at the barge access area, located outside of and to the east of the ESA and at the north side of Pier W2 west as shown on the plans, an amendment to the BCDC permit will be required. The State will request a permit amendment from BCDC.

If the Contractor elects to develop temporary structures or trestles in-bay or from the bay to land, he shall submit to the Engineer plans for temporary structures or trestles within 15 days after the approval of the contract. The Engineer will have 20 days to review the plans. If revisions are required, as determined by the Engineer, the Contractor shall revise and resubmit

the plans within 10 days of receipt of the Engineer's comments. The State will submit a permit amendment request to BCDC for review.

The BCDC amendment process will take a minimum of an additional 90 days, after receiving the final plans from the Contractor.

In addition, the Contractor shall submit to the Engineer the final plans for temporary structures or trestles in-bay or from the bay to land within 15 days after the approval of the BCDC amendment. The plan shall include the area covered by the in-Bay temporary structures, docks, and trestles and volume of water displaced by the in-Bay temporary structures, docks, and trestles to be placed Bayward of the mean-high-water-line. The Engineer will submit to BCDC for final plan review; the Engineer and BCDC will review and the Engineer will provide comments to the Contractor within 50 days. The Contractor will have 10 days to revise and resubmit.

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

5-1.35 RELATIONS WITH UNITED STATES COAST GUARD

This project is located adjacent to and across a navigable channel, which is located between the Yerba Buena Island and the county line between San Francisco City and County and Alameda County and is under the jurisdiction of the United States Coast Guard (USCG), Eleventh District, Coast Guard Island, Alameda, California, 94501-5100.

A U.S. Coast Guard (USCG) Bridge Permit has been issued covering work to be performed under this contract. The Contractor shall be fully informed of all rules, regulations and conditions that may govern the Contractor's operations within the construction right-of-way and shall conduct the Contractor's work accordingly. The Bridge Permit shall be considered part of an integral part of the contract special provisions.

Copies of the Bridge Permit may be obtained at the Department of Transportation, Plans and Bid Documents, Room 200, Transportation Building, P.O. Box 942874, Sacramento, California 94274-0001, telephone number (916) 654-4490, and are available for inspection at the Duty Senior at the District 4 Office, 111 Grand Avenue, Oakland, CA 94612, email: duty_senior_district04@dot.ca.gov, telephone number (510) 286-5209.

The Contractor's attention is directed to Sections 7-1.01, "Laws to be Observed," 7-1.11, "Preservation of Property," and 7-1.12, "Indemnification and Insurance," of the Standard Specifications, and to the section entitled "Sound Control Requirements" of these special provisions.

The Contractor shall comply with all requirements of the USCG with regard to the manner in which he conducts his operations and disposes of material. Any restriction of the channel and all navigation and warning lights shall be in accordance with regulations and subject to the approval of the USCG.

The Contractor's attention is directed to the following conditions which are among those established by the USCG in the work authorization for this project:

Navigation.--The Contractor's operations shall conform to the USCG regulations. Work shall be such that the free navigation of the waterway, navigable depths and channel widths are not impaired, except otherwise directed by the USCG. At least 50 days before anchoring barges or constructing docks, trestles, and temporary structures, including temporary towers and falsework within the construction right-of-way, or as directed by the Engineer, the Contractor shall notify the Engineer, in writing, along with drawings, of their proposed method for anchoring barges and of the location of docks, trestles, and temporary structures, including temporary towers and falsework. The Engineer will transmit the Contractor's proposal to the USCG for approval. The Contractor shall not anchor any barges until their procedure has been approved by the USCG. In the event that the required USCG approval, in the opinion of the Engineer, delays the Contractor's operations, the Contractor will be granted a time extension commensurate with the delays. No barges can be anchored within the ESAs.

Aids to Navigation.--The Contractor shall coordinate with the USCG Commander, Eleventh Coast Guard District, Building 50-6, Coast Guard Island, Alameda, California 94501-5100, Telephone (510) 437-2983 for written authorization at least 60 days prior to any relocation or temporary removal of any aids to navigation within or near any areas involved with dredging or construction. In addition, the Contractor shall not obstruct, willfully damage, make fast to, or interfere with any aid to navigation.

Navigational Obstructions.--Any debris, material, plant or machinery that are incidentally dropped into the waters of the Bay during the progress of work, which may present a hazard or which may obstruct navigation shall be promptly recovered or removed. Floating objects shall be immediately recovered or tied down and marked, so that they do not present hazards to navigation. The Contractor shall give immediate notice of in-place obstructions to the proper authorities and shall mark or buoy such obstructions until they are removed. Should the Contractor neglect or delay compliance with the above requirements, such obstructions shall be removed by the Department of Transportation and the cost of such removal will be deducted from the moneys due to the Contractor or may be recovered from their bond.

Navigational Lighting.--The Contractor shall keep proper warning lights each night between the hours of sunset and sunrise upon all floating equipment, falsework connected with the work and all buoys which are of a size and location as to endanger or obstruct navigation. The Contractor shall provide suitable navigational lighting at any time that construction operations obstruct the waterways. All floating equipment shall be marked in accordance with USCG Regulations.

Nighttime Lighting.--The Contractor shall direct lighting on to the immediate area under construction and avoid shining lights towards residences on YBI and marine traffic. The Contractor shall also not shine lights into the water at night.

Temporary Structures.--Following the completion of construction, the Contractor shall remove all temporary structures, including docks, trestles, and temporary structures, including temporary towers and falsework. Pilings shall be removed and shall be cut off at least 1.0 meter below the original mudline in-bay, and 1.0 meter below the original ground in-land.

The Contractor shall be aware of the USCG facility on the southeast side of Yerba Buena Island. The Contractor's activities shall not interfere with the twenty-four hour a day operations at the USCG facility. The Contractor shall not restrict land or sea access to that facility.

Attention is directed to Section 8-1.06, "Time of Completion," of the Standard Specifications. Days during which the Contractor's operations are restricted in the navigation channel by others shall be considered to be nonworking days if, in the opinion of the Engineer, these restrictions cause a delay in the current controlling operation or operations.

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

5-1.36 RELATIONS WITH SAN FRANCISCO BAR PILOTS

This project is located in the Bay of San Francisco, in which shipping vessels are under the jurisdiction of the San Francisco Bar Pilots. Attention is directed to Division 5, "Pilots for Monterey Bay and the Bays of San Francisco, San Pablo, and Suisun" of the California Harbors and Navigation Code.

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

5-1.37 RELATIONS WITH UNITED STATES FISH AND WILDLIFE SERVICE

This project is located within the jurisdiction of the United States Fish and Wildlife Service (USFWS). The USFWS has issued a Biological Opinion regarding several species which are protected under both the Federal Endangered Species Act and the California Endangered Species Act. The specifics of this opinion are part of an agreement which the Department of Transportation has entered into with the USFWS. The Contractor shall be fully informed of the requirements of this agreement as well as of all rules, regulations, and conditions that may govern the Contractor's operations in said area and shall conduct the Contractor's operations accordingly. Said document shall be considered a part of, and shall become, an integral part of the special provisions and contract for this project.

Copies of the agreement may be obtained at the Department of Transportation, Plans and Bid Documents, Room 0200, Transportation Building, 1120 N Street, P.O. Box 942874, Sacramento, California 94274-0001, Telephone No. (916) 654-4490, and will be available for inspection at the office of the Duty Senior at the District 4 Office, 111 Grand Avenue, Oakland, CA 94612, email: duty_senior_district04@dot.ca.gov, telephone number (510) 286-5209.

Attention is directed to "Environmental Work Restrictions" of these special provisions relating to specific measures required under this contract.

Any modifications to any agreement between the Department and the USFWS shall be fully binding on the Contractor, and the provisions of this section shall be made a part of every subcontract executed pursuant to this contract. Such modifications will be made in accordance with Section 4-1.03, "Changes" of the Standard Specifications.

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

5-1.38 RELATIONS WITH NATIONAL MARINE FISHERIES SERVICES

This project is located within the jurisdiction of the National Marine Fisheries Service (NMFS). The NMFS has concurred with measures developed by the Department regarding the protection of winter-run Chinook salmon habitat and critical habitat for steelhead trout, and for protection of the local California Sea Lion, Harbor Seal populations, and gray whale. The Contractor shall be fully informed of the requirements associated with these measures as well as all rules, regulations and conditions that may govern the Contractor's operations in said area and shall conduct their operations

accordingly. Said document shall be considered a part of, and shall become, an integral part of the special provisions and contract for this project.

Attention is directed to Section "Environmental Work Restrictions" of these special provisions relating to specific measures required under this contract.

The Contractor shall restrict contract vessels from entering a no entry buffer zone of 500 meters radius measured from the harbor seal haul-out site to the southwest of Yerba Buena Island.

The NMFS has prepared advisory letters to the Department, in response to the Department's request for consultation regarding species of fish and marine mammals that may be affected by construction activities. The Contractor shall be fully informed of and abide by the recommendations of the NMFS in performing the Contractor's operations on this project.

Copies of these consultation letters may be obtained at the Department of Transportation, Plans and Bid Documents, Room 0200, Transportation Building, 1120 N Street, P.O. Box 942874, Sacramento, California 94274-0001, Telephone No. (916) 654-4490, and will be available for inspection at the office of the Duty Senior at the District 4 Office, 111 Grand Avenue, Oakland, CA 94612, email: duty_senior_district04@dot.ca.gov, telephone number (510) 286-5209.

Any modifications to any agreement between the Department and the NMFS shall be fully binding on the Contractor, and the provisions of this section shall be made a part of every subcontract executed pursuant to this contract. Such modifications will be made in accordance with Section 4-1.03, "Changes" of the Standard Specifications.

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

5-1.39 INSURANCE

The first sentence of subparagraph F in Section 7-1.165, "Damage by Storm, Flood, Tsunami or Earthquake," of the Standard Specifications, is revised as follows for this contract only:

> "Payment for Repair Work -- When the Occurrence that caused the damage was a tsunami, the State will pay the cost of repair determined as provided in Subsection E, that exceeds 5 percent of the amount of the Contractor's bid for bid comparison purposes. When the Occurrence that caused the damage was an earthquake, the State will pay the cost of repair determined as provided in Subsection E, that exceeds the lesser of $20 million or 5 percent of the amount of the Contractor's bid for bid comparison purposes."

The first sentence of Section 7-1.12B(1)(c), "Liability Limits/Additional Insureds," Subsection (d) of the Standard Specifications, is revised as follows for this contract only:

> "$50,000,000 umbrella or excess liability. Umbrella or excess liability policy shall include products liability completed operations. Further, the umbrella or excess liability coverage shall contain a clause stating that it takes effect (drops down) in the event the primary limits are impaired or exhausted."

The Contractor shall also provide insurance coverage under the Federal Longshoremen's and Harbor Workers Compensation Act, the Jones Act and the Marine Act with respect to work performed from, or by use of, vehicles on any navigable water of the United States, including liability insurance for watercraft operations. The insurance coverage shall contain a combined single limit of at least $50,000,000 per occurrence and $50,000,000 aggregate. At the option of the Contractor, liability insurance for watercraft operations may be covered under a separate Protection and Indemnity policy.

5-1.40 INDEMNIFICATION

The Contractor shall be responsible for any liability imposed by law and for injuries to or death of any person including, but not limited to, workers and the public or damage to property, and shall indemnify and save harmless T.Y. Lin International / Moffatt & Nichol Engineers, a Joint Venture and its consultants and subconsultants, in the same manner and to the same extent conforming to the provisions in Section 7-1.12, "Indemnification and Insurance," of the Standard Specifications, for the protection of the State of California and all officers and employees thereof connected with the work. Contractor's liability policies shall be required to name T.Y. Lin International / Moffatt & Nichol Engineers, a Joint Venture, their respective affiliates, parent or affiliated corporations, directors, officers, partners, representatives, employees, consultants, subconsultants and agents, as additional insureds to the extent that the State is named as an additional insured under the Standard Specifications and these Special Provisions with respect to the liability arising from the activities of the Contractor. Certificates of insurance shall provide thirty (30) days advance written notice of cancellation or nonrenewal and shall clearly specify the Contractor's contract number under which services are provided to the State and the name of the project. Certificates of insurance and endorsements as required herein shall be provided by Contractor's insurers to the following address:

T.Y. Lin International / Moffatt & Nicole Engineers, A Joint Venture
c/o Dealey, Renton & Associates
P.O. Box 12675
Oakland, CA 94604-2675

SECTION 6. (BLANK)

SECTION 7. (BLANK)

SECTION 8. MATERIALS

SECTION 8-1. MISCELLANEOUS

8-1.01 SUBSTITUTION OF NON-METRIC MATERIALS AND PRODUCTS

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

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

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

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

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

SUBSTITUTION TABLE FOR PLAIN WIRE REINFORCEMENT
ASTM Designation: A 82

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

SUBSTITUTION TABLE FOR BAR REINFORCEMENT

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

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

SUBSTITUTION TABLE FOR SIZES OF:

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

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

METRIC SIZE SHOWN ON THE PLANS mm	SIZE TO BE SUBSTITUTED inch
6 or 6.35	1/4
8 or 7.94	5/16
10 or 9.52	3/8
11 or 11.11	7/16
13, 12.70, or M12	1/2
14 or 14.29	9/16
16, 15.88, or M16	5/8
19, 19.05, or M20	3/4
22, 22.22, or M22	7/8
24, 25, 25.40, or M24	1
29, 28.58, or M27	1-1/8
32, 31.75, or M30	1-1/4
35 or 34.93	1-3/8
38, 38.10, or M36	1-1/2
44 or 44.45	1-3/4
51 or 50.80	2
57 or 57.15	2-1/4
64 or 63.50	2-1/2
70 or 69.85	2-3/4
76 or 76.20	3
83 or 82.55	3-1/4
89 or 88.90	3-1/2
95 or 95.25	3-3/4
102 or 101.60	4

SUBSTITUTION TABLE FOR NOMINAL THICKNESS OF SHEET METAL

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

SUBSTITUTION TABLE FOR WIRE

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

SUBSTITUTION TABLE FOR PIPE PILES

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

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

SUBSTITUTION TABLE FOR CIDH CONCRETE PILING

METRIC SIZE SHOWN ON THE PLANS	ACTUAL AUGER SIZE TO BE SUBSTITUTED inches
350 mm	14
400 mm	16
450 mm	18
600 mm	24
750 mm	30
900 mm	36
1.0 m	42
1.2 m	48
1.5 m	60
1.8 m	72
2.1 m	84
2.4 m	96
2.7 m	108
3.0 m	120
3.3 m	132
3.6 m	144
4.0 m	156

SUBSTITUTION TABLE FOR STRUCTURAL TIMBER AND LUMBER

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

SUBSTITUTION TABLE FOR NAILS AND SPIKES

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

SUBSTITUTION TABLE FOR IRRIGATION COMPONENTS

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

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

8-1.02 PREQUALIFIED AND TESTED SIGNING AND DELINEATION MATERIALS

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

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

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

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

PAVEMENT MARKERS, PERMANENT TYPE

Retroreflective With Abrasion Resistant Surface (ARS)

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

Retroreflective With Abrasion Resistant Surface (ARS)

(for recessed applications only)

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

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

Non-Reflective, 100 mm Round

A. Apex Universal (Ceramic)
B. Apex Universal, Models 929 (ABS) and 929PP (Polypropylene)
C. Glowlite, Inc., (Ceramic)
D. Hi-Way Safety, Inc., Models P20-2000W and 2001Y (ABS)
E. Interstate Sales, "Diamond Back" (ABS) and (Polypropylene)
F. Novabrite Models Cdot (White) Cdot-y (Yellow), Ceramic
G. Novabrite Models Pdot-w (White) Pdot-y (Yellow), Polypropylene
H. Road Creations, Model RCB4NR (Acrylic)
I. Three D Traffic Works TD10000 (ABS), TD10500 (Polypropylene)

PAVEMENT MARKERS, TEMPORARY TYPE

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

A. Vega Molded Products "Temporary Road Marker" (75 mm x 100 mm)

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

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

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

STRIPING AND PAVEMENT MARKING MATERIAL

Permanent Traffic Striping and Pavement Marking Tape

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

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

A. Advanced Traffic Marking, Series 200
B. Brite-Line, Series 100
C. Garlock Rubber Technologies, Series 2000
D. P.B. Laminations, Aztec, Grade 102
E. Swarco Industries, "Director-2"
F. Trelleborg Industri, R140 Series
G. 3M, Series 620 "CR", and Series A750

H. 3M, Series A145, Removable Black Line Mask
(Black Tape: for use only on Asphalt Concrete Surfaces)
I. Advanced Traffic Marking Black "Hide-A-Line"
(Black Tape: for use only on Asphalt Concrete Surfaces)
J. Brite-Line "BTR" Black Removable Tape
(Black Tape: for use only on Asphalt Concrete Surfaces)
K. Trelleborg Industri, RB-140
(Black Tape: for use only on Asphalt Concrete Surfaces)

Preformed Thermoplastic (Heated in place)

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

Ceramic Surfacing Laminate, 150 mm x 150 mm

A. Highway Ceramics, Inc.

CLASS 1 DELINEATORS

One Piece Driveable Flexible Type, 1700 mm

A. Bunzl Extrusion, "Flexi-Guide Models 400 and 566"
B. Carsonite, Curve-Flex CFRM-400
C. Carsonite, Roadmarker CRM-375
D. FlexStake, Model 654 TM
E. GreenLine Models HWD1-66 and CGD1-66

Special Use Type, 1700 mm

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

Surface Mount Type, 1200 mm

A. Bent Manufacturing Company, Masterflex Model MF-180EX-48
B. Carsonite, "Super Duck II"
C. FlexStake, Surface Mount, Models 704 and 754 TM
D. Impact Recovery Model D48, with #101 Fixed (Surface-Mount) Base
E. Three D Traffic Works "Channelflex" ID No. 522248W

CHANNELIZERS

Surface Mount Type, 900 mm

A. Bent Manufacturing Company, Masterflex Models MF-360-36 (Round) and MF-180-36 (Flat)
B. Bunzl Extrusion, Flexi-Guide Models FG300PE and FG300UR
C. Carsonite, "Super Duck" (Flat SDF-436, Round SDR-336)
D. Carsonite, "Super Duck II" Model SDCF203601MB "The Channelizer"
E. FlexStake, Surface Mount, Models 703 and 753 TM
F. GreenLine, Model SMD-36
G. Hi-Way Safety, Inc. "Channel Guide Channelizer" Model CGC36
H. Impact Recovery Model D36, with #101 Fixed (Surface-Mount) Base
I. Repo, Models 300 and 400
J. Safe-Hit, Guide Post, Model SH236SMA
K. Three D Traffic Works "Channelflex" ID No. 522053W

Lane Separation System

A. Bunzl "Flexi-Guide (FG) 300 Curb System"

B. Qwick Kurb, "Klemmfix Guide System"
C. Recycled Technology, Inc. "Safe-Lane System"

CONICAL DELINEATORS, 1070 mm
(For 700 mm Traffic Cones, see Standard Specifications)
A. Bent Manufacturing Company "T-Top"
B. Plastic Safety Systems "Navigator-42"
C. Radiator Specialty Company "Enforcer"
D. Roadmaker Company "Stacker"
E. TrafFix Devices "Grabber"
F. Three D Traffic Works "Ringtop" TD7000, ID No. 742143

OBJECT MARKERS
Type "K", 450 mm
A. Bunzl, Model FG318PE
B. Carsonite, Model SMD 615
C. FlexStake, Model 701 KM
D. Repo, Models 300 and 400
E. Safe-Hit, Model SH718SMA

Type "K-4" / "Q" Object Markers, 600 mm
A. Bent Manufacturing "Masterflex" Model MF-360-24
B. Bunzl Extrusion, Model FG324PE
C. Carsonite, Super Duck II
D. FlexStake, Model 701KM
E. Repo, Models 300 and 400
F. Safe-Hit, Models SH8 24SMA_WA and SH8 24GP3_WA
G. The Line Connection, Model DP21-4Q
H. Three D Traffic Works "Q" Marker, ID No. 531702W

CONCRETE BARRIER MARKERS AND
TEMPORARY RAILING (TYPE K) REFLECTORS
Impactable Type
A. ARTUK, "FB"
B. Bunzl Extrusion, Models PCBM-12 and PCBM-T12
C. Duraflex Corp., "Flexx 2020" and "Electriflexx"
D. Hi-Way Safety, Inc., Model GMKRM100
E. Plastic Safety Systems "BAM" Models OM-BARR and OM-BWAR
F. Sun-Lab Technology, "Safety Guide Light Model TM-5"
G. Three D Traffic Works "Roadguide" 9304 Series, ID No. 903176 (One-Way), ID No. 903215 (Two-Way)

Non-Impactable Type
A. ARTUK, JD Series
B. Plastic Safety Systems "BAM" Models OM-BITARW and OM-BITARA
C. Vega Molded Products, Models GBM and JD

METAL BEAM GUARD RAIL POST MARKERS
(For use to the left of traffic)
A. Bunzl Extrusion, "Mini" (75 mm x 254 mm)
B. Creative Building Products, "Dura-Bull, Model 11201"
C. Duraflex Corp., "Railrider"

CONCRETE BARRIER DELINEATORS, 400 mm
(For use to the right of traffic)
A. Bunzl Extrusion, Model PCBM T-16
B. Safe-Hit, Model SH216RBM
C. Sun-Lab Technology, "Safety Guide Light, Model TM16," (75 mm x 300 mm)
D. Three D Traffic Works "Roadguide" ID No. 904364 (White), ID No. 904390 (Yellow)

CONCRETE BARRIER-MOUNTED MINI-DRUM (260 mm x 360 mm x 570 mm)

A. Stinson Equipment Company "SaddleMarker"

SOUND WALL DELINEATOR

(Applied vertically. Place top of 75 mm x 300 mm reflective element at 1200 mm above roadway)

A. Bunzl Extrusion, PCBM S-36
B. Sun-Lab Technology, "Safety Guide Light, Model SM12," (75 mm x 300 mm)

GUARD RAILING DELINEATOR

(Place top of reflective element at 1200 mm above plane of roadway)

Wood Post Type, 686 mm

A. Bunzl Extrusion, FG 427 and FG 527
B. Carsonite, Model 427
C. FlexStake, Model 102 GR
D. GreenLine GRD 27
E. Safe-Hit, Model SH227GRD
F. Three D Traffic Works "Guardflex" TD9100 Series, ID No. 510476

Steel Post Type

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

RETROREFLECTIVE SHEETING

Channelizers, Barrier Markers, and Delineators

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

Traffic Cones, 330 mm Sleeves

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

Traffic Cones, 100 mm and 150 mm Sleeves

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

Barrels and Drums

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

Barricades: Type I, Medium-Intensity (Typically Enclosed Lens, Glass-Bead Element)

A. American Decal, Adcolite
B. Avery Dennison, T-1500 and T-1600 series
C. 3M Engineer Grade, Series 3170

Barricades: Type II, Medium-High-Intensity (Typically Enclosed Lens, Glass-Bead Element)

A. Avery Dennison, T-2500 Series
B. Kiwalite Type II
C. Nikkalite 1800 Series

Signs: Type II, Medium-High-Intensity (Typically Enclosed Lens, Glass-Bead Element)

A. Avery Dennison, T-2500 Series
B. Kiwalite, Type II
C. Nikkalite 1800 Series

Signs: Type III, High-Intensity (Typically Encapsulated Glass-Bead Element)

A. Avery Dennison, T-5500 and T-5500A Series
B. Nippon Carbide Industries, Nikkalite Brand Ultralite Grade II
C. 3M Series 3870

Signs: Type IV, High-Intensity (Typically Unmetallized Microprismatic Element)

A. Avery Dennison, T-6500 Series
B. Nippon Carbide Industries, Crystal Grade, 94000 Series
C. Nippon Carbide Industries, Model No. 94847 Fluorescent Orange
D. Nippon Carbide Industries, Model No. 94844 Fluorescent Yellow Green

Signs: Type VI, Elastomeric (Roll-Up) High-Intensity, without Adhesive

A. Avery Dennison, WU-6014
B. Novabrite LLC, "Econobrite"
C. Reflexite "Vinyl"
D. Reflexite "SuperBright"
E. Reflexite "Marathon"
F. 3M Series RS34 Orange and RS20 Fluorescent Orange

Signs: Type VII, Super-High-Intensity (Typically Unmetallized Microprismatic Element)

A. 3M LDP Series 3924 Fluorescent Orange
B. 3M LDP Series 3970

Signs: Type VIII, Super-High-Intensity (Typically Unmetallized Microprismatic Element)

A. Avery Dennison, T-7500 Series
B. Avery Dennison, T-7511 Fluorescent Yellow
C. Avery Dennison, T-7513 Fluorescent Yellow Green
D. Avery Dennison, W-7514 Fluorescent Orange
E. Nippon Carbide Industries, Nikkalite Crystal Grade Model 92802 White
F. Nippon Carbide Industries, Nikkalite Crystal Grade Model 92844 Fluorescent Yellow/Green
G. Nippon Carbide Industries, Nikkalite Crystal Grade Model 92847 Fluorescent Orange

Signs: Type IX, Very-High-Intensity (Typically Unmetallized Microprismatic Element)

A. 3M VIP Series 3981 Diamond Grade Fluorescent Yellow
B. 3M VIP Series 3983 Diamond Grade Fluorescent Yellow/Green
C. 3M VIP Series 3990 Diamond Grade

SPECIALTY SIGNS

A. Hallmark Technologies, Inc., All Sign STOP Sign (All Plastic), 750 mm
B. Reflexite "Endurance" Work Zone Sign (with Semi-Rigid Plastic Substrate)

SIGN SUBSTRATE

Fiberglass Reinforced Plastic (FRP)

A. Fiber-Brite
B. Sequentia, "Polyplate"
C. Inteplast Group "InteCel" (13 mm for Post-Mounted CZ Signs, 1200 mm or less)

Aluminum Composite

A. Alcan Composites "Dibond Material, 2 mm" (for temporary construction signs only)
B. Mitsubishi Chemical America, Alpolic 350 (for temporary construction signs only)

8-1.03 STATE-FURNISHED MATERIALS

Attention is directed to Section 6-1.02, "State-Furnished Materials," of the Standard Specifications and these special provisions.

The following materials will be furnished to the Contractor:

A. Sign panels for roadside signs and overhead sign structures.
B. Hardware for mounting sign panels as follows:

   1. Blind rivets for mounting overlapping legend at sign panel joints.
   2. Closure inserts.
   3. Aluminum bolts, nuts, and washers for mounting overhead formed panels.

C. Model 170 controller assemblies, as shown on the plans, including controller unit, completely wired controller cabinet, and inductive loop detector sensor units.
D. Call Boxes
E. Force Balance Accelerator pigtails and seismic sensor mounting plates for strong motion detection system.
F. Strong motion detection sensors, recorders and specially formed sealed assembly cap (for the pier sensors)
G. Epoxy asphalt test base plates.
H. Circular segmented bearings.
I. Hinge A pipe beam restraint brackets.
J. Nuts and washers for tower anchor bolts and tower skirt anchor bolts
K. Three metal benches for East-end belvedere of bikepath

Model 170 controller assemblies, including the controller unit and completely wired cabinet, will be furnished to the Contractor at the Caltrans Maintenance Station, 30 Rickard Street, San Francisco, CA 94134.

The locations of state-furnished circular segmented bearings are as follows:

Bearing Type	Hinge AW, AE Type I and Type II	Hinge AW, AE Type III and Type IV
Location	Temporarily placed at Diaphragms C & D of Hinge AW, AE	Within 25 km of the San Francisco-Oakland Bay Bridge Toll Plaza.

Metal benches will be furnished to the Contractor at the warehouse of Pier 7, 315 Dunkirk Street, Oakland, CA 94607.

The Contractor shall notify the Engineer not less than 48 hours before State-furnished material is to be picked up by the Contractor. A full description of the material and the time the material will be picked up shall be provided with notification.

8-1.04 ENGINEERING FABRICS

Engineering fabrics shall conform to the provisions in Section 88, "Engineering Fabrics," of the Standard Specifications and these special provisions.

Filter fabric for this project shall be ultraviolet (UV) ray protected.

SECTION 8-2. CONCRETE

8-2.01 PORTLAND CEMENT CONCRETE

Portland cement concrete shall conform to the provisions in Section 90, "Portland Cement Concrete," of the Standard Specifications and these special provisions.

References to Section 90-2.01, "Portland Cement," of the Standard Specifications shall mean Section 90-2.01, "Cement," of the Standard Specifications.

Mineral admixture shall be combined with cement in conformance with the provisions in Section 90-4.08, "Required Use of Mineral Admixtures," of the Standard Specifications for the concrete materials specified in Section 56-2, "Roadside Signs," of the Standard Specifications.

The requirements of Section 90-4.08, "Required Use of Mineral Admixture," of the Standard Specifications shall not apply to Section 19-3.025C, "Soil Cement Bedding," of the Standard Specifications.

The Department maintains a list of sources of fine and coarse aggregate that have been approved for use with a reduced amount of mineral admixture in the total amount of cementitious material to be used. A source of aggregate will be

considered for addition to the approved list if the producer of the aggregate submits to the Transportation Laboratory certified test results from a qualified testing laboratory that verify the aggregate complies with the requirements. Prior to starting the testing, the aggregate test shall be registered with the Department. A registration number can be obtained by calling (916) 227-7228. The registration number shall be used as the identification for the aggregate sample in correspondence with the Department. Upon request, a split of the tested sample shall be provided to the Department. Approval of aggregate will depend upon compliance with the specifications, based on the certified test results submitted, together with any replicate testing the Department may elect to perform. Approval will expire 3 years from the date the most recent registered and evaluated sample was collected from the aggregate source.

Qualified testing laboratories shall conform to the following requirements:

A. Laboratories performing ASTM Designation: C 1293 shall participate in the Cement and Concrete Reference Laboratory (CCRL) Concrete Proficiency Sample Program and shall have received a score of 3 or better on all tests of the previous 2 sets of concrete samples.
B. Laboratories performing ASTM Designation: C 1260 shall participate in the Cement and Concrete Reference Laboratory (CCRL) Pozzolan Proficiency Sample Program and shall have received a score of 3 or better on the shrinkage and soundness tests of the previous 2 sets of pozzolan samples.

Aggregates on the list shall conform to one of the following requirements:

A. When the aggregate is tested in conformance with the requirements in California Test 554 and ASTM Designation: C 1293, the average expansion at one year shall be less than or equal to 0.040 percent; or
B. When the aggregate is tested in conformance with the requirements in California Test 554 and ASTM Designation: C 1260, the average of the expansion at 16 days shall be less than or equal to 0.15 percent.

The amounts of cement and mineral admixture used in cementitious material shall be sufficient to satisfy the minimum cementitious material content requirements specified in Section 90-1.01, "Description," or Section 90-4.05, "Optional Use of Chemical Admixtures," of the Standard Specifications and shall conform to the following:

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

    1. When the calcium oxide content of a mineral admixture is equal to or less than 2 percent by mass, the amount of mineral admixture shall not be less than 15 percent by mass of the total amount of cementitious material to be used in the mix.
    2. When the calcium oxide content of a mineral admixture is greater than 2 percent by mass, and any of the aggregates used are not listed on the approved list as specified in these special provisions, then the amount of mineral admixture shall not be less than 25 percent by mass of the total amount of cementitious material to be used in the mix.
    3. When the calcium oxide content of a mineral admixture is greater than 2 percent by mass and the fine and coarse aggregates are listed on the approved list as specified in these special provisions, then the amount of mineral admixture shall not be less than 15 percent by mass of the total amount of cementitious material to be used in the mix.
    4. When a mineral admixture that conforms to the provisions for silica fume in Section 90-2.04, "Admixture Materials," of the Standard Specifications is used, the amount of mineral admixture shall not be less than 10 percent by mass of the total amount of cementitious material to be used in the mix.
    5. When a mineral admixture that conforms to the provisions for silica fume in Section 90-2.04, "Admixture Materials," of the Standard Specifications is used and the fine and coarse aggregates are listed on the approved list as specified in these special provisions, then the amount of mineral admixture shall not be less than 7 percent by mass of the total amount of cementitious material to be used in the mix.

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

The Contractor will be permitted to use Type III portland cement for concrete used in the manufacture of precast concrete members.

8-2.02 CORROSION CONTROL FOR PORTLAND CEMENT CONCRETE

Portland cement concrete is considered to be in a corrosive environment and shall conform to the provisions in Section 90, "Portland Cement Concrete," of the Standard Specifications and these special provisions.

Cementitious material to be used in portland cement concrete shall conform to the provisions for cement and mineral admixtures in Section 90-2, "Materials," ," of the Standard Specifications, and shall be a combination of "Type II Modified" portland cement and mineral admixture.

Concrete in a corrosive environment shall contain not less than 400 kg of cementitous material per cubic meter.

No reduction in the cementitious material content specified or ordered, in conformance with the provisions in Section 90-4.05, "Optional Use of Chemical Admixtures," of the Standard Specifications, will be allowed for concrete in a corrosive environment.

Unless otherwise specified, for concrete in a corrosive environment, the amount of cement shall be 75 percent by mass, and the amount of mineral admixture to be combined with cement shall be 25 percent by mass, of the total amount of cementitious material to be used in the concrete mix. The calcium oxide content of mineral admixtures shall not exceed 10 percent.

Mineral admixture for concrete in a corrosive environment shall conform to ASTM Designation: C618 Class F or N.

The amount of free water used in concrete in a corrosive environment shall not exceed 160 kg/ m^3, plus 40 kg for each 100 kg of cementitious material in excess of 400 kg/ m^3.

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

8-2.03 OPTIONAL MARINE-BASED PORTLAND CEMENT CONCRETE BATCH PLANT

At the Contractor's option, a marine-based concrete batch plant may be used to proportion and mix portland cement concrete. The marine-based concrete batch plant shall conform to the provisions in Section 90, "Portland Cement Concrete," of the Standard Specifications and to these special provisions.

The Contractor shall obtaining and comply with all required permits, clearances, and approvals to operate a marine-based concrete batch plant, including transport of materials to and from the batch plant and disposal of all waste products generated by the batch plant. Permitting agencies with jurisdictional responsibilities for the marine-based concrete batch plant include, but are not limited to the U.S. Corps of Engineers, U.S. Coast Guard, San Francisco Bay Regional Water Quality Control Board , San Francisco Bay Conservation and Development Commission and the Bay Area Air Quality Management District. Delays in obtaining permits, clearances, and approvals will not be reason for granting an extension of contract time.

The requirement for providing portland cement concrete undersupports for scale bearing points as specified in Section 9-1.01, "Measurement of Quantities," of the Standard Specifications shall not apply.

The Contractor shall submit, in writing, an operations plan for the marine-based plant to the Engineer at least 30 days prior to performing a prequalification batch test. The plan shall include:

A. a detailed description of the batch plant;
B. the navigational and operational requirements for the batch plant under all expected environmental conditions;
C. the planned movements of the batch plant, the anchoring and berthing locations of the plant, and the frequency and extent of all necessary relocations;
D. the limiting conditions for operation and the production capacity under which the batch plant can safely operate and produce portland cement concrete in compliance with these specifications;
E. the limitations of the weighing equipment to function accurately under shifting and unleveled conditions caused by wind and wave actions;
F. scale accuracy, tolerances and variations expected from shifting and tilting due to wave action; and
G. methods or devices, such as visual and/or audio signals, which will be utilized to notify plant operators that the tolerances of these specifications have been exceeded.

A prequalification batch test shall be performed at least 60 days prior to the production of the first concrete batched by the plant for use in the project. The prequalification batch test shall demonstrate the plant is capable of proportioning and mixing concrete in conformance with these special provisions and under the typical marine conditions which will be encountered during the project. This test shall include a production minimum of four batches. Each batch size shall be a minimum of eight cubic meters or otherwise as approved by the Engineer. These batches shall be produced at locations within the project limits, or as approved by the Engineer. The four batch test produced shall be transported and weighed at a land based certified scales in accordance with the requirements of Section 9-1.01, Measurement and Quantities," of the Standard Specifications. The total weight from the batch plant weigh tickets for each of the batches measured on the floating batch plant shall be within 2% of the weight measured by the land based certified scales. If the total weight varies more than 2% , the Contractor shall revise the operation plan and perform another prequalification test until the total measured weight is

within 2% of the total batch plant weight tickets. Failure to comply with this requirement will be grounds for the Engineer rejecting the use of the batch plant for producing concrete for the contract.

At the discretion of the Engineer, the Contractor shall perform the prequalifiaction batch test again if the Contractor significantly changes equipment or if problems are detected in the normal operation of the marine based portland cement concrete batch plant.

After completion of the prequalification batch test, the concrete produced during the test shall become the property of the Contractor, and all materials shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

A container, capable of holding at least 2.25 cubic meters, shall be available at the batch plant at all times. The container shall be either a cylindrical or of a rectilinear shape. It shall be mortar tight and rigid and its walls shall not deflect more than 1 millimeter (mm) during the placing of concrete. The diameter of the base of the cylinder container shall be between 1000 mm and 1250 mm. The dimensions of the width and length of the rectilinear container shall be between 900 mm and 1000 mm. During production and when ordered by the Engineer, the accuracy of the concrete batching shall be checked against this volumetric measure of two cubic meters. The Contractor, using calibrated measures on the Marine Based Portland Cement Concrete Batch Plant, shall prepare a test batch of two cubic meters. The test batch shall be poured into the measuring device, at which time, the measured volume shall be determined by multiplying the height of the concrete batch in the measuring device by the area of the base of the measuring device. The measured volume shall be within 2% of the volume calculated from the weigh batch tickets.

In addition, commercial class test masses, at least 25% of the total optional batch plant scale capacity shall be available at all times for use of testing the scales during production. The test masses shall be required by California Test 109. The plant scales shall be subjected to operation and scale tolerances testing in all weather.

Facilities on the premises of the floating batch plant shall provided to the Engineer for performing all necessary sampling and testing, including space for safe storage of test samples and testing equipment. For sampling purposes, a method of diverting the freshly mixed concrete between the mixer and the delivery system shall be provided. The sampling and testing facilities on the premises shall be approved by the Engineer.

The aggregates shall be protected from exposure to salt waters. Coarse aggregate may be proportioned by volume. Containers, bags, or other packages of pre-weighed cementitious material if used shall be sealed and moisture proof. The Containers, bags, or packages shall be tagged showing exact weight, date and time of batching, and source of cementitious material. The tags shall be numbered serially. The tag number in addition to the weight of the material shall be included on each batch certificate used incorporating pre-weighed non-bulk material.

Full compensation for operating a floating batch plant, in accordance with the requirements of all permitting agencies, batching materials, disposing of materials, developing and submitting and operations plan, performing prequalification batch tests, periodic weight and volume checks, providing sampling and testing facilities and necessary corrective actions required, including recertification of the batch plant shall be considered as included in the contract prices paid for various items of work involved and no additional compensation will be allowed therefor.

8-2.04 PRECAST CONCRETE QUALITY CONTROL

GENERAL

Precast concrete quality control shall conform to these special provisions.

Precast concrete quality control shall apply when precast members are fabricated for the following work:

A. Precast concrete fender modules

Quality Control (QC) shall be the responsibility of the Contractor. The Contractor's QC inspectors shall perform inspection and testing prior to precasting, during precasting, and after precasting, and as specified in this section and additionally as necessary to ensure that materials and workmanship conform to the details shown on the plans and specifications.

Quality Assurance (QA) is the prerogative of the Engineer. Regardless of the acceptance for a given precast element by the Contractor, the Engineer will evaluate the precast element. The Engineer will reject any precast element that does not conform to the approved Precast Concrete Quality Control Plan (PCQCP), the details shown on the plans, and these special provisions.

The Contractor shall designate in writing a precast Quality Control Manager (QCM) for each precasting facility. The QCM shall be responsible directly to the Contractor for the quality of precasting, including materials and workmanship, performed by the Contractor and all subcontractors. The QCM shall be the sole individual responsible to the Contractor for submitting, receiving, and approving all correspondence, required submittals, and reports to and from the Engineer. The QCM shall not be employed or compensated by any subcontractor, or other persons or entities hired by subcontractors, or suppliers, who will provide other services or materials for the project. The QCM may be an employee of the Contractor.

Prior to submitting the PCQCP required herein, a meeting between the Engineer, the Contractor's QCM, and a representative from each entity performing precast concrete operations for this project, shall be held to discuss the requirements for precast quality control.

QC Inspectors shall either be 1) licensed as Civil Engineers in the State of California, or 2) have a current Plant Quality Personnel Certification, Level II, from the Precast/Prestressed Concrete Institute. A QC Inspector shall witness all precast concrete operations.

PRECAST CONCRETE QUALIFICATION AUDIT

Unless otherwise specified, no Contractors or subcontractors performing precast concrete operations for the project shall commence work without having successfully completed the Department's Precast Fabrication Qualification Audit, hereinafter referred to as the audit. The Engineer will perform the audit, and copies of the audit form, along with procedures for requesting and completing the audit, are available at the Transportation Laboratory or the following website:

http://www.dot.ca.gov/hq/esc/Translab/smbresources.htm

An audit that was previously approved by the Engineer no more than three years prior to the beginning of work on this contract will be acceptable for the entire period of this contract, provided the Engineer determines the audit is for the same type of work that is to be performed on this contract.

Successful completion of an audit shall not relieve the Contractor of the responsibility for furnishing materials or producing finished work of the quality specified in these special provisions and as shown on the plans.

PRECAST CONCRETE QUALITY CONTROL PLAN

Prior to performing any precasting operations, the Contractor shall submit to the Engineer, in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications, 3 copies of a separate PCQCP for each item of work which is to be precast. A separate PCQCP shall be submitted for each facility. As a minimum, each PCQCP shall include the following:

A. The name of the precasting firm, the concrete plants to be used, and any concrete testing firm to be used;
B. A manual prepared by the precasting firm that includes equipment, testing procedures, safety plan, and the names, qualifications, and documentation of certifications for all personnel to be used;
C. The name of the QCM and the names, qualifications, and documentation of certifications for all QC inspection personnel to be used;
D. An organizational chart showing all QC personnel and their assigned QC responsibilities;
E. The methods and frequencies for performing all required quality control procedures, including all inspections, material testing, and any required survey procedures for all components of the precast elements including prestressing systems, concrete, grout, reinforcement, steel components embedded or attached to the precast member, miscellaneous metal, and formwork;
F. A system for identification and tracking of required precast element repairs, and a procedure for the re-inspection of any repaired precast element. The system shall have provisions for a method of reporting nonconforming precast elements to the Engineer; and
G. Forms to be used for Certificates of Compliance, daily production logs, and daily reports.

The Engineer shall have 4 weeks to review the PCQCP submittal after a complete plan has been received. No precasting shall be performed until the PCQCP is approved in writing by the Engineer.

A PCQCP that was previously approved by the Engineer no more than one year prior to the beginning of work on this contract will be acceptable for the entire period of this contract, provided the Engineer determines the PCQCP is for the same type of work that is to be performed on this contract.

An amended PCQCP or addendum shall be submitted to, and approved in writing by the Engineer, for any proposed revisions to the approved PCQCP. An amended PCQCP or addendum will be required for any revisions to the PCQCP, including but not limited to changes in concrete plants or source materials, changes in material testing procedures and testing labs, changes in procedures and equipment, changes in QC personnel, or updated systems for tracking and identifying precast elements. The Engineer shall have 2 weeks to complete the review of the amended PCQCP or addendum, once a complete submittal has been received. Work that is affected by any of the proposed revisions shall not be performed until the amended PCQCP or addendum has been approved.

After final approval of the PCQCP, amended PCQCP, or addendum, the Contractor shall submit 7 copies to the Engineer of each of these approved documents.

It is expressly understood that the Engineer's approval of the Contractor's PCQCP shall not relieve the Contractor of any responsibility under the contract for the successful completion of the work in conformance with the requirements of the plans

and specifications. The Engineer's approval shall neither constitute a waiver of any of the requirements of the plans and specifications nor relieve the Contractor of any obligation thereunder, and defective work, materials, and equipment may be rejected notwithstanding approval of the PCQCP.

REPORTING

The QC Inspector shall provide reports to the QCM on a daily basis for each day that precasting operations are performed.

A daily production log for precasting shall be kept by the QCM for each day that precasting operations, including setting forms, placing reinforcement, setting prestressing steel, casting, curing, post tensioning, and form release, are performed. The log shall include the facility location, and shall include specific description of casting or related operations, any problems or deficiencies discovered, any testing or repair work performed, and the names of all QC personnel and the specific QC inspections they performed that day. The daily report from each QC Inspector shall also be included in the log. This daily log shall be available for viewing by the Engineer, at the precasting facility.

All reports regarding material tests and any required survey checks shall be signed by the person that performed the test or check, and then submitted directly to the QCM for review and signature prior to submittal to the Engineer. Corresponding names shall be clearly printed or typewritten next to all signatures.

The Engineer shall be notified immediately in writing when any precasting problems or deficiencies are discovered and also of the proposed repair or process changes required to correct them. The Engineer shall have 4 weeks to review these procedures. No remedial work shall begin until the Engineer approves these procedures in writing.

A. Reports of all material tests and any required survey checks;
B. Documentation that the Contractor has evaluated all tests and corrected all rejected deficiencies, and all repairs have been re-examined with the required tests and found acceptable; and
C. Daily production log.

At the completion of any precast element, and if the QCM determines that element is in conformance with these special provisions, the QCM shall sign and furnish to the Engineer, a certificate of compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications. This certificate of compliance shall be submitted with the Precast Report. The certificate shall state that all of the materials and workmanship incorporated in the work, and all required tests and inspections of this work, have been performed in conformance with the details shown on the plans and the provisions of the Standard Specifications and these special provisions.

PAYMENT

In the event the Engineer fails to complete the review of 1) a PCQCP, 2) an amended PCQCP or addendum, or 3) a proposed repair or process change, within the time allowed, and if, in the opinion of the Engineer, completion of the work is delayed or interfered with by reason of the Engineer's delay in completing the review, the Contractor will be compensated for any resulting loss, and an extension of time will be granted, in the same manner as provided for in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

All required repair work or process changes required to correct precasting operation deficiencies, whether discovered by the QCM, QC Inspector, or by the Engineer, and any associated delays or expenses to the Contractor caused by performing these repairs, shall be at the Contractor's expense.

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

SECTION 8-3. WELDING

8-3.01 WELDING

GENERAL

Flux core welding electrodes conforming to the requirements of AWS A5.20 E6XT-4 or E7XT-4 shall not be used to perform welding for this project.

Wherever reference is made to the following AWS welding codes in the Standard Specifications, on the plans, or in these special provisions, the year of adoption for these codes shall be as listed:

AWS Code	Year of Adoption
D1.1	2000
D1.4	1998
D1.5 (metric only)	2002
D1.6	1999

Requirements of the AWS welding codes shall apply unless specified otherwise in the Standard Specifications, on the plans, or in these special provisions. Wherever the abbreviation AWS is used, it shall be equivalent to the abbreviations ANSI/AWS or ANSI/AASHTO/AWS.

Sections 6.1.1.1 of AWS D 1.5 is replaced with the following:

Quality Control (QC) shall be the responsibility of the Contractor. As a minimum, the Contractor shall perform inspection and testing of each weld joint prior to welding, during welding, and after welding as specified in this section and to ensure that materials and workmanship conform to the requirements of the contract documents.

Sections 6.1.3 through 6.1.4.3 of AWS D 1.1, Section 7.1.2 of AWS D 1.4, and Sections 6.1.1.2 through 6.1.3.3 of AWS D 1.5 are replaced with the following:

The QC Inspector shall be the duly designated person who acts for and on behalf of the Contractor for inspection, testing, and quality related matters for all welding.

Quality Assurance (QA) is the prerogative of the Engineer. The QA Inspector is the duly designated person who acts for and on behalf of the Engineer.

The QC Inspector shall be responsible for quality control acceptance or rejection of materials and workmanship, and shall be currently certified as an AWS Certified Welding Inspector (CWI) in conformance with the requirements in AWS QC1, "Standard and Guide for Certification of Welding Inspectors."

The QC Inspector may be assisted by an Assistant QC Inspector provided that this individual is currently certified as an AWS Certified Associate Welding Inspector (CAWI) in conformance with the requirements in AWS QC1, "Standard and Guide for Certification of Welding Inspectors." The Assistant QC Inspector may perform inspection under the direct supervision of the QC Inspector within visible and audible range. The QC Inspector shall be responsible for signing all reports and for determining if welded assemblies conform to workmanship and acceptance criteria. The ratio of QC Assistants to QC Inspectors shall not exceed 5 to 1.

When the term "Inspector" is used without further qualification, it shall refer to the QC Inspector.

Section 6.14.6, "Personnel Qualification," of AWS D 1.1, Section 7.7.6, "Personnel Qualification," of AWS D 1.4, and Section 6.1.3.4, "Personnel Qualification," of AWS D 1.5 are replaced with the following:

Personnel performing nondestructive testing (NDT) shall be qualified and certified in conformance with the requirements of the American Society for Nondestructive Testing (ASNT) Recommended Practice No. SNT-TC-1A and the Written Practice of the NDT firm. The Written Practice of the NDT firm shall meet or exceed the guidelines of the ASNT Recommended Practice No. SNT-TC-1A. Only individuals who are either 1) certified as an NDT Level II technician, or 2) Level III technicians who hold a current ASNT Level III certificate in that discipline and are authorized and certified to perform the work of Level II technicians, shall perform NDT, review the results, and prepare the written reports.

Section 6.5.4 of AWS D 1.5 is replaced with the following:

The QC Inspector or CAWI shall inspect and approve each joint preparation, assembly practice, welding technique, joint fit-up, and the performance of each welder, welding operator, and tack welder to make certain that the applicable requirements of this code and the approved WPS are met. The QC Inspector shall examine the work to make certain that it meets the requirements of Sections 3 and 6.26. The size and contour of all welds shall be measured using suitable gages. Visual inspection for cracks in welds and base metal, and for other discontinuities should be aided by strong light magnifiers, or such other devices as may be helpful. Acceptance criteria different from those specified in this code may be used when approved by the Engineer.

Section 6.6.5, "Nonspecified Nondestructive Testing Other Than Visual," of AWS D 1.1, Section 6.6.5 of AWS D 1.4 and Section 6.6.5 of AWS D 1.5 shall not apply.

For any welding, the Engineer may perform or direct the Contractor to perform NDT that is in addition to the visual inspection or NDT specified in the AWS welding codes, in the Standard Specifications, or in these special provisions to verify that the welds are free of defects as defined by the AWS codes specified in this contract. The Contractor will not be entitled to compensation for additional NDT performed by the Engineer. All additional NDT directed by the Engineer that is

performed by the Contractor will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications. The cost of labor and consumables for this additional NDT shall not exceed the cost of any regularly scheduled NDT of the same type on this project. Should any welding defects be discovered by this additional NDT, all costs associated with the repair of the deficient area, including NDT of the weld repair and any delays caused by the repair shall be at the Contractor's expense.

In addition to the requirement outlined in the applicable AWS codes, all joints and portions thereof welded in conformance with the Standard Specifications Section 55, Structural Steel, shall meet the following requirements:

- Weld surfaces shall be ground smooth and flush when noted on the plans.
- Welds indicated to be subject to tensile forces that receive Radiographic Testing (RT) shall be ground smooth and flush on both sides by the Contractor prior to RT.
- Groove weld surface profiles that interfere with the performance of the NDT procedure or produce questionable test results shall be ground smooth and blended with the adjacent material.
- Fillet weld surface profiles that interfere with the performance of the NDT procedure or produce questionable test results shall be ground to blend the toes smoothly with adjacent base metal.

Questionable test results are defined as test results containing relevant or non-relevant indications or results from a situation where a defect may have been masked by the weld profile. Finger dampening the ultra-sonic (UT) signal shall not be considered resolution of questionable test results.

Required repair work to correct welding deficiencies discovered by visual inspection or NDT, or by additional NDT directed or performed by the Engineer, and any associated delays or expenses caused to the Contractor performing the repairs, shall be at the Contractor's expense.

The Engineer shall have the authority to verify the qualifications or certifications of any welder, QC Inspector, or NDT personnel to specified levels by retests as defined by AWS 1.5 or other means approved by the Engineer.

QC inspections shall be provided to ensure continuous inspection when any welding is being performed. Continuous inspection, as a minimum, shall include (1) having QC Inspectors continually present on the shop floor or project site when any welding operation is being performed, and (2) having a QC Inspector within such close proximity of all welders or operators so that inspections by the QC Inspector of each operation, at each welding location, shall not lapse for a period exceeding 30 minutes.

Inspection and approval of all joint preparations, assembly practices, joint fit-ups, welding techniques, and the performance of each welder, welding operator, and tack welder shall be documented by the QC Inspector on a daily basis for each day that welding is performed. For each inspection, the QC Inspector shall confirm and document compliance with the requirements of the AWS code criteria and the requirements of these special provisions on all weld joints before welding, during welding, and after the completion of each weld.

When joint details that are not prequalified to the details of Section 3 of AWS D1.1 or the details of Figure 2.4 or 2.5 of AWS D1.5 are proposed for use in the work, the joint details, their intended locations, and proposed welding parameters and essential variables shall be approved by the Engineer. The Engineer shall have 14 days to complete the review of the proposed joint detail locations. In the event the Engineer fails to complete the review within the time allowed, and if, in the opinion of the Engineer, completion of the work is delayed or interfered with by reason of the Engineer's delay in completing the review, the Contractor will be compensated for any resulting costs, and an extension of time will be granted, in the same manner as provided for in Section 8-1.09, "Right of Way Delays," of the Standard Specifications. Upon approval of the joint detail locations, and qualification of the non-standard joint details, welders and welding operators using these details shall perform a qualification test plate using the Weld Procedure Specification (WPS) variables and the joint detail to be used in production. The test plate shall have the maximum thickness to be used in production and shall have a minimum length of 180 mm and minimum 460 mm finish welded width. The test plate shall be mechanically and radiographically tested.. Mechanical and radiographic testing and acceptance criteria shall be as specified in the applicable AWS codes.

The Engineer will witness qualification tests for WPSs. An approved independent third party will witness the qualification tests for welders or welding operators. The independent third party shall be a current CWI as certified by the American Welding Society and shall not be employed by the contractor performing the welding. The Contractor shall allow the Engineer 14 days to review the qualifications and copy of the current certification of the independent third party. In the event the Engineer fails to complete the review within the time allowed, and if, in the opinion of the Engineer, completion of the work is delayed or interfered with by reason of the Engineer's delay in completing the review, the Contractor will be compensated for any resulting costs, and an extension of time will be granted, in the same manner as provided for in Section 8-1.09, "Right of Way Delays," of the Standard Specifications. Five days notice shall be provided to the Engineer prior to any qualification tests being completed. Witnessing of qualification tests by the Engineer shall not constitute approval of the intended joint locations, welding parameters, or essential variables.

In addition to the requirements outlined in the appropriate code, the period of effectiveness for a welder's or welding operator's qualification shall be a maximum of 3 years for the same weld process, welding position, and weld type. If production welding will be performed without gas shielding, then qualification shall also be without gas shielding. Excluding welding of seismic performance critical members, a valid qualification at the beginning of work on a contract will be acceptable for the entire period of the contract, as long as the welder's work remains satisfactory.

In addition to the requirements of AWS D1.5 Sections 5.12 or 5.13, the following requirements shall be met when qualifying welding procedures:

- ♦ Unless considered prequalified, fillet welds, including reinforcing fillet welds, shall be qualified in each position. The fillet weld soundness test shall be conducted using the essential variables of the WPS as established by the Procedure Qualification Record (PQR).
- ♦ Tests to qualify a groove weld WPS shall use Figure 5.1.
- ♦ Qualification testing of non-standard joints shall use a Fig. 5.3 qualification plate and shall be welded in accordance with Section 5.13 using a subset of the parameters permitted by WPSs qualified to Section 5.12 or 5.13. The WPS for the non-standard joint shall then be written within the essential variable limitations of Table 5.3.
- ♦ The travel speed, amperage and voltage values that are used for tests conducted per Section 5.12 or 5.13 shall be consistent for each pass in a weld joint, and shall in no case vary by more than plus or minus 10% for travel speed, plus or minus 10% for amperage, and plus or minus 7% for voltage as measured from a pre-determined target value or the average. Multiple zones within a weld joint may be qualified with the approval of the Engineer.
- ♦ For WPS qualified per Section 5.13, the values to be used for calculating ranges for amperage, voltage, and travel speed are to be based on the average of all weld passes made in the test. Heat input shall be calculated using the average of amperage, voltage, and travel speed of all weld passes made in the test for WPS qualified per Section 5.12 or 5.13.
- ♦ 3 Macroetch tests are required for all WPS qualification tests. Acceptance is per Section 5.19.3.
- ♦ When a weld joint is to be made using a combination of qualified WPSs, each process is to be qualified separately.
- ♦ When a weld joint is to be made using a combination of qualified and prequalified processes, the WPS needs to reflect both processes and the limitations of essential variables for both processes. This includes weld bead placement.
- ♦ Prior to preparing mechanical test specimens, the PQR welds shall be inspected visually and by radiographic tests. Backing bar shall be 75 mm in width and remain in place during NDT testing. Results of the visual and radiographic tests are to comply with Section 6.26.2, excluding Section 6.26.2.2. Test plates that do not comply with both tests are not to be used.

WELDING QUALITY CONTROL

Welding quality control shall conform to the requirements in the AWS specified welding codes, the Standard Specifications, and these special provisions.

Unless otherwise specified, welding quality control shall apply when any work is welded in conformance with the provisions in Section 49, "Piling," Section 52, "Reinforcement," Section 55, "Steel Structures," or Section 75-1.035, "Bridge Joint Restrainer Units," of the Standard Specifications.

In addition, welding quality control shall apply when welding is performed for the following work:

A. Miscellaneous metal

The welding of seismic performance critical members (SPCM) shall conform to the provisions specified in the Fracture Control Plan (FCP) and the contract.

The Contractor shall designate in writing a welding Quality Control Manager (QCM). The QCM shall be responsible directly to the Contractor for the quality of welding, including materials and workmanship, performed by the Contractor and subcontractors.

The QCM shall be the sole individual responsible to the Contractor for submitting, receiving, reviewing, and approving all correspondence, required submittals, and reports to and from the Engineer. The QCM shall be a professionally registered engineer or shall be currently certified as CWI or CAWI.

The QCM shall not be employed or compensated by any subcontractor, or by other persons or entities hired by subcontractors, who will provide other services or materials for the project. The QCM may be an employee of the Contractor.

Welding inspection personnel or NDT firms to be used in the work shall not be employed or compensated by any subcontractor, or by other persons or entities hired by subcontractors, who will provide other services or materials for the project, except for the following conditions:

A. The work is welded in conformance with AWS D1.5 or AWS D1.1 as applicable to the work being performed and is performed at a permanent fabrication or manufacturing facility which is certified under the AISC Quality Certification Program, Category Cbr, Major Steel Bridge. Additionally, work performed under AWS D1.5 shall have Fracture Critical endorsement F.
B. The welding is performed on pipe pile material at a permanent pipe manufacturing facility where an automatic welding process or seamless pipe operation is used in conformance with the requirements in the applicable welding code as specified elsewhere in these special provisions.

For welding performed at such facilities, the inspection personnel or NDT firms may be employed or compensated by the facility performing the welding provided that there is a complete separation between the QC and production departments. A complete separation shall mean that all inspections and tests listed in section 6 of AWS D1.5, and all QC inspections listed in the special provisions shall be performed by personnel that are employed by the QC Department, and are not employed in any production capacity.

Prior to submitting the Welding Quality Control Plan (WQCP) required herein, a pre-welding meeting between the Engineer, the Contractor's QCM, a representative from each entity performing welding for this project, and a representative from the QC firm, shall be held to discuss the requirements for the WQCP.

The Contractor shall submit to the Engineer, in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications, 2 draft copies of a separate WQCP for each item of work for each subcontractor and supplier which welding is to be performed.

The Contractor shall allow the Engineer 14 days to review the WQCP submittal after a complete plan has been received. No welding shall be performed until the WQCP is approved in writing by the Engineer. In the event the Engineer fails to complete the review within the time allowed, and if, in the opinion of the Engineer, completion of the work is delayed or interfered with by reason of the Engineer's delay in completing the review, the Contractor will be compensated for any resulting loss, and an extension of time will be granted, in the same manner as provided for in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

An amended WQCP or any addendum to the approved WQCP shall be submitted to, and approved in writing by the Engineer, for proposed revisions to the approved WQCP. An amended WQCP or addendum will be required for revisions to the WQCP, including but not limited to a revised WPS, additional welders, changes in NDT firms or procedures, QC, or NDT personnel, or updated systems for tracking and identifying welds. The Engineer shall have 14 days to complete the review of the amended WQCP or addendum. Work affected by the proposed revisions shall not be performed until the amended WQCP or addendum has been approved. In the event the Engineer fails to complete the review within the time allowed, and if, in the opinion of the Engineer, completion of the work is delayed or interfered with by reason of the Engineer's delay in completing the review, the Contractor will be compensated for any resulting loss, and an extension of time will be granted, in the same manner as provided for in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

Each WQCP shall include the following items, as determined by the Engineer. The WQCP shall be divided into the designated sections with each revision and addendum clearly annotated and numbered. Each welding and NDT firm shall have separate sections for each firm.

Organization

A. The name of the welding firm.
B. Name of QCM hired by Contractor, if applicable.
C. Name of Quality Control Inspection Firm hired by Contractor, if applicable.
D. Name of NDT Firm hired by Contractor, if applicable.
E. Organizational chart showing the QCM, all subcontractors performing welding, QC firms and personnel, and NDT firms and personnel.

Qualifications / Certifications

F. Copy of AISC Category III Certification, if applicable.
G. Name, qualifications, and copies of certifications for the following individuals:
   i. QCM, if applicable.
   ii. QC Inspectors
   iii. Assistant QC Inspectors

H. Copies of all certifications for welders for each welding process and position that will be used, and the joint detail. Certifications shall list the filler metals used, test position, base metal and thickness, tests performed, and the witnessing authority. The submitted documentation shall be approved by the Engineer prior to any project welding being performed by a welder or welding operator.
I. A master list of qualified welders that will document the welders and welding operators name, ID, the qualified welding process, welding position, and the date for each individual qualification and person qualified.
J. The written description of the contractors process for maintaining and providing the Engineer a current master list of qualified welders and welding operators that documents the names of each welder with the process, position, and date qualified as described in item "I" above.

QC Procedures

K. The methods and frequencies for performing all required visual inspections and documentation by which continuous visual inspection will not lapse for a period exceeding 30 minutes.
L. A written description of the system and method of documentation the contractor will use for the identification and tracking of all welds, NDT, any required repairs, and re-inspection of non-conforming welds. The contractors system shall include provisions for permanently identifying each weld and the person who performed the weld, NDT, inspection, and repair.
M. Copies of the Quality Control forms to be used to include certificates of compliance, daily production logs, daily reports, and visual inspection report forms.
N. Documentation of the Filler metal, flux, Filler metal Flux combination and shielding gas certifications to be used in the work and documentation of manufacturer's recommended filler metal operating ranges.
O. Authorized copy or original codebook for each of all AWS welding codes and the FCP, which are applicable to the welding being performed.
P. Standard procedures for performing non-critical repair welds. Noncritical repair welds are-defined as welds to deposit additional weld beads or layers to compensate for insufficient weld size and to fill limited excavations that were performed to remove unacceptable edge or surface discontinuities, overlap or undercut. The depth of these excavations shall not exceed 65 percent of the specified weld size.

WPS and PQR

Q. Pre-qualified Welding Procedure Specifications (WPS), if applicable.
R. Documentation, when applicable, of Procedure Qualification Record (PQR) tests within the allowable period of effectiveness.
S. Name of independent third party who performed or witnessed qualification tests, if applicable.
T. Non-prequalified Welding Procedure Specifications (WPSs) supported by PQR testing.
U. Documentation from the Engineer approving any deviation from non-standard joint details, code requirements or other contract documents.

NDT Other Than Visual Procedures

V. Written Practice of the NDT inspection personnel or firm.
W. Name of certifying authority and outside Level III, if applicable.
X. Names, qualifications, and documentation of certifications of NDT personnel to be used to include level of certifications and expiration date.
Y. List of NDT equipment, calibration procedures, frequencies and current qualification/calibration documentation of equipment to be used.
Z. Procedures, methods and frequencies for performing all required NDT as required by the specification to include minimum amounts required.
AA. Code of Safe Practices when Radiographic Testing (RT) is performed.
BB. A written description of the system for placing all identification and tracking information on each radiograph when Radiographic Testing (RT) is performed.
CC. Copies of NDT report forms to be used.

After final approval of the WQCP, amended WQCP, or addendum, the Contractor shall submit 7 copies to the Engineer of the approved documents. A copy of the Engineer approved document shall be available at each location where welding is to be performed.

It is expressly understood that the Engineer's approval of the Contractor's WQCP shall not relieve the Contractor of any responsibility under the contract for the successful completion of the work in conformance with the requirements of the plans and specifications. The Engineer's approval shall not constitute a waiver of any requirement of the plans and specifications

nor relieve the Contractor of any obligation thereunder; and defective work, materials, and equipment may be rejected notwithstanding approval of the WQCP.

A daily production log for welding shall be kept by the QCM for each day that welding is performed. The log shall clearly indicate the locations of all welding. The log shall include the welders' names, amount of welding performed, any problems or deficiencies discovered, and any testing or repair work performed, at each location. The daily report from each QC Inspector shall also be included in the log.

The following items shall be included in a Welding Report that is to be submitted to the Engineer within 10 days following the performance of any welding:

A. Reports of all visual weld inspections and NDT.
B. Radiographs and radiographic reports, and other required NDT reports.
C. Documentation that the Contractor has evaluated all radiographs and other nondestructive tests and corrected all rejectable deficiencies, and all repaired welds have been reexamined by the required NDT and found acceptable.
D. Daily production log.

Radiographic envelopes shall have clearly written on the outside of the envelope the following information: name of the QCM, name of the nondestructive testing firm, name of the radiographer, date, contract number, complete part description, and all included weld numbers or a report number, as detailed in the WQCP. In addition, all innerleaves shall have clearly written on them the part description and all included weld numbers, as detailed in the WQCP.

Reports regarding NDT shall be signed by both the NDT technician and the person that performed the review, and then submitted directly to the QCM for review and signature prior to submittal to the Engineer. Corresponding names shall be clearly printed or typewritten next to all signatures.

The Engineer will review the Welding Report to determine if the Contractor is in conformance with the WQCP. Unless otherwise specified, the Engineer shall be allowed 10 days to review the report and respond in writing after a complete Welding Report has been received. Prior to receiving notification from the Engineer of the Contractor's conformance with the WQCP, the Contractor may encase in concrete or cover welds for which a Welding Report has been submitted. However, should the Contractor elect to encase or cover those welds prior to receiving notification from the Engineer, it is expressly understood that the Contractor shall not be relieved of the responsibility for incorporating material in the work that conforms to the requirements of the plans and specifications. Material not conforming to these requirements will be subject to rejection. Should the Contractor elect to wait to encase or cover welds pending notification by the Engineer, and in the event the Engineer fails to complete the review within the time allowed, and if, in the opinion of the Engineer, completion of the work is delayed or interfered with by reason of the Engineer's delay in completing the review, the Contractor will be compensated for any resulting loss, and an extension of time will be granted, in the same manner as provided for in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

The QC Inspector shall provide reports to the QCM on a daily basis for each day that welding is performed.

Except for noncritical weld repairs, the Engineer shall be notified immediately in writing when welding problems, deficiencies, base metal repairs, or any other type of repairs not submitted in the WQCP are discovered and also of the proposed repair procedures to correct them. The Contractor shall allow the Engineer 10 days to review these procedures. No remedial work shall begin until the repair procedures are approved in writing by the Engineer. In the event the Engineer fails to complete the review within the time allowed, and if, in the opinion of the Engineer, completion of the work is delayed or interfered with by reason of the Engineer's delay in completing the review, the Contractor will be compensated for any resulting loss, and an extension of time will be granted, in the same manner as provided for in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

The QCM shall sign and furnish to the Engineer, a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for each item of work for which welding was performed. The certificate shall state that all of the materials and workmanship incorporated in the work, and all required tests and inspections of this work, have been performed in conformance with the details shown on the plans, the Standard Specifications, and these special provisions.

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

SECTION 8-4. AUDITS

8-4.01 AUDITS

Manufacturing or fabrication of the following materials shall not commence at a facility, nor will working drawings be accepted for submittal for those materials prior to the Engineer or his authorized representative completing or waiving a

facility audit (Department audit) and issuing an audit report determining that the facility is in compliance with the "Manufacturing and Fabrication Self Qualification Audit" (MFSQA) and other contract requirements.

CABLE TIE DOWN
PRESTRESSING HIGH STRENGTH ROD (PIER E2)
FURNISH BEARINGS
TOWER SUSPENDER ASSEMBLIES
FURNISH STRUCTURAL STEEL (BRIDGE)
FURNISH STRUCTURAL STEEL (BRIDGE) (TOWER)
FURNISH STRUCTURAL STEEL (BRIDGE) (TOWER STRUT)
FURNISH STRUCTURAL STEEL (BRIDGE) (ORTHOTROPIC BOX GIRDER)
FURNISH STRUCTURAL STEEL (BRIDGE) (SADDLE)
FURNISH STRUCTURAL STEEL (BRIDGE) (PIPE BEAMS)
FURNISH SUSPENDER SYSTEM
FURNISH STRUCTURAL STEEL (BRIDGE) (BIKEPATH)
FURNISH PWS CABLE SYSTEM
FURNISH AND INSTALL SHEAR KEY (PIER E2)
CLEAN AND PAINT (STRUCTURAL STEEL)
CLEAN AND PAINT STRUCTURAL STEEL (TOWER)
CLEAN AND PAINT STRUCTURAL STEEL (ORTHOTROPIC BOX GIRDER)
CLEAN AND PAINT CABLE SYSTEM
CLEAN AND PAINT STRUCTUAL STEEL (BIKEPATH)

The Contractor shall submit a MFSQA of each facility considered for use by the Contractor or any subcontractor, supplier, or fabricator, including those of all lower subcontracted tiers, to prepare materials for incorporation into the project for which a Department audit is required. Minor component materials and tools supplied which are incidental to the work will not require a MFSQA or be subject to a Department audit, as approved by the Engineer. A copy of the MFSQA form is included as a Material Information Handout in "Project Information," of these special provisions. The form is also available at the following website

http://www.dot.ca.gov/hq/esc/Translab/smbpubs.htm

A Department audit will assess the accuracy of the manufacturer's or fabricator's responses to the questions in the MFSQA, and of the documentation provided regarding the manufacturer's or fabricator's quality control program. Inaccuracies in the MFSQA discovered by the Department's audit will result in the contractor failing that audit. Deductions from the payment to the contractor for failing an audit are as specified in this section. This deduction will be in addition to deductions as specified elsewhere in these specifications. Within 2 weeks of completing the audit, the Engineer will furnish an audit report assessing the facility's compliance with the MFSQA and other contract requirements.

In order to have successfully completed an audit, there shall be only affirmative or not applicable responses to all the questions listed in the MFSQA with included documentation and information to substantiate responses. Facilities that respond to questions with contingencies may qualify for a contingent pass for both the MFSQA review and Department audit if a complete and orderly description of how the facility intends and is capable of meeting the MFSQA item. If there are non-applicable questions, the comment field must provide an explanation, which may be supplemented by additional documentation, if necessary. A negative response to any question in the MFSQA checklist during the audit may result in the determination that the facility is not in compliance with the contract requirements and shall be noted in the audit report.

The Engineer will approve or fail each MFSQA in writing. Should a facility fail a MFSQA, the manufacturer or fabricator must improve the facility to satisfy all requirements in this Contract prior to submitting a revised MFSQA. The Contractor shall submit for the approval of the Engineer, the revised MFSQA and a report of how deficiencies that were noted by the Engineer have been corrected, or notify the Engineer that the particular facility will not be used for the project. The time allowed for the revised MFSQA review shall not be less than the time specified for the initial MFSQA review.

The Contractor shall not request a Department Audit of a facility until its MFSQA is approved in writing by the Engineer. For MFSQA forms received with the bid, the Contractor shall allow the Engineer 28 days from the pre-award qualifications meeting to review the submittal. For manufacturers and suppliers identified subsequent to bid and/or award, the Contractor shall allow the Engineer 14 days from receipt of a complete MFSQA to review the submittal. In the event the Engineer fails to complete the review within the time allowed, and if, in the opinion of the Engineer, completion of the work is delayed or interfered with by reason of the Engineer's delay in completing the review, the Contractor will be compensated

for any resulting loss, and an extension of time will be granted, as provided for in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

The Contractor is responsible for conducting and reviewing the MFSQA of each specified subcontractor, supplier, and fabricator, including those of all lower subcontracted tiers. The MFSQA may be considered part of documentation demonstrating how the shop will meet the Contract requirements. Deficiencies in the MFSQA noted by the Contractor shall be corrected or otherwise satisfactorily addressed prior to submission of the MFSQA to the Department. Deficiencies noted by the Department prior to Award may be cause for determination that the bidder is not capable of meeting the contract requirements.

Prior to requesting the first Department audit, a general steel meeting shall be held between the Engineer, the Contractor, and the QCM. This meeting shall be held in the San Francisco Bay Area. At least 7 days prior to this meeting, the Contractor shall submit a complete list of facilities (noting changes from the list submitted at bid time with the questionnaire) that will be used for the manufacture and fabrication of structural steel items of materials for which a Department audit is required. The facility list shall include the mailing address, the physical address, the owners, the managers, the specific description(s) of the items (as shown in the Engineer's Estimate) and approximate total weight that are to be produced at the respective facility. The list shall designate the sequence in which the facilities are to be audited and shall be regularly updated by the Contractor as audits take place and additional audits are requested. If a fabricator or manufacturer has more than one facility where work will be performed, each facility shall be listed separately and are subject to independent audits, including self qualification audits.

The Contractor shall request, in writing, a Department audit in sufficient advance of the work so as to not impact it. The Contractor shall allow the Engineer 50 days from the date of receipt of the request to complete the first four Department audits. If audits of more than four facilities are requested at one time, the time to be allowed for completing each audit shall be not less than 50 days plus 7 days for each additional facility. After the first four audits and if no audits are currently scheduled, the Contractor shall allow the Engineer 21 days from the date of receipt of the request to complete the Department audits. If audits of more than one facility are requested at one time, the time to be allowed for completing each audit shall be not less than 14 days plus 7 days for each additional facility. The Engineer may waive a Department audit at its discretion only. Should the Engineer, through no fault of the Contractor, fail to complete a given audit within the time specified, and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in completing said audit, the delay will be considered a right of way delay in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

It shall be the Contractor's responsibility to ensure that the facility personnel provide the Engineer sufficient access and cooperation so that the Engineer can complete the audit within the time specified. The Engineer shall be permitted to photograph the facility's capabilities as part of the Department's audit. The Contractor's Quality Control Manager (QCM) and the facility quality control personnel shall be present and cooperative during the Engineer's audit.

Successful completion of an audit shall not relieve the Contractor of the responsibility for furnishing materials or producing finished work of the quality specified in these special provisions and as shown on the plans.

If given a contingent pass, a second Department audit may be required before the facility can commence work, based on the magnitude of the contingencies provided by the Contractor. The method prescribed by the contractor in the MFSQA to substantiate a contingency item must be fully enacted prior to requesting a second Department audit, if necessary. The Department will not designate a facility as having passed a Department audit unless all contingency items are corrected to become affirmative answers. No deduction will be taken for facilities that qualify for a contingent pass, but require a second Department audit as long as that facility passes the second Department audit. Should the manufacturer or fabricator fail a required second Department audit after having received a contingent pass on the first Department audit, a deduction from the payment to the Contractor in the amount of $22,000 shall apply.

Should a facility fail the Department audit, the manufacturer or fabricator must improve the facility to satisfy all requirements in this Contract prior to requesting another audit. The Contractor shall include, in the request for another audit, a report of how deficiencies that were noted by the Engineer have been corrected. The time allowed for any re-audits shall not be less than the time specified for the initial audit, and a revised audit sequence shall be submitted. Should the manufacturer or fabricator fail the first Department audit and require any additional audits, a deduction from the payment to the Contractor in the amount of $22,000 shall apply.

Should the manufacturer or fabricator fail the second Department audit after having failed the first Department audit, an additional deduction per re-audit shall apply for the greater of $22,000 or $.04 per kilogram of steel produced at that facility, not to exceed $45,000. Should a facility be added to the contract post award, but a self audit for that facility is not included with the Pre-award Information/Questionnaire, it is recognized that the Department has been adversely affected in it's ability to perform audits in a timely manner. As such, the cost of conducting an additional Department Audit is $22,000, which is to be deducted from payments due to the Contractor. Additional subcontractors added subsequent to bid may be added without penalty, if it can be demonstrated that the subcontractor was not considered prior to bid, as determined by the Engineer. It is expected that the Contractor will have sufficient facilities selected at bid time to perform the work.

At the Contractor's option, the Contractor may replace a facility that fails an audit with a new facility. All the previously specified audit requirements shall apply to replacement facilities. The time required for review of the MFSQA and the

Department audit shall be as previously specified. A new audit list with sequence designation shall be submitted with the Contractor's audit for the replacement facility.

No more than 3 Department audits will be performed for a given facility.

If a facility fails the third Department audit, deductions will be made for materials produced by that facility. Deductions will be made to compensate for the additional quality assurance inspection and testing that will be performed by the Engineer in the absence of an approved audit. Whereas it is and will be impractical and extremely difficult to ascertain and determine the actual increase in such expense it is agreed that payment to the Contractor for furnishing the materials will be reduced as follows. If the facility is within 480 airline kilometers from both Sacramento and Los Angeles, the deduction shall be $0.08 per kg of steel item produced at this facility or $22,000, whichever is greater. If the facility is more than 480 airline kilometers from both Sacramento and Los Angeles, the deduction shall be $0.10 per kg of steel item produced at this facility or $22,000, whichever is greater. These deductions for failure of the third audit shall be in addition to deductions for inspection by the Engineer as specified elsewhere in these special provisions.

Successful completion of a Department audit does not relieve bidders of the responsibility for furnishing materials or producing finished work of the quality specified in these special provisions and shown on the plans.

Costs incurred as a result of preparing MFSQA forms prior to bid opening shall be considered as included in the cost of preparing bids and no separate payment will be made therefore under the contract. Costs incurred preparing MFSQA forms and Department audits after bid opening shall be considered as included in the various contract items involved and no separate payment will be made therefore, except as provided for below.

The Department has determined the need for the early manufacturing and fabrication shop audit approval. The Contractor shall be reimbursed for each approved Department audit for each shop that fabricates material for each of the following items only:

1. Furnish Structural Steel (Bridge) (Tower)
2. Furnish Structural Steel (Bridge) (Orthotropic Box Girder)
3. Furnish Structural Steel (Bridge) (Saddle)
4. Furnish PWS Cable System
5. Clean and Paint Structural Steel (Tower)
6. Clean and Paint Structural Steel (Orthotropic Box Girder)
7. Clean and Paint Cable System

Payment will be made for each approved Department audit for the above listed items, according to the following schedule.

Days from Contract Award:	Payment amount:
0 - 90	$100,000
90 – 180	$ 75,000
180 – 365	$ 45,000

No partial payments will be made for audits approved after one year from Contract Award. Payments shall be considered a partial payment under the various contract items listed above pursuant to the provisions in Section 9-1.06, "Partial Payments" of the Standard Specifications. At no time shall the total partial payment amount for all shop audits for each contract item above exceed 20 percent of the total contract item price. The contract item partial payment shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work as specified herein.

SECTION 9. DESCRIPTION OF BRIDGE WORK

The bridge work to be done consists, in general, of constructing the following structures as shown on the plans:

SAN FRANCISCO OAKLAND BAY BRIDGE EAST SPAN
SELF-ANCHORED SUSPENSION (SAS) BRIDGE
(Bridge No. 34-0006 L/R)

A. Two span self-anchored suspension bridge approximately 625 meters long and 77 meters wide consisting of an orthotropic steel box girder superstructure.
B. Pier W2: Reinforced concrete cap beam.
C. Tower: Steel tower consisting of 4 tower shafts.
D. Pier E2: Reinforced concrete cap beam.

SECTION 10. CONSTRUCTION DETAILS

SECTION 10-1. GENERAL

10-1.01 ORDER OF WORK

Order of work shall conform to the provisions in Section 5-1.05, "Order of Work," of the Standard Specifications and these special provisions.

Attention is directed to "Strong Motion Detection System," of these special provisions regarding the order of work concerning electrical work for the seismic monitoring system.

No above ground electrical work shall be performed on any system within the project site until all Contractor-furnished electrical materials for that individual system have been tested and delivered to Contractor.

For each box girder location at Pier E2, the shear key shall be installed before the spherical bushing bearings are installed.

The State will furnish to the Contractor working drawings for the as-fabricated tower footing and a steel template with holes that correspond to the as-fabricated location of the tower anchorage anchor bolt pipe sleeves and dowels no later than March 31, 2007, in accordance with the requirements in "STEEL STRUCTURES," subsection "TEMPLATE," of these special provisions.

DESIGNATED PORTIONS OF WORK

Attention is directed to "Beginning Of Work, Time Of Completion And Liquidated Damages," of these special provisions. The designated portions of work shall be defined as follows:

Designated Portion of Work - Phase 1

The Designated Portion of Work – Phase 1 shall be defined as the completion of all work required for the W2 capbeam through Step 3.2 as shown on the "Pier W2 Construction Sequence" plan sheet. This phase also includes removal of all temporary works in Area FP.

Designated Portion of Work - Phase 2

The Designated Portion of Work – Phase 2 shall be defined as including the following items of work:

1. All work necessary to allow the completion of Hinge "K" by the YBI Structures contractor prosecuting Contract No. 04-0120P4 as provided for under "Cooperation," of these special provisions. Temporary supports shall be fully released and shall be clear of any superstructure member by a minimum of 2 meters in any direction.
2. Cable wrapping in the area west of Pier W2(including saddle housings and cable shrouds).
3. Painting of the cable system in the area west of Pier W2
4. Removal of all temporary works in the area west of Pier W2.
5. Dehumidification of cable loop.
6. All mechanical, electrical and access details west of Pier W2.

At the completion of the Designated Portion of Work – Phase 2, the contractor shall vacate the area west of the W2 centerline to allow completion of the Hinge K closure pour by the 04-0120P4 Contractor.

Designated Portion of Work – Phase 3

The Designated Portion of Work – Phase 3 shall be defined as the completion of all elements of the work, as shown on the plans and special provisions, required to place traffic on the structure in the westbound direction with no further lane closures required and no work to be performed over traffic to complete Phase 4.

Designated Portion of Work - Phase 4

The Designated Portion of Work – Phase 4 shall be defined as the completion of all the remaining work, including the following items of work:

1. Complete removal of the temporary towers
2. Tower fender
3. Tower Skirt
4. Traveler installation
5. Internal deck painting

6. Final paint coat below deck level
7. Dehumidification System (except cable loop dehumidification)
8. Access details below the roadway level
9. Eastbound access details
10. Final tightening of the eastbound barriers
11. Eastbound electrical and mechanical work
12. Eastbound Hinge A joint seal assembly
13. Eastbound striping and signs
14. Bike path striping and joint sealing
15. Bike path railing and lighting

Attention is directed to "Maintaining Traffic" of these special provisions and construction sequences as shown on the plans.

Attention is directed to "Progress Schedule (Critical Path Method)" of these special provisions regarding the submittal of a general time-scaled logic diagram within 10 days after approval of the contract. The diagram shall be submitted prior to performing any work that may be affected by any proposed deviations to the construction staging of the project.

The work shall be performed in conformance with construction sequences shown on the plans and these special provisions. Nonconflicting work in subsequent sequences may proceed concurrently with work in preceding sequences, provided satisfactory progress is maintained in the preceding sequences of construction.

Attention is directed to "General Migratory Bird Treaty Act," "Environmental Work Restrictions," and "Environmentally Sensitive Areas (General)," of these special provisions.

Not less than 60 days prior to applying seeds, the Contractor shall furnish the Engineer a statement from the vendor that the order for the seed required for this contract has been received and accepted by the vendor. The statement from the vendor shall include the names and quantity of seed ordered and the anticipated date of delivery.

Attention is directed to "Move In/Move Out (Erosion Control)" in these special provisions regarding the mobilization of equipment and materials for erosion control work.

Attention is directed to "Fiber Rolls" of these special provisions, regarding restrictions for erosion control (Type D) operations.

10-1.02 WATER POLLUTION CONTROL

Water pollution control work shall conform to the provisions in Section 7-1.01G, "Water Pollution," of the Standard Specifications and these special provisions.

This project lies within the boundaries of the San Francisco Bay Regional Water Quality Control Board (RWQCB).

The State Water Resources Control Board (SWRCB) has issued a permit to the Department which governs storm water and non-storm water discharges from its properties, facilities and activities. The Department's Permit is entitled: "Order No. 99-06-DWQ, NPDES No. CAS000003, National Pollutant Discharge Elimination System (NPDES) Permit, Storm Water Permit and Waste Discharge Requirements (WDRs) for the State of California, Department of Transportation Properties, Facilities, and Activities." Copies of the Department's Permit are available for review from the SWRCB, Storm Water Permit Unit, 1001 "I" Street, P.O. Box 1977, Sacramento, California 95812-1977, Telephone: (916) 341-5254, and may also be obtained from the SWRCB Internet website at: http://www.swrcb.ca.gov/stormwtr/caltrans.html.

The Department's Permit references and incorporates by reference the current Statewide General Permit issued by the SWRCB entitled "Order No. 99-08-DWQ, National Pollutant Discharge Elimination System (NPDES) General Permit No. CAS000002, Waste Discharge Requirements (WDRs) for Discharges of Storm Water Associated with Construction Activity," which regulates discharges of storm water and non-storm water from construction activities disturbing 0.4-hectare or more of soil in a common plan of development. Sampling and analysis requirements as specified in SWRCB Resolution No. 2001-46 are added to the Statewide General Permit. Copies of the Statewide General Permit and modifications thereto are available for review from the SWRCB, Storm Water Permit Unit, 1001 "I" Street, P.O. Box 1977, Sacramento, California 95812-1977, Telephone: (916) 341-5254 and may also be obtained from the SWRCB Internet website at: http://www.swrcb.ca.gov/stormwtr/construction.html.

The NPDES permits that regulate this project, as referenced above, are hereafter collectively referred to as the "Permits."

This project shall conform to the Permits and modifications thereto. The Contractor shall maintain copies of the Permits at the project site and shall make the Permits available during construction.

The Permits require the preparation of a Storm Water Pollution Prevention Plan (SWPPP). The SWPPP shall be prepared in conformance with the requirements of the Permits, the Department's "Storm Water Pollution Prevention Plan (SWPPP) and Water Pollution Control Program (WPCP) Preparation Manual," and the Department's "Construction Site Best Management Practices (BMPs) Manual," including addenda to those permits and manuals issued up to and including the date of advertisement of the project. These manuals are hereinafter referred to, respectively, as the "Preparation Manual" and the "Construction Site BMPs Manual," and collectively, as the "Manuals." Copies of the Manuals may be obtained from the

Department of Transportation, Material Operations Branch, Publication Distribution Unit, 1900 Royal Oaks Drive, Sacramento, California 95815, Telephone: (916) 445-3520, and may also be obtained from the Department's Internet website at: http://www.dot.ca.gov/hq/construc/stormwater/stormwater1.htm.

The Contractor shall know and fully comply with applicable provisions of the Permits and all modifications thereto, the Manuals, and Federal, State, and local regulations and requirements that govern the Contractor's operations and storm water and non-storm water discharges from both the project site and areas of disturbance outside the project limits during construction. Attention is directed to Sections 7-1.01, "Laws to be Observed," and 7-1.12, "Indemnification and Insurance," of the Standard Specifications.

The Permits shall apply to storm water and certain permitted non-storm water discharges from areas outside the project site which are directly related to construction activities for this contract including, but not limited to, asphalt batch plants, material borrow areas, concrete plants, staging areas, storage yards and access roads. The Contractor shall comply with the Permits and the Manuals for those areas and shall implement, inspect and maintain the required water pollution control practices. The Engineer shall be allowed full access to these areas during construction to assure Contractor's proper implementation of water pollution control practices. Installing, inspecting and maintaining water pollution control practices on areas outside the highway right of way not specifically arranged and provided for by the Department for the execution of this contract, will not be paid for.

The Contractor shall be responsible for penalties assessed or levied on the Contractor or the Department as a result of the Contractor's failure to comply with the provisions in this section "Water Pollution Control" including, but not limited to, compliance with the applicable provisions of the Permits, the Manuals, and Federal, State and local regulations and requirements as set forth therein.

Penalties as used in this section, "Water Pollution Control," shall include fines, penalties and damages, whether proposed, assessed, or levied against the Department or the Contractor, including those levied under the Federal Clean Water Act and the State Porter-Cologne Water Quality Control Act, by governmental agencies or as a result of citizen suits. Penalties shall also include payments made or costs incurred in settlement for alleged violations of the Permits, the Manuals, or applicable laws, regulations, or requirements. Costs incurred could include sums spent instead of penalties, in mitigation or to remediate or correct violations.

RETENTION OF FUNDS

Notwithstanding any other remedies authorized by law, the Department may retain money due the Contractor under the contract, in an amount determined by the Department, up to and including the entire amount of Penalties proposed, assessed, or levied as a result of the Contractor's violation of the Permits, the Manuals, or Federal or State law, regulations or requirements. Funds may be retained by the Department until final disposition has been made as to the Penalties. The Contractor shall remain liable for the full amount of Penalties until such time as they are finally resolved with the entity seeking the Penalties.

The Engineer will retain an amount equal to $500,000 for each estimate period in which the Contractor fails to conform to the provisions of this section as determined by the Engineer. Retention of funds for failure to conform to the provisions in this section, "Water Pollution Control," shall be in addition to the other retention amounts required by the contract, and to any retentions due to a failure to comply with the permit or any other local, State, or federal requirement. The amounts retained for the Contractor's failure to conform to provisions in this section will be released for payment on the next monthly estimate for partial payment following the date when an approved SWPPP has been implemented and maintained, and when water pollution has been adequately controlled, as determined by the Engineer.

When a regulatory agency identifies a failure to comply with the Permits and modifications thereto, the Manuals, or other Federal, State or local requirements, the Department may retain money due the Contractor, subject to the following:

A. The Department will give the Contractor 30 days notice of the Department's intention to retain funds from partial payments which may become due to the Contractor prior to acceptance of the contract. Retention of funds from payments made after acceptance of the contract may be made without prior notice to the Contractor.
B. No retention of additional amounts out of partial payments will be made if the amount to be retained does not exceed the amount being withheld from partial payments pursuant to Section 9-1.06, "Partial Payments," of the Standard Specifications.
C. If the Department has retained funds, and it is subsequently determined that the State is not subject to the entire amount of the Costs and Liabilities assessed or proposed in connection with the matter for which the retention was made, the Department shall be liable for interest on the amount retained for the period of the retention. The interest rate payable shall be 6 percent per annum.

The Contractor shall notify the Engineer immediately upon request from the regulatory agencies to enter, inspect, sample, monitor, or otherwise access the project site or the Contractor's records pertaining to water pollution control work.

The Contractor shall provide copies of correspondence, notices of violation, enforcement actions or proposed fines by regulatory agencies to the Engineer within one day of receiving any of the documents.

STORM WATER POLLUTION PREVENTION PLAN PREPARATION, APPROVAL AND AMENDMENTS

As part of the water pollution control work, a Storm Water Pollution Prevention Plan (SWPPP) is required for this contract. The SWPPP shall conform to the provisions in Section 7-1.01G, "Water Pollution," of the Standard Specifications, the requirements in the Manuals, the requirements of the Permits, and these special provisions. Upon the Engineer's approval of the SWPPP, the SWPPP shall be considered to fulfill the provisions in Section 7-1.01G, "Water Pollution," of the Standard Specifications for development and submittal of a Water Pollution Control Program.

No work having potential to cause water pollution shall be performed until the SWPPP has been approved by the Engineer. Approval shall not constitute a finding that the SWPPP complies with applicable requirements of the Permits, the Manuals and applicable Federal, State and local laws, regulations, and requirements.

The Contractor shall designate a Water Pollution Control Manager. The Water Pollution Control Manager shall be responsible for the preparation of the SWPPP and required modifications or amendments, and shall be responsible for the implementation and adequate functioning of the various water pollution control practices employed. The Contractor may designate different Water Pollution Control Managers to prepare the SWPPP and to implement the water pollution control practices. The Water Pollution Control Managers shall serve as the primary contact for issues related to the SWPPP or its implementation. The Contractor shall submit to the Engineer a statement of qualifications, describing the training, previous work history and expertise of the individual selected by the Contractor to serve as Water Pollution Control Manager. The Water Pollution Control Manager shall have a minimum of 24 hours of formal storm water management training or certification as a Certified Professional in Erosion and Sediment Control (CPESC). The Engineer will reject the Contractor's submission of a Water Pollution Control Manager if the submitted qualifications are deemed to be inadequate.

The SWPPP shall apply to the areas within and those outside of the highway right of way that are directly related to construction operations including, but not limited to, asphalt batch plants, material borrow areas, concrete plants, staging areas, storage yards, and access roads.

The SWPPP shall incorporate water pollution control practices in the following categories:

A. Soil stabilization.
B. Sediment control.
C. Wind erosion control.
D. Tracking control.
E. Non-storm water management.
F. Waste management and materials pollution control.

The following contract items of work shall be incorporated into the SWPPP as "Temporary Water Pollution Control Practices": Temporary Concrete Washout Facility, Temporary Cover, Move In/Move Out (Temporary Erosion Control), and Temporary Perimeter Barrier (Type WM-1.8). The Contractor's attention is directed to the special provisions provided for Temporary Water Pollution Control Practices.

The following contract items of work, as shown on the project plans or as specified elsewhere in these special provisions, shall be identified in the SWPPP as permanent water pollution control practices: Erosion Control (Type B) and Erosion Control (Type D). These permanent water pollution control practices shall be utilized during the construction period. The Contractor shall maintain and protect the permanent water pollution control practices throughout the duration of the project and shall restore these controls to the lines, grades and condition shown on the plans prior to acceptance of the contract.

The SWPPP shall include, but not be limited to, the items described in the Manuals, Permits and related information contained in the contract documents.

The Contractor shall develop and include in the SWPPP the Sampling and Analysis Plan(s) as required by the Permits, and modifications thereto, and as required in "Sampling and Analytical Requirements" of this section.

The Contractor shall develop a Water Pollution Control Schedule that describes the timing of grading or other work activities that could affect water pollution. The Water Pollution Control Schedule shall be updated by the Contractor to reflect changes in the Contractor's operations that would affect the necessary implementation of water pollution control practices.

The Contractor shall complete the "Construction Site BMPs Consideration Checklist" presented in the Preparation Manual and shall incorporate water pollution control practices into the SWPPP. Water pollution control practices include the "Minimum Requirements" and other Contractor-selected water pollution control practices from the "Construction Site BMPs Consideration Checklist" and the "Project-Specific Minimum Requirements" identified in the Water Pollution Control Cost Break-Down of this section.

No later than 20 days after the approval of the contract or six months prior to beginning work having potential to cause water pollution, whichever is later, the Contractor shall submit ~~3~~5 copies of the complete draft SWPPP to the Engineer. The

Engineer will have 50 days to submit the SWPPP to regulatory agencies for plan review and to review the SWPPP. If revisions are required, as determined by the Engineer, the Contractor shall revise and resubmit the SWPPP within 15 days of receipt of the Engineer's comments. The Engineer will have 15 days to review the revisions. Upon the Engineer's approval of the SWPPP, 4 approved copies of the SWPPP, incorporating the required changes, shall be submitted to the Engineer. In order to allow construction activities to proceed, the Engineer may conditionally approve the SWPPP while minor revisions are being completed. In the event the Engineer fails to complete the review within the time allowed, and if, in the opinion of the Engineer, completion of the work is delayed or interfered with by reason of the Engineer's delay in completing the review, the Contractor will be compensated for resulting losses, and an extension of time will be granted, in the same manner as provided for in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

The Contractor shall prepare an amendment to the SWPPP when there is a change in construction activities or operations which may affect the discharge of pollutants to surface waters, ground waters, municipal storm drain systems, or when the Contractor's activities or operations violate a condition of the Permits, or when directed by the Engineer. Amendments shall identify additional water pollution control practices or revised operations, including those areas or operations not identified in the initially approved SWPPP. Amendments to the SWPPP shall be prepared and submitted for review and approval within a time approved by the Engineer, but in no case longer than the time specified for the initial submittal and review of the SWPPP. At a minimum, the SWPPP shall be amended annually and submitted to the Engineer 25 days prior to the defined rainy season.

The Contractor shall keep one copy of the approved SWPPP and approved amendments at the project site. The SWPPP shall be made available upon request by a representative of the Regional Water Quality Control Board, State Water Resources Control Board, United States Environmental Protection Agency, or the local storm water management agency. Requests by the public shall be directed to the Engineer.

COST BREAK-DOWN

The Contractor shall include a Water Pollution Control Cost Break-Down in the SWPPP which itemizes the contract lump sum for water pollution control work. The Contractor shall use the Water Pollution Control Cost Break-Down provided in this section as the basis for the cost break-down submitted with the SWPPP. The Contractor shall use the Water Pollution Control Cost Break-Down to identify items, quantities and values for water pollution control work, excluding Temporary Water Pollution Control Practices for which there are separate bid items. The Contractor shall be responsible for the accuracy of the quantities and values used in the cost break-down submitted with the SWPPP. Partial payment for the item of water pollution control will not be made until the Water Pollution Control Cost Break-Down is approved by the Engineer.

Attention is directed to "Time-Related Overhead" of these special provisions regarding compensation for time-related overhead.

Line items indicated in the Water Pollution Control Cost Break-Down in this section with a specified Estimated Quantity shall be considered "Project-Specific Minimum Requirements." The Contractor shall incorporate Project-Specific Minimum Requirements with Contractor-designated quantities and values into the Water Pollution Control Cost Break-Down submitted with the SWPPP.

Line items indicated in the Water Pollution Control Cost Break-Down in this section without a specified Estimated Quantity shall be considered by the Contractor for selection to meet the applicable "Minimum Requirements" as defined in the Manuals, or for other water pollution control work as identified in the "Construction Site BMPs Consideration Checklist" presented in the Preparation Manual. In the Water Pollution Control Cost Break-Down submitted with the SWPPP, the Contractor shall list only those water pollution control practices selected for the project, including quantities and values required to complete the work for those items.

The sum of the amounts for the items of work listed in the Water Pollution Control Cost Break-Down shall be equal to the contract lump sum price bid for water pollution control. Overhead and profit, except for time-related overhead, shall be included in the individual items listed in the cost break-down.

WATER POLLUTION CONTROL COST BREAK-DOWN

Contract No. 04-0120F4

ITEM	ITEM DESCRIPTION	UNIT	ESTIMATED QUANTITY	VALUE	AMOUNT
SS-3	Hydraulic Mulch (Bonded Fiber Matrix)	M2	2500		
SS-9	Earth Dikes/Drainage Swales & Lined Ditches	M	60		
SS-11	Slope Drains	EA	6		
SC-1	Silt Fence	M	215		
SC-3	Sediment Trap	EA	2		
SC-6	Gravel Bag Berm	M	15		
SC-7	Street Sweeping and Vacuuming	LS	LUMP SUM		
SC-8	Sandbag Barrier	M	35		
SC-9	Straw Bale Barrier	M	120		
SC-10	Storm Drain Inlet Protection	EA	2		
WE-1	Wind Erosion Control	LS	LUMP SUM		
TC-1	Stabilized Construction Entrance/Exit	EA	4		
TC-2	Stabilized Construction Roadway	M3	2000		
NS-6	Illicit Connection/Illegal Discharge Detection and Reporting	LS	LUMP SUM		
NS-8	Vehicle and Equipment Cleaning	LS	LUMP SUM		
NS-9	Vehicle and Equipment Fueling	LS	LUMP SUM		
NS-10	Vehicle and Equipment Maintenance	LS	LUMP SUM		
WM-1	Material Delivery and Storage	LS	LUMP SUM		
WM-2	Material Use	LS	LUMP SUM		
WM-3	Stockpile Management	LS	LUMP SUM		
WM-4	Spill prevention and control	LS	LUMP SUM		
WM-8	Concrete Waste Management	LS	LUMP SUM		
WM-5	Solid Waste Management	LS	LUMP SUM		
WM-6	Hazardous Waste Management	LS	LUMP SUM		
WM-9	Sanitary/Septic Waste Management	LS	LUMP SUM		

TOTAL _____

Adjustments in the items of work and quantities listed in the approved cost break-down shall be made when required to address amendments to the SWPPP, except when the adjusted items are paid for as extra work.

No adjustment in compensation will be made to the contract lump sum price paid for water pollution control due to differences between the quantities shown in the approved cost break-down and the quantities required to complete the work as shown on the approved SWPPP. No adjustment in compensation will be made for ordered changes to correct SWPPP work resulting from the Contractor's own operations or from the Contractor's negligence.

The approved cost break-down will be used to determine partial payments during the progress of the work and as the basis for calculating the adjustment in compensation for the item of water pollution control due to increases or decreases of quantities ordered by the Engineer. When an ordered change increases or decreases the quantities of an approved cost break-down item, the adjustment in compensation will be determined in the same manner specified for increases and decreases in the quantity of a contract item of work in conformance with the provisions in Section 4-1.03B, "Increased or Decreased Quantities," of the Standard Specifications. If an ordered change requires a new item which is not on the approved cost break-down, the adjustment in compensation will be determined in the same manner specified for extra work in conformance with Section 4-1.03D, "Extra Work," of the Standard Specifications.

If requested by the Contractor and approved by the Engineer, changes to the water pollution control practices listed in the approved cost break-down, including addition of new water pollution control practices, will be allowed. Changes shall be included in the approved amendment of the SWPPP. If the requested changes result in a net cost increase to the lump sum price for water pollution control, an adjustment in compensation will be made without change to the water pollution control item. The net cost increase to the water pollution control item will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications.

SWPPP IMPLEMENTATION

Unless otherwise specified, upon approval of the SWPPP, the Contractor shall be responsible throughout the duration of the project for installing, constructing, inspecting, maintaining, removing, and disposing of the water pollution control practices specified in the SWPPP and in the amendments. Unless otherwise directed by the Engineer, the Contractor's responsibility for SWPPP implementation shall continue throughout temporary suspensions of work ordered in conformance with the provisions in Section 8-1.05, "Temporary Suspension of Work," of the Standard Specifications. Requirements for installation, construction, inspection, maintenance, removal, and disposal of water pollution control practices shall conform to the requirements in the Manuals and these special provisions.

If the Contractor or the Engineer identifies a deficiency in the implementation of the approved SWPPP or amendments, the deficiency shall be corrected immediately unless requested by the Contractor and approved by the Engineer in writing, but shall be corrected prior to the onset of precipitation. If the Contractor fails to correct the identified deficiency by the date agreed or prior to the onset of precipitation, the project shall be in nonconformance with this section, "Water Pollution Control." Attention is directed to Section 5-1.01, "Authority of Engineer," of the Standard Specifications, and to "Retention of Funds" of this section for possible nonconformance penalties.

If the Contractor fails to conform to the provisions of this section, "Water Pollution Control," the Engineer may order the suspension of construction operations until the project complies with the requirements of this section.

Implementation of water pollution control practices may vary by season. The Construction Site BMPs Manual and these special provisions shall be followed for control practice selection of year-round, rainy season and non-rainy season water pollution control practices.

Year-Round Implementation Requirements

The Contractor shall have a year-round program for implementing, inspecting and maintaining water pollution control practices for wind erosion control, tracking control, non-storm water management, and waste management and materials pollution control.

The National Weather Service weather forecast shall be monitored and used by the Contractor on a daily basis. An alternative weather forecast proposed by the Contractor may be used if approved by the Engineer. If precipitation is predicted, the necessary water pollution control practices shall be deployed prior to the onset of the precipitation.

Disturbed soil areas shall be considered active whenever the soil disturbing activities have occurred, continue to occur or will occur during the ensuing 21 days. Non-active areas shall be protected as prescribed in the Construction Site BMPs Manual within 14 days of cessation of soil disturbing activities or prior to the onset of precipitation, whichever occurs first.

In order to provide effective erosion control, the Contractor may be directed by the Engineer to apply permanent erosion control in small or multiple units. The Contractor’s attention is directed to "Erosion Control (Type C)," "Erosion Control (Type D)," "Fiber Rolls," and "Move-In/Move-Out (Erosion Control)" of these special provisions.

The Contractor shall implement, maintain and inspect the following temporary sediment control practices on a year-round basis. The listed practices shall remain in place until their use is no longer needed, as determined by the Engineer.

YEAR-ROUND SEDIMENT CONTROL PRACTICES	LOCATION USED
SC-7 Street Sweeping and Vacuuming	Entrance/Exit to paved roadways
TC-1 Stabilized Construction Entrance/Exit	Construction access from paved roads
TC-2 Stabilized Construction Roadway	Unstable access roadways and work areas
Temporary Perimeter Barrier`	At the limits of earthwork activity

Rainy Season Implementation Requirements

Soil stabilization and sediment control practices conforming to the requirements of these special provisions shall be provided throughout the rainy season, defined as between October 15 and April 15.

An implementation schedule of required soil stabilization and sediment control practices for disturbed soil areas shall be completed no later than 20 days prior to the beginning of each rainy season. The implementation schedule shall identify the soil stabilization and sediment control practices and the dates when the implementation will be 25 percent, 50 percent and 100 percent complete, respectively. For construction activities beginning during the rainy season, the Contractor shall implement applicable soil stabilization and sediment control practices. The Contractor shall implement soil stabilization and sediment control practices a minimum of 10 days prior to the start of the rainy season.

Throughout the defined rainy season, the active disturbed soil area of the project site shall be not more than 2 hectares. The Engineer may approve, on a case-by-case basis, expansions of the active disturbed soil area limit. Soil stabilization and sediment control materials shall be maintained on site sufficient to protect disturbed soil areas. A detailed plan for the mobilization of sufficient labor and equipment shall be maintained to deploy the water pollution control practices required to protect disturbed soil areas prior to the onset of precipitation.

Non-Rainy Season Implementation Requirements

The non-rainy season shall be defined as days outside the defined rainy season. The Contractor's attention is directed to the Construction Site BMPs Manual for soil stabilization and sediment control implementation requirements on disturbed soil areas during the non-rainy season. Disturbed soil areas within the project shall be protected in conformance with the requirements in the Construction Site BMPs Manual with an effective combination of soil stabilization and sediment control.

MAINTENANCE

To ensure the proper implementation and functioning of water pollution control practices, the Contractor shall regularly inspect and maintain the construction site for the water pollution control practices identified in the SWPPP. The construction site shall be inspected by the Contractor as follows:

A. Prior to a forecast storm.
B. After a precipitation event which causes site runoff.
C. At 24 hour intervals during extended precipitation events.
D. Routinely, a minimum of once every 7 days

The Contractor shall use the Storm Water Quality Construction Site Inspection Checklist provided in the Preparation Manual or an alternative inspection checklist provided by the Engineer. One copy of each site inspection record shall be submitted to the Engineer within 24 hours of completing the inspection.

REPORTING REQUIREMENTS

Report of Discharges, Notices or Orders

If the Contractor identifies discharges into surface waters or drainage systems in a manner causing, or potentially causing, a condition of pollution, or if the project receives a written notice or order from a regulatory agency, the Contractor shall immediately inform the Engineer. The Contractor shall submit a written report to the Engineer within 7 days of the discharge event, notice or order. The report shall include the following information:

A. The date, time, location, nature of the operation, and type of discharge, including the cause or nature of the notice or order.
B. The water pollution control practices deployed before the discharge event, or prior to receiving the notice or order.

C. The date of deployment and type of water pollution control practices deployed after the discharge event, or after receiving the notice or order, including additional measures installed or planned to reduce or prevent reoccurrence.
D. An implementation and maintenance schedule for affected water pollution control practices.

Report of First-Time Non-Storm Water Discharge

The Contractor shall notify the Engineer at least 3 days in advance of first-time non-storm water discharge events, excluding exempted discharges. The Contractor shall notify the Engineer of the operations causing non-storm water discharges and shall obtain field approval for first-time non-storm water discharges. Non-storm water discharges shall be monitored at first-time occurrences and routinely thereafter.

Annual Certifications

By June 15 of each year, the Contractor shall complete and submit an Annual Certification of Compliance, as contained in the Preparation Manual, to the Engineer.

SAMPLING AND ANALYTICAL REQUIREMENTS

The Contractor is required to implement specific sampling and analytical procedures to determine whether BMPs implemented on the construction site are:

A. preventing pollutants that are known or should be known by permittees to occur on construction sites that are not visually detectable in storm water discharges, to cause or contribute to exceedances of water quality objectives, and
B. preventing further impairment by sediment in storm waters discharged into the San Francisco Bay due to sediment, siltation or turbidity.

Non-Visible Pollutants

The project has the potential to discharge non-visible pollutants in storm water from the construction site. The project SWPPP shall contain a Sampling and Analysis Plan (SAP) that describes the sampling and analysis strategy and schedule to be implemented on the project for monitoring non-visible pollutants in conformance with this section.

The SAP shall identify potential non-visible pollutants that are known or should be known to occur on the construction site associated with the following: (1) construction materials, wastes or operations; (2) known existing contamination due to historical site usage; or (3) application of soil amendments, including soil stabilization products, with the potential to alter pH or contribute toxic pollutants to storm water. Planned material and waste storage areas, locations of known existing contamination, and areas planned for application of soil amendments shall be shown on the SWPPP Water Pollution Control Drawings.

The SAP shall identify a sampling schedule for collecting a sample down gradient from the applicable non-visible pollutant source and a sufficiently large uncontaminated control sample during the first two hours of discharge from rain events during daylight hours which result in a sufficient discharge for sample collection. If run-on occurs onto the non-visible pollutant source, a run-on sample that is immediately down gradient of the run-on to the Department's right of way shall be collected. A minimum of 72 hours of dry weather shall occur between rain events to distinguish separate rain events.

The SAP shall state that water quality sampling will be triggered when any of the following conditions are observed during the required storm water inspections conducted before or during a rain event:

A. Materials or wastes containing potential non-visible pollutants are not stored under watertight conditions.
B. Materials or wastes containing potential non-visible pollutants are stored under watertight conditions, but (1) a breach, leakage, malfunction, or spill is observed; and (2) the leak or spill has not been cleaned up prior to the rain event; and (3) there is the potential for discharge of non-visible pollutants to surface waters or drainage system.
C. Construction activities, such as application of fertilizer, pesticide, herbicide, methyl methacrylate concrete sealant, or non-pigmented curing compound have occurred during a rain event or within 24 hours preceding a rain event, and there is the potential for discharge of pollutants to surface waters or drainage system.
D. Soil amendments, including soil stabilization products, with the potential to alter pH levels or contribute toxic pollutants to storm water runoff have been applied, and there is the potential for discharge of pollutants to surface waters or drainage system (unless independent test data are available that demonstrate acceptable concentration levels of non-visible pollutants in the soil amendment).
E. Storm water runoff from an area contaminated by historical usage of the site is observed to combine with storm water, and there is the potential for discharge of pollutants to surface waters or drainage system.

The SAP shall identify sampling locations for collecting down gradient and control samples, and the rationale for their selection. The control sampling location shall be selected where the sample does not come into contact with materials, wastes or areas associated with potential non-visible pollutants or disturbed soil areas. Sampling locations shall be shown on the SWPPP Water Pollution Control Drawings. Only trained personnel shall collect water quality samples and be identified in the SAP. Qualifications of designated sampling personnel shall describe training and experience, and shall be included in the SWPPP. The SAP shall state monitoring preparation, sample collection procedures, quality assurance/quality control, sample labeling procedures, sample collection documentation, sample shipping and chain of custody procedures, sample numbering system, and reference the construction site health and safety plan.

The SAP shall identify the analytical method to be used for analyzing down gradient and control samples for potential non-visible pollutants on the project. For samples analyzed in the field by sampling personnel, collection, analysis, and equipment calibration shall be in conformance with the Manufacturer's specifications. For samples that will be analyzed by a laboratory, sampling, preservation, and analysis shall be performed by a State-certified laboratory in conformance with 40 CFR 136. The SAP shall identify the specific State-certified laboratory, sample containers, preservation requirements, holding times, and analysis method to be used. A list of State-certified laboratories that are approved by the Department is available at the following internet site: http://www.dhs.ca.gov/ps/ls/elap/html/lablist_county.htm.

Analytical Results and Evaluation

The Contractor shall submit a hard copy and electronic copy of water quality analytical results and quality assurance/quality control data to the Engineer within 5 days of sampling for field analyses and within 30 days for laboratory analyses. Analytical results shall be accompanied by an evaluation from the Contractor to determine if down gradient samples show elevated levels of the tested parameter relative to levels in the control sample. If down gradient or downstream samples, as applicable, show increased levels, the Contractor will assess the BMPs, site conditions, and surrounding influences to determine the probable cause for the increase. As determined by the assessment, the Contractor will repair or modify BMPs to address increases and amend the SWPPP as necessary. Electronic results (in one of the following file formats: .xls, .txt, .csv, .dbs, or .mdb) shall have at a minimum the following information: sample identification number, contract number, constituent, reported value, method reference, method detection limit, and reported detection limit. The Contractor shall document sample collection during rain events.

Water quality sampling documentation and analytical results shall be maintained with the SWPPP on the project site until a Notice of Completion has been submitted and approved.

If construction activities or knowledge of site conditions change, such that discharges or sampling locations change, the Contractor shall amend the SAP in conformance with this section, "Water Pollution Control."

PAYMENT

The contract lump sum price paid for prepare storm water pollution prevention plan shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals for doing all the work involved in developing, preparing, obtaining approval of, revising, and amending the SWPPP, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Attention is directed to Section 9-1.06, "Partial Payments," and Section 9-1.07, "Payment After Acceptance," of the Standard Specifications. Payments for prepare storm water pollution prevention plan will be made as follows:

A. After the SWPPP has been approved by the Engineer, 75 percent of the contract item price for prepare storm water pollution prevention plan will be included in the monthly partial payment estimate.
B. After acceptance of the contract in conformance with the provisions in Section 7-1.17, "Acceptance of Contract," of the Standard Specifications, payment for the remaining 25 percent of the contract item price for prepare storm water pollution prevention plan will be made in conformance with the provisions in Section 9-1.07.

The contract lump sum price paid for water pollution control shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in installing, constructing, removing, and disposing of water pollution control practices, including non-storm water management, and waste management and materials pollution water pollution control practices, except those for which there is a contract item of work as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Storm water sampling and analysis will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications. No payment will be made for the preparation, collection, analysis, and reporting of storm water samples required where appropriate BMPs are not implemented prior to a rain event, or if a failure of a BMP is not corrected prior to a rain event.

For items identified on the approved Water Pollution Control Cost Break-Down, the cost of maintaining the temporary water pollution control practices shall be divided equally by the State and the Contractor as follows:

Soil Stabilization

Temporary water pollution control practices except:
SS-1 Scheduling
SS-2 Preservation of Existing Vegetation

Sediment Control

Temporary water pollution control practices except:
SC-7 Street Sweeping and Vacuuming

Wind Erosion Control

No sharing of maintenance costs will be allowed.

Tracking Control

TC-1 Stabilized Construction Entrance/Exit.

Non-Storm Water Management

No sharing of maintenance costs will be allowed.

Waste Management & Materials Pollution Control

No sharing of maintenance costs will be allowed.

The division of cost will be made by determining the cost of maintaining water pollution control practices in conformance with the provisions in Section 9-1.03, "Force Account Payment," of the Standard Specifications and paying to the Contractor one-half of that cost. Cleanup, repair, removal, disposal, improper installation, and replacement of water pollution control practices damaged by the Contractor's negligence, shall not be considered as included in the cost for performing maintenance.

The provisions for sharing maintenance costs shall not relieve the Contractor from the responsibility for providing appropriate maintenance on items with no shared maintenance costs.

Full compensation for non-shared maintenance costs of water pollution control practices, as specified in this section, "Water Pollution Control," shall be considered as included in the contract lump sum price paid for water pollution control and no additional compensation will be allowed therefor.

Water pollution control practices for which there is a contract item of work, will be measured and paid for as that contract item of work.

10-1.03 TURBIDITY CONTROL

Turbidity control work shall conform to Section 7-1.01G, "Water Pollution," of the Standard Specifications, the plans, these special provisions, and with all regulatory permits and waste discharge requirements pertaining to any work that has the potential to cause turbidity within the project limits. Turbidity control work shall consist of implementing control measures to limit transport of disturbed sediment into environmentally sensitive areas (ESA). Except as specified in the Standard Specifications and these special provisions, compliance monitoring for turbidity will be performed by the Engineer in conformance with regulatory permits, waste discharge requirements and a turbidity monitoring program developed by the Department.

Attention is directed to "Environmentally Sensitive Areas (General)" of these special provisions.

The Contractor shall be responsible for the costs and for liabilities imposed by law as a result of the Contractor's failure to comply with the provisions set forth in this section "Turbidity Control", including but not limited to, compliance with the applicable provisions of Permits, and Federal, State and local regulations. Costs and liabilities include, but are not limited to, fines, penalties, and damages whether assessed against the State or the Contractor, including those levied under the Federal Clean Water Act and the State Porter Cologne Water Quality Act.

In addition to the remedies authorized by law, money due the Contractor under the contract, in an amount determined by the Department, may be retained by the State of California until disposition has been made of the costs and liabilities.

When a regulatory agency or other third party identifies a failure to comply with the permit or any other local, State, or federal requirement, the Engineer may retain money due the Contractor, subject to the following:

A. The Department will give the Contractor 30 days notice of the Department's intention to retain funds from partial payments which may become due to the Contractor prior to acceptance of the contract. Retention of funds from payments made after acceptance of the contract may be made without prior notice to the Contractor.

B. No retention of additional amounts out of partial payments will be made if the amount to be retained does not exceed the amount being withheld from partial payments pursuant to Section 9-1.06, "Partial Payments," of the Standard Specifications.
C. If the Department has retained funds and it is subsequently determined that the State is not subject to the costs and liabilities in connection with the matter for which the retention was made, the Department shall be liable for interest on the amount retained for the period of the retention, and the rate of interest payable shall be 6 percent per annum.

Turbidity is defined as the condition that prevails when sediment and debris are suspended in water, resulting in diminished water clarity. Turbidity will be measured using an optical backscatter meter providing a minimum of 30-second weighted average turbidity reading in nephelometric turbidity units (NTU).

No later than 20 days after contract approval or six months prior to beginning work in marine environments, whichever is later, the Contractor shall submit, for review and approval by the Engineer, a Turbidity Control Plan for all work that has the potential to cause turbidity. The Contractor shall allow 50 days for the Engineer to review and approve the plan. If revisions are required, as determined by the Engineer, the Contractor shall revise and resubmit the plan within 15 days of receipt of the Engineer's comments and shall allow 15 days for the Engineer to review and approve the revisions. The Turbidity Control Plan shall describe equipment used to do work that has the potential to cause turbidity, operation schedule, deployment of turbidity control measures and containment contingency. Plans and working drawings shall be submitted in accordance with "Working Drawings" of these special provisions. Three copies of the plan shall be furnished to the Engineer initially with equal copies furnished following subsequent revisions and updating. Final approval of the plan will be subject to field testing. The Contractor shall demonstrate that the proposed turbidity control measures work as intended under actual working and field conditions. At the time of approval, the Contractor shall incorporate the turbidity control plan into the approved SWPPP via the established amendment process as described within "Water Pollution Control" of these special provisions.

All work that has the potential to cause turbidity within 100 meters of a non-land-based ESA boundary as shown on the plans shall have turbidity control measures implemented to conform with regulatory permits and to protect the ESA. The following control measure, as a minimum, shall be used and maintained within this 100 meter zone:

Construction methods that minimize sediment disturbance and drift.

In addition, if the control measure fail to adequately control turbidity in accordance with regulatory permits, the following additional control measures shall be implemented in conjunction with those listed above to enhance turbidity control:

A. Install engineered silt curtains along the ESA boundary or along the perimeter of the work area at locations where the silt curtain will remain floating during lower low tides;
B Modify size and type of marine equipment employed; and
C. Conduct work during tidal periods that result in sediment transport away from all ESA.

The tide time period shall be in accordance with the time period and tidal fluctuation outlined in the National Oceanic Atmospheric Administration (NOAA) Tide Station at Yerba Buena Island.

All removed control measures shall be disposed of in accordance with section 7-1.13, "Disposal of Material Outside the Highway Right of Way" of the Standard Specifications.

The following increases in natural background turbidity of the receiving water within the ESA will be allowed:

Natural Background Turbidity (NTU)	Allowed Increase
0 to 49	Receiving water turbidity may be increased to 50 NTU
50 and greater	10 percent

In the event that these allowable increases are exceeded for a continuous period of 4 hours; or for 8 hours or more during any 1 week period from October 1 - March 31; or for 16 hours or more in any 1 week period from April 1 - September 31, the work causing the increase shall be suspended until turbidity levels have dropped below the allowable limit for a minimum of 4 consecutive hours. The Engineer will decide if additional control measures are needed.

Temporary suspension of work shall conform to the provisions in Section 8-1.05, "Temporary Suspension of Work", of the Standard Specifications. If the Contractor fails to conform to the provisions of "Turbidity Control", the Engineer may order the suspension of specific aquatic construction operations. No further work shall be performed on the ongoing operation until the turbidity control measures are adequate and, if required by the Engineer, a revised turbidity control plan has been accepted.

If the Contractor fails to correct the identified deficiency by the date agreed upon, the project shall be in noncompliance. The Engineer will notify the Contractor in writing when the project is out of compliance with the turbidity control plan.

The State will not be liable to the Contractor for failure to accept all or any portion of an originally submitted or revised turbidity control plan, nor for any delays to the work due to the Contractor's failure to submit an acceptable turbidity control plan.

The Contractor is directed to Section 5-1.01, "Authority of Engineer," of the Standard Specifications and the payment section of these special provisions for possible noncompliance penalties.

The Engineer will retain an amount equal to $500,000 for each estimate period in which the Contractor fails to conform to the provisions of this section "Turbidity Control" as determined by the Engineer.

Retention for failure to conform to the provisions in this section "Turbidity Control" shall be in addition to the other retention amounts required by the contract, and to any retentions due to a failure to comply with the permit or any other local, State, or federal requirement.

The amounts retained for failure of the Contractor to conform to the provisions in this section will be released for payment on the next monthly estimate for partial payment, in conformance with Section 9-1.06, "Partial Payments," and Section 9-1.07, "Payment After Acceptance," of the Standard Specifications, following the date that an approved Turbidity Control Plan has been implemented and maintained, and turbidity is adequately controlled, as determined by the Engineer.

PAYMENT

The contract lump sum price paid for turbidity control shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in turbidity control complete in place, including development and submittal of the Turbidity Control Plan and removal and disposal of all measures, when no longer necessary, as specified in these special provisions, and as directed by the Engineer.

10-1.04 NON-STORM WATER DISCHARGES

Non-storm water discharges shall conform to the requirements in Section 7-1.01G, "Water Pollution" of the Standard Specifications, "Water Pollution Control" of these special provisions, and these special provisions.

EXCAVATION DEWATERING

The discharge of oil, floating materials and other deleterious substances are prohibited. Suspended solids shall be removed to the extent that deleterious bottom deposits, turbidity, and discoloration are not caused by the discharge. Compliance monitoring will be performed by the Engineer in conformance with regulatory permits, waste discharge requirements and a monitoring program developed by the Department. Turbidity will be measured in Nephelometric Turbidity Units (NTU). The point of effluent discharge shall not cause bottom sediments or aquatic vegetation to become dislodged or disturbed.

The Engineer will monitor both the discharge and the receiving water body. The observations made during monitoring will include color difference, presence of suspended material, presence of water fowl or aquatic wildlife, wind direction and velocity, tidal condition, atmospheric condition, time, and date. In addition, the observations will be supplemented with photographs. During monitoring events, the Engineer will obtain depth-averaged turbidity, dissolved oxygen, and pH measurements for the discharge and background receiving water. Depth-averaged measurements will be obtained by taking measurements from 3 points within the water column and averaging the 3 measurements: one at 0.3 m below the surface, one at mid depth, and one at 0.3 m above the bottom. In receiving waters that are less than 1.0 meter in depth, only one measurement will be taken at 0.3 m below the surface. In the event that discharges are not made directly into the San Francisco Bay, inline-sampling ports shall be installed in the system to facilitate sample collection. Monitoring measurements will be made on samples drawn from the ports.

The Engineer will perform monitoring, at a minimum, one hour before discharge, ten minutes after initiating discharge, four hours after initiating discharge, once daily after the initial startup monitoring, and upon cessation of discharge. The background receiving water turbidity, dissolved oxygen, and pH will be measured at a location that is unaffected by the discharge at the same frequency as the discharge monitoring. The observations, turbidity, dissolved oxygen, and pH measurements will be recorded daily.

The following increases in natural background conditions of the receiving water will be allowed:

Water Quality Parameter	Water Quality Limit
Natural Background Turbidity (NTU)	
0 to 49	Receiving water turbidity may be increased to 50 NTU
50 and greater	10 percent incremental increase
Natural background pH	± 0.5 pH units
Natural Background Dissolved Oxygen	5 mg/L minimum

When observations and measurements indicate that a discharge is having an effect on receiving water by more than allowed and the effect is confirmed by an additional measurement obtained no less than 15 minutes and no more than 1 hour after the initial measurement, the discharge activity shall immediately cease, and corrective actions undertaken to modify, repair, or replace the equipment used for the discharge. The resumption of discharge activities will be allowed upon approval of the corrective measures by the Engineer.

The Contractor shall submit to the Engineer, as provided in Working Drawings," of these special provisions, a Dewatering Plan that includes the following:

A. Dewatering Operation Description - written description of all dewatering operations that shall include, but is not limited to, start up date of discharge, an estimate of the discharge volume, flow rate, and frequency.
B. Working Drawings - working drawings of dewatering operations showing both a sectional and plan view that details the removal techniques for suspended solids and known or introduced contaminants. The drawings shall define the flow path and placement of pipes, hoses, pumps, treatment systems, holding tanks, and other equipment used to convey the discharge; the general position of the dewatering measures relative to the excavations undergoing dewatering; and the point of effluent discharge.

The plan shall be submitted in the draft Storm Water Pollution Prevention Plan (SWPPP) or as an amendment to the SWPPP before beginning dewatering operations.

Holding tanks for pre-discharge storage shall be transportable and totally enclosed, with a minimum holding capacity sufficient to prevent delay of other work and capable of connecting multiple tanks in series. Holding tanks shall have an inlet and outlet capable of receiving and discharging minimum flows, at a rate sufficient to reach the treatment goals. Holding tanks shall be able to accommodate temporary installation of submersible pumps.

INSPECTION

The Contractor shall conduct a daily inspection of the dewatering equipment, when in use, and ensure that all components are functional and routinely maintained to prevent leakage before removal of suspended solids and petroleum hydrocarbons. If any component of the dewatering equipment is damaged so that the performance of the equipment is diminished below allowable operational levels, the dewatering operation shall be discontinued and the component shall be repaired or replaced with substitute equipment.

SPILL CONTINGENCY

The Contractor shall prepare and submit to the Engineer a contingency plan for the management of spills or leaks of any materials or wastes that may impact the water quality of the San Francisco Bay.

The spill contingency plan shall be included in the draft SWPPP, as specified in "Water Pollution Control" of these special provisions.

The contingency plan shall include instructions and procedures for reporting spills, and a list of spill containment and collection materials and equipment to be maintained onsite. The contingency plan shall be reviewed and updated quarterly.

LIQUIDS, RESIDUES AND DEBRIS

The Contractor shall prevent the discharge of slurries, liquids, residues, or debris produced during the work to storm water facilities or surface waters of the State. The SWPPP shall, at a minimum, depict and describe the procedural and structural methods of detaining, collecting, and disposing of all slurries, liquids, residues, and debris associated with the operations. Sufficient redundancy shall be incorporated into the procedural and structural methods such that the slurries, liquids, residues, and debris are not conveyed into or become present in drainage systems, San Francisco Bay, or other water bodies.

PAYMENT

The contract lump sum price paid for non-storm water discharges shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in non-storm water discharges, complete in

place, as shown on the plans, as specified in the Standard Specifications, and these special provisions, and as directed by the Engineer.

10-1.05 TEMPORARY COVER

Temporary cover shall be furnished, installed, maintained, and later removed at the locations shown on the approved Storm Water Pollution Prevention Plan in conformance with "Water Pollution Control" of these special provisions, and in conformance with details shown on the plans and these special provisions.

Attention is directed to "Water Pollution Control" of these special provisions.

Temporary cover shall be one of the water pollution control practices for soil stabilization. The Storm Water Pollution Prevention Plan shall include the use of temporary cover.

MATERIALS

Temporary Cover Fabric

Temporary cover fabric shall be either a geomembrane (plastic sheeting) or a geotextile (engineering fabric) conforming to one of the following requirements:

A. Geotextile shall be a woven, slit film fabric which is also known as woven tape. The fabric shall be non-biodegradable, resistant to deterioration by sunlight, and inert to most soil chemicals. Edges of the film fabric shall be selvage or serge to prevent unraveling. The film fabric shall also conform to the following requirements:

Specification	Requirements
Grab tensile strength (25-mm grip), kilonewtons, min. ASTM Designation: D4632*	0.89
Elongation at break, percent min. ASTM Designation: D4632*	15
Toughness, kilonewtons, min. (percent elongation x grab tensile strength)	13.3
Permittivity, 1/sec, max. (liters per minute per square meter) ASTM Designation: D 4491	0.08 (244)
Ultraviolet light stability, percent tensile strength retained after 500 hours, min. ASTM Designation: D 4355 (xenon arc lamp method)	70

* or appropriate test method for specific polymer

B. Geomembrane shall consist of 0.25-mm thick, single-ply material in conformance with the requirements in ASTM Designation: D 5199.

Temporary cover fabric shall be manufactured from polyethylene or polypropylene, or comparable polymers. The polymer materials may be virgin, recycled, or a combination of virgin and recycled materials. The polymer materials shall not contain biodegradable filler materials that can degrade the physical or chemical characteristics of the finished fabric. The Engineer may order tests to confirm the absence of biodegradable filler materials in conformance with the requirements in ASTM Designation: E 204 (Fourier Transformed Infrared Spectroscopy-FTIR).

Restrainers

Restrainers for securing the temporary cover fabric on slopes and stockpiles shall consist of one or a combination of the following:

A. Gravel-filled bags used as restrainers shall be knotted, roped, and placed at a maximum of 2 m apart on the temporary cover fabric as shown on the plans. Gravel-filled bags shall be between 13 kg and 22 kg in mass, between 600 mm and 800 mm in length, and between 400 mm and 500 mm in width. Gravel bag fabric shall be non-woven polypropylene geotextile with a minimum unit weight of 270 g/m^2. The fabric shall have a minimum grab tensile strength (25-mm grip) of 0.89-kN in conformance with the requirements in ASTM Designation: D 4632, and an ultraviolet (UV) stability of 70 percent tensile strength retained after 500 hours in conformance to the requirements in ASTM Designation: D 4355, xenon arc lamp method. Gravel shall consist of non-cohesive material between 10 mm and 20 mm in diameter, free of clay balls, organic matter, and other deleterious material. The openings of filled gravel bags shall be secured to prevent escape of gravel.

B. Restrainers consisting of a steel anchor with a wooden lath shall be fabricated and placed as shown on the plans. Wooden lath shall conform to the provisions in Section 20-2.12, "Lumber," of the Standard Specifications and shall be fir or pine, 38 mm x 89 mm in size, and 2.4 m in length. The wooden lath shall be secured to the temporary cover with steel anchors placed 1.2 m apart along the lath.

The Contractor may use an alternative restrainer if approved by the Engineer in writing. The Contractor shall submit details for an alternative restrainer to the Engineer prior to installation. The alternative restrainer shall be installed and maintained in conformance with these special provisions.

INSTALLATION

Temporary cover shall be installed as follows:

A. Temporary cover fabric shall be placed and anchored as shown on the plans.
B. Abutting edges of the temporary cover fabric shall overlap a minimum of 600 mm. Non-abutting edges shall be embedded in the soil a minimum of 150 mm.
C. Restrainers shall be placed at the overlap area and along the toe of the slope. Restrainers outside the overlap areas shall be placed at a maximum spacing of 2.4 m.
D. Steel anchors shall be installed to allow the leg of the steel anchor to pierce through the temporary cover fabric into the slope with the crown section securing the wooden lath firmly against the slope.
E. Earthen berm, a linear sediment barrier, shall be constructed adjacent to the toe of the slope with a minimum height of 200 mm and a minimum width of 940 mm. The earthen berms shall be hand or mechanically compacted. Alternative linear sediment barrier may be used at the Contractor's expense if approved by the Engineer in writing .

If the Contractor removes the temporary cover in order to facilitate other work, the temporary cover shall be replaced and secured by the Contractor at the Contractor's expense.

When no longer required as determined by the Engineer, temporary cover shall become the property of the Contractor and be removed and disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Ground disturbances, including holes and depressions, caused by the installation and removal of the temporary cover shall be backfilled and repaired in conformance with the provisions in Section 15-1.02, "Preservation of Property," of the Standard Specifications.

MAINTENANCE

The Contractor shall maintain the temporary cover throughout the contract to prevent displacement or migration of the material on the slope or stockpiled.

Temporary cover shall be maintained to minimize exposure of the protected area. Restrainers shall be relocated and secured as needed to restrain the temporary cover fabric in place. Temporary cover that breaks free shall be immediately secured. Holes, tears, and voids in the temporary cover fabric shall be patched, repaired, or replaced. When patches or repairs are unacceptable as determined by the Engineer, the temporary cover shall be replaced.

Temporary cover shall be repaired or replaced on the same day when the damage occurs. Damage to the temporary cover resulting from the Contractor's vehicles, equipment, or operations shall be repaired at the Contractor’s expense.

MEASUREMENT AND PAYMENT

The quantity of temporary cover to be paid for will be measured by the square meter for the actual area covered.

The contract price paid per square meter for temporary cover shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in installing temporary cover, complete in place, including trench excavation and backfill, maintenance, and removal of temporary cover, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

No adjustment of compensation will be made for any increase or decrease in the quantities of temporary cover required, regardless of the reason for the increase or decrease. The provisions in Section 4-1.03B, "Increased or Decreased Quantities," of the Standard Specifications shall not apply to temporary cover.

10-1.06 TEMPORARY CONCRETE WASHOUT FACILITY

Temporary concrete washout facilities shall be constructed, maintained, and later removed at the locations shown on the approved Storm Water Pollution Prevention Plan in conformance with "Water Pollution Control" of these special provisions, and in conformance with details shown on the plans and these special provisions.

Attention is directed to "Water Pollution Control" of these special provisions.

Temporary concrete washout facilities shall be one of the water pollution control practices for waste management and materials pollution control. The Storm Water Pollution Prevention Plan shall include the use of temporary concrete washout facilities.

MATERIALS

Plastic Liner

Plastic liner shall be single ply, new polyethylene sheeting, a minimum of 0.25-mm thick and shall be free of holes, punctures, tears or other defects that compromise the impermeability of the material. Plastic liner shall not have seams or overlapping joints.

Gravel-filled Bags

Gravel bag fabric shall be non-woven polypropylene geotextile (or comparable polymer) and shall conform to the following requirements:

Specification	Requirements
Mass per unit area, grams per square meter, min. ASTM Designation: D 5261	270
Grab tensile strength (25-mm grip), kilonewtons, min. ASTM Designation: D4632*	0.89
Ultraviolet stability, percent tensile strength retained after 500 hours, ASTM Designation: D4355, xenon arc lamp method	70

* or appropriate test method for specific polymer

Gravel bags shall be between 600 mm and 800 mm in length, and between 400 mm and 500 mm in width.

Yarn used for binding gravel bags shall be as recommended by the manufacturer or bag supplier and shall be of a contrasting color.

Gravel shall be between 10 mm and 20 mm in diameter, and shall be clean and free from clay balls, organic matter, and other deleterious materials.

The opening of gravel-filled bags shall be secured to prevent gravel from escaping. Gravel-filled bags shall be between 13 kg and 22 kg in mass.

Straw Bales

Straw for straw bales shall conform to the provisions in Section 20-2.06, "Straw," of the Standard Specifications.

Straw bales shall be a minimum of 360 mm in width, 450 mm in height, 900 mm in length and shall have a minimum mass of 23 kg. The straw bale shall be composed entirely of vegetative matter, except for binding material.

Straw bales shall be bound by either wire, nylon or polypropylene string. Jute or cotton binding shall not be used. Baling wire shall be a minimum 1.57 mm in diameter. Nylon or polypropylene string shall be approximately 2 mm in diameter with 360 N of breaking strength.

Stakes

Stakes shall be wood or metal. Wood stakes shall be untreated fir, redwood, cedar, or pine, shall be cut from sound timber, and shall be straight and free from loose or unsound knots and other defects which would render them unfit for the purpose intended. Wood stakes shall be minimum 50 mm x 50 mm in size. Metal stakes may be used as an alternative, and shall be a minimum 13 mm in diameter. Stakes shall be a minimum 1.2 m in length. The tops of the metal stakes shall be bent at a 90-degree angle or capped with an orange or red plastic safety cap that fits snugly to the metal stake. The Contractor shall submit a sample of the metal stake and plastic cap, if used, for Engineer's approval prior to installation.

Staples

Staples shall be as shown on the plans. An alternative attachment device such as geotextile pins or plastic pegs may be used instead of staples. The Contractor shall submit a sample of the alternative attachment device for Engineer's approval prior to installation.

Signs

Wood posts for signs shall conform to the provisions in Section 56-2.02B, "Wood Posts," of the Standard Specifications. Lag screws shall conform to the provisions in Section 56-2.02D, "Sign Panel Fastening Hardware," of the Standard Specifications.

Plywood shall be freshly painted for each installation with not less than 2 applications of flat white paint. Sign letters shown on the plans shall be stenciled with commercial quality exterior black paint. Testing of paint will not be required.

INSTALLATION

Temporary concrete washout facilities shall be as follows:

A. Temporary concrete washout facilities shall be installed prior to beginning placement of concrete and located a minimum of 15 m from storm drain inlets, open drainage facilities, and water courses unless determined infeasible by the Engineer. Temporary concrete washout facilities shall be located away from construction traffic or access areas at a location determined by the Contractor and approved by the Engineer.
B. A sign shall be installed adjacent to each washout facility at a location determined by the Contractor and approved by the Engineer. Signs shall be installed in conformance with the provisions in Section 56-2.03, "Construction," and Section 56-2.04, "Sign Panel Installation," of the Standard Specifications.
C. The length and width of a temporary concrete washout facility may be increased from the minimum dimensions shown on the plans, at the Contractor's expense and upon approval of the Engineer.
D. Temporary concrete washout facilities shall be constructed in sufficient quantity and size to contain liquid and concrete waste generated by washout operations for concrete wastes. These facilities shall be constructed to contain liquid and concrete waste without seepage, spillage or overflow.
E. Berms for below grade temporary concrete washout facilities shall be constructed from compacted native material. Gravel may be used in conjunction with compacted native material.
F. Plastic liner shall be installed in below grade temporary concrete washout facilities.

Details for an alternative temporary concrete washout facility shall be submitted to the Engineer for approval at least 7 days prior to installation.

When temporary concrete washout facilities are no longer required for the work, as determined by the Engineer, the hardened concrete and liquid residue shall be removed and disposed of in conformance with the provisions in Section 15-3.02, "Removal Methods," of the Standard Specifications. Temporary concrete washout facilities shall become the property of the Contractor and be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Ground disturbance, including holes and depressions, caused by the installation and removal of the temporary concrete washout facilities shall be backfilled and repaired in conformance with the provisions in Section 15-1.02, "Preservation of Property," of the Standard Specifications.

MAINTENANCE

Temporary concrete washout facilities shall be maintained to provide adequate holding capacity with a minimum freeboard of 300 mm. Maintaining temporary concrete washout facilities shall include removing and disposing of hardened concrete and returning the facilities to a functional condition. Hardened concrete materials shall be removed and disposed of in conformance with the provisions in Section 15-3.02, "Removal Methods," of the Standard Specifications. Holes, rips, and voids in the plastic liner shall be patched and repaired by taping or the plastic liner shall be replaced. Plastic liner shall be replaced when patches or repairs compromise the impermeability of the material as determined by the Engineer.

Gravel bags shall be replaced when the bag material is ruptured or when the yarn has failed, allowing the bag contents to spill out.

Temporary concrete washout facility shall be repaired or replaced on the same day when the damage occurs. Damage to the temporary concrete washout facility resulting from the Contractor's vehicles, equipment, or operations shall be repaired at the Contractor’s expense.

MEASUREMENT AND PAYMENT

The quantity of temporary concrete washout facility to be paid for will be measured as unit determined from actual count in place.

The contract lump sum price paid for temporary concrete washout facility shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in constructing temporary concrete washout facility, complete in place, including excavation and backfill, maintenance, and removal of temporary concrete washout facility, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

No adjustment of compensation will be made for any increase or decrease in the quantities of temporary concrete washout facility required, regardless of the reason for the increase or decrease. The provisions in Section 4-1.03B, "Increased or Decreased Quantities," of the Standard Specifications shall not apply to temporary concrete washout facility.

10-1.07 MOVE-IN/MOVE-OUT (TEMPORARY EROSION CONTROL)

Move-in/move-out (temporary erosion control) shall include moving onto the project when an area is ready to receive temporary hydraulic mulch (bonded fiber matrix) as determined by the Engineer, setting up required personnel and equipment for the application of erosion control materials and moving out all personnel and equipment when temporary erosion control in that area is completed.

When areas are ready to receive applications of temporary hydraulic mulch (bonded fiber matrix), as determined by the Engineer, the Contractor shall begin erosion control work in that area within 5 days of the Engineer's notification to perform the temporary erosion control work.

Attention is directed to the requirements of temporary hydraulic mulch (bonded fiber matrix) specified elsewhere in these special provisions.

Quantities of move-in/move-out (temporary erosion control) will be determined as units from actual count as determined by the Engineer. For measurement purposes, a move-in followed by a move-out will be considered as one unit.

The contract unit price paid for move-in/move-out (temporary erosion control) shall include full compensation for furnishing all labor, materials (excluding temporary erosion control materials), tools, equipment, and incidentals and for doing all the work involved in moving in and removing from the project all personnel and equipment necessary for application of temporary erosion control, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

No adjustment of compensation will be made for increases or decreases in the quantities of move-in/move-out (temporary erosion control) required, regardless of the reason for the increase or decrease. The provisions in Section 4-1.03B, "Increased or Decreased Quantities," of the Standard Specifications shall not apply to move-in/move-out (temporary erosion control).

10-1.08 TEMPORARY PERIMETER BARRIER (TYPE WM-1.8)

Temporary perimeter barrier (Type WM-1.8) shall be furnished, constructed, maintained, and later removed as shown on the plans, as specified in these special provisions and as directed by the Engineer.

Temporary perimeter barrier (Type WM-1.8) shall consist of a wire mesh fence covered with a combination of silt fence and high visibility fabric. Given that portions of the fence will be installed on steep terrain, additional support guy wires and bracing shall be installed at posts to resist deflection due to the accumulation of built up material.

Except as otherwise specified in this section, temporary perimeter barrier (Type WM-1.8) shall conform to the plan details and the specifications for permanent fence of similar character as provided in Section 80, "Fences," of the Standard Specifications.

Used materials may be installed provided the used materials are good, sound and are suitable for the purpose intended, as determined by the Engineer.

Materials may be commercial quality provided the dimensions and sizes of the materials are equal to, or greater than, the dimensions and sizes shown on the plans or specified herein.

MATERIALS

Welded Wire Mesh

Welded wire mesh materials shall conform to the provisions in Section 80-3.01 D, ‘Wire Mesh’ of the Standard specifications and as follows:

Welded wire mesh shall have a maximum opening of 51 mm X 102 mm. The top and bottom wires shall be 10-gage and the intermediate wires and vertical stays 14-gage.

Roll length shall be a nominal 1.82 m X 15.23 m.

Silt Fence Fabric

Silt fence fabric shall be geotextile and manufactured from woven polypropylene or polymer material. Silt Fence Fabric may be virgin or recycled, or a combination of virgin and recycled polymer materials. No virgin or recycled polymer materials shall contain biodegradable filler materials that can degrade the physical or chemical characteristics of the finished fabric. The Engineer may order tests to confirm the absence of biodegradable filler materials in conformance to the requirements in ASTM Designation: E 204 (Fourier Transformed Infrared Spectroscopy-FTIR).

Silt fence fabric shall conform to the following requirements:

Specification	Requirements
Width, mm, minimum.	900
Grab tensile strength (25 mm grip), kilonewtons, minimum in each direction ASTM Designation: D 4632	0.45
Elongation, percent, minimum in each direction ASTM Designation: D 4632 (25 mm grip)	15
Ultraviolet stability, percent tensile strength retained after 500 hours, minimum ASTM Designation: D 4355 (xenon-arc lamp and water spray weathering device)	70

High Visibility Fabric

High visibility fabric shall be machine produced mesh manufactured from polypropylene or polyethylene and shall be orange in color. High visibility fabric may be virgin or recycled polymer materials, or a combination of virgin and recycled polymer materials. No virgin or recycled polymer materials shall contain biodegradable filler materials that degrade the physical or chemical characteristics of the finished fabric. High visibility fabric shall be fully stabilized ultraviolet (UV) resistant. High visibility fabric shall be a minimum of 1.22 m in width with a maximum mesh opening of 50 mm x 50 mm. High visibility fabric shall be furnished in one continuous width and shall not be spliced to conform to the specified width dimension.

Support Guy Wires

Support wires shall be 2 strand braided wire conforming to Section 80-3.01F "Miscellaneous" of the Standard Specifications.

Posts shall be metal.

Galvanizing and painting of steel items will not be required.

Concrete footings for metal posts will not be required except at angle points or locations where individual post stability would be increased by installation of a concrete footing as determined by the Engineer.

Temporary perimeter barrier (Type WM-1.8) that is damaged during the progress of the work shall be repaired or replaced by the Contractor at the Contractor's expense.

When no longer required for the work, as determined by the Engineer, temporary perimeter barrier (Type WM 1.8) shall be removed. Removed facilities shall become the property of the Contractor and shall be removed from the site of the work, except as otherwise provided in this section.

Holes caused by the removal of temporary perimeter barrier (Type WM-1.8) shall be backfilled in conformance with the provisions in the second paragraph of Section 15-1.02, "Preservation of Property," of the Standard Specifications.

MEASUREMENT AND PAYMENT

The quantity of temporary perimeter barrier (Type WM-1.8) will be measured by the meter as determined from actual measurements, the measurements to be made parallel with the ground slope along the line of the completed temporary perimeter barrier (Type WM 1.8), deducting the widths of openings.

The contract price paid per meter for temporary perimeter barrier (Type WM-1.8) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in installing temporary perimeter barrier (Type WM-1.8), complete in place, including trench excavation and backfill, and removal of temporary perimeter barrier (Type WM-1.8), as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The cost for maintaining the temporary perimeter barrier (Type WM-1.8) will be borne equally by the State and the Contractor.

The division of cost will be made by determining the cost of maintaining temporary perimeter barrier (Type WM-1.8) in conformance with the provisions in Section 9-1.03, "Force Account Payment," of the Standard Specifications and paying to the Contractor one half of that cost. Clean up, repair, removal, disposal, and replacement due to improper installation, and replacement of temporary perimeter barrier (Type WM-1.8) damaged as a result of the Contractor’s negligence will not be considered as included in the cost of maintaining temporary perimeter barrier (Type WM-1.8).

10-1.09 TEMPORARY FENCE AND GATE

Temporary fence and gate shall be furnished, constructed, maintained, and later removed as shown on the plans, as specified in these special provisions and as directed by the Engineer.

Except as otherwise specified in this section, temporary fence and gate shall be Type CL-1.8 and shall conform to the plan details and the specifications for permanent fence of similar character as provided in Section 80, "Fences," of the Standard Specifications, and these special provisions.

Used materials may be installed provided the used materials are good, sound and are suitable for the purpose intended, as determined by the Engineer.

Materials may be commercial quality provided the dimensions and sizes of the materials are equal to, or greater than, the dimensions and sizes shown on the plans or specified herein.

Galvanizing and painting of steel items will not be required.

Concrete footings for metal posts will not be required.

Temporary fence and gate that is damaged during the progress of the work shall be repaired or replaced by the Contractor at the Contractor's expense.

When no longer required for the work, as determined by the Engineer, temporary fence and gate shall be removed. Removed facilities shall become the property of the Contractor and shall be removed from the site of the work, except as otherwise provided in this section.

Removed temporary fence and gate materials that are not damaged may be constructed in the permanent work provided the materials conform to the requirements specified for the permanent work and such materials are new when used for the temporary fence.

Holes caused by the removal of temporary fence shall be backfilled in conformance with the provisions in the second paragraph of Section 15-1.02, "Preservation of Property," of the Standard Specifications.

The temporary fence and gate will be measured and paid for in the same manner specified for permanent fence of similar character as provided in Section 80, "Fences," of the Standard Specifications.

Full compensation for maintaining, removing, and disposing of temporary fence and gate shall be considered as included in the contract price paid per meter for temporary fence(Type CL-1.8) and the contract unit price paid for 3.66 m temporary gate (Type CL-1.8) respectively, and no additional compensation will be allowed therefor.

10-1.10 COOPERATION

Attention is directed to Section 5-1.20 "Areas for Contractor's Use" of these special Provisions, "Construction Details-Areas for Contractor Use" of the project plans, Section 7-1.14, "Cooperation," and Section 8-1.10, "Utility and Non-Highway Facilities," of the Standard Specifications.

It is anticipated that work by other contractors may be in progress adjacent to or within the limits of this project during progress of the work on this contract. The Contractor shall be responsible for coordinating with other contractors performing work adjacent to or within these contract limits. Contracts which may be in progress during the working period of this contract, include, but are not necessarily limited to the following:

1. Contract No. 04-012024 constructing San Francisco-Oakland Bay Bridge structures, Route 80, in the City and County of San Francisco and Alameda County, between KP 1.6 (PM 1.0) and KP 1.6 (PM 1.0), adjacent to the eastern limit of the project site.
2. Contract No. 04-0120E4 constructing Piers E2 and T1 foundations of Main Span Bridge structures, in the City and County of San Francisco, on Route 80, at Yerba Buena Island at KP 13.4 (PM 8.3) and at KP 13.8 (PM 8.6)
3. Contract No. 04-0120R4 constructing the YBI South-South Detour in the City and County of San Francisco, on Route 80, at Yerba Buena Island, between KP 12.6 (PM 7.8) and KP 13.2 (PM 8.2).
4. Contract No. 04-0120P4 reconstructing YBI Structures in the City and County of San Francisco, on Route 80, at Yerba Buena Island, between KP 12.6 (PM 7.8) and KP 13.2 (PM 8.2).
5. Contract No. 04-012044 constructing San Francisco-Oakland Bay Bridge approach structure and roadway on Route 80, between the east end of Contract 04-012024 at KP 1.6 (PM 1.0) and San Francisco-Oakland Toll Plaza at KP 3.2 (PM 2.0).
6. Contract No. 04-002974 constructing Toll Operation Building, and ramps, at the south side of the San Francisco-Oakland Toll Plaza, on Route 80, between KP 1.6 (PM 1.0) and KP 3.7 (PM 2.3), in Alameda County.
7. Contract No. 04-0435V4 providing Seismic Retrofit by Replacement, on Route 80 from West Anchorage San Francisco-Oakland Bay Bridge at KP 7.9 (PM 4.9) to 5th Street On/Off-Ramps at KP 9.5 (PM 5.9), in the City and County of San Francisco.
8. Contract No. 04-014004 constructing Maintenance Buildings and Maintenance roadway access and reconstructing ramps, on Route 80, between KP 1.6 (PM 1.0) and San Francisco-Oakland Toll Plaza at KP 3.7 (PM 2.3), in Alameda County.
9. Contract 04-0105U4 providing Bridge Deck Rehabilitation, on the West span of San Francisco-Oakland Bay Bridge, on Route 80 from San Francisco Anchorage to Yerba Buena Anchorage, from KP 9.01 (PM5.6) to KP 12.22 (PM7.6), in the City and County of San Francisco.

Once the Designated Portion of Work is completed by the Contractor, the contractor prosecuting Contract No. 04-0120P4 shall be provided full and unrestricted access to Hinge "K" work by the Contractor.

Progress schedules for the above contracts, when available, may be inspected by the Contractor. Such progress schedules are tentative and no guarantee can be made by the State that such work will actually be performed as indicated by the schedules.

The Contractor shall attend joint weekly meetings, to be organized by the Engineer with other contractors on the adjacent projects in order to minimize potential conflicts. Furthermore, the Contractor shall be responsible for coordinating with other contractors, agencies or their authorized personnel or representative performing work within these contract limits. This includes:

1. Work by State forces will be in progress within the contract limits during the working period of this contract.
2. Work by Biological Monitoring Contractor and its authorized representatives and personnel will be engaged in monitoring biological activities resulting from the State's entering into agreements with and securing permits from various Local, State and Federal agencies as specified elsewhere in these special provisions.

10-1.11 PHOTO SURVEY/PUBLIC RELATIONS

The Contractor shall provide time-lapse video and still photography to document pre-construction conditions, and progress and completion of the work, and facilitate public relation activities as directed by the Engineer. Photography will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications, and will not be considered a special service as specified in Section 9-1.03B of the Standard Specifications.

10-1.12 TRANSPORTATION FOR THE ENGINEER

The Contractor shall provide transportation for the Engineer in accordance with Section 5-1.08, "Inspection," of the Standard Specifications and these special provisions.

The Contractor shall provide, operate, berth and maintain, beginning with the first mobilization of marine equipment until contract completion, one crew boat for the sole use of the Engineer and the Engineer's staff in performance of their work. In addition, the Engineer and all authorized representatives of the State, acting within the scope of their duties in connection with the work under this contract, shall be permitted to ride as passengers, without charge, on any boat operated by, or for, the Contractor for the transportation of personnel, equipment or materials. It is agreed that such transportation will be only on the boats that are making trips in connection with the Contractor's operation.

The crew boat shall be 40 foot, adequate for open water operations, or equal, with protected seating and meeting or exceeding the following minimum requirements:

A. DRIVE POWER:

1. Engines – Diesel engines, 600 HP total, twin screw, capable of at least 25 knots.
2. Fuel Tank – 173 gal. tank

B. EQUIPMENT:

1. Aluminum or steel hull construction
2. Tires or rubber fenders for fendering around the boat
3. Mooring bits located forward and aft on boat
4. 50 lb. anchor with chain and line (adequate for specific site condition)

C. ELECTRONICS:

1. VHF/FM Radio System
2. One (1) Com 58 or equal
3. Radar system Furuno 1731, or equal
4. Depth finder digital
5. Compass Richie navigator 2 each, or equal

United States Coast Guard-approved life jackets for the Contractor's personnel shall be provided and maintained on the boats at all times, as required by the United States Coast Guard. Life jackets for the Department's visitors and representatives will be provided by the Department at no cost to the Contractor.

The contractor shall provide for the Department's visitors and representatives safe and protected permanent vertical access, as approved by the Engineer, to all marine construction equipment being utilized for construction of the project.

The Contractor shall provide safety training relative to marine transportation to the State's and the Contractor's personnel, prior to the commencement of work. Training shall include a review of the approved U.S. Coast Guard Safety Manual by all personnel prior to using the Contractor's provided marine transportation. The Contractor shall also conduct a quarterly Marine Safety Workshop for the Department's representatives.

The Contractor shall furnish a licensed boat operator and crew members, as required for the boat's operation and in accordance with all Maritime Agreements and Laws, including, but not limited to, the regulations contained in Title 46 Code of Federal Regulation Section 16 and Sections 24 through 26. The boat must have a valid U.S. Coast Guard Certificate of Inspection (COI), and must be manned and operated in accordance with the COI. The boat, boat operator and crew shall be furnished beginning with the first mobilization of marine equipment until contract completion for the duration of the contract. The boat, boat operator and crew shall be furnished for the complete duration of the work on the days when the Contractor's work is in progress and for 8 hours each day excluding Sundays and legal holidays on the days when the Contractor's work is not in progress.

The Contractor shall provide berthing facilities at the same location the Contractor utilizes for the departure of its construction crew, or at an alternate location approved by the Engineer.

The Contractor shall maintain the boat provided to the Engineer, including daily fueling, routine maintenance, equipment compliance, systems operations and the immediate repair of damage to the boat or its elements.

The boat shall remain the property of the Contractor. The boat shall not be removed from the site of the work until after acceptance of the contract.

The contract lump sum price paid for transportation for the engineer shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in providing transportation for the engineer as specified herein.

Payment for furnishing a boat, boat operator and crew prior to the times specified and in excess of the complete duration of the work on the days when the Contractor's work is in progress, in excess of 8 hours per day and on Sundays and legal holidays when the Contractor's work is not in progress will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications. No additional payment will be made for furnishing the boat, boat operator and the crew in excess of the time specified herein.

10-1.125 SOLID WASTE DISPOSAL AND RECYCLING REPORT

This work shall consist of reporting disposal and recycling of construction solid waste, as specified in these special provisions. For the purposes of this section, solid waste includes construction and demolition waste debris, but not hazardous waste.

Annually by the fifteenth day of January, the Contractor shall complete and certify Form CEM-2025, "Solid Waste Disposal and Recycling Report," which quantifies solid waste generated by the work performed and disposed of in landfills or recycled during the previous calendar year. The amount and type of solid waste disposed of or recycled shall be reported in either metric tonnes or cubic meters. The Contractor shall also complete and certify Form CEM-2025 within 5 days following contract acceptance.

Form CEM-2025, "Solid Waste Disposal and Recycling Report" can be downloaded from the following website:

http://www.dot.ca.gov/hq/construc/manual2001

If the Contractor has not submitted Form CEM-2025, by the dates specified above, the Department will withhold the amount of $10,000 for each missing or incomplete report. The moneys withheld will be released for payment on the next monthly estimate for partial payment following the date that a complete and acceptable Form CEM-2025 is submitted to the Engineer. Upon completion of all contract work and submittal of the final Form CEM-2025, remaining withheld funds associated with this section, "Solid Waste Disposal and Recycling Report," will be released for payment. Withheld funds in conformance with this section shall be in addition to other moneys withheld provided for in the contract. No interest will be due the Contractor on withheld amounts.

Full compensation for preparing and submitting Form CEM-2025, "Solid Waste Disposal and Recycling Report," shall be considered as included in the contract price for the various items of work involved and no additional compensation will be allowed therefor.

10-1.13 PROGRESS SCHEDULE (CRITICAL PATH METHOD)

Progress schedules will be required for this contract. Progress schedules shall utilize the Critical Path Method (CPM). Attention is directed to "Cooperation," and "Obstructions" of these special provisions. Nothing in these special provisions shall be construed as relieving the Contractor from the responsibilities specified in Section 7, "Legal Relations and Responsibility," of the Standard Specifications. All schedules are required to reflect a reasonable plan to execute the contract scope of work. The Contractor shall be solely responsible for the content of the schedules and the execution of all contract requirements.

The provisions in Section 8-1.04, "Progress Schedule," of the Standard Specifications shall not apply.

DEFINITIONS

The following definitions apply to this section "Progress Schedule (Critical Path Method)":

A. Activity: Any task, or portion of a project, which takes time to complete.
B. Baseline Schedule: The initial CPM schedule representing the Contractor's original work plan, as accepted by the Engineer.
C. Controlling Operation: The activity considered at the time by the Engineer, within that series of activities defined as the critical path, which if delayed or prolonged, will delay the time of completion of the contract.
D. Critical Path: The series of activities, which determines the earliest completion of the contract (Forecast Completion Date). This is the longest path of activities having the least amount of float.
E. Critical Path Method: A mathematical calculation to determine the earliest completion of the contract represented by a graphic representation of the sequence of activities that shows the interrelationships and interdependencies of the elements composing a project.
F. Contract Completion Date: The current extended date for completion of the contract shown on the weekly statement of working days furnished by the Engineer in accordance with Section 8-1.06, "Time of Completion," of the Standard Specifications.
G. Early Completion Time: The difference in time between the current contract completion date and the Contractor's scheduled early forecast completion date as shown on the accepted baseline schedule, or schedule updates and revisions.
H. Float: The amount of time between the early start date and the late start date, or the early finish date and the late finish date, of any activity or group of activities in the network.
I. Scheduled Completion Date: The completion date of the last scheduled work activity identified on the critical path.
J. Free Float: The amount of time an activity can be delayed before affecting a subsequent activity.
K. Hammock Activity: An activity added to the network to span an existing group of activities for summarizing purposes.
L. Milestone: A marker in a network, which is typically used to mark a point in time or denote the beginning or end of a sequence of activities. A milestone has zero duration, but will otherwise function in the network as if it were an activity.
M. Revision: A change in the future portion of the schedule that modifies logic, adds or deletes activities, or alters activities, sequences, or durations.
N. Tabular Listing: A report showing schedule activities, their relationships, durations, scheduled and actual dates, and float.
O. Total Float: The amount of time that an activity may be delayed without affecting the total project duration of the critical path.
P. Update Schedule: The modification of the CPM progress schedule through a regular review to incorporate actual progress to date by activity and to reflect the current plan to complete the project.
Q. Time Scaled Logic Diagram: A schematic display of the logical relationships of project activities, drawn from left to right to reflect project chronology with the positioning and length of the activity representing its duration.
R. Bar Chart (Gantt Chart): A graphic display of scheduled-related information, activities or other project elements are listed down the left side of the chart, dates are shown across the top, and activity durations are shown as date-placed horizontal bars.
S. Near Critical Path: A path having 30 days or less of total float.
T. Delay: The time period during which some part of the construction project has been extended beyond what was originally planned due to unanticipated circumstances. A delay occurs when the respective activity or group of activities, requiring additional time, impacts the completion of the successor construction activity and also extend the scheduled contract completion date.
U. Data date: The day after the date through which a schedule is current. Everything occurring earlier than the data date is "as-built" and everything on or after the data date is "planned."
V. Narrative Report: A document submitted with each schedule that discusses topics related to project progress and scheduling.
W. State Owned Float Activity: The activity documenting time saved on the critical path by actions of the State. It is the last activity prior to the scheduled completion date.
X. Time Impact Analysis: A schedule and narrative report developed specifically to demonstrate what effect a proposed change or delay has on the current scheduled completion date.

The Engineer will schedule and conduct a Preconstruction Scheduling Conference with the Contractor's Project Manager and Construction Scheduler within seven days after the bidder has received the contract for execution. At this meeting, the requirements of this section of the special provisions will be reviewed with the Contractor. The Contractor shall be prepared to discuss its schedule methodology, proposed sequence of operations, the activity identification system for labeling all work activities, the schedule file numbering system, and any deviations it proposes to make from the Stage Construction Plans. The Engineer will submit a scheduling shell project on electronic medium, displaying an activity code dictionary consisting of fields populated with the Caltrans scheduling codes, filters, layouts, report formats, contract milestones, and a resource dictionary. The Contractor shall utilize these codes, filters, layouts, etc. and may add other codes as necessary, to group and organize the work activities. Periodically the Engineer may request the Contractor to utilize additional filters, layouts or activity codes to be able to further group or summarize work activities.

Also, the Engineer and the Contractor shall review the requirements for all submittals applicable to the contract and discuss their respective preparation and review durations. All submittals and reviews are to be reflected on the Interim Baseline Schedule and the Baseline Schedule.

GENERAL SCHEDULE ITEMS

The following items are applicable to all schedules:

A. Activity identification numbers for deleted activities are not to be reused. Added activities shall be assigned a new and unique activity identification number.
B. Activity descriptions are not to be revised when the scope of the activity is changed. The existing activity shall be deleted and a new activity shall be added.
C. When forecasting new durations for activities that have not started, the original duration field shall be revised.
D. All Resource requirements shall be included for all new construction activities.
E. All activities shall have durations of not more than 20 days and not less than one day unless permitted otherwise by the Engineer.
F. All activities in the schedule, with the exception of the first and last activities, shall have a minimum of one predecessor and a minimum of one successor.
H. Negative lags shall not be assigned for any activity relationships.
I. All out of sequence activities identified on the scheduling and leveling report shall be reviewed and their relationships either verified or changed.
J. The Contractor shall not add job inefficiencies or weather days to a project calendar without prior approval by the Engineer.
K. Offsite fabrication and material/equipment delivery activities shall be sufficiently detailed to allow monitoring of schedule progress.
L. The Contractor shall provide to the Engineer two copies of all schedules on electronic medium, together with printed copies of the network diagrams or bar charts and tabular reports described under "Project Schedule Reports", and the Schedule Narrative Report.

The Engineer’s review and acceptance of schedules shall not waive any contract requirements and shall not relieve the Contractor of any obligation thereunder or responsibility for submitting complete and accurate information. Schedules that are rejected shall be corrected by the Contractor and resubmitted to the Engineer within 5 days of notification by the Engineer, at which time a new review will begin.

Errors or omissions on schedules shall not relieve the Contractor from finishing all work within the time limit specified for completion of the contract. If, after a schedule has been accepted by the Engineer, either the Contractor of the Engineer discover that any aspect of the schedule has an error or omission, it shall be corrected by the Contractor on the next update schedule.

INTERIM BASELINE SCHEDULE

Within 15 days after approval of the contract, the Contractor shall submit to the Engineer an Interim Baseline Project Schedule which will serve as the progress schedule for the first 120 days of the project, or until the Baseline Schedule is accepted, whichever is sooner. The Interim Baseline Schedule shall utilize the critical path method of scheduling. The Interim Baseline Schedule shall depict how the Contractor plans to perform the work for the first 120 days of the contract. Additionally, the Interim Baseline Schedule shall show all required submittals working drawings, and review periods, and shall provide for all permits, and other non-work activities necessary to begin the work. The Contractor shall also submit a Summary Schedule, reflecting the duration of the contract, grouped by major areas of the project identified by the scheduling codes provided in the Caltrans scheduling codes or as defined by the Engineer. This summary schedule is for information purposes only and is to be used as a reference until the Baseline Schedule is accepted.

The Interim Baseline Schedule submittal shall include the data files used to generate the schedule on electronic medium.

The Engineer shall be allowed 10 days to review the schedule and to provide comments, including the Contractor's application of the supplied activity codes. All comments are to be implemented into the Baseline Schedule. Re-submittal of the Interim Baseline Schedule is not required. Late review of the Interim Baseline Schedule shall not restrain the submittal of the Baseline Schedule. No contract payments shall be made to the Contractor until a Interim Baseline Schedule is submitted in accordance with the above requirements.

BASELINE SCHEDULE

Within 90days, after approval of the contract, the Contractor shall submit to the Engineer a Baseline Project Schedule including the incorporation of all comments provided to the Interim Baseline Schedule. The Baseline Schedule shall have a data date of the day prior to the first working day of the contract. The schedule shall not include any actual start dates, actual finish dates, or constraint dates (except for Contract Milestone dates) and activities scheduled to start or finish between the data date and the run date shall reflect dates that can be attained. The Baseline Schedule shall meet interim milestone dates, contract milestone dates, stage construction requirements, internal time constraints, show logical sequence of activities, and must not extend beyond the number of days originally provided for in the contract.

All task activities shall be assigned to a project calendar. Each calendar shall identify a workweek, and holidays. Different calendars shall be used for work activities that occur on different work schedules. Activities for the preparation and the review of submittals; offsite fabrication, and material/equipment deliveries are to be assigned to the same calendar unless approved by the Engineer. All non-activity periods for Environmental work restrictions shall be identified with the appropriate calendars.

The Baseline CPM Schedule submitted by the Contractor shall have a sufficient number of activities to assure adequate planning of the project and to permit monitoring and evaluation of progress and the analysis of time impacts. The Baseline Schedule shall depict how the Contractor plans to complete the whole work involved, and shall show all activities that define the critical path. Multiple critical paths and near-critical paths shall be kept to a minimum, as determined by the Engineer.

State owned float shall be considered a resource for the exclusive use of the State. The Engineer may accrue State owned float by the early completion of review of any type of required submittal when it saves time on the critical path. The Engineer will document State owned float by directing the Contractor to update the State owned float activity on the next schedule update. The Contractor shall include a log of the action on the State owned float activity and include a discussion of the actions in the narrative report. The Engineer may use State owned float to mitigate past or future State delays by offsetting potential time extensions.

The Contractor shall be responsible for assuring that all work sequences are logical and the network shows a coordinated plan for complete performance of the work. Failure of the Contractor to include any element of work required for the performance of the contract in the network shall not relieve the Contractor from completing all work within the time limit specified for completion of the contract. If the Contractor fails to define any element of work, activity or logic, the Contractor in the next monthly update or revision of the schedule shall correct it.

The Baseline Schedule shall be supplemented with resource allocations for every task activity to a level of detail that facilitates report generation based on labor craft and equipment class for the Contractor and subcontractors.

The Contractor shall optimize labor to reflect a reasonable plan for accomplishing the work of the contract and to assure that resources are not over committed in concurrent activities. The Contractor shall not create hammock activities for the purpose of resources loading. The Baseline Schedule shall not attribute negative float to any activity.

Along with the baseline progress schedule, the Contractor shall also submit to the Engineer time-scaled resource histograms of the labor crafts and equipment to be utilized on the contract.

Each schedule submitted to the Engineer will comply with all limits imposed by the contract, with all specified intermediate milestone and contract completion dates, and with all constraints, restraints or sequences included in the contract. The degree of detail shall include factors including, but not limited to:

A. Physical breakdown of the project;
B. Contract milestones and completion dates, substantial completion dates, constraints, restraints, sequences of work shown in the contract, the planned substantial completion date, and the final completion date;
C. Type of work to be performed, the sequences, and the major subcontractors involved;
D. All purchases, submittals, submittal reviews, manufacture, fabrication, tests, delivery, and installation activities for all major materials and equipment, including submittal of requests for audits of manufacturers and fabricators in conformance with "Manufacturing and Fabrication Qualification Audit for Materials" of these special provisions;
E. Preparation, submittal and approval of shop and working drawings and material samples, showing time, as specified elsewhere, for the Engineer's review.
F. Identification of interfaces and dependencies with preceding, concurrent and follow-on contractors, railroads, and utilities as shown on the plans or specified in the specifications;
G. Identification of each and every utility relocation and interface as a separate activity, including activity description and responsibility coding that identifies the type of utility and the name of the utility company involved;

H. Actual tests, submission of test reports, and approval of test results;
I. All start-up, testing, training, and assistance required under the Contract;
J. Punchlist and final clean-up;
K. Identification of any manpower, material, or equipment restrictions, as well as any activity requiring unusual shift work, such as double shifts, 6-day weeks, specified overtime, or work at times other than regular days or hours;
L. Identification of each and every ramp closing and opening event as a separate one day activity, including designation by activity coding and description that it is a north-bound, south-bound, east-bound, west-bound, and entry or exit ramp activity;
M. Separate resources graphs for the Contract's labor, equipment and critical path labor, with an accompanying analysis of each and explanation for any variances;
N. Equipment and labor shall be differentiated by a cost account code within the resource dictionary.
O. State owned float as the last activity in the schedule, at the end of which is the Scheduled Completion Date.

The Engineer will be allowed 30 days to review and accept or reject the baseline project schedule submitted. Rejected schedules shall be resubmitted to the Engineer within 5 days, at which time a new 15-day review period by the Engineer will begin.

PROJECT SCHEDULE REPORTS

Schedules submitted to the Engineer including Interim Baseline, Baseline, and update schedules shall include time scaled network diagrams or bar charts in a layout format requested by the Engineer. The network diagrams or bar charts submitted to the Engineer shall also be accompanied by four computer-generated mathematical analysis tabular reports for each activity included in the project schedule. The reports (215-mm x 280-mm size) shall include a network diagram report showing the activity columns only, a predecessor and successor report, a resource report (Interim Baseline and Baseline Schedules), and a scheduling and leveling calculation report. The network diagram report~~s~~ shall include, at a minimum, the following for each activity:

A. Activity number and description;
B. Activity codes;
C. Original, actual and remaining durations;
D. Early start date (by calendar date);
E. Early finish date (by calendar date);
F. Actual start date (by calendar date);
G. Actual finish date (by calendar date);
H. Late start date (by calendar date);
I. Late finish date (by calendar date);
J. Identify activity calendar ID;
K. Total Float and Free Float, in work days; and
L. Percentage complete.

Network diagrams or bar charts shall be sorted and grouped in a format requested by the Engineer reflecting the project breakdown per the Caltrans activity codes. They shall show a continuous flow of information from left to right per the project sorting and grouping codes; e.g., project milestones, submittals sub-grouped by description, and the construction activities sub-grouped by the scope breakdown structure. The primary paths of criticality shall be clearly and graphically identified on the diagrams or charts. The network diagram or bar chart shall be prepared on E-size sheets (914-mm x 1219-mm), shall have a title block in the lower right-hand corner, and a timeline on each page. Exceptions to the size of the network sheets and the use of computer graphics to generate the networks or bar charts shall be subject to the approval of the Engineer.

Schedule network diagrams the tabular reports shall be submitted to the Engineer for acceptance in the following quantities:

A. 2 sets of the Network Diagrams or Bar Charts;
B. 2 copies of the tabular reports (215-mm x 280-mm size); and
C. 2 copies on electronic medium, each with a backup of the current schedule file.

WEEKLY SCHEDULE MEETINGS

The Engineer and the Contractor shall hold weekly scheduling meetings to discuss the near term schedule activities, to address any long-term schedule issues, and to discuss any relevant technical issues. The Contractor shall develop a rolling 4-weeks schedule identifying the previous week worked and a 3-week look ahead. It shall provide sufficient detail to include

the actual and planned activities of the Contractor and all the subcontractors for offsite and construction activities, addressing all activities to be performed and to identify issues requiring engineering action or input.

Each activity in the 4 week rolling schedule should be identified by an associated CPM schedule activity ID numbering system. This schedule should not be hand written. The Contractor shall utilize a schedule layout as acceptable by the Engineer. The schedule shall be electronically submitted to the Engineer one day prior to the scheduled meeting date.

MONTHLY CASH FLOW REPORTS

The Contractor shall allocate a portion of each bid item cost to the appropriate schedule activities. A minimum of one activity shall be added to the schedule for each bid item. The total of all activity costs shall equal the total contract bid amount. This information shall be sufficient to generate a monthly cash flow report showing the anticipated monthly contract progress payments. The format for the report shall be acceptable to the Engineer. Actual Progress Payments shall be made in accordance with Standard Specification 9-1.06, Partial Payments.

MONTHLY UPDATE SCHEDULES

The Contractor shall submit a Monthly Update Schedule to the Engineer once in each month within 5 days of the data date. The proposed update schedule prepared by the Contractor shall include all information available as of the 20th day of the month, or other data date as established by the Engineer. A detailed list of all proposed schedule changes such as logic, duration, lead/lag, forecast completion date, additions and deletions shall be submitted with the update.

The Monthly Update Schedule submitted to the Engineer will be accompanied by a Schedule Narrative Report. The report shall describe the physical progress during the report period, plans for continuing the work during the forthcoming report period, actions planned to correct any negative float, and an explanation of potential delays or problems and their estimated impact on performance, milestone completion dates, forecast completion date, and the overall project completion date. In addition, alternatives for possible schedule recovery to mitigate any potential delay or cost increases shall be included for consideration by the Engineer. The report shall follow the outline set forth below:

Contractor's Schedule Narrative Report Outline:

A. Contractor's Transmittal Letter;
B. Work completed during the period;
C. Description of the current critical path;
D. Description of current problem areas;
E. Current and anticipated delays;
    1. Cause of the delay;
    2. Corrective action and schedule adjustments to correct the delay; and
    3. Impact of the delay on other activities, milestones, and completion dates;
F. Changes in construction sequences;
G. Pending items and status thereof;
    1. Permits;
    2. Change Orders;
    3. Time Extensions; and
    4. Non-Compliance Notices;
    5. Notice of Potential Claims
H. Contract completion date(s) status;
    1. Ahead of schedule and number of days; and
    2. Behind schedule and number of days; and
I. Include updated Network Diagram and Reports.
J Response to Previous Schedule Comments

Portions of the network diagram on which all activities are complete need not be reprinted and submitted in subsequent updates. However, the submitted schedule and the related reports shall constitute a clear record of progress of the work from award of contract to final completion.

On a date determined by the Engineer, the Contractor shall meet with the Engineer to review the monthly schedule update. At the monthly progress meeting, the Contractor and the Engineer shall review the updated schedule and shall discuss the content of the Narrative Report. The Engineer will be allowed 10 days after the meeting to review and accept or reject the update schedule submitted. Rejected schedules shall be resubmitted to the Engineer within 5 days, at which time a new 5-day review period by the Engineer will begin. All efforts shall be made between the Engineer and the Contractor to complete the review and the acceptance process prior to the next update schedule data date. To expedite the process, a second meeting between the Engineer and the Contractor may be held.

SCHEDULE REVISIONS

If the Contractor desires to make a change to the accepted schedule, the Contractor shall request permission from the Engineer in writing, stating the reasons for the change, and proposed revisions to activities, logic and duration. The Contractor shall submit for acceptance an analysis showing the effect of the revisions on the entire project. The analysis shall include:

A. An updated schedule not including the revisions. The schedule shall have a data date just prior to implementing the proposed revisions and includes a project completion date;
B. A revised schedule that includes the proposed revisions. The schedule will have the same data date as the updated schedule and include a project completion date;
C. The Contractor should add resources for all new activities, also adjust resources for those activities that their remaining duration were changed;
D. A narrative explanation of the revisions and their impact to the schedule;
E. Computer files of the updated schedule and the revised schedule sequentially numbered or renamed for archive (record) purposes.

The Engineer will provide a response within 10 days to Contractor's proposed schedule revisions.

Within 15 days, the Contractor shall submit a revised CPM network for approval when requested by the Engineer, or when any of the following occurs:

A. There is a significant change in the Contractor's operations that will affect the critical path;
B. The current updated schedule indicates that the contract progress is 4 weeks or more behind the planned schedule, as determined by the Engineer; or
C. The Engineer determines that an approved or anticipated change will impact the critical path, milestone or completion dates, contract progress, or work by other contractors.

The Engineer shall be allowed 10 days to review and accept or reject a schedule revision. Rejected schedule revisions shall be revised and resubmitted to the Engineer within 10 days, at which time a new 10-day review period by the Engineer will begin. Only upon approval of a change by the Engineer shall it be reflected in the next schedule update submitted by the Contractor. The revised schedule shall also include a narrative explanation of the revisions and their impact to the schedule.

TIME IMPACT ANALYSIS

When the Contractor requests a time adjustment due to contract change orders or delayed activities or if the Contractor or the Engineer considers that an approved or anticipated change will impact the critical path or contract progress, the Contractor shall submit to the Engineer a written Time Impact Analysis illustrating the impact of each change or delay to the current contract completion date or milestone completion date, utilizing the current accepted schedule. Each Time Impact Analysis shall include a schedule update (an accepted schedule with a data date within the previous month of the event) reflecting the "before conditions", and schedule revision reflecting the "after condition", both with the same data dates, demonstrating how the Contractor proposes to incorporate the change order or delay into the current schedule. The schedule revision shall include the sequence of activities and any revisions to the existing activities to demonstrate the impact of the delay, or change into the schedule. The Time Impact Analysis shall also include proposed mitigation measures or work arounds including but not limited to alternate work calendars, re-sequencing of other activities, or performing work activities out-of-sequence to minimize the impact of the change order or the delayed activities.

Each Time Impact Analysis shall demonstrate the estimated or actual time impact based on the events of delay, the estimated or actual date of the contract change order work performance, the status of construction at that point in time, and the event time computation of all activities affected by the change or delay. The event times used in the analysis shall be those included in the latest update of the current schedule in effect at the time the change or delay was encountered.

Time extensions will be granted only to the extent that equitable time adjustments for the activity or activities affected exceed the total or remaining float along the critical path of activities from the time of actual delay, or from the time the contract change order work is performed. Mitigation measures shall be included in the analysis. The Time Impact Analysis shall also consider the use of State owned float as a mitigation measure. Time extensions will not be granted nor will delay damages be paid unless:

A. The delay is beyond the control and without the fault or negligence of the Contractor and its subcontractors or suppliers, at any tier; and
B. The delay extends the actual performance of the work beyond the currently approved contract completion date.

C. The delay impacts a fabrication or construction activity – delays to the Contractor's submittal or shop drawing process must impact a successor fabrication or construction activity. The Time Impact Analysis shall be based on the impact to fabrication or construction activities.

Time Impact Analyses shall be submitted within 15 days after the delay occurs or after initiation of the contract change order. The schedule files will be submitted on electronic medium along with the Time Impact Analysis, which shall include a narrative description of the delay, its impact on contract completion or milestone dates and proposed mitigation measures. Mitigation measures utilized to minimize the impact of the change order or delay shall include but are not limited to work arounds, re-sequencing of work, alternate work calendars, increased resources, expedited procurement and use of State owned float.

A response to each Time Impact Analysis by the Engineer will be made within 15 days after receipt of the Time Impact Analysis. The Engineer's review shall utilize actual data unless it is appropriate to use estimated data. Resolution of each Time Impact Analysis by the Engineer shall be completed after all effects of the disruption are documented, which may include mitigation measures. A copy of the Time Impact Analysis accepted by the Engineer shall be returned to the Contractor and the accepted schedule revisions illustrating the impact of the contract change orders or delays shall be incorporated into the project schedule during the first update after acceptance. Until such time that the Contractor provides the analysis, the Engineer may, at his option, construct and utilize the project as-built schedule or other method to determine adjustments in contract time.

FINAL SCHEDULE UPDATE

Within 15 days after the acceptance of the contract by the Director, the Contractor shall submit a final update of the schedule with actual start and actual finish dates for all activities. This schedule submission shall be accompanied by a certification, signed by an officer of the company and the Contractor's Project Manager stating "To the best of my knowledge, the enclosed final update of the project schedule reflects the actual start and completion dates of the activities contained herein."

EQUIPMENT AND SOFTWARE

The Contractor shall provide for the State's exclusive possession and use a complete computer system specifically capable of creating, storing, updating and producing CPM schedules utilizing the latest hardware and software technology. Before delivery and setup of the computer system, the Contractor shall submit to the Engineer for approval a detailed list of all computer hardware and software the Contractor proposes to furnish. The minimum computer system to be furnished shall include the following:

A. Complete computer system, including keyboard, mouse, 530-mm color SVGA monitor (1,024x768 pixels), current Intel Pentium IV micro processor chip, or equivalent or later;
B. Computer operating system software, compatible with the selected processing unit, for Windows NT/Windows 2000, equivalent;
C. Minimum one gigbyte (1000 MB) of random access memory (RAM);
D. A 20 gigabyte minimum hard disk drive, a 1.44 megabyte 90-mm floppy disk drive, 32x speed minimum CD-RW drive, Ethernet card, two UBCUSB ports, and 56k modem;
E. A color-ink-jet plotter with a minimum 36 Megabytes RAM, capable of 300 dots per inch color, 600 dots per inch monochrome, or equivalent. Capable of printing fully legible, time scaled charts, and network diagrams, in four colors, with a minimum size of 914-mm by 1219-mm (E size) and is compatible with the selected system. Plotter paper and ink cartridges will be provided throughout the contract. HP Designjet 1055 CM, equivalent or later
F. CPM software shall be Primavera Project Planner, Version 3.1 , or later;
G. Scheduler Analyzer Pro or equivalent – a suite of programs to assist in schedule analysis, the latest version for Windows NT/ Windows 2000, or later and,
H. Microsoft Office software, the latest version for Windows NT/Windows 2000, or later, and McAfee Virus software or equivalent.

The computer hardware and software furnished shall be compatible with that used by the Contractor for the production of the CPM progress schedule required by the Contract, and shall include original instruction manuals and other documentation normally provided with the software.

The Contractor shall furnish, install, set up, maintain and repair the computer hardware and software ready for use at a location determined by the Engineer. The hardware and software shall be installed and ready for use within 30 days of the contract award. The Contractor shall provide 24 hours of formal training for the Engineer, and three other agents of the department designated by the Engineer, in the use of the hardware and software to include schedule analysis, reporting, and resource and cost allocations. An authorized vendor of Primavera Project Planner shall perform the training.

All computer hardware and software furnished shall remain the property of the Contractor and shall be removed by the Contractor upon acceptance of the contract when no claims involving contract progress are pending. When claims involving contract progress are pending, computer hardware or software shall not be removed until the final estimate has been submitted to the Contractor.

PAYMENT

Progress schedule (critical path) will be paid for at a lump sum price. The contract lump sum price paid for progress schedule (critical path) shall include full compensation for all labor, materials (including computer hardware and software), tools, equipment, and incidentals; and for doing all the work involved in preparing, furnishing, updating and revising CPM progress schedules. Also for maintaining and repairing the computer hardware and training the Engineer in the use of the computer hardware and software as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Payments for progress schedule (critical path) will be made as follows:

A. Interim baseline schedule accepted, then 10 percent payment for progress schedule (critical path) will be made.
B. Baseline schedule accepted, then 10 percent payment for progress schedule (critical path) will be made.
C. Monthly update schedules accepted, then 75 percent payment for progress schedule (critical path) will be made equally for each update.
D. Final schedule update accepted, then 5 percent payment for progress schedule (critical path) will be made.

The Department will retain an amount equal to $500,000 for each estimate period in which the Contractor fails to conform to the provisions of this section, including failure to submit an interim baseline, baseline, revised or updated CPM schedule conforming to the requirements of this section, as determined by the Engineer. Retentions for failure to submit acceptable CPM schedules shall be in additio~~nal~~ to all other retentions provided for in the contract. The retention for failure to submit acceptable CPM schedules will be released for payment on the next monthly estimate for partial payment following the date that acceptable CPM schedules are submitted to the Engineer.

The adjustment provisions in Section 4-1.03, "Changes," of the Standard Specifications, shall not apply to the item of progress schedule (critical path). Adjustments in compensation for the project schedule will not be made for any increased or decreased work ordered by the Engineer in furnishing project schedules.

10-1.14 TIME-RELATED OVERHEAD

The Contractor will be compensated for time-related overhead in conformance with these special provisions.

Attention is directed to "Beginning of Work, Time of Completion and Liquidated Damages," "Force Account Payment," and "Progress Schedule (Critical Path Method)" of these special provisions.

The provisions in Section 9-1.08, "Adjustment of Overhead Costs," of the Standard Specifications shall not apply.

Time-related overhead shall consist of those overhead costs, including field and home office overhead, that are in proportion to the time required to complete the work. Time-related overhead shall not include costs that are not related to time, including but not limited to, mobilization, licenses, permits, and other charges incurred only once during the contract.

Field office overhead expenses include time-related costs associated with the normal and recurring operations of the construction project, and shall not include costs directly attributable to the work of the contract. Time-related costs of field office overhead include, but are not limited to, salaries, benefits, and equipment costs of project managers, general superintendents, field office managers and other field office staff assigned to the project, and rent, utilities, maintenance, security, supplies, and equipment costs of the project field office.

Home office overhead or general and administrative expenses refer to the fixed costs of operating the Contractor's business. These costs include, but are not limited to, general administration, insurance, personnel and subcontract administration, purchasing, accounting, and project engineering and estimating. Home office overhead costs shall exclude expenses specifically related to other contracts or other businesses of the Contractor, equipment coordination, material deliveries, and consultant and legal fees.

The quantity of time-related overhead associated with a reduction in contract time for cost reduction incentive proposals accepted and executed in conformance with the provisions in Section 5-1.14, "Cost Reduction Incentive," of the Standard Specifications shall be considered a construction cost attributable to the resultant estimated net savings due to the cost reduction incentive.

If the final increased quantity of time-related overhead exceeds 149 percent of the number of working days specified in the Engineer's Estimate, the Contractor shall, within 60 days of the Engineer's written request, submit to the Engineer an audit examination and report performed by an independent Certified Public Accountant of the Contractor's actual overhead costs. The independent Certified Public Accountant's audit examination shall be performed in conformance with the requirements of the American Institute of Certified Public Accountants Attestation Standards. The audit examination and report shall depict the Contractor's project and company-wide financial records and shall specify the actual overall average

daily rates for both field and home office overhead for the entire duration of the project, and whether the costs have been properly allocated. The rates of field and home office overhead shall exclude unallowable costs as determined in the Federal Acquisition Regulations, 48 CFR, Chapter 1, Part 31. The audit examination and report shall determine if the rates of field office overhead and home office overhead are:

A. Allowable in conformance with the requirements of the Federal Acquisition Regulations, 48 CFR, Chapter 1, Part 31.
B. Adequately supported by reliable documentation.
C. Related solely to the project under examination.

Within 20 days of receipt of the Engineer's written request, the Contractor shall make its financial records available for audit by the State for the purpose of verifying the actual rate of time-related overhead specified in the audit submitted by the Contractor. The actual rate of time-related overhead specified in the audit, submitted by the Contractor, will be subject to approval by the Engineer.

If the Engineer requests the independent Certified Public Accountant audit, or if it is requested in writing by the Contractor, the contract item payment rate for time-related overhead, in excess of 149 percent of the number of working days specified in the Engineer's Estimate, will be adjusted to reflect the actual rate.

The cost of performing an independent Certified Public Accountant audit examination and submitting the report, requested by the Engineer, will be borne equally by the State and the Contractor. The division of the cost will be made by determining the cost of providing an audit examination and report in conformance with the provisions of Section 9-1.03B, "Work Performed by Special Forces or Other Special Services," of the Standard Specifications, and paying to the Contractor one-half of that cost. The cost of performing an audit examination and submitting the independent Certified Public Accountant audit report for overhead claims other than for the purpose of verifying the actual rate of time-related overhead shall be entirely borne by the Contractor.

The quantity of time-related overhead to be paid will be measured by the working day, designated in the Engineer's Estimate as WDAY. The estimated number of working days is the number of working days, as specified in "Beginning of Work, Time of Completion and Liquidated Damages" of these special provisions. The quantity of time-related overhead will be increased or decreased only as a result of suspensions or adjustments of contract time which revise the current contract completion date, and which satisfy any of the following criteria:

A. Suspensions of work ordered in conformance with the provisions in Section 8-1.05, "Temporary Suspension of Work," of the Standard Specifications, except:

    1. Suspensions ordered due to weather conditions being unfavorable for the suitable prosecution of the controlling operation or operations.
    2. Suspensions ordered due to the failure on the part of the Contractor to carry out orders given, or to perform the provisions of the contract.
    3. Suspensions ordered due to factors beyond the control of and not caused by the State or the Contractor, for which the Contractor is granted extensions of time in conformance with the provisions of the third paragraph of Section 8-1.07, "Liquidated Damages," of the Standard Specifications.
    4. Other suspensions that mutually benefit the State and the Contractor.

B. Extensions of contract time granted by the State in conformance with the provisions in the fifth paragraph in Section 8-1.07, "Liquidated Damages," of the Standard Specifications and set forth in approved contract change orders, in conformance with the provisions in Section 4-1.03, "Changes," of the Standard Specifications.
C. Reductions in contract time set forth in approved contract change orders, in conformance with the provisions in Section 4-1.03, "Changes," of the Standard Specifications.

In the event an early completion progress schedule, as defined in "Progress Schedule (Critical Path Method)" of these special provisions, is submitted by the Contractor and approved by the Engineer, the amount of time-related overhead eligible for payment will be based on the total number of working days for the project, in conformance with the provisions in "Beginning of Work, Time of Completion and Liquidated Damages" of these special provisions, rather than the Contractor's early completion progress schedule.

The contract price paid per working day for time-related overhead shall include full compensation for time-related overhead, including the Contractor's share of costs of the independent Certified Public Accountant audit of overhead costs requested by the Engineer, as specified in these special provisions, and as directed by the Engineer.

The provisions in Sections 4-1.03B, "Increased or Decreased Quantities," and 4-1.03C, "Changes in Character of the Work," of the Standard Specifications shall not apply to the contract item of time-related overhead.

Full compensation for additional overhead costs involved to satisfy internal milestone or multiple calendar requirements shall be considered as included in the contract items of work involved and no additional compensation will be allowed therefor.

Full compensation for additional overhead costs incurred during days of inclement weather when the contract work is extended into additional construction seasons due to delays caused by the State shall be considered as included in the time-related overhead paid during the contract working days, and no additional compensation will be allowed therefor.

Full compensation for additional overhead costs involved in performing additional contract item work that is not a controlling operation shall be considered as included in the contract items of work involved and no additional compensation will be allowed therefor.

Full compensation for overhead, other than time-related overhead measured and paid for as specified above, and other than overhead costs included in the markups specified in "Force Account Payment" of these special provisions, shall be considered as included in the various items of work and no additional compensation will be allowed therefor.

Overhead costs incurred by joint venture partners, subcontractors, suppliers or other parties associated with the Contractor shall be considered as included in the various overhead costs for which the Contractor is compensated, and no additional compensation will be allowed therefor.

For the purpose of making partial payments pursuant to the provisions in Section 9-1.06, "Partial Payments," of the Standard Specifications, the number of working days to be paid for time-related overhead in each monthly partial payment will be the number of working days, specified above to be measured for payment that occurred during that monthly estimate period, including compensable suspensions and right of way delays. Working days granted by contract change order due to extra work or changes in character of the work, will be paid for upon completion of the contract. The amount earned per working day for time-related overhead shall be the lesser of the following amounts:

A. The contract item price.
B. Fifteen percent of the original total contract amount divided by the number of working days specified in "Beginning of Work, Time of Completion and Liquidated Damages," of these special provisions.

After acceptance of the contract in conformance with the provisions in Section 7-1.17, "Acceptance of Contract," of the Standard Specifications, the amount of the total contract item price for time-related overhead not yet paid, will be included for payment in the first estimate made after acceptance of the contract in conformance with the provisions in Section 9-1.07, "Payment After Acceptance," of the Standard Specifications.

10-1.15 OBSTRUCTIONS

Attention is directed to Section 8-1.10, "Utility and Non-Highway Facilities," and Section 15, "Existing Highway Facilities," of the Standard Specifications and these special provisions.

Attention is directed to the existence of certain underground facilities that may require special precautions to be taken by the Contractor to protect the health, safety and welfare of workers and of the public. Facilities requiring special precautions include, but are not limited to: conductors of petroleum products, oxygen, chlorine, and toxic or flammable gases; natural gas in pipelines greater than 150 mm in diameter or pipelines operating at pressures greater than 415 kPa (gage); underground electric supply system conductors or cables, with potential to ground of more than 300 V, either directly buried or in a duct or conduit which do not have concentric grounded or other effectively grounded metal shields or sheaths.

The Contractor shall notify the Engineer and the appropriate regional notification center for operators of subsurface installations at least 2 days, but not more than 14 days, prior to performing any excavation or other work close to any underground pipeline, conduit, duct, wire or other structure. Regional notification centers include, but are not limited to, the following:

Notification Center	Telephone Number
Underground Service Alert-Northern California (USA)	1-800-642-2444 1-800-227-2600
Underground Service Alert-Southern California (USA)	1-800-422-4133 1-800-227-2600

10-1.16 WORKING DRAWING CAMPUS

Attention is directed to requirements of "Areas for Contractor's Use," subsection "Port of Oakland Pier 7", of these special provisions.

The objective of the working drawing campus is to prepare, submit, review and process working drawings in the shortest and most efficient manner possible. After approval of the contract, the Department will make its Design engineers available for consultation on site with the Contractor's engineers and detailers who are preparing working drawings. The effort will focus on the most critical and time dependent working drawings first to prevent delay to the project schedule. It is the

Contractor's responsibility to submit working drawings sufficiently in advance of the start of the affected work, in accordance with "Working Drawings" of these special provisions. The working drawing campus shall be available for the duration of the contract, or until no longer required as approved by the Engineer.

The Contractor shall provide the following within 60 days of contract award to facilitate early resolution of construction working drawings:

1. Suitable office facility located within area described on plot map titled "Pier 7 – Area for Contractor's Use. The facilities shall include workspace for the Contractor's staff as determined by the Contractor plus a minimum of 8 vacant, separate office cubicles or rooms intended for the use by the Department or its representatives, and a common meeting room with meeting table to seat a minimum of 10 people. The facilities shall also include access to a copier, and a fax machine. Each workspace shall include a minimum of a desk, office chair, bookshelf, phone, and T1 computer cabling. The Contractor is responsible for providing local phone service, internet access and building utility services.
2. On-site Coordination Engineer. The Coordination Engineer shall be a full time, on-site, registered Civil Engineer in the State of California, and available to coordinate, manage, and process shop/working drawings for the project.
3. Full time, on-site staff authorized by the Contractor to be capable of producing and revising working drawings, and in conjunction with such work generating and assisting in resolution of requests for information and potentially resultant change orders. It is not required that all the Contractor's design staff be located on-site.
4. Regularly scheduled submittal status meetings (daily if required) to discuss the status and resolve shop/working drawing issues, attended by representatives of the Engineer and the Contractor's coordinator and staff as appropriate.
5. Regular updates of the working drawing submittal schedule specified in "Working Drawing Submittal Schedule," of these special provisions.

If the Contractor elects to centralize their field office to the designated area on Pier 7, the Working Drawing Campus facility may be co-located within the same facility provided that the Department or its representatives have access to the Working Drawing Campus portion of the office at all times.

The Contractor shall provide a submittal for the Working Drawing Campus within the first 30 days of award of contract. The submittal shall show the location of the office, layout of the office space and meeting room, and list of the furnishings, including office computers, telephones, desks and chairs to be supplied. The Department will review within 5 days.

Conformance with these special provisions does not relieve the Contractor of the responsibility for furnishing complete shop/working drawings or producing finished work of the quality specified in the Standard Specifications, these special provisions and as shown on the plans.

The Contractor shall submit, for approval by the Engineer, a schedule of costs detailing the breakdown of the contract lump sum item. The schedule of costs shall be proportionate to the work involved and shall detail the costs and payment schedule for each cost item associated with the process entailed in obtaining approval on all approved working drawing as specified hereunder. When requested by the Engineer, the Contractor shall furnish any cost data, which might assist the Engineer in verifying one-time partial payments and establishing a suitable schedule of costs. The schedule of costs will be used to determine progress payments for " Working Drawing Campus" during the progress of the work. The schedule of costs shall be submitted to the Engineer for approval within 10 days of contract award. The Engineer shall be allowed 10 days for approval or return for correction of the submittal.

EQUIPMENT AND SOFTWARE

Attention is directed to "Integrated Shop Drawings" elsewhere in these special provisions.

The Contractor shall provide for the State's exclusive possession and use, one complete computer system specifically capable of creating, storing, and updating Integrated Shop Drawings utilizing the latest hardware technology. The software shall be identical to that used by the Contractor in generating the ISD. The software and plug-ins used to navigate, collaborate, and coordinate the checking and identification of the interferences shall also be provided. Before delivery and setup of the computer system, the Contractor shall submit to the Engineer for approval a detailed list of all computer hardware and software the Contractor proposes to furnish. The minimum computer system to be furnished shall include the following:

A. Complete computer system, including keyboard, mouse with scroll, video card with one hundred twenty eight (128) megabyte on board memory and dual ports, two 530-mm color SVGA monitors (1,024 x 78 pixels, current Pentium IV microprocessor chip, or equivalent or later;
B. Computer operating system software, compatible with the selected processing unit and CAD software, for Windows 2000, equivalent;
C. Minimum one (1) gigabytes of random access memory (RAM);

D. A 100 gigabyte minimum hard disk drive, a 1.44 megabyte 90-mm floppy disk drive, 32x speed minimum CD-RW drive, 10/100 Ethernet card, two UBCUSB ports;
E. CAD and other software identical to those used by the Contractor to check for conflicts and generate ISD's
F. Microsoft Office software, the latest version for Windows NT/Windows 2000, or later, and McAfee Virus software or equivalent;
G. A color laser –jet printer with a minimum of eight (8) megabytes of RAM, capable of 600 dots per inch in color, 600 dots per inch in monochrome or equivalent. Capable of printing fully legible plots in color with a minimum size of 279-mm by 432-mm. LaserJet toner and paper to be provided throughout the contract. HP LaserJet 5500 or later.

The furnished computer hardware shall be compatible with that used by the Contractor for the production of the ISD. The furnished software shall be identical with that used by the Contractor for the production of the ISD and for the identification of the interferences of the ISD, and shall include original instruction manuals and other documentation normally provided with the software.

The Contractor shall furnish, install, set up, maintain and repair the computer hardware and software ready for use at the Working Drawing Campus. The hardware and software shall be installed and ready for use at least 30 days prior to submittal of the first ISD. The Contractor shall provide 16 hours of formal training for the Engineer, and three other agents of the Department designated by the Engineer, in the use of the hardware and software to include generating 3-D drawings, merging files, checking for conflicts in three dimensions and manipulating drawing elements. An authorized vendor of the software products shall perform the training.

All computer hardware and software furnished shall remain the property of the Contractor and shall be removed by the Contractor upon acceptance of the contract.

PAYMENT

Attention is directed to "Payments," of these special provisions.

The contract lump sum price paid for working drawing campus shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in facilitating early resolution of construction working drawings, including but not limited to utility connection costs, maintenance costs, purchasing of office equipment and furniture, and set up and removal of the office facility.

10-1.17 ACCELERATED WORKING DRAWINGS SUBMITTAL

The Contractor shall accelerate the following working drawing submittals from the shop plan preparation staff to the Engineer to facilitate early resolution of construction working drawing issues and keep these submittals off the critical path of the project.

Submittal	Special provisions sections
Working drawings required for the W2 cap beam	"INTEGRATED SHOP DRAWINGS"
Working drawings and design calculations for all temporary towers	"Working Drawings" in "TEMPORARY TOWERS"
Working drawings required for the fabrication of box girder structural steel	"Working Drawings" in "STEEL STRUCTURES"
Working drawings required for the fabrication of all tower structural steel	"Working Drawings" in "STEEL STRUCTURES"
Working drawings and supplemental calculations for the erection of tower and superstructure structural steel	"Erection Plan" in "STEEL STRUCTURES"
Working drawings for castings	"Castings" in "STEEL STRUCTURES"
Written, detailed procedures for the fabrication and erection of the complex assemblies listed under "Fabrication/Erection Procedure and Mock-Ups"	"Fabrication/Erection Procedure and Mock-Ups" in "STEEL STRUCTURES"
Working drawings for the construction of the cable system	"Working Drawings" in "CABLE SYSTEM"

The Contractor shall receive approval from the Engineer for his working drawing submittal schedule, preliminary erection plan, and weight control procedure prior to preparing working drawings for the fabrication of the box girder structural steel, tower structural steel, and the cable system.

The Contractor shall submit, for approval by the Engineer, a schedule of costs detailing the breakdown of the contract lump sum item. The schedule of costs shall be proportionate to the work involved and shall detail the costs and payment

schedule for each cost item associated with the process entailed in obtaining approval on all approved working drawing as specified herein. When requested by the Engineer, the Contractor shall furnish any cost data, which might assist the Engineer in verifying one-time partial payments and establishing a suitable schedule of costs. The schedule of costs will be used to determine progress payments for "Accelerated Working Drawings Submittal" during the progress of the work. The schedule of costs shall be submitted to the Engineer for approval with the working drawing submittal schedule as specified in "Working Drawing Submittal Schedule" of these special provisions.

Attention is directed to "Payments," "Temporary Towers," "Steel Structures," and "Cable System," of these special provisions.

The contract lump sum price paid for Accelerated Working Drawings Submittal shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in facilitating early resolution of construction working drawings and preparing all the above specified working drawings, in conformance with the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Payment will be made in accordance with "Payments," of these special provisions. Payments will not be made for partial submittals, although partial submittals may be accepted, as determined by the Engineer. For a submittal to be considered complete, all items listed under the individual submittal requirements shall be completed, and all facets of the operation/element fully developed. Payment will be made in the estimate following approval of each submittal set of the working drawings. Submittals other than those listed herein will not receive separate payments, and shall be considered as included in the various contract items involved.

10-1.18 WORKING DRAWING SUBMITTAL SCHEDULE

Attention is directed to "Working Drawings" in these special provisions.

The Contractor shall submit the working drawing submittal schedule in accordance with the requirements of these special provisions.

The Contractor's attention is directed to the section "Progress Schedule (Critical Path Method)" of these special provisions for the definitions of Baseline Schedule and Controlling Operation.

Within 90 days after approval of the contract, the Contractor shall submit to the Engineer for acceptance the working drawing submittal schedule in conjunction with the Baseline Schedule. The working drawing submittal schedule shall include the following:

A. Name and brief description of all working drawings and supplement including all subsections required by the Standard Specifications and these special provisions.
B. Reference section of the Standard Specifications or these special provisions for each working drawing submittal.
C. Allowable time for review of the working drawings by the Engineer as specified in the Standard Specifications and these special provisions.
D. A time-scaled logic diagram which shows all working drawing submittals, working drawing activities, and demonstrates any interdependency between separate working drawing submittals or partial submittals.
E. A listing of all working drawing submittals affecting the Controlling/critical path Operation.
F. Identification of the first occurrence of any Controlling/critical path Operation affected by each working drawing submittal.
G. A time-scaled diagram showing the estimated number of working drawing submittal sheets to be submitted for the Engineer's review.
H. In the event that several related working drawing submittals with review times on the controlling/critical path are submitted simultaneously, or an additional working drawing submittal is submitted for review before the review of a previous submittal has been completed, the Contractor shall designate the sequence in which the submittals are to be reviewed.

The Contractor's proposed working drawing submittal schedule shall be in the order of the activities listed in the Baseline Schedule. Working drawing submittal schedules in contradiction with the Baseline Schedule will not be accepted. Items 'D' through 'H,' above, of the working drawing submittal schedule, shall be updated and submitted to the Engineer on a monthly basis in conjunction with the monthly updates provided for under Progress Schedule (Critical Path Method). The working drawing submittal schedule updates shall reflect actual durations and proposed revisions in durations, resources, and logic.

No compensation will be allowed for any costs incurred or for delay in completing the work resulting from rejected working drawing submittal. Pursuant to Item 'H,' above, of the working drawing submittal schedule, should the Contractor submit several related working drawing submittals with review times on the controlling/critical path, or an additional working drawing submittal for review before the review of a previous submittal has been completed, the time to be provided for the review of any submittal in the sequence shall be not less than the review time specified for that submittal, plus 7 days for each submittal of higher priority which is still under review, unless specified otherwise in these special provisions.

Full compensation for preparing and submitting the working drawing submittal schedule including all revisions shall be considered as included in the contract lump sum price paid for Progress Schedule (Critical Path Method), and no additional compensation will be allowed therefor. The initial working drawing schedule submittal, as specified herein, shall be considered a component of the Baseline Schedule provisions of Progress Schedule (Critical Path Method), and the monthly working drawing schedule update provisions, as specified herein, shall be considered a component of the provisions of Progress Schedule (Critical Path Method), and the deduction and retention provisions of Progress Schedule (Critical Path Method) shall apply.

The following table is a summary of the major structural working drawing submittals and the Engineer's initial review times per submittal. This summary is intended as a planning tool and is not a complete list of all submittals. If the review times in this table conflict with review times specified elsewhere in these special provisions, the review times specified elsewhere shall control.

SPECIAL PROVISIONS SECTION	WORKING DRAWING SUBMITTAL	Numbers of Days for review
10-1.41	Temporary Tower working drawings and design calculations – each location	50 + 10 days-for each additional submittal
10-1.41	Temporary Tower Foundations-Driving System Submittal	15
10-1.42	Prestressing Concrete- complete working drawings and supplement	60
10-1.43	High Strength Prestressing Rod (75mm) - complete working drawings and supplement	25
10-1.44	Cable Tie Down- complete working drawings	25
10-1.45	Mass Concrete –thermal control plan	20
10-1.45	Falsework – Pier W2 Cap Beam Construction	50
10-1.45	Falsework – Pier E2 Crossbeam Construction	50
10-1.46	Precast Concrete Fender Modules	20
10-1.47	Spherical Bushing Bearing (Pier E2) - complete working drawings and supplement	40
10-1.48	Spherical Bushing Ring Bearing (Hinge K) - complete working drawings and supplement	40
10-1.49	Tower Cross Bracing Spherical Bushing Bearing - complete working drawings and supplement	40
10-1.50	Shear Key (Pier E2) - complete working drawings and supplement	40
10-1.52	Circular Segmented Bearing (Hinge A) - complete working drawings and supplement	20
10-1.55	Polyester Concrete Overlay (13mm) – public safety plan	10
10-1.56	High Strength Nonshrink Grout) - complete working drawings and supplement	35

SPECIAL PROVISIONS SECTION	WORKING DRAWING SUBMITTAL	Numbers of Days for review
10-1.59	Structural steel working drawings	50
10-1.59	Structural Steel - erection working drawings	50
10-1.59	Structural Steel – weight control procedure	20
10-1.59	Pipe Beam installation system working drawings and supplemental design calculations	25
10-1.59	Steel casting fabrication and erection procedures	50
10-1.60	Cable System working drawings	60
10-1.61	Tower Suspender working drawings	20
10-1.63	Traveler Scaffolds – complete drawings and all supplemental data	50
10-1.65	Sign structure working drawings	30
10-1.68	Plastic lumber working drawings	20
10-1.69 10-1.70	Painting Quality Work Plan	30

10-1.19 ELECTRONIC MOBILE DAILY DIARY SYSTEM DATA DELIVERY

Attention is directed to Sections 5-1.10, "Equipment and Plants," and 7-1.01A(3), "Payroll Records," of the Standard Specifications, and these special provisions.

The Contractor shall submit to the Engineer a list of each piece of equipment and its identifying number, type, make, model and rate code in accordance with the Department of Transportation publication entitled "Labor Surcharge and Equipment Rental Rate" which is in effect on the date the work is performed, and the names, labor rates and work classifications for all field personnel employed by the Contractor and all subcontractors in connection with the public work, together with such additional information as is identified below. This information shall be updated and submitted to the Engineer weekly through the life of the project.

This personnel information will only be used for this mobile daily diary computer system and it will not relieve the Contractor and subcontractors from the payroll records requirements as required by Section 7-1.01A(3), "Payroll Records," of the Standard Specifications.

The Contractor shall provide the personnel and equipment information not later than 15 days prior to the start of work for its own personnel and equipment, and not later than 7 days before start of work by any subcontractor for the labor and equipment data of that subcontractor.

The minimum data to be furnished shall comply with the following specifications:

DATA CONTENT REQUIREMENTS.

A. The Contractor shall provide the following basic information for itself and for each subcontractor that will be used on the contract:

Caltrans contract ID	Alphanumeric; up to 15 characters.
Company name.	Alphanumeric; up to 30 characters.
Federal tax ID	Alphanumeric; up to 10 characters.
State contractor license	Alphanumeric; up to 20 characters.
Company type (prime or sub)	Alphanumeric; up to 10 characters.
Address (line 1).	Alphanumeric; up to 30 characters.
Address (line 2).	Alphanumeric; up to 30 characters.
Address (city).	Alphanumeric; up to 30 chars.
Address (2-letter state code).	Alphanumeric; up to 2 characters.
Address (zip code)	Alphanumeric; up to 14 characters.

Contact First Nname.	Alphanumeric; up to 15 characters
Contact Last Name	Alphanumeric; up to 20 characters
Telephone number (with area code).	Alphanumeric; up to 20 characters.
Company code: short company name.	Alphanumeric; up to 10 characters.
Type of work (Department-supplied codes)	Alphanumeric; up to 30 characters
DVBE status (Department-supplied codes)	Alphanumeric; up to 20 characters.
List of laborers to be used on this contract (detail specified below).	
List of equipment to be used on this contract (detail specified below).	

For example, one such set of information for a company might be:

04-072359
XYZ CONSTRUCTION, INC.
94-2991040
AL1649T
SUB
1240 9TH STREET
SUITE 600
OAKLAND
CA
94612
JOHN
SMITH
(510) 834-9999
XYZ
PAVING
MBE
BLACK

B. The Contractor shall provide the following information for each laborer who will be used on the contract:

Caltrans contract ID	Alphanumeric; up to 15 characters.
Company code (as defined above).	Alphanumeric; up to 10 characters.
Employee ID	Alphanumeric; up to 10 characters.
Last name.	Alphanumeric; up to 20 characters.
First name.	Alphanumeric; up to 15 characters.
Middle name.	Alphanumeric; up to 15 characters.
Suffix	Alphanumeric; up to 15 characters
Labor trade (Department-provided codes).	Alphanumeric; up to 10 characters.
Labor classification (Department-provided codes).	Alphanumeric; up to 10 characters.
Regular hourly rate.	Alphanumeric; up to (6,2)
Overtime hourly rate.	Alphanumeric; up to (6,2)
Doubletime hourly rate	Alphanumeric; up to (6,2)
Standby hourly rate.	Alphanumeric; up to (6,2)
Ethnicity (Department-provided codes).	Alphanumeric; up to 20 characters.
Gender.	Alphanumeric; up to 1 characters.

For example, one such set of information might be:
04-072359
XYZ
1249
GONZALEZ
HECTOR
VINCENT
JR.
OPR
JNY
12.50
18.75
25.00
0.00
HISPANIC
M

C. The Contractor shall provide the following information for each piece of equipment that will be used on the contract:

Caltrans contract ID	Alphanumeric; up to 15 characters.
Company code (as defined above).	Alphanumeric; up to 10 characters.
Company's equipment ID number.	Alphanumeric; up to 10 characters.
Company's equipment description.	Alphanumeric; up to 60 characters.
Equipment type (from Department ratebook).	Alphanumeric; up to 60 characters.
Equipment make (from Department ratebook).	Alphanumeric; up to 60 characters.
Equipment model (from Department ratebook).	Alphanumeric; up to 60 characters.
Equipment rate code (from Department ratebook).	Alphanumeric; up to 10 characters
Regular hourly rate.	Alphanumeric; up to (6,2)
Overtime hourly rate.	Alphanumeric; up to (6,2)
Standby hourly rate	Alphanumeric; up to (6,2)
Idle hourly rate.	Alphanumeric; up to (6,2)
Rental flag.	Alphanumeric; up to 1 character.

For example, one such set of information might be:
04-072359
XYZ
B043
CAT TRACTOR D-6C
TRACC
CAT
D-6C
3645
75.00
75.00
0.00
0.00
N

DATA DELIVERY REQUIREMENTS.

A. All data described in "Data Requirements" of this section shall be delivered to the Department electronically, on 90 mm floppy disks compatible with the Microsoft Windows operating system. The Contractor shall provide a weekly disk and hard copy of the required correct updated personnel and equipment information for the Contractor and all the subcontractors and verified correct by the Engineer.

B. Data of each type described in the previous section (contractor, labor, and equipment information) shall be delivered separately, each type in one or more files on floppy disk. Any given file may contain information from one contractor or from multiple contractors, but only one type of data (contractor, labor, or equipment information).

C. The file format for all files delivered to Caltrans shall be standard comma-delimited, plain text files. This type of file (often called "CSV") is the most standard type for interchange of formatted data; it can be created and read by all desktop spreadsheet and desktop database applications. Characteristics of this type of file are:

1. All data is in the form of plain ASCII characters.
2. Each row of data (company, person, equipment) is delimited by a carriage return character.
3. Within rows, each column (field) of data is delimited by a comma character.

D. The files shall have the following columns (i.e., each row shall have the following fields):

1. Contractor info: 17 columns (fields) as specified in "Data Requirements #1", above.
2. Labor info: 15 columns (fields) as specified in "Data Requirements #2", above.
3. Equipment info: 13 columns (fields) as specified in "Data Requirements #3", above.

For every one type of file, columns (fields) must be in the order specified under "Data Requirements", above. All columns (fields) described under "Data Requirements" must be present for all rows, even if some column (field) values are empty. The first row of each file must contain column headers (in plain text).

E. Column (field) contents shall conform to the data type and length requirements described in the "Data Requirement" section, above. In addition, column (field) data must conform to the following restrictions:

1. All data shall be uppercase.
2. Company type shall be either "PRIME" or "SUB".
3. Labor trade and classification codes must conform to a list of standard codes that will be supplied by Department.
4. Contractor type of work codes and DBE status codes must conform to a list of standard codes that will be supplied by Department.
5. Ethnicity codes must conform to standard codes that will be supplied by Department.
6. Data in the "gender" column must be either "M" or "F".
7. Data in the "rental equipment" column must be either "Y" or "N".
8. Equipment owner's description may not be omitted. (The description, together with the equipment number, is how the equipment will be identified in the field.) Include manufacturer, rated capacity & trade description.
9. Equipment type, make, model, and ratebook code shall conform to the Department of Transportation Publication entitled "Labor Surcharge and Equipment Rental Rate", which is in effect on the date the work is performed. If the equipment in question does not have an entry in the book then alternate, descriptive entries may be made in these fields as directed by the Engineer.

F. The name of each file shall indicate its contents, e.g., "labor.csv" for laborers, "equipment.csv" for equipment, and "contractor.csv" for contractors. Each floppy disk supplied to Caltrans must be accompanied by a printed list of the files it contains with a brief description of the contents of each file.

PAYMENT

The contract lump sum price paid for electronic mobile daily diary computer system data delivery shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in electronic mobile daily diary computer system data delivery as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract lump sum bid price paid for electronic mobile daily diary computer system data delivery will be made according to the following schedule:

The Contractor will receive not more than 2.5 per cent per month of the total bid price for electronic mobile daily diary computer system data delivery. After the completion of the work, 100 percent payment will be made for electronic mobile daily diary computer system data delivery less the permanent deduction, if any, for failure to deliver complete weekly electronic mobile daily diary computer system data in each month.

The Department will retain an amount equal to $500,000 for each estimate period in which the Contractor fails to submit electronic mobile daily diary computer system data conforming to the requirements of this section, as determined by the Engineer. Retentions for failure to submit acceptable electronic mobile daily diary computer system data shall be in addition

to all other retentions provided for in the contract. The retention for failure to submit acceptable electronic mobile daily diary computer system data will be released for payment on the next monthly estimate for partial payment following the date that acceptable electronic mobile daily diary computer system data is submitted to the Engineer.

The adjustment provisions in Section 4-1.03, "Changes," of the Standard Specifications, shall not apply to the item of electronic mobile daily diary computer system data delivery. Adjustments in compensation for electronic mobile daily diary computer system data delivery will not be made for any increased or decreased work ordered by the Engineer in furnishing electronic mobile daily diary computer system data.

10-1.20 DOCUMENT MANAGEMENT SYSTEM

The Contractor shall provide the complete computer system (hardware and software), including one system for the State's exclusive possession and use, specifically capable of a Document Management System that is the latest version of "PMIV" by Integral Vision or equivalent to facilitate efficient document management and control.

The Contractor shall use the Document Management System for all documents created and received during the life of the project, which may include, but are not limited to, submittals, transmittals, shop drawings and calculations, Request for Information (RFI), letters, memorandums and plan sheets.

Attention is directed to "Payments" of Section 5 of these special provisions.

COMPUTER SYSTEM

The computer system to be furnished by the Contractor shall be complete with keyboard, mouse, monitor and network copier. The system shall be from those identified by the Gartner Group as Tier 1 and shall conform to the following requirements:

Hardware Requirements

A. Latest industry-available Intel Pentium Xeon processor or equivalent, in dual processor configuration at 2.8 GHz or faster.
B. Latest computer server operating system software compatible with the selected processor and associated hardware, Windows 2000 server with 80 client licenses or equivalent.
C. Minimum of 2 gigabytes of Random Access Memory (RAM).
D. Internal disk system with 800 Gigabytes storage with a RAID (Level 5) controller, one 1.44–megabyte 90 mm floppy disk drive and one DVD ROM/CD-RW or equivalent.
E. Tape Backup unit (100/200 Gigabyte) and 20 backup tapes.
F. Two Ethernet Network Interface Cards (NIC), 1000/100 Mbit or equivalent.
G. Fax/modem, V-90 or equivalent.
H. Network Attached Storage (NAS) device, minimum 800 Gigabytes
I. Uninterruptible power supply (minimum battery backup time of 15 minutes).
J. A 430 mm minimum, color monitor capable of at least 1,024 x 768 pixels.
K. The network copier shall be a multifunction, Adobe Postscript Level 3 or compatible, copier/scanner/laser printer with a minimum of 128 megabytes RAM,. The laser printer shall print in color at 24 dots per millimeter (600 dots per inch) resolution. The scanner shall have a minimum resolution of 24 dots per millimeter x 24 dots per millimeter (600 dots per inch x 600 dots per inch), a minimum of 24 bit color depth, scan color or black and white documents at a minimum of 20 pages per minute and shall be capable of scanning images to the TIF (tagged image format) and PDF (Adobe Portable Document Format) file formats. The scanner shall have the ability for the user to name the scanned documents using the network copier keypad. The network copier shall be able to scan, copy and print in letter, legal and 280 mm x 432 mm paper sizes and shall have the capability of being connected to a network with 10/100 Mbit Ethernet.

Software Requirements

A. General software shall be the latest versions of Microsoft Office Professional, McAfee VirusScan virus protection or equivalent and tape backup software. The general software shall be compatible with the hardware provided.
B. One (1) Document Management System software, including 80 licenses and 5 annual maintenance renewal fees until 30 days after the final estimate has been received by the Contractor. The software for use to implement the Document Management System must be a commercially available software package.

PRE-CONSTRUCTION CONFERENCE

The Contractor shall schedule a pre-construction conference with the Engineer and the Contractor's project manager within 5 days of the approval of the contract. At this meeting the Engineer will review the requirements of this section of the special provisions with the Contractor.

The Contractor shall be prepared to discuss the proposed work plan and methodology for the Document Management System, that comply with the requirements of these special provisions.

DELIVERY AND SETUP

Before delivery and setup of the computer system, the Contractor shall submit, for approval by the Engineer, a detailed list of the computer hardware and software the Contractor proposes to furnish. The Engineer will have 3 days to review and approve the Contractor's proposal.

Upon approval by the Engineer, the Contractor shall furnish, install, set up, and maintain the computer system ready-for-use, and provide network copier supplies as necessary during the course of the project at a location determined by the Engineer. The Document Management System technical support and repair shall be performed by a 3rd party vendor selected by the Contractor. The hardware and software shall be installed and ready for use on to the first working day of the contract. Software maintenance, including licensing and other fees shall be maintained for the duration of the project until 30 days after receiving of the final estimate by the Contractor. The Contractor shall instruct and assist the Engineer in the use of the hardware and software. Hardware repairs shall be made within 48 hours of notification by the Engineer, or replacement equipment shall be furnished and installed by the Contractor until repairs have been completed.

Computer hardware and software furnished shall remain the property of the Contractor and shall not be removed until 30 days after the Contractor has received the final estimate, or as authorized by the Engineer.

The Contractor shall furnish software and all original software instruction manuals to the Engineer. The State will compensate the Contractor in conformance with the provisions in Section 4-1.03, "Extra Work," of the Standard Specifications for replacement of software which is damaged, lost or stolen after delivery to the Engineer.

TRAINING

After approval of the Document Management System by the Engineer and prior to the first working day of the contract, the Contractor shall provide an initial 8-hour training session to the Department in the use of the software.

The Contractor shall provide a total of 20 training sessions, at 4 hours per session during the duration of the contract. The Contractor can expect subsequent training sessions to be distributed throughout the duration of the project until the total number of sessions have been completed.

Each training session shall accommodate up to 15 Department Employees. Training sessions shall be at a location, date and time acceptable to the Engineer.

The Session Trainer shall be approved by the Engineer.

DATA DELIVERY REQUIREMENTS

All data shall be delivered to the Engineer electronically on CD-ROM (ISO 9660 format with Joliet extensions) and shall be compatible with the Document Management System hardware and software and with general hardware running Microsoft Windows operating system. The electronic files shall conform to the following requirements:

A. The CD-ROM shall contain the electronic document(s) contents of only one submittal or transmittal.
B. A searchable Adobe Portable Document Format (PDF), version 4 or higher format, shall be used for all electronic documents.
C. The electronic documents shall be scanned to their original size.
D. The minimum resolution for the electronic PDF shall be 6 dots per millimeter (150 dots per inch) and the minimum color depth shall be 256 colors.
E. Each plan sheet shall consist of one electronic PDF file.
F. Each PDF electronic file shall not exceed 50 pages.

The Document Management System shall also provide a method of exporting all data to the relational database, Microsoft Access, keeping all the existing relationships intact. This export function should be accessible by the user and should be able to be performed at any time by the user.

The Contractor shall not be relieved of the requirements of "Working Drawings" of Section 5 of these special provisions.

DOCUMENT MANAGEMENT SYSTEM COST BREAK-DOWN
Contract No. 04-0120F4

ITEM	ITEM DESCRIPTION	UNIT	ESTIMATED QUANTITY	VALUE	AMOUNT
PC-1	Computer Hardware - Server	EA	2		
NC-1	Network Copier Hardware	EA	2		
NC-2	Network Copier Support	MO	144		
SW-1	Computer Software - Server Operating System Software	EA	2		
SW-2	Computer Software for Document Management System for server	EA	2		
SW-3	Computer Software for DMS for clients – concurrent users	EA	80		
SW-4	Computer Software for DMS for clients – Annual Maintenance	EA	880		
SW-5	Software Technical Support for Server/Client for DMS	Hrs	2040		
SW-6	Software Technical Support for Server/Client for DMS - Sacramento	Hrs	120		
SW-7	Add-on Software – PDF Split	EA	12		
SW-8	Add-on Software – PDF doc	EA	105		
TR-1	Computer Software Training Sessions – ½ Day	EA	20		
DI-1	Data Input Support for the Department	Hrs	600		

TOTAL _____

The approved cost break-down will be used to determine partial payments during the progress of the work and as the basis for calculating the adjustment in compensation for the item of Document Management System due to increases or decreases of quantities ordered by the Engineer. When an ordered change increases or decreases the quantities of an approved cost break-down item, the adjustment in compensation will be determined in the same manner specified for increases and decreases in the quantity of a contract item of work in conformance with the provisions in Section 4-1.03B, "Increased or Decreased Quantities," of the Standard Specifications. If an ordered change requires a new item which is not on the approved cost break-down, the adjustment in compensation will be determined in the same manner specified for extra work in conformance with Section 4-1.03D, "Extra Work," of the Standard Specifications.

If requested by the Contractor and approved by the Engineer, changes to the Document Management System listed in the approved cost break-down, including addition of new computer hardware and software, will be allowed. The net cost increase to the Document Management System item will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications.

PAYMENT

The contract lump sum price paid for Document Management System shall include full compensation for furnishing all labor, material, tools, equipment, and incidentals, and for doing all the work involved in providing and maintaining the Document Management System, as specified in the Standard Specifications and these special provisions.

The Department will retain an amount equal to $500,000 for each estimate period in which the Contractor fails to provide the Document Management System or maintain the Document Management System conforming to the requirements of these special provisions, as determined by the Engineer. Retentions held in conformance with this section shall be in addition to all other retentions provided for in the contract. The retention for failure to provide or maintain an acceptable Document Management System will be released for payment on the next monthly estimate for partial payment following the date that an acceptable Document Management System has been provided or maintained. Upon completion of all contract work, any remaining withheld funds associated with the Document Management System will be released for payment. No interest will be due the Contractor on withheld amounts.

If the Contractor fails to complete any of the work in providing and maintaining the Document Management System required by this section, the Engineer shall make an adjustment in compensation in conformance with the provisions in Section 4-1.03C, "Changes in Character of Work," of the Standard Specifications for the work not performed. Adjustments in compensation for Document Management System will not be made for any increased or decreased work ordered by the Engineer in furnishing Document Management System.

10-1.21 MOBILIZATION

Mobilization shall conform to the provisions in Section 11, "Mobilization," of the Standard Specifications.

Attention is directed to "Payments" of these special provisions, and Sections 9-1.06, "Partial Payments," and 9-1.07, "Payment After Acceptance," of the Standard Specifications. Payments for mobilization will be made as follows:

A. In the first monthly partial payment estimate, 25 percent of the contract item price for mobilization or 3.75 percent of the original contract amount, whichever is the lesser, will be included in the estimate for payment.
B. In the fourth monthly partial payment estimate, 30 percent of the contract item price for mobilization or 4.5 percent of the original contract amount, whichever is the lesser, will be included in the estimate for payment.
C. In the seventh monthly partial payment estimate, 30 percent of the contract item price for mobilization or 4.5 percent of the original contract amount, whichever is the lesser, will be included in the estimate for payment.
D. In the tenth monthly partial payment estimate, 15 percent of the contract item price for mobilization or 2.25 percent of the original contract amount, whichever is the lesser, will be included in the estimate for payment.
E. After acceptance of the contract pursuant to Section 7-1.17, "Acceptance of Contract," of the Standard Specifications, the amount, if any, of the contract item price for mobilization in excess of 15 percent of the original contract amount will be included for payment in the first estimate made in accordance with the provisions in Section 9-1.07.

The adjustment provisions in Section 4-1.03, "Changes," of the Standard Specifications shall not apply to the contract lump sum item of mobilization. The retention of funds provisions in "Payments" of these special provisions shall apply to the contract lump sum item of mobilization.

10-1.215 ESTABLISH MARINE ACCESS

This work shall consist of furnishing, erecting, maintaining and removing barges, trestles and other facilities to provide marine access to the job site. This work shall be separate from and in addition to the work specified in Section 11, "Mobilization," of the Standard Specifications.

The Contractor may construct an access trestle for access to the jobsite in accordance with the permits obtained by the Department and these special provisions.

The Contractor shall submit, for approval by the Engineer, in accordance with the provisions in "Working Drawings," of these special provisions, calculations and working drawings of any access trestle and other temporary facilities that are to be constructed. The Contractor shall allow the Engineer 50 days to review and approve the working drawings and supplemental calculations. If revisions are required, as determined by the Engineer, the Contractor shall revise and resubmit the working drawings and calculations within 10 days of receipt of the Engineer's comments and shall allow 15 days for the Engineer to review the revisions.

The Contractor shall submit, for approval by the Engineer, a schedule of values detailing the cost breakdown of the contract lump sum item for establish marine access. The schedule of values shall reflect the items, work, quantities and costs required to establish marine access to the job site, including as a minimum: initial mobilization of marine access facilities, monthly facility and equipment rental, monthly maintenance, and demobilization. The Contractor shall be responsible for the accuracy of the quantities and costs used in the schedule of values submitted for approval.

The sum of the amounts for the items and work listed in the schedule of values shall be equal to the contract lump sum price for establish marine access.

The schedule of values for establish marine access shall be submitted to the Engineer within the time required for submittal of the Interim Baseline Schedule, as specified in "Progress Schedule (Critical Path)" of these special provisions.

When approved in writing by the Engineer, the schedule of values will be used to determine progress payments for establish marine access during the progress of the work. No partial payment for establish marine access will be made until the schedule of values is approved in writing by the Engineer.

The contract lump sum price paid for establish marine access shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in establishing marine access to the job site, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The adjustment provisions in Section 4-1.03, "Changes," of the Standard Specifications shall not apply to the contract lump sum price for establish marine access. Full compensation for damages due to delays shall be considered as included in the payments made in accordance with "Time-Related Overhead" of these special provisions and Section 8-1.09, "Right of Way Delays," of the Standard Specifications and no additional compensation will be allowed therefor.

10-1.22 DUST CONTROL

Dust control shall conform to the provisions in Section 10, "Dust Control," of the Standard Specifications and these special provisions.

10-1.23 CONSTRUCTION SURVEYING

This work shall consist of construction surveying by the Contractor using Global Positioning System (GPS) surveying methods, including Static and Real-time kinematic (RTK) GPS, conventional total station and other surveying means to establish and control the lines and grades required for completion of the bridge work as shown on the plans and in these special provisions specified in the Standard Specifications. Construction surveying shall include geometry control for the fabrication of steel structures.

Attention is directed to ""Steel Structures" of these special provisions for additional construction surveying requirements.

Except as otherwise provided herein for establishment of project horizontal and vertical control and right-of-way staking (on land only), by the Engineer, all other specifications, including the first two paragraphs of Section 5-1.07, "Lines and Grades," of the Standard Specifications, which require the establishment of lines and grades by the Engineer, shall not apply.

The Engineer will determine the horizontal and vertical survey control data to be used for the project and will provide survey control referenced to the California Coordinate System 1983 (1991.35), Zone 3 coordinates and NGVD 1929 at western end of the Oakland Mole and the eastern side of Yerba Buena Island. Attention is directed to "Project Information" of these special provisions for the identification of project horizontal and vertical survey control data. The Contractor shall verify the accuracy of the control data prior to initiating construction surveying. The Engineer will also provide a control diagram for the monumentation. The Contractor’s attention is directed to the third paragraph of Section 5-1.07, "Lines and Grades," of the Standard Specifications with regard to preserving control monuments furnished by the State.

Stake markings shall be in accordance with Chapter 12, "Construction Surveys," of the California Department of Transportation "Survey Manual."

The Contractor shall use GPS combined with software specifically designed for precise positioning of large structures. The software shall provide a visual display on a computer screen that allows the viewer to see real-time, three-dimensional coordinates, attitude and orientation information with regard to a predetermined target position. The software shall also have user-defined reporting functions for quality control and as-built reporting. The records of the GPS work shall be submitted to the Engineer on a weekly basis.

Before starting any construction survey work, the Contractor shall submit a Survey Plan to the Engineer. The Survey Plan shall include working drawings and supplements in conformance to "Working Drawings" of these special provisions.

The working drawing submittal shall include the following:

A. Stake layout;
B. Location of all control points;
C. Datum information; and
D. Bridge alignment.

The supplement to the working drawing shall show the Contractor's proposed methods of construction surveying and a quality control plan for surveying, and shall include the following:

A. A detailed narrative of the step-by-step surveying control process;
B. A listing of the types of methods and the related item(s) to be constructed;
C. Detailed calculation forms, and a set of calculation for each type of survey method, including sample input and output of computer programs;
D. Identifications of all measuring equipment, procedures;
E. Qualifications of personnel who will carry out construction surveying, and for the Land Surveyor of record; and
F. Correlation between the data from geometry control for furnishing precast concrete segments and furnishing steel structures with data for erection and final line and grade.

Prior to submitting the Survey Plan, the Contractor and any entity performing surveying for this project shall hold a pre-survey meeting with the Engineer to the proposed procedures. The pre-survey meeting shall be held within the San Francisco Bay Area.

The Contractor shall allow 15 days for the Engineer to review the Survey Plan after a complete plan has been submitted. If revisions are required, as determined by the Engineer, the Contractor shall revise and resubmit the Survey Plan. The Contractors shall allow 10 days for the Engineer to review the revisions. No construction surveying shall began until the Engineer approves the written proposal.

The Contractor shall make the calculations necessary to establish the exact position of the work from the Project control points. Calculations, survey notes computer output, and other construction survey notes and records shall be neat, legible, and accurate. Copies of the survey calculations, notes and other records shall be submitted to the Engineer on a weekly basis.

The Survey Plan, and the calculations, survey notes and other records submitted to establish the exact position of the work shall be completed under the direction of and signed by a Land Surveyor who is licensed by the State of California.

The Contractor shall submit to the Engineer, a schedule of values detailing the cost breakdown of the contract lump sum item for construction surveying. The schedule of values shall reflect the items, work, quantities and costs required to do the surveying required by these special provisions, including surveying for geometry control for the erection of steel structures. The Contractor shall be responsible for the accuracy of the quantities and costs used in the schedule of values submitted for approval.

The sum of the amounts for the items and work listed in the schedule of values shall be equal to the contract lump sum price for construction surveying. Changes in the schedule of values, due to changes by the Contractor in the items and work listed, shall not result in a change in the contract lump sum price for construction surveying.

The schedule of values will be used only to determine progress payments for construction surveying during the progress of the work. No payment for construction surveying will be made until the schedule of values is approved in writing by the Engineer.

The contract lump sum price paid for construction surveying shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the required survey work involved in constructing the new bridge, including surveying for lines and grades, and for geometry control as specified in the these special provisions, and as directed by the Engineer.

10-1.24 CONSTRUCTION AREA TRAFFIC CONTROL DEVICES

Flagging, signs, and all other traffic control devices furnished, installed, maintained, and removed when no longer required shall conform to the provisions in Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications and these special provisions.

Category 1 traffic control devices are defined as those devices that are small and lightweight (less than 45 kg), and have been in common use for many years. The devices shall be known to be crashworthy by crash testing, crash testing of similar devices, or years of demonstrable safe performance. Category 1 traffic control devices include traffic cones, plastic drums, portable delineators, and channelizers.

If requested by the Engineer, the Contractor shall provide written self-certification for crashworthiness of Category 1 traffic control devices. Self-certification shall be provided by the manufacturer or Contractor and shall include the following: date, Federal Aid number (if applicable), expenditure authorization, district, county, route and kilometer post of project

limits; company name of certifying vendor, street address, city, state and zip code; printed name, signature and title of certifying person; and an indication of which Category 1 traffic control devices will be used on the project. The Contractor may obtain a standard form for self-certification from the Engineer.

Category 2 traffic control devices are defined as those items that are small and lightweight (less than 45 kg), that are not expected to produce significant vehicular velocity change, but may otherwise be potentially hazardous. Category 2 traffic control devices include: barricades and portable sign supports.

Category 2 devices purchased on or after October 1, 2000 shall be on the Federal Highway Administration (FHWA) Acceptable Crashworthy Category 2 Hardware for Work Zones list. This list is maintained by FHWA and can be located at the following internet address: http://safety.fhwa.dot.gov/fourthlevel/hardware/listing.cfm?code=workzone. The Department maintains a secondary list at the following internet address: http://www.dot.ca.gov/hq/traffops/signtech/signdel/pdf.htm.

If requested by the Engineer, the Contractor shall provide a written list of Category 2 devices to be used on the project at least 5 days prior to beginning any work using the devices. For each type of device, the list shall indicate the FHWA acceptance letter number and the name of the manufacturer.

Full compensation for providing self-certification for crashworthiness of Category 1 traffic control devices and for providing a list of Category 2 devices used on the project and labeling Category 2 devices as specified shall be considered as included in the prices paid for the various contract items of work requiring the use of the Category 1 or Category 2 traffic control devices and no additional compensation will be allowed therefor.

10-1.25 CONSTRUCTION AREA SIGNS

Construction area signs, as ordered by the Engineer, shall be furnished, installed, maintained, and removed when no longer required in conformance with the provisions in Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications and these special provisions.

Attention is directed to the provisions in "Prequalified and Tested Signing and Delineation Materials" of these special provisions. Type II retroreflective sheeting shall not be used on construction area sign panels.

The Contractor shall notify the appropriate regional notification center for operators of subsurface installations at least 2 days, but not more than 14 days, prior to commencing excavation for construction area sign posts. The regional notification centers include, but are not limited to, the following:

Notification Center	Telephone Number
Underground Service Alert-Northern California (USA)	1-800-642-2444 1-800-227-2600
Underground Service Alert-Southern California (USA)	1-800-422-4133 1-800-227-2600

Excavations required to install construction area signs shall be performed by hand methods without the use of power equipment, except that power equipment may be used if it is determined there are no utility facilities in the area of the proposed post holes.

Sign substrates for stationary mounted construction area signs may be fabricated from fiberglass reinforced plastic as specified under "Prequalified and Tested Signing and Delineation Materials" of these special provisions.

The Contractor may be required to cover certain signs during the progress of the work. Signs that are no longer required or that convey inaccurate information to the public shall be immediately covered or removed, or the information shall be corrected. Covers for construction area signs shall be of sufficient size and density to completely block out the complete face of the signs. The retroreflective face of the covered signs shall not be visible either during the day or at night. Covers shall be fastened securely so that the signs remain covered during inclement weather. Covers shall be replaced when they no longer cover the signs properly.

Construction area signs or covers for construction area signs, as ordered by the Engineer, will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

10-1.26 MAINTAINING TRAFFIC

Attention is directed to Sections 7-1.08, "Public Convenience," 7-1.09, "Public Safety," and 12, "Construction Area Traffic Control Devices," of the Standard Specifications and to the provisions in "Public Safety" of these special provisions and these special provisions. Nothing in these special provisions shall be construed as relieving the Contractor from the responsibilities specified in Section 7-1.09.

Lane closures shall conform to the provisions in section "Traffic Control System for Lane Closure" of these special provisions.

Personal vehicles of the Contractor's employees shall not be parked within the right of way , on the traveled way or shoulders including any section closed to public traffic, except in the area proposed by the Contractor and approved by the Engineer.

Vehicles parked outside areas designated as Temporary Construction Easements will be ticketed by local parking authorities.

The Contractor shall notify the United States Coast Guard Officer, at (415) 399-3504, at least 5 days prior to the Contractor's intent to begin work. The Contractor shall cooperate with the United States Coast Guard relative to handling traffic on Torpedo Factory Road and Macalla Road, and shall make arrangements to keep the working area clear of parked vehicles.

The Contractor shall provide access and maintain Macalla Road and Torpedo Factory Road, which are the primary access to United States Coast Guard (USCG), United States Navy facilities, University of California-Berkeley (UCB) Seismographic Stations, and other project sites on Yerba Buena Island, in the vicinity of the contract, at all times.

Full compensation for providing and maintaining the above access shall be considered as included in the contract price paid for various items of work involved and no additional compensation will be allowed therefor.

Lanes shall be closed only during the hours shown on the charts included in this section "Maintaining Traffic," except as otherwise provided in Table Z (Lane Closure Restrictions for Designated Legal Holidays and Special Days) or work required under Sections 7-1.08 and 7-1.09.

Attention is directed to "Bridge Tolls" of these special provisions. The access for the contractor's trucks hauling material and surplus materials to and from the project site, from westbound Route 80, westbound and eastbound on and off-ramps to and from Treasure Island/Yerba Buena Island, shall not be allowed, during the peak periods from 5:00 a.m. to 10:00 a.m., and 3:00 p.m. to 7:00 p.m., on weekdays. Furthermore, the access for the contractor's trucks hauling materials to the project site from westbound Route 80 through the bus and carpool lanes, at San Francisco-Oakland Bay Bridge toll plaza, shall not be allowed, during the peak periods from 5:00 a.m. to 10:00 a.m., and 3:00 p.m. to 7:00 p.m., on weekdays. The westbound Route 80 on-ramp, eastside of the Tunnel will be closed to Contractor's traffic.

The Contractor is encouraged to organize carpool, vanpool, boat, or other modes of mass transit for transport of manpower, materials and equipment to the maximum extent, practical, from San Francisco/Oakland to and from the project site.

Designated legal holidays are: January 1st, the last Monday in May, July 4th, the first Monday in September, November 11th, Thanksgiving Day, and December 25th. When a designated legal holiday falls on a Sunday, the following Monday shall be a designated legal holiday. Special days are: the third Monday in January, February 12th, the third Monday in February, March 31st, the second Monday in October, and any day on which a major event, as determined by the Engineer, is scheduled at Monster (Candlestick) Park, SBC Park, downtown San Francisco, Treasure Island, Networks Associates Coliseum, or downtown Oakland.

Minor deviations from the requirements of this section concerning hours of work which do not significantly change the cost of the work may be permitted upon the written request of the Contractor, if in the opinion of the Engineer, public traffic will be better served and the work expedited. These deviations shall not be adopted by the Contractor until the Engineer has approved the deviations in writing. All other modifications will be made by contract change order.

Chart No. 1
Multilane Lane Requirements

Location: Eastbound Route 80, between eastbound off-ramp (Lt) KP 12.4 and Southgate Road

	a.m.												p.m.											
FROM HOUR TO HOUR	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	1	1	1	1	1	1	1																		1
Fridays	1	1	1	1	1	1	1																		
Saturdays	1	1	1	1	1	1	1	1	1																
Sundays	1	1	1	1	1	1	1	1	1	1													1	1	

Legend:

1	One lane may be closed in direction of travel
	No lane closure allowed

REMARKS: Refer to Table Z for lane closure restrictions for designated legal holidays and special days. Table Z lane closure restrictions shall take precedence over lane requirements in this chart.

Chart No. 2
Multilane Lane Requirements

Location: Westbound Route 80, between Southgate Road and westbound on-ramp (Rt) at KP 12.3

	a.m.												p.m.											
FROM HOUR TO HOUR	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	1	1	1	1	1																1	1	1	1	
Fridays	1	1	1	1	1																	1	1	1	
Saturdays	1	1	1	1	1	1	1	1																1	
Sundays	1	1	1	1	1	1	1	1	1													1	1	1	

Legend:

1	One lane may be closed in direction of travel
	No lane closure allowed

REMARKS: Refer to Table Z for lane closure restrictions for designated legal holidays and special days. Table Z lane closure restrictions shall take precedence over lane requirements in this chart.

Table Z

Lane Closure Restrictions for Designated Legal Holidays and Special Days											
Each row represents an individual legal holiday or special day situation	**Thu**	**Fri**	**Sat**	**Sun**	**Mon**	**Tues**	**Wed**	**Thu**	**Fri**	**Sat**	**Sun**
	x	**H** xx	xx	xx							
		SD xx									
	x	xx	**H** xx	xx							
			SD xx								
		x	xx	**H** xx	xx						
				SD xx							
		x	xx	xx	**H** xx						
		x	xx	xx	**SD** xx						
					x	**H** xx					
						SD xx					
						x	**H** xx				
							SD xx				
							x	**H** xx	xx		xx
								SD xx			

H = Designated Legal Holiday
SD = Special Day

	Refer to lane closure charts
x	The full width of the traveled way shall be open for use by public traffic after 4:30 a.m.
xx	The full width of the traveled way shall be open for use by public traffic.

10-1.27 CLOSURE REQUIREMENTS AND CONDITIONS

Lane closures shall conform to the provisions in "Maintaining Traffic" of these special provisions and these special provisions.

The Engineer will have the authority to disapprove any closure schedule request, deny or abort any closure on any portion of the traveled way, when deemed necessary for the safe and efficient operation of public traffic or when necessary to resolve conflicts in closure schedules' among Contractors or other State forces performing work within the State right of way

The term closure, as used herein, is defined as the closure of a traffic lane or lanes, including ramp or connector lanes, within a single traffic control system.

CLOSURE SCHEDULE

By noon Monday, the Contractor shall submit a written schedule of planned closures for the following week period, defined as Friday noon through the following Friday noon.

The Closure Schedule shall show the locations and times when the proposed closures are to be in effect. The Contractor shall use the Closure Schedule request forms furnished by the Engineer. Closure Schedules submitted to the Engineer with

incomplete, unintelligible or inaccurate information will be returned for correction and resubmittal. The Contractor will be notified of disapproved closures or closures that require coordination with other parties as a condition of approval.

Amendments to the Closure Schedule, including adding additional closures, shall be submitted to the Engineer, in writing, at least 3 days in advance of a planned closure. Approval of amendments to the Closure Schedule will be at the discretion of the Engineer.

The Contractor shall confirm, in writing, all scheduled closures by no later than 8:00 a.m. 3 days prior to the date on which the closure is to be made. Approval or denial of scheduled closures will be made no later than 4:00 p.m. 2 days prior to the date on which the closure is to be made. Closures not confirmed or approved will not be allowed.

Confirmed closures that are cancelled due to unsuitable weather may be rescheduled at the discretion of the Engineer for the following day.

CONTINGENCY PLAN

The Contractor shall prepare a contingency plan for reopening closures to public traffic. The Contractor shall submit the contingency plan for a given operation to the Engineer within one day of the Engineer's request.

LATE REOPENING OF CLOSURES

If a closure is not reopened to public traffic by the specified time due to the contractor's work, work shall be suspended in conformance with the provisions in Section 8-1.05, "Temporary Suspension of Work," of the Standard Specifications. The Contractor shall not make any further closures until the Engineer has accepted a work plan, submitted by the Contractor, that will insure that future closures will be reopened to public traffic at the specified time. The Engineer will have 2 days to accept or reject the Contractor's proposed work plan. The Contractor will not be entitled to any compensation for the suspension of work resulting from the late reopening of closures.

For each 10-minute interval, or fraction thereof past the time specified to reopen the closure, the Department will deduct $8,500 per interval from moneys due or that may become due the Contractor under the contract.

COMPENSATION

The Contractor shall notify the Engineer of any delay in the Contractor's operations due to the following conditions, and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of those conditions, and the Contractor's loss due to that delay could not have been avoided by rescheduling the affected closure or by judicious handling of forces, equipment and plant, the delay will be considered a right of way delay within the meaning of Section 8-1.09, "Right of Way Delays," and compensation for the delay will be determined in conformance with the provisions in Section 8-1.09:

A. The Contractor's proposed Closure Schedule is denied and his planned closures are within the time frame allowed for closures in "Maintaining Traffic" of these special provisions, except that the Contractor will not be entitled to any compensation for amendments to the Closure Schedule that are not approved.
B. The Contractor is denied a confirmed closure.

Should the Engineer direct the Contractor to remove a closure prior to the time designated in the approved Closure Schedule, any delay to the Contractor's schedule due to removal of the closure will be considered a right of way delay within the meaning of Section 8-1.09, "Right of Way Delays," and compensation for the delay will be determined in conformance with the provisions in Section 8-1.09.

10-1.28 TRAFFIC CONTROL SYSTEM FOR LANE CLOSURE

A traffic control system shall consist of closing traffic lanes in conformance with the details shown on the plans, the provisions in Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications, the provisions under "Maintaining Traffic" and "Construction Area Signs" of these special provisions, and these special provisions.

The provisions in this section will not relieve the Contractor from the responsibility to provide additional devices or take measures as may be necessary to comply with the provisions in Section 7-1.09, "Public Safety," of the Standard Specifications.

Each vehicle used to place, maintain and remove components of a traffic control system on multilane highways shall be equipped with a Type II flashing arrow sign which shall be in operation when the vehicle is being used for placing, maintaining or removing components. Vehicles equipped with Type II flashing arrow sign not involved in placing, maintaining or removing components when operated within a stationary lane closure shall only display the caution display mode. The sign shall be controllable by the operator of the vehicle while the vehicle is in motion. The flashing arrow sign shown on the plans shall not be used on vehicles which are being used to place, maintain and remove components of a traffic control system and shall be in place before a lane closure requiring its use is completed.

If components in the traffic control system are displaced or cease to operate or function as specified, from any cause, during the progress of the work, the Contractor shall immediately repair the components to the original condition or replace the components and shall restore the components to the original location.

When lane closures are made for work periods only, at the end of each work period, components of the traffic control system, except portable delineators placed along open trenches or excavation adjacent to the traveled way, shall be removed from the traveled way and shoulder. If the Contractor so elects, the components may be stored at selected central locations designated by the Engineer within the limits of the highway right of way.

The contract lump sum price paid for traffic control system shall include full compensation for furnishing all labor, materials (including signs), tools, equipment, and incidentals, and for doing all the work involved in placing, removing, storing, maintaining, moving to new locations, replacing, and disposing of the components of the traffic control system shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The adjustment provisions in Section 4-1.03, "Changes," of the Standard Specifications shall not apply to the item of traffic control system. Adjustments in compensation for traffic control system will be made only for increased or decreased traffic control system required by changes ordered by the Engineer and will be made on the basis of the cost of the increased or decreased traffic control necessary. The adjustment will be made on a force account basis as provided in Section 9-1.03, "Force Account Payment," of the Standard Specifications for increased work and estimated on the same basis in the case of decreased work.

Traffic control system required by work which is classed as extra work, as provided in Section 4-1.03D of the Standard Specifications, will be paid for as a part of the extra work.

10-1.29 TEMPORARY CRASH CUSHION MODULE

This work shall consist of furnishing, installing, and maintaining sand filled temporary crash cushion modules in groupings or arrays at each location shown on the plans, as specified in these special provisions or where designated by the Engineer. The grouping or array of sand filled modules shall form a complete sand filled temporary crash cushion in conformance with the details shown on the plans and these special provisions.

Attention is directed to "Public Safety", "Order of Work", and "Temporary Railing" of these special provisions.

Whenever the work or the Contractor's operations establishes a fixed obstacle, the exposed fixed obstacle shall be protected with a sand filled temporary crash cushion. The sand filled temporary crash cushion shall be in place prior to opening the lanes adjacent to the fixed obstacle to public traffic.

Sand filled temporary crash cushions shall be maintained in place at each location, including times when work is not actively in progress. Sand filled temporary crash cushions may be removed during a work period for access to the work provided that the exposed fixed obstacle is 4.6 m or more from a lane carrying public traffic and the temporary crash cushion is reset to protect the obstacle prior to the end of the work period in which the fixed obstacle was exposed. When no longer required, as determined by the Engineer, sand filled temporary crash cushions shall be removed from the site of the work.

At the Contractor's option, the modules for use in sand filled temporary crash cushions shall be either Energite III Inertial Modules, Fitch Inertial Modules or TrafFix Sand Barrels manufactured after March 31, 1997, or equal:

A. Energite III and Fitch Inertial Modules, manufactured by Energy Absorption Systems, Inc., One East Wacker Drive, Chicago, IL 60601-2076. Telephone 1-312-467-6750,FAX 1-800-770-6755

1. Distributor (North): Traffic Control Service, Inc., 8585 Thys Court, Sacramento, CA 95828. Telephone 1-800-884-8274, FAX 1-916-387-9734
2. Distributor (South): Traffic Control Service, Inc., 1881 Betmor Lane, Anaheim, CA 92805. Telephone 1-800-222-8274, FAX 1-714-937-1070

B. TrafFix Sand Barrels, manufactured by TrafFix Devices, Inc., 220 Calle Pintoresco, SanClemente, CA 92672. Telephone 1-949 361-5663, FAX 1-949 361-9205

1. Distributor (North): United Rentals, Inc., 1533 Berger Drive, San Jose, CA 95112.Telephone 1-408 287-4303, FAX 1-408 287-1929
2. Distributor (South): Statewide Safety & Sign, Inc., P.O. Box 1440, Pismo Beach, CA 93448. Telephone 1-800-559-7080, FAX 1-805 929-5786

Modules contained in each temporary crash cushion shall be of the same type at each location. The color of the modules shall be the standard yellow color, as furnished by the vendor, with black lids. The modules shall exhibit good workmanship free from structural flaws and objectionable surface defects. The modules need not be new. Good used undamaged modules conforming to color and quality of the types specified herein may be utilized. If used Fitch modules requiring a seal are

furnished, the top edge of the seal shall be securely fastened to the wall of the module by a continuous strip of heavy duty tape.

Modules shall be filled with sand in conformance with the manufacturer's directions, and to the sand capacity in kilograms for each module shown on the plans. Sand for filling the modules shall be clean washed concrete sand of commercial quality. At the time of placing in the modules, the sand shall contain not more than 7 percent water as determined by California Test 226.

Modules damaged due to the Contractor's operations shall be repaired immediately by the Contractor at the Contractor's expense. Modules damaged beyond repair, as determined by the Engineer, due to the Contractor's operations shall be removed and replaced by the Contractor at the Contractor's expense.

Temporary crash cushion modules shall be placed on movable pallets or frames conforming to the dimensions shown on the plans. The pallets or frames shall provide a full bearing base beneath the modules. The modules and supporting pallets or frames shall not be moved by sliding or skidding along the pavement or bridge deck.

A Type R or P marker panel shall be attached to the front of the crash cushion as shown on the plans, when the closest point of the crash cushion array is within 3.6 m of the traveled way. The marker panel, when required, shall be firmly fastened to the crash cushion with commercial quality hardware or by other methods determined by the Engineer.

At the completion of the project, temporary crash cushion modules, sand filling, pallets or frames, and marker panels shall become the property of the Contractor and shall be removed from the site of the work. Temporary crash cushion modules shall not be installed in the permanent work.

Temporary crash cushion modules placed in conformance with the provisions in "Public Safety" of these special provisions will not be measured nor paid for.

10-1.30 EXISTING HIGHWAY FACILITIES

The work performed in connection with various existing highway facilities shall conform to the provisions in Section 15, "Existing Highway Facilities," of the Standard Specifications and these special provisions.

Attention is directed to "Project Information," of these special provisions, regarding underwater debris. Underwater debris, within the project limits, at the bottom of the bay, has been mapped and is shown in "Phase I Archaeological Survey Report - Maritime Archaeology", and "Addendum Archaeological Survey Report - Maritime Archaeology." Full compensation for removal of underwater debris (shown in said report) that is in conflict with construction work shown shall be considered as included in the prices paid for the various items of work involved, and no additional compensation will be allowed therefor.

REMOVE CONCRETE

Existing concrete at the Pier W2 retaining walls (Bridge No. 34-0006 L/R), where shown on the plans to be removed, shall be removed, in conformance with the provisions in Section 15-3, "Remove Concrete," of the Standard Specifications and these special provisions.

Concrete removed shall be disposed of outside the highway right of way in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Full compensation for remove concrete shall be considered as included in the contract price paid per cubic meter for structural concrete, bridge and no separate payment will be made therefor.

REMOVE FENCE

Existing fence, where shown on the plans to be removed, shall be removed and disposed of.

REMOVE GATE

Existing gate, where shown on the plans to be removed, shall be removed and disposed of.

RECONSTRUCT CHAIN LINK FENCE AND GATE (TYPE CL-2.4)

Existing chain link fence and gate (Type CL-2.4, Black Vinyl-Clad) with barbed wire extension arms, at the locations shown on the plans, shall be removed and reconstructed in conformance with the provisions in Section 80, "Fences," of the Standard Specifications, and these special provisions.

Barbed wire supporting arms (extension arms) shall extend upwards from the tops of the fence posts at an approximate angle of 45 degrees and shall be fitted with clips or other suitable means for attaching 3 lines of barbed wire. The top outside wire shall be attached to the extension arm at a point approximately 300 mm above the top of the chain link fabric and 300 mm out from the fence line. The other wires shall be attached to the arm uniformly between the top of the fence and the top outside wire.

Barbed wire shall conform to the provisions in Section 80-3.01C, "Barbed Wire," of the Standard Specifications.

Fence removed in excess of that required for reconstructing chain link fence shall be disposed of.

Full compensation for removing and disposing of chain link fence (Type CL-2.4, Black Vinyl-Clad) with barbed wire extension arms, shall be considered as included in the contract price paid per meter for reconstruct chain link fence (Type CL-2.4, Black Vinyl-Clad) with barbed wire extension arms, and no separate payment will be made therefor.

Full compensation for removing and disposing of chain link gate (Type CL-2.4, Black Vinyl-Clad) with barbed wire extension arms shall be considered as included in the contract unit price paid for reconstruct chain link gate (Type CL-2.4, Black Vinyl-Clad) with barbed wire extension arms and no additional compensation will be allowed therefor.

10-1.31 PHOTO SURVEY OF EXISTING FACILITIES

Attention is directed to "Environmentally Sensitive Areas (General)" elsewhere in these special provisions, regarding protection of Building No. 262.

The Contractor shall perform two photo surveys, pre-construction and post-construction, of Building No. 262.

The Contractor shall perform the pre-construction photo survey 7 days prior to any field work in the vicinity of Building No. 262, on Yerba Buena Island. Photo surveys shall be conducted in conformance with the requirements in these special provisions. The scope of the examination shall include both internal and external cracks in structures, settlement, and leakage. Crack monitoring shall be performed on all existing cracks with initial crack-gauge installation as part of the photo survey project, as directed by the Engineer. Such monitoring shall include recording gauge readings twice a week, or as determined by the Engineer. A report detailing such readings shall be provided to the Engineer.

The post-construction photo survey shall be completed after removal of temporary towers and falsework.

The Contractor shall submit to the Engineer for approval a complete description of the work to be completed for each surveyed location. The work to be completed shall consist of records of observations, and photographs.

The photograph prints shall be 12.7 cm x 17.8 cm. All negatives shall be provided. All photos shall be identified by date, location, orientation, and labeled with a detailed description. All photos shall be submitted in a 3-ring binder and shall include protective photo sleeves, building layout (including layout of each floor as necessary), and a summary sheet indexing all photos.

Digital photos may be submitted in lieu of print film photographs described above. All other requirements as referenced above shall also apply. In addition, requirements for digital photos are as follows:

- Photos shall have a minimum resolution of 1280 x 960 pixels with no compression.
- Digital prints shall be on a Disublimation Printer (a magazine quality printer capable of color fusion and continuous tone) or a laser printer utilizing photo quality paper.
- All digital photos shall be stored with TIFF File formats on a CD ROM and provided to the Engineer.

The Contractor shall provide the Engineer with 6 copies of approved photo survey records.

The above records and photographs are intended for use as indisputable evidence in ascertaining the extent damage which may occur as a result of the Contractor's operations and are for the protection of the listed property owners, the Contractor, and the State.

PAYMENT

The contract lump sum price paid for photo survey of existing facilities, shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in conducting photo surveys as specified in these special provisions, complete in place, including crack monitoring, and furnishing 6 sets of the approved photo survey records, as specified in these special provisions.

Additional photo surveys of existing facilities other than Building No. 262 will be paid for as extra work as provided in Section 4-l.03D of the Standard Specifications.

10-1.32 VIBRATION MONITORING

This work shall consist of furnishing, installing and maintaining vibration-monitoring instrumentation; collecting vibration data; and interpreting and reporting the results of vibration monitoring as specified herein. This work shall include the implementation by the Contractor of any required remedial and precautionary measures, using the vibration monitoring data, to protect Building No. 262 from excess vibration during construction activities.

GENERAL

The Contractor shall be responsible for the following, including but not limited to:

1. Furnish and install vibration-monitoring instrumentation.
2. Protect from damage and maintain instruments installed by the Contractor and repair or replace damaged or inoperative instruments.

3. Collect, interpret and report data from instrumentation specified herein.
4. Implement response actions.

The Department is not responsible for the safety of the work based on vibration-monitoring data, and compliance with this section does not relieve the Contractor of full responsibility for damage caused by the Contractor's operations.

VIBRATION MONITORING PERSONNEL

The Contractor's vibration-monitoring personnel shall have the qualifications specified herein. Vibration monitoring personnel may be on the staff of the Contractor. However, they shall not be employed nor compensated by subcontractors, or by persons or entities hired by subcontractors, who will provide other services or material for the project.

The Contractor's vibration-monitoring personnel shall include a Vibration Instrumentation Engineer who meets one of the following minimum qualifications:

1. Registered Geophysicist or Professional Engineer in the State of California with at least 5 years of experience in the installation and use of vibration-monitoring instrumentation and data interpretation.
2. Graduate level degree from an accredited University in Physics or Acoustics with at least 5 years experience in the installation and use of vibration-monitoring instrumentation and data interpretation.

The Vibration Instrumentation Engineer shall:

1. Be on site and supervise the initial installation of each vibration-monitoring instrument.
2. Supervise interpretations of vibration-monitoring data.

The Contractor's vibration-monitoring personnel shall be subject to the Engineer's approval.

SUBMITTALS

Prior to any significant impact work and prior to performing any vibration monitoring, the Contractor shall submit to the Engineer a written vibration monitoring plan, vibration monitoring equipment manufacturer's product data and the resumes of the Vibration Instrumentation Engineer and any vibration monitoring technical support personnel.

The vibration monitoring equipment manufacturer's data shall describe in detail all vibration-monitoring instruments. Requests for consideration of substitutions, if any, together with product data and instruction manuals for requested substitutions.

The resumes of the Vibration Instrumentation Engineer and any vibration monitoring technical support personnel shall be sufficient to define details of relevant experience.

The written vibration monitoring plan shall detail the procedures for vibration monitoring. Such details shall include, but not limited to:

1. The name of the Firm providing the vibration monitoring services.
2. Description of the instrumentation and equipment to be used.
3. Measurement locations and methods for mounting the vibration sensors.
4. Procedures for data collection and analysis.
5. Means and methods of providing warning when the particle velocity equals or exceeds specified limits.
6. Generalized plans of action to be implemented in the event the particle velocity equals or exceeds specified limits. The generalized plans of action shall be positive measures by the Contractor to control vibrations (e.g. using alternative construction methods).
7. Name of the "responsible person" designated by the Contractor. The responsible person designated by the Contractor shall have the authority to stop the work causing the vibration.

Within 5 days of receipt of each instrument at the site, the Contractor shall submit to the Engineer a copy of the instruction manual and the laboratory calibration and test equipment certification.

In addition, the Contractor shall submit data and reports as specified in "Data Reduction, Processing, Plotting and Reporting" in these special Provisions.

The review period shall be the same as those set forth in Section 51-1.06A, Falsework Design and Drawings" of the Standard Specifications.

VIBRATION MONITORING EQUIPMENT

The Contractor shall provide portable seismographs for monitoring the velocities of ground vibrations resulting from construction activities. Seismographs shall be Model DS-477 Blastmate II as manufactured by Instantel Inc., Kanata (Ottawa), Ontario, Canada, Model VMS-500 as manufactured by Thomas Instruments, Inc., Spofford, NH, or Model NC5310/D, as manufactured by Nomis Inc., Birmingham, AL, or acceptable equivalent. The seismograph shall have the following minimum features:

1. Seismic range: 0.25 to 102 mm per second with an accuracy of +5 percent of the measured peak particle velocity or better at frequencies between 10 Hertz and 100 Hertz, and with a resolution of 0.25 mm per second or less.
2. Frequency response (+3 dB points): 2 to 200 Hertz.
3. Three channels for simultaneous time-domain monitoring of vibration velocities in digital format on three perpendicular axes.
4. Two power sources: internal rechargeable battery and charger and 115 volts AC. Battery must be capable of supplying power to monitor vibrations continuously for up to 24 hours.
5. Capable of internal, dynamic calibration.
6. Direct writing to printer and capability to transfer data from memory to 90-mm magnetic disk. Instruments must be capable of producing strip chart recordings of readings on site within one hour of obtaining the readings. Provide computer software to perform analysis and produce reports of continuous monitoring.
7. Continuous monitoring mode must be capable of recording single-component peak particle velocities, and frequency of peaks with an interval of one minute or less.

Whenever any product is specified by brand name and model number, such specifications shall be deemed to be used for the purpose of establishing a standard of quality and facilitating the description of the product desired. The term "acceptable equivalent" shall be understood to indicate a product that is the same or better than the product named in the specifications in function, quality, performance, reliability, and general configuration. This procedure is not to be construed as eliminating other manufacturers' suitable products of equal quality.

The Contractor may request to substitute an "acceptable equivalent" vibration monitoring equipment and shall submit complete comparative data to the Engineer for consideration of another product. Any request from the Contractor for consideration of a substitution shall clearly state the nature of the deviation from the product specified. Substitute products shall not be used in the work unless accepted by the Engineer in writing. The Engineer will be the sole judge of the suitability and equivalency of the proposed substitution.

The Contractor's instrumentation personnel shall conduct regular maintenance of seismograph installations.

All seismographs shall have been calibrated by the manufacturer or certified calibration laboratory within one year of their use on site. A current certificate of calibration shall be submitted to the Engineer with the Contractor's data.

A record of laboratory calibration shall be provided for all vibration-monitoring instruments to be used on site. Certification shall be provided to indicate that the instruments are calibrated and maintained in accordance with the equipment manufacturer's calibration requirements and that calibrations are traceable to the U. S. National Institute of Standards and Technology (NIST).

VIBRATION MONITORING

The Contractor shall furnish all installation tools, materials, and miscellaneous instrumentation components for vibration monitoring. At the above listed locations, vibration monitoring and recording shall be performed during the course of all significant impact work, when that activity occurs within 26 meters of the said facility. The 26 meters shall be measured from the edge of the construction activity.

The Contractor shall notify the Engineer at least 24 hours prior to starting a new vibration-producing construction task, and shall have the seismographs in place and functioning properly prior to any work within 26 meter as defined above. No work occurring within this zone shall occur unless monitoring equipment is functioning properly.

The equipment shall be set up in a manner such that an immediate warning is given when particle velocity equal to or exceeding 10 millimeter per second is produced. The warning emitted by the vibration-monitoring equipment shall be instantaneously transmitted to the responsible person designated by the Contractor by means of warning lights, audible sounds or electronic transmission.

Monitoring equipment shall be stationed within 0.9 meter of the exterior of designated buildings on the side facing the Contractor's work site. For buildings whose frontage exceeds 60 meter, at least 2 monitors shall be utilized at that location.

When any reading on monitoring equipment equals or exceeds 10 millimeters per second, work shall immediately cease and the Contractor shall immediately notify the Engineer. If directed by the Engineer, the Contractor shall submit within 24 hours a detailed specific plan of action so that the vibration limits are not violated. The Contractor shall take whatever action is necessary to reduce and maintain the monitoring equipment reading below a particle velocity of 10 millimeters per second.

The seismograph vibration sensors shall be firmly mounted on the surface slab of concrete or asphalt, or firmly set in undisturbed soil.

DATA COLLECTION

Prior to any vibration-producing construction activity, the Contractor shall collect seismograph data to document background vibrations at each monitoring location. This monitoring shall consist of a continuous recording of the maximum single-component peak particle velocities for one-minute intervals, which shall be printed on a strip chart. The background monitoring shall be performed for a minimum of two non-consecutive workdays, spanning the hours during which construction activities will take place.

The Contractor shall monitor vibration during significant vibration-producing construction activities. This monitoring shall consist of a continuous recording of the maximum single-component peak particle velocities for one-minute intervals, which shall be printed on a strip chart. During the monitoring, the Contractor shall document all events that are responsible for the measured vibration levels, and submit the documentation to the Engineer with the data as specified in section "Data Reduction, Processing, Plotting and Reporting" in these Special Provisions. A record form for documenting these events is included herein as Figure 2.

All vibration monitoring data shall be recorded contemporaneously and plotted continuously on a graph by the data acquisition equipment. Each graph shall show time-domain wave traces (particle velocity versus time) for each transducer with the same vertical and horizontal axes scale.

DATA REDUCTION, PROCESSING, PLOTTING AND REPORTING

Within 10 days after the completion of the background vibration monitoring, the Contractor shall submit to the Engineer a hard copy report documenting the results at each of the monitoring locations.

During bridge construction, the Contractor shall provide weekly, hard copy reports summarizing any vibration monitoring data collected at the specified vibration-monitoring locations. The reports for each week shall be submitted on or before the end of the following week.

All reports shall be signed by the approved Vibration Instrumentation Engineer, and shall include the following:

1. Project identification, including District, County, Route, Post Mile, Project Name and Bridge number as shown on the project plans.
2. Location of the monitoring equipment.
3. Location of vibration sources (e.g. traffic, demolition equipment, etc.)
4. Summary tables indicating the date, time and magnitude and frequency of maximum single-component peak particle velocity measured during each one-hour interval of the monitoring period.
5. Field data forms (construction vibration monitoring only).
6. Appendix graphs of the strip charts printed during the monitoring periods.

In addition to the hard copy data specified herein, the Contractor shall provide data on 90 mm diskettes with each report. Electronic data files for all instrument data shall be provided in dBASE IV (.DBF) format.

The Contractor shall not disclose any instrumentation data to third parties and shall not publish data without prior written consent of Caltrans.

PAYMENT

The contract lump sum price paid for vibration monitoring shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for performing all work involving vibration monitoring, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.33 CLEARING AND GRUBBING

Clearing and grubbing shall conform to the provisions in Section 16, "Clearing and Grubbing," of the Standard Specifications and these special provisions.

Attention is directed the provisions in "General Migratory Bird Treaty Act," and in section "Species of Concerns," of "Environmental Work Restrictions," of these special provisions.

At locations where there is no grading adjacent to a bridge or other structure, clearing and grubbing of vegetation shall be limited to 1.5 m outside the physical limits of the bridge or structure.

Existing vegetation outside the areas to be cleared and grubbed shall be protected from injury or damage resulting from the Contractor's operations.

Activities controlled by the Contractor, except cleanup or other required work, shall be confined within cleared and grubbed areas.

Nothing herein shall be construed as relieving the Contractor of the Contractor's responsibility for final cleanup of the highway as provided in Section 4-1.02, "Final Cleaning Up," of the Standard Specifications.

Full compensation for clearing and grubbing shall be considered as included in the contract lump sum price paid for furnish and remove temporary tower and no separate payment will be made therefor.

10-1.34 EARTHWORK

Earthwork shall conform to the provisions in Section 19, "Earthwork," of the Standard Specifications and these special provisions.

Geocomposite drain required as part of the utility opening relocation work at the Pier W2 retaining walls shall be removed and replaced in kind in accordance with the details shown on the plans and the following:

A. Attention is directed to "Engineering Fabrics" under "Materials" of these special provisions.
B. Geocomposite drain shall consist of a manufactured core not less than 6.35 mm thick nor more than 50 mm thick with one or both sides covered with a layer of filter fabric that will provide a drainage void. The drain shall produce a flow rate, through the drainage void, of at least 25 liters per minute per meter of width at a hydraulic gradient of 1.0 and a minimum external applied pressure of 168 kPa.
C. A Certificate of Compliance conforming to the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications shall be furnished for the geocomposite drain certifying that the drain produces the required flow rate.
D. Filter fabric for the geocomposite drain shall conform to the provisions for fabric for underdrains in Section 88, "Engineering Fabrics," of the Standard Specifications.
E. The manufactured core shall be either a preformed grid of embossed plastic, a mat of random shapes of plastic fibers, a drainage net consisting of a uniform pattern of polymeric strands forming 2 sets of continuous flow channels, or a system of plastic pillars and interconnections forming a semirigid mat.
F. The core material and filter fabric shall be capable of maintaining the drainage void for the entire height of geocomposite drain. Filter fabric shall be integrally bonded to the side of the core material with the drainage void. Core material manufactured from impermeable plastic sheeting having nonconnecting corrugations shall be placed with the corrugations approximately perpendicular to the drainage collection system.
G. The geocomposite drain shall be installed with the drainage void and the filter fabric facing the embankment. The fabric facing the embankment side shall overlap a minimum of 75 mm at all joints and wrap around the exterior edges a minimum of 75 mm beyond the exterior edge. If additional fabric is needed to provide overlap at joints and wrap-around at edges, the added fabric shall overlap the fabric on the geocomposite drain at least 150 mm and be attached thereto.
H. Should the fabric on the geocomposite drain be torn or punctured, the damaged section shall be replaced completely or repaired by placing a piece of fabric that is large enough to cover the damaged area and provide a minimum 150-mm overlap.
I. Plastic pipe shall conform to the provisions for edge drain pipe and edge drain outlets in Section 68-3, "Edge Drains," of the Standard Specifications.
J. Treated permeable base to be placed around the slotted plastic pipe at the bottom of the geocomposite drain shall be cement treated permeable base in Section 29, "Treated Permeable Bases," of the Standard Specifications and these special provisions.
K. The treated permeable base shall be enclosed with a high density polyethylene sheet or PVC geomembrane, not less than 250 μm thick, which is bonded with a suitable adhesive to the concrete and geocomposite drain. Surfaces to receive the polyethylene sheet shall be cleaned before applying the adhesive. The treated permeable base shall be compacted with a vibrating shoe type compactor.

Full compensation for geocomposite drain shall be considered as included in the contract price paid per cubic meter for structural concrete, bridge and no additional compensation will be allowed therefor.

Full compensation for structure excavation and structure backfill shall be considered as included in the contract price paid per cubic meter for structural concrete, bridge and no separate payment will be made therefor.

10-1.35 DREDGING

Dredging shall include removal and disposal of marine sediment resulting from temporary structures and maintenance; and shall be considered dredging under the terms of the various permits obtained by the Department.

Attention is directed to "Permits And Licenses" and "Environmental Work Restrictions" of these special provisions.

Attention is directed to "Turbidity Control" of these special provisions for turbidity control requirements for all dredging.

Lateral displacement of dredged material will not be allowed. Maintenance dredging to reach or preserve final grade shall be at the Contractor's expense. Dredging shall be done in accordance with the provisions of the various permits

obtained by the Department. All dredged material shall be disposed of according to the permit requirements and these special provisions.

Dredging Operations Plan

The Contractor shall submit a Dredging Operations Plan (DOP) 60 days prior to the proposed commencement of dredging. Dredging shall not commence until all comments have been addressed and written approval has been granted by the Army Corps of Engineers and the Engineer. The DOP shall include the following:

A. Name and telephone number of the dredging Contractor's representatives on site;
B. Army Corp of Engineers permit number;
C. Dredging start and completion dates;
D. Schedule of dredging operations including sequence of work, anticipated quantities and production rates;
E. Name(s) of vessels;
F. Numbers or identification for all equipment;
G. Bin or barge capacities;
H. Identification and purpose of work;
I. Proposed dredging procedures, including types of equipment to be used, method of slurry of the material with detailed drawings or specifications of the grid or centrifugal pump system;
J. Quality of material to be removed;
K. Overall location of the area authorized to be dredged;
L. A vicinity map showing the proposed upland disposal sites;
M. Proposed volume of material to be dredged and disposed;
N. Dredging design depth based on 1929 National Geodetic Vertical Datum (NGVD) and typical cross section including overdepth; and
O. Date of last dredging operations and design depth.

The DOP shall also provide the following information:

A. The controls being established to ensure that dredging operations occur at the locations shown on the plans and as specified in these special provisions.
B. The controls being established to ensure that disposal of the dredged material at the disposal sites is at the assigned location and depth and the horizontal and vertical positioning systems that will be utilized.
C. Method of determining horizontal and vertical electronic positioning of dredge or dump scow during entire dredging operation at dredge site, disposal site and en route to and from disposal site.
D. Contractor's Dredging Quality Control Plan (DQCP) including:

    1. A description of the DQCP organization including, a chart showing lines of authority; and acknowledgment that the Contractor quality control staff shall conduct the inspections for all aspects of the work specified and shall report to the Contractor's Project Manager, or someone of higher authority, in the Contractor's organization;
    2. The name, qualifications, duties, responsibilities and authorities of each person assigned a quality control function;
    3. A copy of the letter to the DQCP manager; signed by an authorizing official of the firm, which describes the responsibilities and delegates the authorities of the DQCP manager; shall be furnished to the DQCP manager and shall be countersigned by the DQCP manager acknowledging receipt; and
    4. Reporting procedures and methods used to obtain information for quality control forms, including the submittal of displacement and capacity charts for all scows.

After acceptance of the DOP, the Contractor shall notify the Engineer in writing of any proposed changes. Proposed changes are subject to acceptance by the Engineer.

Attention is directed to the provisions in section "Species of Concern," of "Environment Work Restriction," of the special provisions, regarding dredging restrictions.

Solid Debris Management Plan

The Contractor shall submit a Solid Debris Management plan 60 days prior to commencement of dredging. The plan shall describe measures to ensure that solid debris generated during any dredging operation is retained and properly disposed of. At a minimum the plan shall include the following:

A. Source and expected type of debris;
B. Debris retrieval method;
C. Disposal method and site;
D. Schedule of disposal operations; and
E. Debris containment method to be used, if floatable debris is involved.

All such debris shall become the property of the Contractor and shall be disposed of outside the State's right of way in accordance with Section 7-1.13 of the Standard Specifications. No such material shall be disposed of within the jurisdictions of the Army Corps of Engineers and Bay Conservation and Development Commission. Material deemed to be of historical significance as determined by the Engineer shall become the property of the State.

Overflow

No overflow of dredged material or water will be allowed from the receiving barges, bins or dump scows during the dredging operations except for spillage incidental to clamshell dredging operations.

Spillage and Leakage

Dredged material and water shall not be permitted to spill over or leak out of barges or dump scows while in transit to the disposal site. The Contractor shall record draft of hull for each scow load as specified under quality control. No loss in draft or volume will be permitted from containers transporting dredged materials for land disposal. The Contractor shall paint visible draft levels at 0.3 meter intervals and at the 80 percent load line on the inside of each scow.

Overflow and Leakage Monitoring Requirements

The Contractor shall provide equipment that will furnish a continuous printed record of readings and measurements of bulk density and mass flow rate for each pump. These records shall be provided to the Engineer as requested and approved in the Dredging Operation Plan. The Contractor shall provide a list of equipment that will provide the required records. In the event either velocity or displacement equipment breaks down during the dredging operation, the following actions shall be accomplished:

A. An alternative means of measurement shall be performed as approved; and
B. Alternative measurements shall not exceed duration of 72 hours after the equipment breakdown. Verification of repairs shall be provided to the Engineer in the form of receipts or other documentation.

For clamshell dredges, the Contractor shall monitor hull displacement of each scow loaded by the dredge. For hydraulic dredges the Contractor shall provide equipment that will furnish a continuous printed record of readings for measurement of flow rate of the material within 6 meters of the dredge pump, and furnish a continuous printed record of readings for measurement of flow rate of the material within 6 meters of the discharge manifold. The Contractor shall also furnish continuous velocity records at booster pumps. Equipment shall be accessible from above water platforms. If the readings from the velocity flow equipment indicate leakage within the system, the Contractor shall immediately cease work and repair the leaks. In the event that the dredged material is pumped into a barge or scow, displacement shall be monitored as specified for clamshell dredges after dredging and before disposal at the disposal site. The Contractor shall furnish to the Engineer, displacement and capacity plans of all scows. Monitoring for clamshell and hydraulic dredges shall be continuous from initial loading through discharge at the disposal site. The Contractor may use the general configuration in these special provisions for developing a system of monitoring displacement or submit an alternative method for approval. The method shall provide average hull displacement of each scow as specified. The data recorders shall store two-minute averages of the one second input signals from the sensors. The Contractor shall provide and maintain throughout the duration of the contract, one data transfer unit with support software to the State within 30 days after award of the contract, which shall become State property upon completion of the contract. In the event the displacement monitoring equipment breaks down during the dredging operation for any of the scows, an alternative means of measurement shall be performed and results reported using a form. Alternative measurements shall not exceed duration of 72 hours after equipment breakdown. If repairs to the primary equipment are not accomplished within this period, the scow shall not be used until repaired.

The Contractor shall submit the continuous recording records specified for clamshell dredge reports to the Engineer electronically. All data shall be recorded in ASCII text. Any alternatives submitted by the Contractor shall be subject to the approval of the Engineer.

Control and Monitoring Surveys

A short to medium range Electronic Positioning System (EPS) or Global Positioning System (GPS) shall be provided on all vessels involved in dredging operations. The EPS shall be established, operated and maintained by the Contractor during

the period of the contract when dredging work is actively underway. The EPS using range-range methods shall display and record the vessel's location continuously during dredging and transport for disposal. A continuous graphic printout plotter and/or graphic monitor shall be provided on any dredge utilizing a range-range positioning system and a complete record copy of the position data (dredge track history) including date, time, coordinates and Root Mean Square (quality of position closure); and such record shall be submitted to the Engineer as part of the daily report. The Engineer shall have access to the monitoring equipment in order to observe its operation during the dredging work.

The EPS system shall be similar or equal in design, performance, accuracy, operating characteristics, and frequency to those identified in "Hydrographic Surveying" Department of the Army Engineering Manual No. 1110-2-1003, 28 February 1991 (or latest version). This manual is available for purchase at:

USACE Publications Depot
2803 52nd Avenue
Hyattsville, MD 20781-1102

or may be reviewed at the Army Corps of Engineers Construction-Operations Division, San Francisco District Office, 333 Market Street, San Francisco, California.

The Contractor shall be responsible for establishing the horizontal control to locate active or passive shore-based EPS transmitter/receiver devices. All control shall meet Third Order, Class 1, accuracy standards as defined in the publication "Standards and Specifications for Geodetic Control Networks" published by the Federal Geodetic Control Committee (and referenced) under chapter 2 of the Army Corps of Engineers Manual "Hydrographic Surveying". The Contractor shall obtain all right-of-entry permits and/or leases as required to operate and maintain shore-based electronic equipment on public/private property.

EPS calibration techniques shall conform to standard hydrographic surveying practice; consistent with minimization of systematic errors inherent to, and consistent with, the selected EPS system as specified under Chapter 6 of the Army Corps of Engineers manual "Hydrographic Surveying". The Contractor shall be responsible for accurate and reliable EPS calibration for the duration of this contract.

Transport and Disposal

The Contractor shall transport and dispose of the dredged material in accordance with these special provisions and the conditions of the various permits the State has obtained for this contract.

During transport to the disposal sites, no material shall be permitted to overflow, spill, or leak out of the barges, bins or dump scows.

Tugboats are required to use an electronic positioning system (i.e., a miniranger system with at least two transponders or a Global Positioning System (GPS) with a minimum accuracy and precision of 8 meters for disposal operations). If the positioning system fails, all disposal operations shall cease until the navigational capabilities are restored.

The Contractor shall maintain daily records of dredging operations, transportation schedules, barge load volumes disposed, and exact location and time of disposal.

The tug captain shall maintain a copy of all weather reports and shall make wind and sea observations.

The Contractor shall observe all dredging operations and submit reports containing; a description of operations for each barge load, a checklist, a transit route map, a printout of coordinates from each way point and release point, a record of radio transmission, and facsimile from the tug captain on a daily basis.

The Contractor shall allow observers from the State and other appropriate independent observers as specified in permits and approved by the Engineer to be present on disposal vessels on trips to the disposal areas.

Development and implementation of a more sophisticated surveillance systems, which can be demonstrated to and approved by the Engineer to be effective and capable of being audited, may be substituted for one or more of the above provisions.

The Electronic Positioning System (EPS) and methods used for the dredge, as specified herein, shall also be used to display and record the disposal vessel's location at one minute time intervals.

All of the above-mentioned documentation shall be submitted to the Engineer after each transportation and disposal event.

Air Quality Requirements

If the work is performed by clamshell or hydraulic dredge, the Contractor shall be responsible for compliance with all BAAQMD regulations and standards including obtaining a permit for operation of a stationary source of air pollutants. A copy of the permit shall be included with the quality control plan. If applicable, at the Contractor-furnished land disposal site(s), the Contractor will be required to obtain any necessary air quality permits for operation of pumps and equipment. Copies of the permits shall be included with the quality control plan.

Unless "optimized" or diesel powered equipment with the "Best Available Control Technology" emission devices are used, injection timing on diesel powered dredges and equipment shall be retarded two degrees from manufacturer's recommended setting to reduce air pollutant emissions.

Reformulated diesel fuel shall be used for all diesel-powered dredges and equipment to reduce air pollutant emissions. Reformulated diesel fuel shall be a low sulfur, reduced aromatics diesel fuel meeting the following specifications, unless otherwise approved by the Engineer:

A. Sulfur content less than 0.05 percent by weight; and
B. Aromatic content less than 20 percent by volume. Prior to dredging or construction operations, the Contractor shall submit certification from the fuel supplier or manufacturer stating that the fuel contents meet the above requirements and proof of purchase of the above-specified fuel shall be submitted to the Engineer. Dredges and equipment shall not be allowed to idle when not required in performing the work. Dredges and equipment shall be given a tune-up at least annually.

Radiological Safety

If the Contractor intends to use any radiological source on the project, such use shall be reported by letter to the Engineer. The letter shall state the type of radioactive material in the source, serial number of the equipment, manufacturer, licensee, and the purpose for which the equipment will be used. A copy of the last safety certification(s) from the appropriate 01430-3 Federal and State agencies shall be included with the letter. No radiological materials shall be stored, handled or used on this contract without the prior approval of the Engineer. The storage, handling and use of radioactive materials shall comply with the pertinent State and Federal (EM 385-1-1) safety regulations.

Landfill Disposal

Landfill disposal shall be provided by the Contractor for the following dredged material:

A. Material in contact with synthetic slurry used in pile operations;
B. Material resulting from test boring operations; and
C. Material that does not pass through a debris grid as specified.

In-Bay (Aquatic) Disposal

The Alcatraz Dredged Material Disposal Site (SF-11) is not available for disposal of dredged material from this project because the permitted disposal allocation has been met by other contracts.

Ocean (Aquatic) Disposal

The San Francisco Deep Ocean Disposal Site is not available for disposal of dredged material from this project because the permitted disposal allocation has been met by other contracts.

Other Upland Disposal Sites

Land disposal sites for the dredged material not listed in "Landfill Disposal" of this Section consisting of clay, silt, or sand may be approved by the Engineer in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Contractor–Furnished Land or Aquatic Disposal Sites

The Contractor may propose to use alternative aquatic or land disposal site for disposing dredged material intended to be disposed at Alcatraz or the SF-DODS. If an aquatic or land disposal site is proposed, its acceptance will be based on receipt of written evidence from the Contractor stating that the owner's written consent for use of such area has been obtained; that the proposed area has been coordinated with the applicable Federal, State and local agencies; and that all permits have been obtained for use of such sites.

The Contractor shall also submit to the Engineer for approval a plan for the disposal site, which covers, as a minimum, impounding levees and weir structures, pipeline leakage and repair, and effluent weirs and spillways. All expenses incurred in connection with providing and making available such disposal site shall be borne by the Contractor, and all materials deposited thereon, and all operations in connection therewith shall be at the Contractor's risk. EPS monitoring of land disposal operations will not be required.

Combination State and Contractor-Furnished Disposal Sites

The use of both State and Contractor-furnished disposal sites will be allowed. The Contractor may propose to utilize all or a portion of the State-furnished disposal sites. The acceptance of such proposal will be subject to the approval of the Engineer.

Disposal Site Verification Log (DSVL)

The Contractor shall submit a weekly log by 10a.m. each Monday to the Engineer. The DSVL sheets attached to the Army Corps of Engineers Permit (Pages 1 & 2) shall be used to enumerate the work accomplished during the preceding week for submission to the Army Corps of Engineers, Regulatory Branch. The Vessel Traffic Control System will issue a confirmation number, which shall be included in the weekly log. If the DSVL is not submitted on Monday by 10 a.m., no work shall begin on the dredging operations for that week.

Hydrographic Surveys

In the event that open-water dredging is required to complete the work, the following provisions for surveys shall apply. The Contractor shall be responsible for providing an independent surveyor to perform the pre-and post-dredging and quality control surveys for performing the related computations and furnishing the required drawings.

The independent surveyor's equipment and work force shall be independent from the Contractor. The name of the surveyor and samples of previous hydrographic work shall be submitted to the Engineer for review and approval.

The Engineer shall be allowed to board all watercraft performing the hydrographic surveys.

The independent surveyor shall be required to document and certify in writing to the Engineer that he has at least three years of experience in hydrographic surveying of navigable channels and possess either a current land surveyor's or professional engineer's license valid in California and American Congress on Surveying and Mapping (ACSM) certification as an "Inshore Certified Hydrographic Surveyor." He shall provide documentation that modern electronic horizontal positioning and depth finding equipment are available for the surveys to be performed including Differential Global Positioning System (DGPS) capability and shall include as a minimum; the name, model, and year of manufacture of the electronic equipment; the electronic frequencies of the horizontal positioning equipment and the depth finding equipment; and the manufacturer's stated positioning accuracy and capability of the equipment proposed for usage. In addition, he shall document availability of a safe and suitable workboat for operation in the water where the surveys are to be performed, and that experienced staff are available for the operation of the workboat as well as the operation and calibration of the electronic positioning and depth finding equipment calibration. Survey procedures, data collection equipment, methods and densities, and equipment calibration for this work shall follow the criteria given in the hydrographic survey manual specified in this Section for a Class I hydrographic survey. Survey line spacing shall not exceed the limits given in Table 3-1 of the hydrographic survey manual for a Class I hydrographic survey. Survey lines shall be referenced to the project horizontal and vertical datum. Cross sections shall be run at 10 meters center to center (c/c) and shall extend 10 meters past the slope-original ground intersect point.

The Contractor's hydrographic survey procedures (positioning modes, EPS calibration, accuracy requirements, depth measurement/calibration, and data reduction, adjustment, processing, and plotting) shall conform to industry standards identified in the hydrographic survey manual specified elsewhere in these special provisions. Horizontal location observations shall compensate for errors, geodetic corrections, and atmospheric variations. Data recordation, annotation, and processing procedures shall be in accordance with the hydrographic survey manual specified elsewhere. Failure to perform and process such surveys in accordance with the manual and these specifications will result in rejection and nonpayment for work performed. All vertical control shall be of second order accuracy, including levels for the setting of tide gage to NGVD elevation. An automatic electronic tide recording system shall be required during all surveying and dredging operations.

Survey data shall include tidal cycle(s) (whether ebb, flood or slack tide conditions) while performing surveys.

The Contractor shall conduct surveys using electronic system positioning method in accordance with the Hydrographic Survey Manual. The Contractor shall use an echo sounder to obtain soundings. The analog recording of soundings shall indicate a calibration check (bar check) of the echo sounding at the beginning and end of each analog paper change and at such times as necessary to ensure sounding accuracy. Echo sounder shall have a frequency of 200 kHz, with 3.5 degrees cone measured at 6-dB point. The top of the return signal trace shall be the point of interpretation of sounding. The bar check shall be taken at identical locations. Soundings shall be on NGVD datum. The excavation centerlines and slope toes shall be field marked on the fathogram chart during the data acquisition. The contract station, time of survey, tide height and direction that line is surveyed shall also be marked on the fathograms. Annotated survey data shall include tidal cycle(s), i.e., slack or slack tide conditions are occurring while performing surveys.

Field notes shall indicate the location of each sounding line, the date and the time (hour and minutes) each sounding line was taken and explanation for any line terminated early. The tide shall be recorded for each line surveyed and noted on the sections during the survey. Notes shall include tidal data, i.e., height of tide (Mean Lower Low Water Datum), bar checks, time of the tide readings and date and location of the tide gage used for each survey.

Bound field survey books shall be used to record all field data. Fully automated survey systems shall require a field log to supplement the data recorded on magnetic media.

The cross sections of hydrographic sounding line survey results shall be plotted at the scales specified in Table 3-1 of the Hydrographic Survey Manual. Soundings shall be plotted on transparent sheets and show pay quantity excavation templates shown on the plans with survey cross-section. The Contractor's firm name shall be printed on each sheet along with contract name, number and date of survey. Plot scales shall be as approved by the Engineer.

The Contractor shall perform Pre-Dredging Surveys not earlier than 60 days and not later than 30 days before commencement of dredging. The Pre-Dredging Survey shall be completed with accuracy to within 30 mm which delineates the following: areas to be dredged; width overdepth allowances; existing depths; estimated quantities to be dredged for the project; and estimated quantities for overdepth.

The Contractor shall perform hydrographic Quality Control Surveys thirty days after start of dredging and every thirty days thereafter, and after any natural event that would create shoaling of previously dredged areas of the project (e.g., severe storms and earthquakes). These surveys shall verify that all foundation excavation dimensions are being obtained as specified. All surveys shall begin where dredging commenced and end as close as possible to last dredging position. The accuracy shall be consistent with the Pre-Dredging Survey above.

From the Quality Control Surveys, the Contractor shall compute quantities by the average end area method to the nearest cubic meter based on the sounding lines surveyed and the dredging section indicated on the plans. Tabular summaries shall be submitted to show standard depth, overdepth, and total dredging quantities both incrementally and cumulative for open water locations.

The Contractor shall perform a Post-Dredging Survey within 15 days of the last disposal activity at each open water location prior to placing backfill (last being defined as that activity after which no further activity occurs for 15 days), a survey with accuracy to one-tenth foot which delineates the following: areas dredged; dredged depths; actual quantities dredged for the project; and actual quantities of overdepth. The Post-Dredging Survey shall contain the dates of commencement and completion. The Contractor shall substantiate the total quantity dredged by including calculations used to determine the volume difference (in cubic meters) between the Pre- and Post Dredging Surveys and explain any variation in quantities greater than 15 percent beyond estimated quantities.

The quantities calculated from pre-dredging, quality control, and post-dredging surveys shall only be used for permit reporting purposes. Quantities from these surveys shall not be used for measurement of quantities for payment.

The Contractor shall submit all drawings, field notes and quantity computations within 5 days after completion of any survey. The number of sets of drawings shall be as specified below. The Contractor shall mail or deliver drawings and computations to the Engineer for review and submission to the various agencies:

A. Three sets of transparent drawings for each survey;
B. Three sets of computer sheet printouts or calculation sheets for dredging quantities for each survey; and
C. Three sets of cross-sections for each survey.

The Contractor shall submit for each survey, the ASCII file of raw and corrected survey data. Data shall be on CD-Rom, operating under MSWindows 2000 or newer version. The files shall have hydrosurvey information, in both raw and adjusted format. The raw data shall be original data from the hydrosurvey computer. The adjusted data shall be corrected to National Ocean Survey NGVD datum. The record of raw data shall be comma delimited and consist of the following information: index, "x" coordinate; "y" coordinate; "z" elevation; and time. Each adjusted record shall consist of the following information: index; "x" coordinate; "y" coordinate; "z" elevation; time; and tide. The index shall be the first entry, representing the sequence that each point was taken. The index shall be numerical, beginning with the number "one" and continuing until a 24 hour work effort is completed. Each day shall be in one file (one or more disks). This convention is applicable for both raw and adjusted data. Time shall be reported in Gregorian day and military hours and seconds. (For example, "17 March 2001, 9:00 a.m." would be "170301, 090000"). The recording distance between the hydrosurvey points shall be 3 meters or less. All data recorded shall be in ASCII test. Other data collection formats will be considered if presented by the Contractor. Revisions in collection format will not be considered after the project has begun. All alternatives shall be approved by the Engineer.

The Contractor shall provide a complete listing of hydrographic equipment to be used on the project prior to the survey conference specified herein below.

At least 5days prior to performing any survey, the person responsible for that survey, the Contractor's chief surveyor and/or the independent surveyor, shall meet with the Engineer in a survey conference to outline the scope of survey and section interval. No survey work shall be performed until such conference has taken place.

The Department will retain an amount equal to 5 percent of the estimated value of the associated item of work performed during each estimate period in which the Contractor fails to complete the hydrographic surveys.

MEASUREMENT AND PAYMENT

Full compensation for Dredging Operation Plan preparation and updating; preparing and implementing Solid Debris Management Plan; overflow and leakage monitoring; implementing air quality requirements; performing control and monitoring surveys; preparation of disposal site verification logs; and performing hydrographic surveys including data collection and preparation of drawings, cross-sections and calculations shall be considered as included in the contract prices paid for the items of work involved and no additional compensation will be allowed therefor.

10-1.36 EROSION CONTROL (TYPE B)

Erosion control (Type B) shall conform to the plans, the provisions in Section 20-2, "Materials," of the Standard Specifications and these special provisions.

Erosion control (Type B) work shall consist of installing erosion control netting, wire mesh and securing the netting and wire mesh to the slope surface with slope anchors and rope restraint at locations shown on the plans.

Following the installation of erosion control (Type B), erosion control materials shall be applied onto the netting face, measured and paid for, as specified in Erosion Control (Type D) of the contract specifications.

MATERIALS

Materials shall conform to the provisions in Section 20-2, "Materials," of the Standard Specifications and these special provisions.

Erosion Control Netting

Erosion control netting shall consist of 100 percent spun coir fiber and shall conform to the following:

Specification	Requirement
Weight, grams per square meter ASTM Designation: D 3776	400
Minimum Tensile Strength, kilonewtons, ASTM Designation: D 4595-86	9.0 to 11.3 kN/m in longitudinal direction (dry) 5.0 to 10.7 kN/m in cross-direction (dry) 6.0 to 9.8 kN/m in longitudinal direction (wet) 4.0 to 9.4 kN/m in cross- direction (wet)
Roll Width, meters, min.	4
Area/Roll, square meters, min.	200
Open Area, percent	63-70

Staples

Staples for erosion control netting shall be as shown on plans.

Welded Wire Mesh

Welded wire mesh materials shall conform to the provisions in Section 80-3.01 D, 'Wire Mesh' of the Standard specifications and as follows:

Welded wire mesh shall have a maximum opening of 51mm X 102mm. The top and bottom wires shall be 10-gage and the intermediate wires and vertical stays 14-gage.

Roll length shall be a nominal 1.82 X 15.23 M.

Tie wires used to fasten the mesh to adjacent panels shall be no smaller than 13.5-gage.

Slope Anchors

Slope anchors shall conform to the following:

Slope anchors installed in soil shall be made of ductile iron with minimum yield strength of 16 KN. The anchor shall be designed to pivot once embedded into the ground. Holding capacity and pull out resistance is achieved by the anchor pivoting below ground while the anchor is being set. The anchor shall be hot dipped galvanized and shall be equipped with a forged screw zinc coated anchor rod. The anchor rod shall have a minimum diameter of 9.5 mm. and an overall length of 1.0M. The entire anchor rod shall be threaded.

Anchor Plate

Anchor plates shall be metal and treated with a corrosion resistant coating. Anchor plates shall have bent corners and be of dimensions as shown on the plans.

Rope Restraint

Rope restraint shall be a 15.8 mm minimum diameter hemp rope that is multi-strand and braided.

Miscellaneous Material

All miscellaneous hardware such as thimbles, bolts, nuts, etc., shall be galvanized and conform to Section 75, "Miscellaneous Metals," of the Standard Specifications.

INSTALLATION

Erosion control (Type B) shall be installed as follows:

Erosion control netting strips shall be placed loosely on the slope with the vertical joints perpendicular to the slope contour lines. Vertical and transverse joints of each strip shall be overlapped a minimum of 100mm with adjacent strips and stapled. Staples shall be driven perpendicular to the slope, and shall be located and spaced as shown on the plans. Staples shall be driven such that the top of the staple is flush with the ground surface. All ends of the netting shall be buried in place as shown on the plans.

Welded wire mesh shall be placed over the erosion control netting with the vertical joints perpendicular to the slope contour lines and staggered between sections of the erosion control netting such that vertical joints of the mesh are not located on top of vertical netting joints.

Wire mesh shall be secured to the slope with anchor bolt assemblies as shown on the plans. Each wire mesh panel shall overlap the adjacent panel by 100mm and shall be fastened together with tie wires 150mm apart along the overlapped edged. Due to irregular slope surface, individual panels may not overlap each other along the panel edges. In order to mold each panel to lie flush with the slope face and to maintain as perpendicular as possible the alignment of each panel, some gaps between panels may be necessary. Gaps shall be filled by installing filler panels fitted to provide the specified overlap requirement shall be attached by either threading and lacing a tie wire along the perimeter edge or installing ties at a maximum spacing of 150mm along the perimeter.

The Anchor rod shall be tensioned to set the anchor. Once the rod has been driven into the soil to its maximum depth, the anchor rod shall be drawn back at least 100mm or a torque of 1.5 ft./lbs. (18inch-lbs.) is achieved to ensure that the anchor has reached full pivot. A torque wrench may be required to verify pull out resistance. The Engineer shall randomly test installed slope anchors to verify adequate pull out strength.

Once the wire mesh panels are laid down, the anchor plate and rope restraints shall be installed to secure all sections of wire mesh together. Anchor plates shall be located and spaced as shown on the plans. Anchor bolt assemblies shall be located at the overlapped edge portion of adjoining panels or at a closer interval that conforms to the existing topography, as shown on the plans.

Care shall be taken to ensure that a sufficient length of the threaded portion of all slope anchors are above the plane of the slope to accept the metal anchoring plate, washers and nuts.

A rope restraint shall be installed as shown on the plans and secured at each anchor plate.

CERTIFICATE OF COMPLIANCE

The contractor shall provide the Engineer with a Certificate of Compliance from the manufacturer in accordance with the provisions of Section 6-1.07 "Certificate of Compliance" of the Standards.

MEASUREMENT AND PAYMENT

The quantity of Erosion Control (Type B) will be determined by the square meter from actual measurement of the area covered by the erosion control netting and twisted wire mesh excluding overlapped portions.

The contract price paid per square meter for Erosion Control (Type B) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in installing and securing erosion control netting and wire mesh complete in place as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.37 MOVE-IN/MOVE-OUT (EROSION CONTROL)

Move-in/move-out (erosion control) shall include moving onto the project when an area is ready to receive erosion control as determined by the Engineer, setting up all required personnel and equipment for the application of erosion control materials and moving out all personnel and equipment when erosion control in that area is completed.

When areas are ready to receive applications of erosion control (Type D), as determined by the Engineer, the Contractor shall begin erosion control work in that area within 5 days of the Engineer's notification to perform the erosion control work.

Attention is directed to the requirements of "Erosion Control (Type D)" of these special provisions.

Quantities of move-in/move-out (erosion control) will be determined as units from actual count as determined by the Engineer. For measurement purposes, a move-in followed by a move-out will be considered as one unit.

The contract unit price paid for move-in/move-out (erosion control) shall include full compensation for furnishing all labor, materials (excluding erosion control materials), tools, equipment, and incidentals and for doing all the work involved in moving in and removing from the project all personnel and equipment necessary for application of erosion control (Type D), as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

No adjustment of compensation will be made for any increase or decrease in the quantities of move-in/move-out (erosion control) required, regardless of the reason for the increase or decrease. The provisions in Section 4-1.03B, "Increased or Decreased Quantities," of the Standard Specifications shall not apply to the item of move-in/move-out (erosion control).

10-1.38 EROSION CONTROL (TYPE D)

Erosion control (Type D) shall conform to the provisions in Section 20-3, "Erosion Control," of the Standard Specifications and these special provisions and shall consist of applying erosion control materials to Erosion control (Type B) areas, embankment and excavation slopes and all other areas disturbed by construction activities.

Erosion control (Type D) shall be applied when an area is ready to receive erosion control as determined by the Engineer and in conformance with the provisions in "Move-in/Move-out (Erosion Control)" of these special provisions.

If the slope on which the erosion control is to be placed is finished during the rainy season as specified in "Water Pollution Control" of these special provisions, the erosion control shall be applied immediately to the slope.

Erosion Control (Type D) shall be applied upon completion of Erosion Control (Type B) and Fiber Roll installation as described in these special provisions.

MATERIALS

Materials shall conform to the provisions in Section 20-2, "Materials," of the Standard Specifications and these special provisions.

Seed

Seed shall conform to the provisions in Section 20-2.10, "Seed," of the Standard Specifications. Individual seed species shall be measured and mixed in the presence of the Engineer.

Seed shall be delivered to the project site in unopened separate containers with the seed tag attached. Containers without a seed tag attached will not be accepted.

A sample of approximately 30 g of seed will be taken from each seed container by the Engineer.

Legume Seed

Legume seed shall be pellet-inoculated or industrial-inoculated and shall conform to the following:

A. Inoculated seed shall be inoculated in conformance with the provisions in Section 20-2.10, "Seed," of the Standard Specifications.
B. Inoculated seed shall have a calcium carbonate coating.
C. Industrial-inoculated seed shall be inoculated with Rhizobia and coated using an industrial process by a manufacturer whose principal business is seed coating and seed inoculation.
D. Industrial-inoculated seed shall be sown within 180 days after inoculation.
E. Legume seed shall consist of the following:

LEGUME SEED

Botanical Name (Common Name)	Percent Germination (Minimum)	Kilograms Pure Live Seed Per Hectare (Slope Measurement)
Lotus purshianus (Spanish clover)	40	5.0
Lupinus bicolor (Pygmy-Leaf Lupine)	50	4.0
Trifolium incarnatum (Crimson clover)	50	10.0
Lupinus succulentus (Arroyo Lupine)	50	7.0

Non-Legume Seed

Non-legume seed shall consist of the following:

NON-LEGUME SEED

Botanical Name (Common Name)	Percent Germination (Minimum)	Kilograms Pure Live Seed Per Hectare (Slope Measurement)
Hordeum vulgare 'UC 337' (Cereal Barley)	80	45.0
Eschscholzia californica (California Poppy)	50	6.0
Collinsia heterophyllus (Chinese houses)	40	2.0
Hordeum californicum (California Barley)	50	14.0
Elymus glaucus, Berkeley (Blue wild Rye, berkeley)	40	12.0
Nassela Pulchra (Purple needlegrass)	35	10.0
Achillea millefolium (White Yarrow)	35	1.0

Compost

Compost shall be derived from green material consisting of chipped, shredded or ground vegetation or clean processed recycled wood products or a Class A, exceptional quality biosolids composts, as required by the United States Environmental Protection Agency (EPA), 40 CFR, Part 503c regulations or a combination of green material and biosolids compost. The compost shall be processed or completed to reduce weed seeds, pathogens and deleterious material, and shall not contain paint, petroleum products, herbicides, fungicides or other chemical residues that would be harmful to plant or animal life. Other deleterious material, plastic, glass, metal or rocks shall not exceed 0.1 percent by weight or volume. A minimum internal temperature of 57˚C shall be maintained for at least 15 continuous days during the composting process. The compost shall be thoroughly turned a minimum of 5 times during the composting process and shall go through a minimum 90-day curing period after the 15-day thermophilic compost process has been completed. Compost shall be screened through a maximum 9.5-mm screen. The moisture content of the compost shall not exceed 35 –40 percent. Compost products with higher moisture content may be used provided the weight of the compost is increased to equal the compost with a moisture content of 35 –40 percent. Moist samples of compost on an as received basis shall be dried in an oven at a temperature between 105°C and 115°C until a constant dry weight of the sample is achieved. The percentage of moisture will be determined by dividing the dry weight of the sample by the moist weight of the sample and then multiplying by 100. Compost will be tested for maturity and stability with a Solvita test kit. The compost shall measure a minimum of 5-6 on the maturity and stability scale.

Stabilizing Emulsion

Stabilizing emulsion shall conform to the provisions in Section 20-2.11, "Stabilizing Emulsion," of the Standard Specifications and these special provisions.

Stabilizing emulsion shall be in a dry powder form, may be reemulsifiable, and shall be a processed organic adhesive derivative of Plantago ovata used as a soil tackifier.

APPLICATION

Erosion control materials shall be applied in separate applications in the following sequence:

A. The following mixture in the proportions indicated shall be applied with hydro-seeding equipment within 60 minutes after the seed has been added to the mixture:

Material	Kilograms Per Hectare (Slope Measurement)
Legume Seed	26.0
Non-Legume Seed	90.0
Fiber	310
Compost	940

B. The following mixture in the proportions indicated shall be applied with hydro-seeding equipment:

Material	Kilograms Per Hectare (Slope Measurement)
Fiber	310
Compost	940
Stabilizing Emulsion (Solids)	140

Hydraulic application of materials for Erosion control (Type B) areas shall be by hose, from the ground. Erosion control materials shall be applied at close range onto the slope face such that the materials are well integrated into the erosion control materials and in close contact with the ground surface. Application shall be perpendicular to the slope face such that erosion control (netting) materials are not damaged or displaced. Any erosion control materials that are damaged or displaced shall be immediately be repaired by the Contractor at his expense.

The ratio of total water to total stabilizing emulsion in the mixture shall be as recommended by the manufacturer.

The proportions of erosion control materials may be changed by the Engineer to meet field conditions.

MEASUREMENT AND PAYMENT

Compost (erosion control) will be measured by the kilogram or tonne, whichever unit is designated in the Engineer's Estimate. The weight will be as determined by the Engineer from marked mass and sack count or by weight.

The contract price paid per kilogram or tonne for compost (erosion control) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in applying compost for erosion control, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.39 FIBER ROLLS

Fiber rolls shall conform to the details shown on the plans and these special provisions.

MATERIALS

Fiber rolls shall consist of one of the following:

A. Fiber rolls shall be constructed with manufactured blankets consisting of one material or a combination of materials consisting of wood excelsior, rice or wheat straw, or coconut fibers. Blankets shall measure approximately 2.0 to 2.4 m wide by 20 m to 29 m in length. Wood excelsior material shall have individual fibers, 80 percent of which shall be 150 mm or longer in fiber length. Blankets shall have a photodegradable plastic netting or biodegradable jute, sisal or coir fiber netting on at least one side. The blanket shall be rolled on the blanket's width and secured with jute twine spaced 2 m apart along the roll for the full length and 150 mm from each end of the individual rolls The finished roll diameter shall be a minimum of 200 mm and a maximum of 250 mm and shall weigh not less than 0.81 kg/m. Overlapping of more than one blanket may be required to achieve the finished roll diameter. When overlapping is required, blankets shall be longitudinally overlapped 150 mm along the length of the fabric.

B. Fiber rolls shall be pre-manufactured rice or wheat straw, wood excelsior or coconut fiber rolls encapsulated within a photodegradable plastic or biodegradable jute, sisal or coir fiber netting. Each roll shall be a minimum of 200 mm and a maximum of 250 mm in diameter, 3 m to 6 m in length and shall weigh not less than 1.6 kg/m. The netting shall have a minimum durability of one year after installation. The netting shall be secured tightly at each end of the individual rolls.

C. Stakes shall be fir or pine and shall be a minimum of 19 mm x 38 mm x 450 mm in length. Metal stakes may be used as an alternative. The Contractor shall submit a sample of the metal stake to the Engineer prior to installation. The tops of the metal stakes shall be bent over at a 90-degree angle. No additional compensation will be allowed for the use of a metal stake.

INSTALLATION

Fiber rolls shall be joined tightly together to form a single linear roll that is installed as shown on the plans. Fiber rolls shall be installed prior to the application of other erosion control materials.

Furrows shall be constructed at a slight angle to the slope contour-to a depth of 50 mm to 100 mm, and at a sufficient width to hold the fiber rolls The bedding area for the fiber roll shall be cleared of obstructions including, but not limited to, rocks, clods and debris greater than 25 mm in diameter prior to installation. Fiber rolls shall be installed as shown on the plans.

Stakes shall be installed 600 mm apart along the total length of the rolls and 125 mm from the end of each individual roll. Stakes shall be driven flush or a maximum of 50 mm above the roll.

MEASUREMENT AND PAYMENT

Fiber rolls will be measured by the meter from end to end along the centerline of the installed rolls.

The contract price paid per meter for fiber rolls shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in installing fiber rolls, complete in place, including stakes, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.40 EPOXY ASPHALT CONCRETE SURFACING

Epoxy asphalt concrete surfacing shall be furnished and placed in conformance with the provisions in Section 39, Asphalt Concrete," of the Standard Specifications and these special provisions.

The furnishing of epoxy asphalt concrete surfacing will require the modification of an asphalt concrete batch plant, the use of a special metering mix machine, and the purchasing of epoxy asphalt binder from a sole source supplier in order to provide epoxy asphalt concrete surfacing as specified herein. The placing of epoxy asphalt concrete surfacing will require the use of a special bond coat spray distributor and the purchasing of epoxy asphalt bond coat from a sole source supplier in order to provide epoxy asphalt concrete surfacing as specified herein.

GENERAL

Epoxy asphalt concrete surfacing shall be placed on the entire orthotropic steel deck roadway, between barriers, to the limits shown on the plans and to a test area on a Caltrans maintenance roadway located at the Toll Plaza of the San Francisco-Oakland Bay Bridge, as designated by the Engineer.

The epoxy asphalt concrete surfacing shall be placed in two (2) courses, a leveling course and a surface course to the total nominal thickness shown on the plans. The leveling course shall be placed to a variable thickness because of variations in the grade of the steel deck.

Epoxy asphalt binder and bond coat each consist of two separate components, an epoxy resin and a petroleum-derived asphalt with resin hardeners, mixed at high temperatures before being metered into the pug mill as binder or being sprayed on the roadway as bond coat. Both epoxy asphalt binder and bond coat require a very rigid control of mixture, time and temperature.

The binder content of the epoxy asphalt paving mixture shall be between 5.7% and 6.3% by mass of total mix. The Contractor shall determine the binder content to be used per the manufacturer's recommendations and as approved by the Engineer.

The Contractor shall submit a quality control plan in conformance with the requirements in "Quality Control" of this section. The submittal of the quality control plan shall conform to the requirements in "Working Drawings," of these special provisions. At a minimum, the quality control plan shall include the following:

A. Location of the batch plant
B. Complete list of modifications to the batch plant controls, tanks, and piping
C. Methods for controlling epoxy asphalt mix properties including gradation, binder content, mix time, and heat control
D. Hauling times and distances to the jobsite
E. Provisions for temperature control and monitoring during hauling
F. Procedures for controlling temperature and application of bond coat
G. Lay down procedures for epoxy asphalt paving
H. Procedures for attaining specified compaction
I. The names, qualifications, and documentation of certifications for the quality control manager and all quality control inspectors
J. Details, procedures, and schedules of inspection
K. Name and address of test facility and qualifications of personnel performing the tests
L. Details, procedures, and schedules of testing as required by these special provisions
M. Manufacturer's certificates of compliance for both the binder and bond coat

Prior to submitting the quality control plan, a meeting between the Engineer, Contractor, and epoxy asphalt concrete manufacturer shall be held to discuss the requirements of the quality control plan. The meeting shall be held in the San Francisco Bay Area.

After a complete quality control plan is received by the Engineer, the Contractor shall allow the Engineer 10 days to review the submittal. An amended quality control plan or addendum shall be submitted to and approved in writing by the Engineer for proposed revisions to the approved QCP. The Contractor shall allow the Engineer 10 days to complete the review of the amended quality control plan or addendum. No epoxy asphalt concrete work shall begin until a preliminary approval has been given, in writing, by the Engineer.

Epoxy asphalt concrete surfacing shall be furnished and installed in accordance with the approved quality control plan, including any amendments and addenda, and the recommendations of the manufacturer's representative.

SOLE SOURCE SUPPLIER

The components for epoxy asphalt binder and epoxy asphalt bond coat shall be obtained from the following manufacturer:

VENDOR ADDRESS AND PHONE NUMBER
CHEMCO SYSTEMS, INC 2800 BAY ROAD REDWOOD CITY, CA 94063 TEL: 650-261-3790 FAX: 650-261-3799 CONTACT: ROBERT GAUL OR JOHN BORS

The price quoted by the manufacturer for epoxy asphalt binder and epoxy asphalt bond coat are as follows:

Epoxy asphalt binder	$5.82 per kilogram
Epoxy asphalt bond coat	$5.82 per kilogram

Epoxy asphalt binder and epoxy asphalt bond coat prices include delivery to the batch plant site. The above unit prices are based on a minimum combined quantity of binder and bond coat of 250,000 kilograms, delivered in bulk to any site within 64 kilometers of the San Francisco-Oakland Bay Bridge. Prices do not include sales tax. Payment terms are net 45 days after delivery of material.

Price and conditions quoted include all discounts and will be firm for all orders placed on or before December 31, 2005 provided delivery is accepted within 12 months after the order is placed. Total price will be increased by 5% for orders placed with ChemCo Systems, Inc. for each year thereafter, provided that delivery is accepted within 12 months after the order is placed.

The epoxy asphalt bond coat and epoxy asphalt binder prices quoted include all materials, technical advice, and inspections by a qualified representative of the manufacturer, both at the batch plant and during installation, along with a final inspection of the in-place epoxy asphalt concrete. The prices also include consultation on the quality control plan and manufacturer's certificates of compliance for both the epoxy asphalt binder and epoxy asphalt bond coat. The prices also include the rental of a meter/mix machine to process the epoxy asphalt binder at the batch plant the rental of a spray distributor machine to apply the bond coat, each for a period of 60 continuous days.

MATERIALS

Epoxy Asphalt Bond Coat and Binder

Epoxy Asphalt Type V shall be used as the binder for epoxy asphalt concrete and Epoxy Asphalt Type Id shall be used as the bond coat, both as supplied by ChemCo Systems, Inc. and which conform to the following specifications:

Epoxy Resin (Part A for Bond Coat and Binder)

Property	Value	Method
Viscosity @ 23ºC. Poise	110 to 150	ASTM D 445
Epoxide equivalent weight	185 to 192	ASTM D 1652
Color, Gardner. max.	4	ASTM D 1544
Moisture content. % max.	0.05	ASTM D 1744
Flash point, Cleveland open cup. ºC, min.	200	ASTM D 92
Specific Gravity @ 23ºC.	1.16 to 1.17	ASTM D 1475
Appearance.	Transparent amber	Visual

Part B for Bond Coat and Binder

	Bond Coat	Binder	
Product Designation	Type Id	Type V	
Property	Value	Value	Method
Viscosity @ 100ºC. cP, min.	800	140	Brookfield
Specific Gravity @ 23ºC	0.98 to 1.02	0.98 to 1.02	ASTM D 1475
Color	Black	Black	Visual
Acid Value, mg KOH/g.	60 to 80	40 to 60	ASTM 664
Flash Point, Cleveland open cup. ºC, min.	250	200	ASTM D 92

Parts A and B Combined and Cured

	Bond Coat	Binder	
Product Designation	Type Id	Type V	
Property	Value	Value	Method
Weight Ratio, Parts A/B	100/445	100/585	
Tensile Strength @ 23ºC. MPa, min.	6.90	1.52	ASTM D 638
Elongation at break @ 23ºC. % min.	180	200	ASTM D 638
Viscosity increase to 1000 cP @ 121ºC, Minutes, min.	20	50	See Testing
Thermoset Property @ 300ºC	Shall not melt	Shall not melt	Small sample placed on hot plate

Notes: Min = minimum max. = maximum cP = centipoise

Component Part A shall be a liquid diepoxy resin obtained entirely from the condensation of bisphenol A and epichlorohydrin. No diluents, flexibilizers, or plasticizers shall be present. Component Part A shall contain no inorganic fillers, pigments, or other contaminants or insolubles. Component Part A shall be the same for the Type Id bond coat and Type V binder.

Component Part B shall be a homogenous composition of a petroleum-derived asphalt and epoxy resin hardeners. Component Part B shall contain no insolubles such as inorganic fillers or pigments, and no contaminants which would adversely affect automatic metering, mixing, or dispensing.

Components Part A and Part B shall be mixed and applied as specified by the manufacturer and these special provisions.

Specimens for tensile cast sheets of bond material shall be prepared in accordance with the manufacturers recommendation and the following:

A. Two glass sheets (305 mm X 305 mm X 6.35 mm) shall be coated with a suitable spray-on dry film mold release.
B. A seal to contain the liquid shall be formed by threading a length of copper or annealed iron wire through a length of latex rubber tubing 3 mm inch I.D. and 0.75 mm inch wall thickness. The seal shall be bent into a U-shape and shall be placed to within 25 mm of three edges of the plate.
C. Three 2.3 mm spacers shall be placed between the seal and the edges of the plate. The second plate shall be placed on top of the assembly with the coated side down. The assembly shall be firmly clamped together and placed in an oven at 121°C for at least 1 hour but no longer than 5 hours to avoid damage to the rubber seal.

D. The heated assembly shall be removed from the oven and the prepared binder poured into the mold. The mold shall be returned to the oven at 121°C and cured for 4 hours with the mold assembly in the vertical position.
E. After 4 hours the mold shall be taken from the oven and the clamps removed immediately. The mold shall be allowed to cool for no less than 15 minutes then the spacers shall be removed and the glass plates shall be carefully pried apart. The exposed side shall be dusted with powdered talc and the casting carefully removed from the other plate and the reverse side dusted with talc. The wire in the gasket shall be cut at the two corners and removed from the latex tubing. Brush off excess talc and place the casting on a clean flat surface.
F. The casting shall be allowed to cool to room temperature and age for a minimum of 10 hours. The Contractor shall cut dumbbell shaped specimens from the casting in accordance with the requirements in ASTM Designation: D412 using a C die. Cut specimens shall be laid out flat and straight and stored at a temperature of 23 +/- 2 °C for a minimum of 12 hours before testing.

Aggregates

Aggregates for epoxy asphalt concrete surfacing shall conform to Section 39-2.02 "Aggregate," of the Standard Specifications and these special provisions.

Aggregates shall be obtained from the following quarries or equal, as determined by the Engineer:

A. Dumbarton Quarry
B. Brisbane Quarry

Aggregates shall consist of 100% crushed particles. Elongated particles with an aspect ratio of greater than 1 to 3 should be no more than 5% of all aggregate particles by weight.

The combined aggregate grading shall conform to the following gradation immediately prior to mixing with the epoxy asphalt binder:

Grading Limits of Combined Aggregates
9.5-mm Maximum

Sieve Sizes (mm)	Percentage Passing
12.5	100
9.5	95-100
4.75	65-85
2.36	50-70
600 µm	28-40
75 µm	7-14

The aggregate shall conform to the following quality requirements prior to addition of the epoxy asphalt:

Aggregate Quality Requirements

Test	California Test	Requirement
Loss in Los Angeles Rattler (after 100 revolutions)	211	7% Max
Loss in Los Angeles Rattler (after 500 revolutions)	211	22% Max
Sand Equivalent:	217	
A. Individual Test Results	217	42 min.
B. Moving Average Result	217	45 min.
Film Stripping (Max.)*	302	25 %

* After mixing with AR 4000 paving asphalt

If the results of either or both the aggregate grading and Sand Equivalent tests do not meet the requirements specified, the Contractor shall immediately stop paving operations and the Engineer may require removal of the epoxy asphalt concrete that is represented by the tests.

In addition, the aggregate from each separate batch plant bin used for epoxy asphalt concrete, except for the bin containing the fine material, shall have a Cleanness Value of 57 minimum for "contract compliance" and a 65 minimum for "operating range" as determined by California Test 227, modified as follows:

A. Tests shall be performed on the material retained on the 2.36-mm sieve from each batch plant bin and shall not be a combined or averaged result.
B. Each test specimen shall be prepared by hand shaking for 30 seconds, a single loading of the entire sample on a 300 mm diameter, 4.75 mm sieve, nested on top of a 300 mm diameter, 2.36 mm sieve.

Where a coarse aggregate batch plant bin contains material which will pass the maximum size specified and be retained on a 9.5-mm sieve, the test specimen mass and volume of wash water specified for 25 mm x 4.75 mm aggregate size shall be used.

Samples shall be obtained from the batch plant weigh box area during or immediately after discharge from each bin of the batch plant.

If the results of the Cleanness Value tests do not meet the requirements specified for "operating range" but meet the "contract compliance" requirements, placement of the material may be continued for the remainder of that day. However, another day's work may not be started until tests, or other information, indicate to the satisfaction of the Engineer that the next material to be used in the work will comply with the requirements specified for "operating range."

If the results of the Cleanness tests do not meet the requirements for "contract compliance" specified, the Contractor shall immediately stop paving operations and the Engineer may require removal of the epoxy asphalt concrete that is represented by the tests.

Supplemental fine aggregate shall be added to the aggregate as required to conform to the gradation limits specified. Supplemental fine aggregate shall conform to Section 39-3.01 "Storage," and Section 39-3.03A, "Proportioning for Batch Mixing," of the Standard Specifications and the following:

Supplemental fine aggregate shall be ground limestone consisting of a minimum of 90% calcium carbonate, containing no active lime and conforming to the following requirements immediately prior to mixing:

Supplemental Fine Aggregate Requirements

Test	California Test	Requirement
Composition by mass	202	100%
Percentage Passing 300 µm Sieve	202	90-100
Surface Area (sq. meter per kg)	340	29 Max
Specific Gravity	208	2.5 Min.
Moisture Content (%)	226	0.2 Max.

The addition of ground limestone will be limited to 4% of the aggregate batch mass.

The addition of bag house dust will be limited to 1% of the aggregate batch mass.

Composite Properties of Epoxy Asphalt Concrete

Epoxy asphalt concrete in the fully cured condition, as defined by the manufacturer, shall have the following properties:

Properties of Fully Cured Epoxy Asphalt Concrete

Property	Value (Type V)	Test Method
Marshall stability at 60ºC, kN, minimum	40.0	ASTM D1559-91
Flow value at 60ºC, mm, minimum	2.0	ASTM D1559-91
Recovery at 60ºC, percent, minimum	60	ASTM D1559-91
Percent air voids total mix, maximum	3.0	ASTM D3203/1188

The Contractor shall also prepare specimens for testing of uncured epoxy asphalt as follows:

A. Collect specimen material immediately after discharge from pug mill
B. Place specimen in a chamber at a controlled temperature of 115ºC±2ºC within 5 minutes of collection.
C. Specimen shall remain at the specified controlled temperature for a minimum of 60 minutes and a maximum of 70 minutes.
D. Compact specimen and allow to cool in the molds to 23ºC±2ºC. Cooling in water will not be permitted.
E. Test shall be performed within 2 hours of reaching 25ºC.

The uncured epoxy asphalt concrete shall have the following properties:

Properties of Uncured Epoxy Asphalt Concrete

Property	Value (Type V)	Test Method
Marshall Stability at 60ºC, kN, minimum	5.34	ASTM D1559-91
Flow value at 60ºC, mm, minimum	2.0	ASTM D1559-91

Storage, Proportioning and Mixing Materials

General

Epoxy asphalt concrete shall be produced in a batch mixing plant.

1. Storage - Aggregate shall be stored in accordance with Sections 39-3.01, "Storage," 39-3.01A, "Cold Storage" and 39-3.01B, "Hot Storage," of the Standard Specifications. For storage purposes, aggregates shall be considered Type A.

Aggregate shall be stored so that separately sized aggregates will not be intermingled. Any aggregate that has intermingled with another size of aggregate shall be removed and replaced with aggregate of specified grading.

Epoxy asphalt binder and bond coat components shall be stored in separate heated tanks that are free of any contaminants and in accordance with Section 39-3.01C, "Asphalt Binder Storage," of the Standard Specifications and these special provisions. Contaminated materials shall be disposed of in accordance with the requirements of Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications. During the production of epoxy asphalt concrete by the batch plant, the tanks shall be able to maintain the temperature of the Part A (Epoxy Resin) at 82°C to 93°C and the Part B component of the Binder at 138°C to 149°C.

2. Drying - Aggregates shall be dried in accordance with Section 39-3.02, "Drying," of the Standard Specifications.

3. Proportioning - Aggregates and epoxy asphalt shall be proportioned in accordance with Sections 39-3.03, "Proportioning," and Section 39-3.03A, "Proportioning for Batch Mixing," of the Standard Specifications and these special provisions.

The Contractor shall furnish aggregate samples at least 30 days prior to their intended use.

Samples of the proposed aggregate sizes, including bag house dust and limestone dust, shall be sampled and tested for sieve analysis, specific gravity, and quality determination. The Contractor shall determine per the manufacturers recommendation the blend that most nearly fits the optimum hot bin gradations. The blend shall be approved by the Engineer.

After theoretical design gradations have been determined, cold feed trial runs at different gate settings shall be performed until a blending of the resulting hot bin samples produces a gradation in conformance with the mix design gradation. A full

production trial run through the plant at operating temperatures shall be performed and samples taken, separated, and tested. The full production trial run shall be completed and approved by the Engineer before starting the Production Trial.

Adjustments to cold feed settings may be necessary depending on the results of daily samples taken from the hot bins and the results from gradations determined from the extracted paving mixture.

4. Mixing –Aggregate, supplemental fine aggregate, bag house dust and epoxy asphalt binder shall be mixed in a central batch mixing plant in accordance with Sections 39-3.04, "Mixing" and Section 39-3.04A, "Batch Mixing," of the Standard Specifications and these special provisions. ChemCo Systems Meter Mix Machine Model MM2.2 shall be installed at the batch plant and shall be used to meter, mix, and inject mixed binder into the pug-mill of the batch plant.

The batch plant shall conform to the provisions of Section 39-3.06, "Asphalt Concrete Plants," of the Standard Specifications and these special provisions. The plant shall be modified to produce epoxy asphalt concrete. The wet mixing cycle, after all epoxy asphalt binder, aggregates and fine aggregate have been loaded into the pug mill, shall be a minimum of 30 seconds. Depending on the mixing efficiency of the pug mill this minimum time may be increased by the Engineer based on the experience from the Production Trial as described elsewhere in the special provisions.

The plant shall be capable of a minimum production of 50 tonnes per hour with a batch capacity of not less than 1 tonne. Flow meters in the feed lines used to proportion the two epoxy components shall be sealed in accordance with the provisions in the fourth paragraph of Section 9-1.01, "Measurement of Quantities," of the Standard Specifications.

The Contractor's attention is directed to the inter-relationship of batch temperature, hauling times and placement temperature for epoxy asphalt concrete specified in these special provisions. To comply with the above constraints, the location of the batch plant is critical and shall be so located that the batch loading, hauling, and placing times shall comply with the time limits specified in "Spreading and Compacting," of this section.

The epoxy asphalt content of the completed mixture shall be determined by California Test 310 modified as follows:

A. Use samples of 1500g ±150g.
B. Take field samples and mix with extraction solvent within 15 minutes of discharge of the mixture from the pug mill.
C. Verify that sample is completely submerged in solvent.
D. Agitate mixture at least once every 15 minutes until extraction is initiated.
E. Initiate extraction procedure within 90 minutes of discharge of mixture from the pug mill.

Immediately prior to mixing in the meter mix machine, the temperature of the individual components shall be within the following ranges:

A. Part A component 82°C to 93°C.
B. Part B component 138°C to 149°C.

The temperature of the aggregate at the time the epoxy asphalt binder is added shall be sufficient to result in at temperature of the mixture as it is discharged from the pug mill between 110°C and 121°C.

Production Trials

Before epoxy asphalt concrete surfacing operations are started on the deck, the Contractor shall perform production trials which satisfactorily demonstrate to the Engineer that the plant, equipment and procedures to be employed are adequate for proper production, placement, compaction and finishing of epoxy asphalt concrete surfacing. The Contractor shall notify the Engineer, in writing, at least 10 days prior to the start of the Production Trial.

The Contractor shall demonstrate his production operations by applying bond coat and placing at least two paving passes of epoxy asphalt concrete surfacing. The total thickness of the paving shall be 50 mm. The location for the paving pass will be the Caltrans maintenance roadway located at the Toll Plaza of the San Francisco-Oakland Bay Bridge. The paving passes shall not begin until the area involved has been prepared in the same manner specified in "Epoxy Asphalt Bond Coat" elsewhere in this specification. Both passes shall be contiguous to each other and a minimum of 3.65 m wide by not less than 50 m long. During the production trials, the Contractor shall demonstrate his ability to make satisfactory longitudinal and transverse construction joints by stopping the placing operations approximately at the mid-point of the test strip, preparing the construction joint, then resuming the placing operations after a one hour waiting period.

Additional paving passes, at no additional cost to the State, may be required if ordered by the Engineer until the Contractor is able to demonstrate satisfactory production, making longitudinal and transverse construction joints, and producing in-place epoxy asphalt conforming to the requirements in these special provisions. The Contractor shall allow 5 days between the production trial and the start of the surfacing on the deck of the suspension structure for evaluation, testing, and approval by the Engineer.

Epoxy Asphalt Bond Coat.

1. General. Epoxy asphalt bond coat shall be applied to the area to be surfaced as shown on the plans, as specified in these special provisions, and per the manufacturer's recommendations.

Epoxy asphalt bond coat shall be applied only when the roadway surface is dry, the atmospheric temperature is at least 10ºC, and the roadway surface temperature is above 10ºC. If heavy fog or rain is imminent or might be reasonably expected before the bond coat can be covered with finished pavement, the bond coat shall not be applied.

Before application of the bond coat, the bridge railing, new pavement and all other portions of the bridge susceptible to spattering by over spray shall be masked with plastic sheets or other wrapping methods approved by the Engineer, or protected with a traveling shield of a suitable material approved by the Engineer. If over spray does occur, over-sprayed areas shall be cleaned at the Contractor's expense to the satisfaction of the Engineer.

Where the protective paint coating on the steel deck has been damaged, regardless of the cause of damage, the steel shall be painted with one application of a zinc rich primer (organic vehicle type), applied by brush, daubers or spraying as specified in Section 59-2.13, "Application of Zinc-Rich Primer," of the Standard Specifications. The paint shall be thoroughly cured prior to application of the epoxy asphalt bond coat.

Prior to the application of the bond coat, the entire area to be paved shall be swept clean, washed with a 1% solution of nonionic surface active agent (Triton X-100 or equal) and scrubbed with stiff bristle brooms or mechanical sweepers to remove all oil, grease, zinc oxides and loose zinc paint. After washing the entire area shall be rinsed by flushing twice with clean water. The wash water and rinse water shall be prevented from entering storm water conveyances and San Francisco Bay in conformance with the provisions in "Non-storm Water Discharges" of these special provisions.

Areas that have been cleaned and later show contamination prior to application of the bond coat shall be re-cleaned.

Surfaces shall be dry when the bond coat is applied.

Immediately prior to mixing in the Spray Distributor machine, the temperature of the individual components shall be within the following ranges:

A. Part A component 82°C to 93°C
B. Part B component 143°C to 157°C

The mixed bond coat shall be applied at a rate of 0.68 liters per square meter on the primed steel deck and 0.45 liters per square meter on the first course, unless directed otherwise by the Engineer.

The bond coating shall be uniform and continuous and shall be applied to all vertical surfaces of existing pavement, curbs, barriers, construction joints in the surfacing against which additional material is to be placed, the deck or pavement to be surfaced, and to other surfaces designated by the Engineer.

Bond coat applications shall be placed sufficiently in advance of paving operations to prevent slippage of the paving machine. Bond coat shall be reapplied if the coated areas are not covered within 3 days. If the bond coat becomes wet after application from rain or condensation the epoxy asphalt concrete shall not be placed until the moisture has evaporated. Bond coat shall be applied to an area not exceeding 75-mm wider than the width of the paving pass.

The applicators of the bond coat shall wear protective clothing, including face shields and dust/mist respirators.

Transporting, Spreading and Compacting

1. General - Spreading and compacting equipment shall conform to the requirements of Section 39-5, "Spreading and Compacting Equipment," of the Standard Specifications and as specified in these special provisions.

Epoxy asphalt concrete surfacing shall be placed in 2 (two) courses. Epoxy asphalt mixtures shall be placed only when the roadway surface is dry, the atmospheric temperature is at least 10ºC, and the roadway surface temperature is above 10ºC. If heavy fog, rain or temperature drop to below 10ºC is imminent or might reasonably be expected before placement can be completed or dew is forming, epoxy asphalt mixtures shall not be placed.

After compaction the Contractor shall remove 75 mm along the longitudinal edge by power cutting a 45-degree slope in a general straight longitudinal line. The Contractor shall also remove 150 mm of transverse joints by power cutting to a vertical face and to a neat line. The longitudinal and transverse joints of the leveling and finish courses shall be off set approximately 150 mm.

At locations where the epoxy asphalt concrete is to be placed over areas inaccessible to spreading and rolling equipment, including the railing edge, the epoxy asphalt concrete shall be spread to obtain the specified results and shall be compacted thoroughly to the required lines, grades and cross sections by means of vibrating rollers, pneumatic tampers, or by other methods that will produce the same degree of compaction as required by these special provisions.

2. Transporting – Epoxy asphalt concrete shall be transported from the batch plant to the job site in haul trucks having tight, clean, smooth container bodies that have been oiled with a minimum amount of thin oil, as recommended by the manufacturer, to prevent adhesion of the surfacing mixture to the truck bodies. Each load of surfacing mixture shall be covered with canvas or other approved material to protect the mixture from the weather and to prevent loss of heat. Any load

wetted by rain will be rejected. Haul trucks shall have tires with well-defined treads. Trucks with smooth, bald tires will not be permitted.

Each haul truck shall have three, 10 mm holes drilled in the two side walls of the truck bed through which long-stem (approximately 30 cm) thermometers can be inserted for measuring temperature of the mix in the truck. The holes shall be located 30 ± 5 cm above the bottom of the bed and located at the mid point and 60 ± 10 cm from each end of the truck bed. Before each truck leaves the batch plant long-stem thermometers shall be placed into each of the three holes in the side walls of the truck bed.

In order to reach the paving machine haul trucks must pass over uncured bond coat. To minimize tracking of bond coat from the haul truck tires onto the clean steel deck or freshly paved epoxy asphalt, plywood or other suitable material shall be placed on the deck at the location haul trucks drive off of the uncured bond coat after discharging their load into the paving machine.

Epoxy asphalt concrete shall be discharged directly from the mixer into the hauling vehicle, except a holding container such as a front end loader or other device as approved by the Engineer may be used while verifying mix requirements prior to discharging into the hauling vehicle. The use of a storage silo to accumulate batches will not be permitted.

The allowable time between batching at the plant and placing into the paving machine at the job site is dependent upon the temperature of the batch mixture taken at the batch plant. Batches or portions thereof registering below 110ºC or above 121ºC when discharged from the pug mill will be rejected. No load or portion of a load shall be placed after the specified reject times.

Allowable times between batching at the plant and placing into the paving machine at the job site for respective temperatures, shall conform to the following:

Time Limits For Making And Transporting Epoxy Asphalt Type V

Temperature of Mix* Degrees C	110	111	112	113	114	115	116	117	118	119	120	121
Maximum time in minutes	94	90	86	82	79	76	73	70	66	63	60	57
Minimum time in minutes	69	66	63	60	58	55	53	51	49	48	46	45

Notes:
1. *Temperature of Mix is average temperature of all batches in a truck load.
2. Maximum time is the longest time allowable from making first batch in a truckload to emptying truck into paving machine.
3. Minimum time is the shortest time allowable from making first batch in a truckload to emptying truck into paving machine.

The temperature of each load shall be measured as each haul truck reaches the bridge deck using the long stem thermometers that had been inserted through the holes in the truck bed side wall and into the paving mix at the batch plant. If any of the three thermometers are not embedded in the load because of the manner of placement of the load in the truck that reading shall be disregarded in calculating the average temperature. Any load with a temperature registering below 110ºC or above 121ºC, based on the average temperature determined with these three temperature readings, will be rejected. Rejected loads shall be removed from the bridge deck.

Each haul truck shall carry a record of the average temperature of all batches in the truck and time of first and last batch into the truck. Any rise in the temperature of a batched mix of epoxy asphalt concrete at the time of placement in the paving machine shall be cause for rejection of the batch by the Engineer.

3. Spreading – Epoxy asphalt concrete mix shall be placed with an asphalt-paving machine as specified herein. The epoxy asphalt mix shall be deposited directly from the haul trucks into the hopper of the paving machine. Depositing the epoxy asphalt mix in a windrow followed by pickup and placement into the hopper of the asphalt-paving machine by loading equipment will not be permitted.

In addition to the requirements in Section 39-5.01, "Spreading Equipment," of the Standard Specifications, epoxy asphalt paving equipment shall be equipped with automatic screed controls and sensing devices.

The deck surface shall be surveyed to determine flatness. If the plane of the deck does not vary more than ±3 mm over 3.6 m, a ski may be used with the paving machine to control the thickness of the pavement.

When placing epoxy asphalt concrete the automatic controls shall control the longitudinal grade and transverse slope of the screed. Grade and slope references shall be furnished, installed and maintained by the Contractor. Should the Contractor elect to use a ski device, the minimum length of the ski device shall be 10 m. The ski device shall be a one-piece unit and the entire 10-m length shall be utilized in activating the sensor.

When placing epoxy asphalt concrete, on the initial paving pass, the end of the screed nearest the centerline shall he controlled by a sensor activated by a ski device not less than 10-m long. The opposite end of the screed shall be controlled by an automatic transverse slope device set to reproduce the cross slope designated by the Engineer and maintaining the minimum thickness of the course.

When paving contiguously with previously placed mats, the end of the screed adjacent to the previously placed mat shall be controlled by a sensor that responds to the grade of the previously placed mat and will reproduce the grade in the new mat within a 3-mm tolerance. The end of the screed farthest from the previously placed mat shall be controlled in the same manner as when placing the initial mat.

Should the methods and equipment furnished by the Contractor fail to produce a layer of epoxy asphalt concrete conforming to the requirements, including straightedge tolerance required in Section 39-6.03, "Compacting," of the Standard Specifications, the paving operations shall be discontinued and the Contractor shall modify his equipment or furnish substitute equipment in order to achieve the specified results.

Should the automatic screed controls fail to operate properly during any day's work, the Contractor may use manual control of the spreading equipment to place the epoxy asphalt concrete already mixed and on hand. However the equipment shall be corrected or replaced with alternative automatically controlled equipment conforming to the requirements in this section before restarting the batch plant.

The epoxy asphalt concrete shall be placed in 2 (two) lifts. The first course (leveling course) shall establish a uniform finished grade within 25 mm ± 3 mm of the final grade. The final compacted thickness of the pavement shall be 50 mm ± 3 mm. The minimum thickness of either course shall be 19 mm.

4. Compacting - Rolling shall produce an epoxy asphalt concrete surface of uniform smoothness and density and a pavement that has a maximum 3% air voids, as measured in accordance with ASTM Designation: D3203. The Engineer may require cores to be taken from the completed pavement to measure air void content.

A minimum of two tandem steel-tired rollers weighing not less than 9,000 kg nor more than 12,000 kg and two pneumatic-tired roller, all fully operated, shall be furnished for each paving machine operated on the project. Pneumatic tired rollers shall be not less than 1.2 m in width and with all tires of equal size and diameter and shall have a tread approved by the Engineer. Wobble-wheeled rollers will not be permitted. The tires shall be so spaced that the gaps between adjacent tires will be covered by the following tires. The tires shall be inflated to 620 kPa and have an operating mass per tire of not less than 900 kg.

The initial or breakdown compaction for the leveling course shall be performed with a pneumatic-tired roller and shall consist of 3 coverages of the epoxy asphalt concrete, and shall be completed before the temperature of the mix drops below 82ºC. The initial or breakdown compaction for the leveling course shall be followed immediately with a steel-tired tandem roller and shall consist of 3 coverages. Final rolling shall be performed with a pneumatic-tired roller and shall consist of 3 coverages before the temperature drops to 65ºC.

The initial or breakdown compaction for the surface course shall be performed with a steel-tired tandem roller and shall consist of 3 coverages of the epoxy asphalt concrete, and shall be completed before the temperature of the mix drops below 82ºC. The initial or breakdown compaction for the surface course shall be followed immediately with a pneumatic-tired roller and shall consist of 3 coverages. The surface course of the epoxy asphalt concrete shall be compacted additionally without delay by a final rolling consisting of not less than 3 coverages with a steel-tired roller weighing not less than 9,000 kg. and shall be completed before the temperature of the mix drops below 65ºC.

Minimum amounts of water shall be used on rollers as required to prevent pickup of paving materials. Additives may be used as release agents provided they are approved by the manufacturer. Rollers shall be equipped with scrapers or brushes to remove any paving material that may be picked up.

Random blisters shall be punctured immediately with a sharp object and the area re-compacted.

If the finished surface of the epoxy asphalt concrete on the traffic lanes does not meet the specified surface tolerances, it shall be brought within tolerance by either (1) abrasive grinding with fog seal coat on the areas which have been ground or (2) removal and replacement. The method will be selected by the Engineer. The corrective work shall be at the Contractor's expense.

If abrasive grinding is used to bring the finished surface to specified surface tolerances, additional grinding shall be performed as necessary to extend the area ground in each lateral direction so that the lateral limits of grinding are at a constant offset from, and parallel to, the nearest lane line or pavement edge, and in each longitudinal direction so that the grinding begins and ends at lines normal to the pavement centerline, within any ground area. All ground areas shall be neat rectangular areas of uniform surface appearance. Abrasive grinding shall conform to the requirements in the first paragraph and the last four paragraphs in Section 42-2.02, "Construction," of the Standard Specifications.

Vehicles and equipment will not be permitted to stand on the freshly paved epoxy asphalt until 48 hours after final rolling.

The Contractor shall remove excess loose material by means of a vacuum sweeper.

Unless otherwise permitted by the Engineer, the use of water to cool the mat will not be permitted.

QUALITY CONTROL

During paving operations, including the Production Trial, samples shall be taken and tested as follows:

A. Cold feed bins shall be sampled and tested to determine Sand Equivalent, aggregate grading, and Cleanness Value twice each day
B. Epoxy asphalt concrete mixture shall be sampled and tested in the uncured condition to determine Marshall stability, and flow value twice per 100 tonnes of paving
C. Epoxy asphalt concrete mixture shall be cured as determined by the manufacturer and tested to determine Marshall stability, flow value, percent recovery and percent air voids twice per 100 tonnes of paving
D. Extraction shall be performed on the paving mixture in accordance with California Test 310, as modified by these special provisions, and determination made of binder content twice each day
E. Extraction shall be performed on the paving mixture in accordance with California Test 310, as modified by these special provisions, and sieve analysis performed on the extracted aggregate twice each day
F. At the start of each day's bond coat application, a sample shall be taken from the spray wand and a tensile sheet cast and tested as specified in "Epoxy Asphalt Bond Coat and Binder" of these special provisions

MEASUREMENT AND PAYMENT

The quantity of epoxy asphalt concrete aggregate measured in accordance with the provisions in Section 9-1.01, "Measurement of Quantities," of the Standard Specifications, will be the difference between the mass of the completed mixture and the mass of the epoxy asphalt binder added thereto, and will be paid for by the tonne as epoxy asphalt concrete aggregate.

Epoxy asphalt bond coat and binder will be measured and paid for by the kilogram . Component materials shall be weighed separately or combined. Quantities of bond coat and binder component materials remaining at the end of the surfacing work shall be measured and deducted from payment quantities if such materials have been previously included in payment measurements.

Apply epoxy asphalt bond coat and place epoxy asphalt concrete surfacing will be measured and paid for by the square meter. The area to be paid for will be calculated from the contract plans and field measurements. Measurements will be made to the nearest 30 mm. Areas will be calculated to the nearest tenth of a square meter.

The above contract prices and payments shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing epoxy asphalt concrete complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for supplemental fine aggregate shall be considered as included in the contract price paid per tonne for epoxy asphalt concrete aggregate, and no additional compensation will be allowed therefor.

Full compensation for performing cold feed trial runs and full production runs shall be considered as included in the various contract items involved for epoxy asphalt concrete, and no additional compensation will be allowed therefor.

Full compensation for producing and testing specimens shall be considered as included in the contract price paid per square meter for place epoxy asphalt concrete surfacing and no additional compensation will be allowed therefor.

Full compensation for conforming to the requirements of quality control shall be considered as included in the various contract items involved for epoxy asphalt concrete and no additional compensation will be allowed therefor.

Full compensation for repairing damaged paint on the steel deck shall be considered as included in the various contract items involved for epoxy asphalt concrete and no additional compensation will be allowed therefor.

10-1.41 TEMPORARY TOWERS

Temporary towers used for the construction of the bridge superstructure shall conform to the information shown on the plans and these special provisions.

The temporary towers shown on the approved working drawings shall be designed and constructed by the Contractor in conformance with the requirements in Section 49, "Piling," and Section 51-1.06, "Falsework," of the Standard Specifications and these special provisions.

Temporary towers shall include jacking assemblies and appurtenant items necessary to jack and support the superstructure, and compensate and maintain the proper roadway alignment and profile.

GENERAL

Attention is directed to the following sections of these special provisions regarding permit restrictions and regulations that may impact temporary tower design and construction:

1. Relations with U. S. Coast Guard
2. Relations with Regional Water Quality Control Board
3. Relations with United States Fish and Wildlife Service
4. Relations with California Department of Fish and Game
5. Relations with National Marine Fisheries Service
6. Maintaining Traffic
7. Relations with Bay Conservation Development Commission

Temporary tower foundation information and piling design procedures (including example calculations) are included in the "Information Handout" available to the Contractor as provided for in "Project Information" of these special provisions and Section 2-1.03, "Examination of Plans, Specifications, Contract, and Site of Work," of the Standard Specifications.

SCHEDULE OF VALUES

Attention is directed to "Accelerated Working Drawings Submittal" in these special provisions.

The Contractor shall submit, for approval by the Engineer, a schedule of values detailing the cost breakdown of the contract lump sum item for furnish and remove temporary towers. The schedule of values shall reflect the items, work, quantities and costs required to furnish, erect, and remove temporary towers, except for costs required to prepare working drawings as included in the contract lump sum price paid for "Accelerated Working Drawings Submittal". The Contractor shall be responsible for the accuracy of the quantities and cost used in the schedule of values.

The sum of the costs for the items of work listed in the schedule of values shall equal the contract lump sum price for furnish and remove temporary towers.

No adjustment in compensation will be made in the contract lump sum price paid for furnish and remove temporary towers due to differences between the quantities shown in the schedule of values furnished by the Contractor and the quantities required to complete the work as shown on the plans and specified in these special provisions.

The schedule of values shall be submitted to the Engineer within the time required for submittal of the Interim Baseline Schedule, as specified in "Progress Schedule (Critical Path)," of these special provisions. When approved in writing by the Engineer, the schedule of values will be used to determine progress payments for furnish and remove temporary towers during the progress of the work. No progress payment for furnish and remove temporary towers will be made until the schedule of values is approved in writing by the Engineer.

The schedule of values shall categorize the work by tower location and shall quantify the values into the following progress payment milestones:

A. Furnish temporary tower material
B. Erect temporary tower
C. Remove temporary tower

The Contractor may propose additional milestones for progress payment subject to approval by the Engineer.

WORKING DRAWINGS

The Contractor shall submit to the Engineer working drawings and design calculations for temporary towers, in conformance with the requirements in "Working Drawings," of these special provisions. The Contractor shall allow the following review times, after notification is received from the Engineer, for the review of temporary tower working drawings and design calculations:

Location	Review Time
AE and AW	50 Days
BE and BW	50 Days
CE and CW	50 Days
DE and DW	50 Days
EE and EW	50 Days
FE and FW	50 Days
GE and GW	50 Days
HE and HW	50 Days

When several temporary tower drawings or calculations are submitted simultaneously, or additional drawings or calculations are submitted for review before the review of previously submitted drawing or calculation has been completed, the Contractor shall designate the preferred sequence in which the plans and calculations are to be reviewed. The time to be provided for the review of any drawings and calculations in the sequence shall be not less than the review time specified above for that plan, plus 10 days for each plan of higher priority which is still under review.

Working drawings for temporary towers shall include, the following:

A. Locations of the temporary towers needed to support the deck
B. Complete details showing the proposed construction sequence, including the deck and foundations.
C. Concrete placing diagram.
D. Method and plans for release of tower to superstructure connections.
E. Erection methods and removal plans.
F. Descriptions of equipment and associated loads, including the loads shown on the plans.
G. Complete details for providing grade adjustment to compensate for anticipated settlement and proper fit up.
H. Complete details and descriptions of the displacement monitoring system described in these special provisions.
I. Details and descriptions of equipment and methods proposed for monitoring the erection, position, settlement and deflection of temporary towers.
J. Schedule of taking displacement measurements.
K. Pile Data Table including the design loads, bearing value, and required pile tip elevations.
L. Details for pile installation techniques, spread footings, tie-downs, driven piles and CIDH piles, as appropriate.
M. Details for alternative installation techniques for installing driven piles, in case pile refusal is encountered more than 3 meters above the design penetration. Techniques shall include the effects on bearing value and any design modifications.

Design calculations for temporary towers shall include, at a minimum, the following:

A. Summary of computed stresses in the temporary towers for all design loading conditions. Computed stresses shall include effects from any grade adjustment assumed by the Contractor to ensure proper grade and fit up.
B. Assessment of lateral stiffness and significant periods of vibration of the temporary towers system.
C. Calculations for providing grade adjustment to compensate for anticipated settlement and ensure proper fit up.
D. Calculation of pile setup period(s).
E. Calculation of pile alignment and location tolerances.
F. Driven pile refusal criteria.
G. Driving system submittal.
H. Dynamic monitoring equipment and setup.
I. CIDH drilling system submittal.
J. Pile handling submittal.
K. Design pile length.
L. Schedule.

SLOPE RESTORATION

Attention is directed to the existing steep slope at Yerba Buena Island between Bent W2 and Building No. 262 (Torpedo Building). The slope, and any other areas affected by the construction and removal of temporary towers, shall be restored to the original (existing) grade by the Contractor and approved by the Engineer.

The Contractor shall submit to the Engineer slope restoration working drawings that include existing contour grading, restoration procedures, erosion control treatment, materials, and design calculations for any earth reinforcement and support structure for the restoration of the slope. Areas excavated shall be returned to pre-excavation conditions.

Any work that will change the existing contour grade of the slope will not be allowed before slope restoration working drawings are approved.

TEMPORARY TOWER FOUNDATIONS

The types of foundations used for the temporary towers will vary along the length of the bridge. Spread footings, footing tie-downs, driven piling and cast-in-drilled-hole (CIDH) piling may be used, depending on the surficial materials and the depth to bedrock. The recommendations presented in the Information Handout for the allowable bearing pressures, tie-down bond strength, CIDH bearing capacity and driven piling capacity shall be adopted in the design of these types of foundations.

SPREAD FOOTINGS AND TIE-DOWNS

Spread footings and tie-downs shall be designed and constructed in accordance with the design recommendations in the Information Handout, the Standard Specifications, and these special provisions.

Spread footings shall be constructed in a dry or dewatered condition.

Equipment or methods for drilling tie-down sockets in rock shall not result in a smooth hole. The Contractor shall provide to the Engineer for approval information on the roughness that is expected for the sockets.

DRIVEN PILING

Driven piling used to support temporary towers located in the bay shall be steel pipe piling. The pile sections shall be compact, capable of plastic deformations without local buckling.

The requirements in Section 49-1.03, "Determination of Length," of the Standard Specifications shall not apply.

Driven piling shall be of such length as required to develop the minimum bearing value, as defined the Information Handout, to obtain the design penetration and to extend into the pile cap, as shown on the approved working drawings. Attention is directed to the use of Pile Dynamic Monitoring of piles which are designed to be tipped into rock to obtain end bearing capacity.

Driving Equipment

Diesel and steam hammers shall not be used to install driven piling.

Jetting and drilling in conformance with Section 49-1.05, "Driving Equipment," of the Standard Specifications shall not be used.

Pile Dynamic Monitoring

Where required to obtain verification of rock contact for end bearing, as shown on the approved working drawings, or as otherwise required by the Engineer, the Contractor shall conduct dynamic monitoring of pile driving and conduct penetration and bearing analyses based on a wave equation analysis. The analysis shall be signed by an engineer who is registered as a Civil Engineer in the State of California and submitted to the Engineer prior to completion of temporary tower erection.

The Contractor's monitoring equipment shall be capable of generating a continuous computer printout of monitoring results.

Each pile to be dynamically monitored shall be fitted with two sets of attachments. These attachments shall be located on opposite sides of the pile.

Bearing Criteria

The first and second paragraphs in Section 49-1.08 "Bearing Value and Penetration," of the Standard Specifications shall not apply. Pile tip elevation and bearing capacity shall be determined as shown the Information Handout using capacity curves where appropriate. Where the locations of the temporary towers are outside the limits shown in the Information Handout, the Contractor shall determine the bearing capacity of the piles at that location, using the same method specified in the Information Handout and this capacity shall be submitted to the Engineer for approval.

Piles shall be driven to the design tip elevation and a minimum bearing value of not less than the design loading shown on the approved working drawings, unless otherwise specified in these special provisions or permitted in writing by the Engineer. Pile bearing values shall be determined using skin friction only, except where the pile is tipped in rock.

For piles that encounter driving refusal above the approved design tip elevation, the Contractor shall notify the Engineer in writing. The Contractor shall evaluate these piles and propose alternative pile installation techniques. No additional compensation will be allowed for developing and using alternative pile installation methods.

The Contractor shall provide a pile driving log at the completion of driving each pile and with the notification of driving refusal.

CIDH PILING

Drilling Equipment

The fifth paragraph in Section 49-4.03 "Drilled Holes" of the Standard Specifications shall not apply.

Drilling equipment shall be selected and operated to ensure that the surfaces of sockets drilled in rock are not smooth.

The Contractor shall provide to the Engineer for approval information on the roughness that is expected for the sockets.

Bearing Criteria

Pile tip elevation and bearing capacity shall be determined as shown in the Information Handout. End bearing shall not be used in the determination of bearing capacity. The bearing capacity calculations shall be submitted to the Engineer for approval.

TEMPORARY TOWER DESIGN

Temporary towers shall consist of steel braced frames with bolted connections used for field erection splices. Welded connections performed in the Contractor's fabrication facilities shall be designed in accordance with AISC or API RP2A for hot rolled sections and steel tubular sections, respectively. The Contractor shall provide 2 copies of the stated codes to the Engineer. Timber walkways and decks will be permitted. At the option of the Contractor, temporary tower pile caps may be made of reinforced concrete.

The temporary towers shall be classified as "building and other structures designated as essential facilities," per ANSI ASCE 7-95.Cable bracing and tie-rod bracing will not be permitted.

Timber connections shall be designed in conformance with the procedures, stresses and loads permitted in the Falsework Manual as published by the California Department of Transportation, Division of Structures, Division of Structure Construction.

The construction equipment loads shall be the actual weight of the construction equipment, material and personnel, but in no case shall be less than 960 N/m2 of deck surface area.

Temporary towers shall be designed in accordance with the following criteria/codes:

Subject	Design Code or Reference	Year
Structural Steel	AISC-LRFD	Current Edition
Structural Steel – Tubular Members and Connections	API RP2A	Current Edition
Concrete	AASHTO-LRFD Bridge Construction Code	Current Edition
Wind Loads	ASCE 7-95	1995
Falsework	State of California Dept. of Transportation – Falsework Manual	Current Edition

In case of a difference between the code clauses, the more stringent clause shall apply.

In addition to the above design criteria and design codes, temporary tower design shall also conform to the wind loading requirement specified in Section 10-1.59, "Steel Structures," subsection "Assembly," of these special provisions.

Design of temporary towers shall account for any change in the loads imposed on the tower by the bridge superstructure due to the construction sequence of the bridge.

Temporary towers shall be designed to adequately support the bridge without imparting distortion or exceeding the allowable stresses in the bridge. Allowable stresses in the box girder shall not exceed the allowable values given in AISC.

The total design settlement of temporary towers shall not exceed 25 mm.

The twentieth paragraph of Section 51-1.06A "Falsework Design and Drawings," of the Standard Specifications shall not apply.

The design of temporary towers shall be based on assumed loads that are equal to or greater than those described in this section.

The design of the temporary towers shall conform to both the service and ultimate limit state criteria set in these special provisions as well as in the referred codes. The Contractor shall be responsible for the proper evaluation of the falsework materials and design of the falsework to safely carry the actual loads imposed.

The fifth and sixth paragraphs of Section 51-1.06A(1), "Design Loads," of the Standard Specifications shall not apply.

Vertical Loads

Temporary towers and their foundations shall be designed to carry the anticipated total effective tower load.

The total effective tower load shall be determined including, at a minimum, the effects of the following:

A. Tower foundation, including fenders;
B. Load from supported bridge; and
C. Contractor's equipment and live load.

The vertical loads from the supported bridge shall be determined by the Contractor for the selected construction method. Vertical loads shown on the plans are for information only and shall be calculated by the Contractor.

Seismic Design Loads

Temporary towers shall be designed to resist horizontal seismic loads as defined below in combination with the appropriate vertical loads covering all significant construction stages. The seismic analyses shall consider the interactions of the temporary towers with the bridge superstructure at all appropriate stages. Seismic design loads need not be considered during lifting operations. The seismic performance of the temporary towers shall be such that the bridge superstructure is undamaged and not stressed excessively. The temporary towers shall remain serviceable and capable of carrying the design loads. Tower vertical load carrying members and connections shall remain elastic. Structural steel of the bracing members may yield. Extreme fibers of the structural steel piles may yield to a maximum of 2% strain.

Analysis and design calculations shall correctly incorporate all contributing mass, stiffness, loading and energy dissipation characteristics of the temporary towers including geotechnical and structural components and hydrodynamic added mass. P-delta effects shall be considered in the analyses.

Modal spectral analysis with sufficient number of modes to capture at least 90% of the mass of the structure shall be used to establish the peak seismic displacements. Longitudinal and transverse static push-over analyses shall be used to verify that temporary towers capacities exceed the demands corresponding to 1.50 times the peak seismic displacements. Pushover analyses of the temporary towers shall be carried out based upon displaced shapes defined, at a minimum, as the primary transverse and longitudinal mode shapes. The mode shapes shall be determined from modal analyses of the temporary towers and the supported bridge superstructure.

Seismic demands shall be determined for two independent horizontal loading conditions in perpendicular directions. The directions are defined to be in the longitudinal axis of the bridge and the transverse axis of the bridge. In order to account for directional uncertainty of earthquake motions, the demands resulting from analyses of the two perpendicular seismic loading directions shall be combined into two load cases as follows:

EQ load case 1 1.0 longitudinal and 0.3 transverse
EQ load case 2 0.3 longitudinal and 1.0 transverse

Acceleration levels applied to the temporary towers shall be generated using the Acceleration Response Spectrum shown on plan sheet "Construction Sequence 1A." For the purpose of practicality, the response spectrum can be used for all locations along the length of the self-anchored suspension bridge as input motion. These lateral loadings supersede the 0.02 g lateral load requirement in the California Department of Transportation Falsework Manual.

These Seismic Design Loads are the minimum required during construction. The Contractor may elect to design and construct the temporary towers for a greater level of loading. No additional compensation will be allowed nor extension of time will be granted due to the Contractor's use of loading that exceeds the required minimum.

Within 90 days of contract award, the Contractor shall hold a meeting between the Engineer, the Contractor and the Contractor's designer of the temporary towers. The Contractor shall present to the Engineer preliminary temporary tower design and details and methods of analyses he proposes to use.

Vessel Impact Design Loads

Temporary towers shall be designed for accidental vessel impact and coincident wind, and current loads calculated in accordance with API RP2A. Tide and current information are included in Section 3.4 of the Ship Collision Report contained in the Information Handout.

Attention is directed to the AASHTO Guide Specification and Commentary for Vessel Collision Design of Highway Bridges (1991) regarding design for accidental impact.

Temporary towers shall be designed to resist loads from impact of the Contractor's equipment. At a minimum, temporary towers shall be designed to resist an accidental impact load of 7.6 MN from any direction caused by an unattended barge, acting between elevation +7.6 m and –1.8 m NGVD, without causing any damage to the supported superstructure.

The rake of the bow of a 76 m x 14 m hopper barge shall be used to determine whether the impact force will occur on the fenders and foundation or whether the vessel will impact the tower substructure.

Temporary towers shall not be used for mooring the Contractor's vessels, unless they are specifically designed for mooring loads, including the effects of the eccentric application of these loads.

Design Load Combinations for Load Factor Design

Temporary towers shall be designed using the following load combinations:

1.1 DL + 1.3 LL
1.0 (DL + LL + 0.5 Wind + Current + Vessel Impact)
1.0 (DL + LL + EQ)
1.0 (DL + LL + Wind)

Temporary Tower Foundations - Driving System Submittal

The Contractor's temporary tower working drawings shall include a driven pile installation schedule that is in conformance with "Progress Schedule (Critical Path Method)," of these special provisions.

Prior to installing driven piling at a given temporary tower location, the Contractor shall provide a driving system submittal for that tower location, including a driveability analysis, in conformance with the provisions in "Working Drawings," of these special provisions. Technical data for all proposed driving systems (i.e., each hammer that may be brought onto the site) shall be included in the submittal.

The driving system submittal shall be based on the soil profiles shown in the Information Handout and shall contain an analysis showing that the proposed driving systems will install piling to the Contractor's design tip elevation, as shown on the approved working drawings without overstressing the piles. Submittals shall include the following:

A. Complete description of soil parameters used, including soil quake and damping coefficients, skin friction distribution, percentage shaft friction, and total soil resistance to driving.
B. List of all hammer operation parameters assumed in the analysis, including manufacturer's rated energy, fuel settings, stroke limitations, and hammer efficiency.
C. Driveability studies that are based on a wave equation analysis using a computer program that has been approved by the Engineer. Driveability studies shall model the Contractor's proposed driving systems, including the hammers, capblocks, pile cushions, followers and driving shoes, as well as determine driving resistance and pile stresses for assumed site conditions. For open-ended steel pipe piles, soil resistance to driving shall be computed for both plugged and unplugged cases. The range of soil resistance to driving and the percentage shaft resistance shall be determined for site conditions ranging from 5 meters above to 5 meters below the Contractor's design tip elevation shown on the approved working drawings. Separate analyses shall be completed at elevations above the design tip elevations where difficult driving or pile splices are anticipated. Driveability analysis results shall include plots of the following:

    1. Maximum pile head and pile toe compressive stress versus blows per 250 mm.
    2. Soil resistance to driving versus blows per 250 mm.

D. Copies of all test results from any previous pile load tests, dynamic monitoring, and all driving records used in the analyses.
E. Completed "Pile and Driving Data Form," which is shown in these special provisions.
F. Estimate of pile penetration due to self-weight and the weight of the hammer.

The Contractor shall allow the Engineer 15 days to review a driving system submittal.

The Contractor shall use the driving system and installation methods described in the approved driving system submittal for each temporary tower location. Any change in hammers from those submitted and approved by the Engineer shall also meet the requirements for driving system submittals. Revised and new driving system submittals shall be approved by the Engineer prior to using corresponding driving systems on temporary tower piling. The Contractor shall allow the Engineer 15 days to review each revised and each new driving system submittal after a complete set has been received, as determined by the Engineer.

Approval of pile driving equipment shall not relieve the Contractor of his responsibility to drive piling free of damage to the design penetration.

Temporary Tower Foundations – CIDH Drilling System Submittal

The Contractor's temporary tower working drawings shall include a CIDH pile installation schedule that is in conformance with "Progress Schedule (Critical Path Method)," of these special provisions.

Prior to installing CIDH piling at a given temporary tower location, the Contractor shall provide a drilling system submittal for that tower location, including drilling rig details, drilling fluids, drilling casing, fluid handling system and cuttings disposal system. Technical data for the proposed drilling systems shall be included in the submittal.

MANUFACTURED ASSEMBLIES

Manufactured assemblies shall conform to the provisions in Section 51-1.06A(2) "Design Stresses, Loadings, and Deflections," of the Standard Specifications and these special provisions.

All jacks shall be equipped with a load cell for determining the jacking force. Pressure gages shall have an accurately reading dial at least 150 mm in diameter. Each jack shall be calibrated by a private laboratory approved by the Transportation Laboratory within 6 months prior to use and after each repair, unless otherwise directed. Each jack and its gage shall be calibrated as a unit with the cylinder extension in the approximate position that it will be at final jacking force and shall be accompanied by a certified calibration chart. Load cells shall be calibrated and provided with an indicator by which the jacking force is determined.

Jacks for temporary towers shall be load-rated for at least 125% of the design service loads.

CONSTRUCTION

The construction of temporary towers at each location shall not begin until the Engineer has reviewed and approved the drawings for that location.

The Contractor shall be responsible for monitoring the erection, position, settlement and deflection of temporary towers in accordance with the requirements of this section and submitting logs of these deflections and settlements to the Engineer. Deflection logs shall be provided to the Engineer within 12 hours of recording the measurements.

The third paragraph of Section 51-1.06B, "Falsework Construction," of the Standard Specifications shall not apply.

Welding, welder qualification, and inspection of welding for all steel members shall conform to the requirements of AWS D1.1, except that all CJP welds that sustain tension shall be tested by UT or RT.

Prior to erecting bridge members on the temporary towers, an engineer for the Contractor who is registered as a Civil Engineer in the State of California shall inspect the temporary towers, including grade adjustment and displacement monitoring systems, for conformity with the working drawings. The Contractor's registered engineer shall certify in writing that the temporary towers, including grade adjustment and displacement-monitoring systems, substantially conform to the working drawings, and that the material and workmanship are satisfactory for the purpose intended. A copy of this certification shall be submitted to the Engineer and shall be available at the site of the work at all times.

Grade adjustment operations shall be carefully controlled and monitored to prevent imparting distortion and excessive stresses that would damage the structure.

Adequate means shall be employed to prevent unplanned lateral and longitudinal movement of the temporary tower during jacking. The temporary towers, jacks, and the superstructure shall be stable during all phases of the operation. The jacking system shall be designed such that pressure loss of any hydraulic system cannot cause movement after jacking operations. This may be by means of a mechanical lock off of the jacks, replacement of the jacks by supports that can be cast in, or alternative methods. The Contractor's jacking methods shall include provisions for blocking up the superstructure from the temporary towers such that the gap between the temporary tower and the superstructure during all phases of the jacking operation does not exceed 25 mm.

Temporary towers shall be protected from damage during construction.

Fenders and navigation lighting for temporary towers shall conform to the requirements in "Relations with the United States Coast Guard" of these special provisions.

REMOVING TEMPORARY TOWERS

When no longer required, temporary towers shall be completely removed, unless otherwise directed by the Engineer. Temporary tower piling shall be removed at least 1.0 meter below the original mudline in-bay, and at least 1.0 meter below the original ground in-land.

Working drawings for the existing Skyway temporary towers (AE) and (AW) are included in the Information Handout, available to the Contractor as provided for in "Project Information" of these special provisions and Section 2-1.03, "Examination of Plans, Specifications, Contract, and Site of Work," of the Standard Specifications.

Section 51-1.06C, "Removing Falsework," of the Standard Specifications shall not apply.

MEASUREMENT AND PAYMENT

The contract lump sum price paid for furnish and remove temporary towers, shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in furnishing and removing temporary towers, including designing, constructing, maintaining, and removing temporary towers, furnishing and installing temporary tower foundations, temporary tower foundation installation submittals, monitoring and redriving piles, necessary grade adjustment and displacement monitoring, as shown on the plans, and all work involved with slope restoration, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer. Section 49-6, "Measurement and Payment," of the Standard Specifications shall not apply.

Costs for preparing working drawings in excess of amounts allocated in "Accelerated Working Drawings Submittal" item shall be considered as included in contract prices paid for the various items of work and no additional compensation will be allowed therefor.

The contract lump sum price paid for remove Skyway temporary tower, of the types listed in the Engineer's Estimate, shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in removing Skyway temporary towers, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.42 PRESTRESSING CONCRETE

Prestressing concrete shall conform to the provisions in Section 50, "Prestressing Concrete," of the Standard Specifications and these special provisions.

WORKING DRAWINGS

The Contractor shall submit prestressing working drawings in conformance with the provisions in Section "Working Drawings" elsewhere in these special provisions. Working drawings and supplement shall be submitted for all prestressing operations including permanent and temporary prestressing.

The Contractor shall submit substantiating calculations for the prestressing steel system and stressing method proposed by the Contractor whether or not it differs in any respect from that shown on the plans.

Working drawings shall include the following:

A. Required jacking force and elongation of tendon and prestressing bar at the time of tensioning.
B. Details of local reinforcement in the concrete to resist anchorage stresses including the reinforcement shown on the plans, required by the anchorage manufacturer, and designed by the Contractor.
C. Detailed grouting plan for each tendon or bar including the following:

    1. Types and locations of inlet and outlet vents.
    2. Types and sizes of grout hoses and connections.
    3. Direction of grouting.
    4. Sequence of vent closing.

A supplement to working drawings shall include the following:

A. Stress in anchorage and distribution plates.
B. Stress-strain curves of the prestressing steel to be used.
C. Seating losses.
D. Losses due to both vertical and horizontal angle changes.
E. Characteristics of the prestressing system to be used such as curvature and wobble friction coefficients, anchor set, and relaxation curves.
F. Force diagrams indicating tendon forces after friction losses, anchor set losses, and elastic shortening based on the characteristics of the prestressing system to be used.
G. The locations and the connections of vents to be placed.
H. The stressing sequences of all tendons.
I. The grouting sequences for all ducts.
J. Supplement to detailed grouting plan including the following:

    1. Type, quantity, and brand of grout materials.
    2. Grout physical property test laboratory and frequency.
    3. Type of grouting equipment needed, including capacity in relation to demand and working condition, as well as provisions for back-up equipment and spare parts.
    4. Duct cleaning methods prior to grouting.
    5. Mixing and pumping procedures.
    6. Procedures for handling blockages, including flushing of ducts.
    7. Procedures for possible regrouting.
    8. The names of the persons in responsible charge of the grouting operation, including their relevant experience and skill.

K. Detailed grouting quality control plan including the following:

1. Inspection of grout materials to ensure the specified type and quantity
2. Inspection of grout equipment to ensure satisfactory condition
3. Inspection of ducts to ensure that they are free of water, debris, and other obstructions
4. Inspection of ducts to ensure there is no grout leakage between adjacent ducts in joint areas
5. Temperature measurement of air, water, and concrete elements to ensure compliance with the grout manufacturer's recommendations

After complete working drawings and supplement are submitted to the Engineer, the Contractor shall allow the Engineer 60 days to review and approve the working drawings and supplement. No stressing operation shall be performed without the Engineer's approval of the working drawings and supplement.

After a submittal has been approved, if the Contractor submits a revised prestressing working drawing submittal, the Contractor shall allow the Engineer additional 10 days to review the revised submittal.

MATERIALS

The Contractor shall provide the Engineer all certificates of compliance for materials used in prestressing and grouting construction.

Anchorages and Distribution

Anchorages shall be set in a plane normal to the axis of the tendons such that uniform bearing on the concrete is achieved. Anchorages shall be furnished with a steel reinforcing spiral for those tendons having a prestressing force greater than 1350 kN.

Ducts

Embedded ducts shall be corrugated.

Ducts for multi-strand tendons shall be a diameter that provides an inside area at least 2.5 times the net area of the prestressing steel.

Duct spacing shall be detailed in the working drawings such that there is sufficient concrete between parallel ducts to prevent interconnections between ducts during grouting operations. Ducts shall have a minimum clear spacing of 25 mm, or shall be placed in bundles and grouted simultaneously as a group.

CONSTRUCTION

Stressing

Post-tensioning forces shall not be applied until at least 3 days for concrete members after the last concrete has been placed in the member to be prestressed and until all concrete has attained the specified compressive strength as shown on the plans.

Prestressing steel shall be cut by an abrasive saw within 20 to 40 mm from the anchoring device. Flame cutting of prestressing steel will not be allowed.

In the event that more than 2 percent of the number of wires in a tendon break during the stressing operation, the tendon shall be removed and replaced.

The Contractor shall submit to the Engineer a system of tendon identification, individually and in groups, the sequence of all tendons to be stressed to expedite the tasks of the Contractor and the Engineer in identifying and tracking the installation and stressing of the post-tensioning.

At least 20 days prior to the start of prestressing, the Contractor shall submit a sample prestressing log for the Engineer's approval. This shall provide for the recording of the following data (at both ends of tendons, when appropriate):

A. Dates of tendon installation and stressing.
B. Tendon identification.
C. Tendon location.
D. Tendon size.
E. Tendon length.
F. Strand or bar identification.
G. Duct type and diameter (ID, OD).
H. Anchorage type.
I. Tendon elongation and slippage (theoretical).
J. Gage pressure.
K. Master gage pressure, if used.
L. Jacking force (per calibration curve).

M. Anchor set (theoretical).
N. Jack and gage identification.
O. Dates of tendon installation and stressing (actual).
P. Tendon length (actual).
Q. Jacking force (actual).
R. Tendon elongation and slippage (actual).
S. Anchor set (actual).
T. Wire or strand breakage, if observed.
U. Corrosion inhibitor, if used, date inserted.
V. Dates of grouting.
W. Grout volume placed.
X. Grout pressure.
Y. Remarks.
Z. Signatures of persons conducting the stressing and grouting operations.

For each tendon, at least 2 days prior to prestressing operation, the Contractor shall submit the partial prestressing log including the records listed above from A through N to the Engineer for review. No stressing operation shall be performed without the Engineer's approval. The Contractor shall submit the full prestressing log to the Engineer within 3 days after the prestressing of each tendon is complete.

The stressing method shall permit the jacking force and tendon elongation to be measured at all times; the tendon elongation shall be measured to an accuracy of ±2 mm. For a tendon to be immediately acceptable, the measured jacking force in the tendon shall be within ±5% of the value shown on the plans, and simultaneously the measured tendon elongation shall be within ±7% of the theoretical value (calculated from the measured stress-strain curves and friction coefficients).

Based on actual characteristics of the prestressing system to be used, if the Contractor's calculated jacking forces are different from that shown on the plans, the Contractor shall adjust the jacking forces to match the required tendon force diagrams as shown on the plans.

If the Contractor fails to meet these tolerance requirements, the Engineer may suspend further stressing operations and the Contractor shall review the stressing records for the out of tolerance tendons, determine the discrepancy, and propose a solution for approval by the Engineer. The proposed solution shall include the necessary steps to improve the accuracy of stressing. No compensation will be made for any costs incurred or for delay in completing the stressing operations resulting from failure to meet the tolerance requirements.

Grouting

The grouting equipment shall utilize gravity feed to the pump from a hopper attached to and directly over it. The hopper shall be kept at least partially full of grout at all times during the pumping operation to prevent air from being drawn into the post-tensioning duct. The grouting equipment shall be capable of continuously grouting the longest tendon in no more than 30 minutes. The pump shall have seals adequate to prevent introduction of oil, air, and other foreign substances into the grout and to prevent loss of grout or water. The grouting equipment shall be capable of continuously and mechanically mixing and producing a grout free of lumps and undispersed cement.

The Contractor shall use positive displacement type grout pumps capable of producing an outlet pressure of at least 1 MPa, with seals adequate to prevent oil, air or other foreign substances entering into the grout and to prevent loss of grout or water. The Contractor shall place a pressure gauge having a full-scale reading of no more than 2 MPa at some point in the grout line between the pumping outlet and the duct injection inlet.

The Contractor shall provide back up grouting equipment and independent back up power supply to ensure that grout placement can continue if the primary equipment or power supply fails.

The grout shall be continuously agitated until it is pumped.

Batches shall be placed within 30 minutes of the start of mixing.

All grout vents shall be open before grouting starts. The Contractor shall provide injection and ejection vents with positive shut-offs. Grout shall be allowed to flow from the first vent after the inlet pipe until all residual flushing water and entrapped air has been removed, at which time the vent shall be capped or otherwise closed. Remaining vents shall be closed in the same manner. A continuous flow of grout at a rate between 5 and 15 meters of duct per minute shall be maintained. If a one-way flow of grout cannot be maintained as outlined above, the grout shall be immediately flushed out of the duct with water.

The pumping pressure at the injection vent shall not exceed 1 MPa for oval ducts nor 1.7 MPa for circular ducts. Normal operations shall be performed at approximately 500 kPa. If the actual grouting pressure exceeds the maximum allowed, the injection vent shall be closed and the Contractor shall inject the grout at the next vent that has been, or is ready to be, closed as long as a one-way flow is maintained. The Contractor shall not inject grout into a succeeding vent from which grout has not yet flowed. Bottom-up grouting shall be performed from the low points.

Positive shut-offs at the vents shall not be removed or opened until the grout has set. In temperatures below 0°C degrees, the ducts shall be free of water to avoid damage to ducts due to freezing. The temperature of the concrete or air surrounding the tendon shall be 2°C or higher from the time grout is placed until the minimum compressive strength of 5.5 MPa, as determined from tests on 50 mm cubes cured under the same condition as the in-place grout, is obtained. Grout shall not be above 32°C during mixing or pumping. If necessary, the mixing water shall be cooled.

Vertical or nearly vertical tendon grout tubes shall be terminated in reservoirs at the uppermost point. The reservoirs shall have a sufficient capacity to store all bleed water to enable its reabsorption into the grout. The reservoirs shall be maintained until the grout is set and the bleed water absorbed. Top vertical post-tensioning anchorages shall have additional holes for regrouting top part of the tendons if necessary.

Ends of steel vents shall be removed at least 25 mm below the concrete surface after the grout has set. Ends of plastic vents shall be removed to the surface of the concrete after the grout has set. All miscellaneous materials used for sealing grout caps including paper, tie wire, and duct tape shall be removed before carrying out further work to protect end anchorages or filling in concrete anchorage blockouts.

When friction must be reduced, water soluble oil or graphite shall be used as a lubricant. The chemical composition of either water soluble oil or graphite shall not be deleterious to the steel or concrete, and either substance used shall be flushed, and the duct shall be blown dry with oil-free air.

If a water soluble lubricant is applied to the prestressing steel, the tendon shall be flushed, and the water shall be totally drained from within the tendon and it shall be blown out to dry the prestressing steel and the inside surfaces of the duct.

Within 4 hours after stressing and prior to grouting, the Contractor shall protect tendons against ingress or water, corrosion or harmful effects of debris, by temporarily plugging or sealing all vents and placing the grout caps over the wedge plate until the tendon is grouted.

The Contractor shall record the progress of grouting operations for each tendon and submit a written report to the Engineer within 72 hours after grouting. This report shall include:

A. The quantities and types of materials used.
B. Discussions of problems encountered during grouting and steps taken to resolve them.
C. The maximum pumping pressure at inlet.
D. Temperature measurement of air, water, cement, prepackaged material, mix grout, and concrete member in the duct shall also be recorded and reported. The report shall indicate whether all applicable parameters were within allowable limits of these special provisions.

The Contractor shall complete the grout operation within 30 days after prestressing steel is stressed. Failure to grout the tendons within 30 days will result in stoppage of the affected work.

For enclosures of prestressing anchorages, tight fitting forms shall be installed and held in place securely against the previously placed concrete.

Concrete with a water cement ratio of 0.35 and with a high range water reducer providing a ball penetration value between 90 mm to 115 mm, shall be placed behind the forms and cured.

All excess materials and fluids generated from the grouting operation shall be collected, contained and removed from the structure and disposed of in conformance with Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

10-1.43 HIGH STRENGTH PRESTRESSING ROD (75 MM)

GENERAL

High strength prestressing rods in the W2 cap beam consisting of 75 mm steel rods with anchorages that are grouted in steel ducts shall conform to the details shown on the plans, the provisions in Section 50, "Prestressing Concrete," of the Standard Specifications, and the requirements of these special provisions. Splices in high strength prestressing rods will not be permitted.

Whenever the term "rod" or "rods" appear on the plans or in these special provisions, it shall mean bars conforming to the requirements of British Standard 4486, "Hot Rolled and Hot Rolled and Processed High Tensile Alloy Steel Bars for the Prestressing of Concrete," as follows:

A. Section 1 to 6 – Applicable
B. Section 7 – Replace this section with the following:

    1. The nominal tensile strength = 1030 N/mm2
    2. The nominal 0.1% proof load = 835 N/mm2
    3. The minimum elongation at fracture = 6%

C. Section 8 - Not applicable
D. Section 9 - Superseded by the requirements of this section

Whenever "member" is referred to in Section 50, "Prestressing Concrete," of the Standard Specifications it shall be considered to mean high strength prestressing rod.

HIGH STRENGTH PRESTRESSING ROD MANUFACTURER

High strength prestressing rods (75 mm) shall be manufactured and supplied by:

MACALLOY LIMITED
HAWKE STREET, SHEFFIELD, S9 2LN
UNITED KINGDOM

TEL: +44 (0) 114 242 6704
FAX: +44 (0) 114 243 1324

Macalloy MFT75 rods and anchorages are the only large diameter high strength prestressing rods known to the State meeting the requirements of this contract. Preliminary testing results and technical data for 75 mm Macalloy MFT75 rods and anchorages have been submitted, reviewed, and determined to be satisfactory by the Engineer.

Macalloy Limited has agreed to furnish 75 mm high strength prestressing MFT75 rods and other services described in these special provisions at the guaranteed price in United States dollars as shown in the following table:

No. of Rod Assemblies	Guaranteed Unit Price	Guaranteed Price
304	$780	$237,120

The guaranteed price is valid for a United Kingdom Pounds (GBP) to United States Dollars (USD) exchange rate of 1 GBP = $1.72 USD +/- 5 percent at the time of order. For exchange rates outside of these limits, the guaranteed price will be based on the actual exchange rate at the time the order is placed.

The guaranteed price includes the following:

A. Working drawings and supplements.
B. Quality control for the manufacture of both the final products and test specimens.
C. Manufacture of 75 mm high strength prestressing rods and anchorages.
D. Proof testing of high strength prestressing rods and anchorages in accordance with the requirements of "Testing," in this section.
E. Furnishing rods for sampling and testing, including shipping to the independent laboratory.

The guaranteed price does not include the following:

A. Delivery to U.K. Port, sea transportation to U.S. Port, installation and stressing of high strength prestressing rods.
B. Inspection and installation consultation by a qualified representative of the manufacturer at the job-site during installation and stressing of all high strength prestressing rod assemblies.
C. Steel ducts and grouting of ducts after stressing.
D. Applicable sales taxes and customs duties.
E. The cost of transportation and accommodations for manufacturer's personnel.

The manufacturer's charge for stressing the prestressing rods, including all necessary labor and equipment is $700 per day for weekdays and $1050 per day for Saturdays and Sundays. The estimated duration of stressing is 12-14 days. The manufacturer's charge for a qualified representative at the job site for inspection and consultation during prestressing rod installation is $700 per day for weekdays and $1050 per day for Saturdays and Sundays. These charges apply from day of departure from U.K. to the day of return back to U.K. The FOB location for prestressing rod assemblies is U.K. Port.

The Contractor shall notify the Engineer and Macalloy Limited at least 30 days prior to the date on which a Macalloy representative is required to be present at the job site.

The above prices will be guaranteed for orders placed with Macalloy Limited on or before December 31, 2005, provided delivery is accepted between 8 and 20 weeks after the order is placed. The total price will be increased 5 percent for orders placed with Macalloy Limited after December 31, 2005 and on or before December 31, 2006, provided delivery is accepted between 8 and 20 weeks after the order is placed.

Use of the Macalloy high strength prestressing rods is contingent on approval of the contract specific working drawing submittal and successful performance of the Macalloy high strength prestressing rods and anchorages under the testing requirements of this section.

WORKING DRAWINGS

The Contractor shall submit working drawings and supplement for 75 mm high strength prestressing rods in conformance with the provisions in "Working Drawings" elsewhere in these special provisions.

Working drawings and supplement shall include complete details, information, and drawings of the 75 mm high strength prestressing rods and anchorages and the method, materials, equipment, and procedures for installation and stressing the rod assemblies the Contractor proposes to use. The working drawings shall also include the details, procedures, and schedules of proof testing for 75 mm high strength prestressing rods.

After complete working drawings and supplement are received by the Engineer, the Contractor shall allow the Engineer 15 days to review the submittal. No manufacture of the prestressing rods shall begin until complete working drawings and supplement are reviewed and approved, in writing, by the Engineer.

MATERIALS

The 75 mm high strength prestressing rods shall conform to British Standard 4486, "Hot Rolled and Hot Rolled and Processed High Tensile Alloy Steel Bars for the Prestressing of Concrete," except that rods shall be quenched and tempered instead of cold worked. Grout shall conform to the provisions in Section 50-1.09, "Bonding and Grouting," of the Standard Specifications.

TESTING

The Contractor shall submit a certificate of compliance in conformance with the requirements in Section 6-1.07 "Certificates of Compliance," of the Standard Specifications for high strength prestressing rod assemblies.

All rods shall be marked and traceable to a specific cast and heat treatment batch. For each heat treatment batch a machined tensile coupon test shall be performed by the Contractor to verify the ultimate strength of the rods. Should a machined tensile coupon test fail to achieve the minimum ultimate tensile stress, that heat treatment batch will be rejected.

The Contractor shall perform full section tensile and anchorage tests on production rods and anchorages in accordance with the requirements of this section. Upon completion of all production rods and anchorages, the Contractor shall notify the Engineer that the rods and anchorages are ready for sampling. The notification shall include results of the machined tensile coupon tests representing each heat treatment batch. The Contractor shall allow the Engineer 35 days to sample, witness testing, and tag the rods and anchorages before shipping. The Engineer shall choose 10 production rods, 5 to be full section tensile tested and 5 to be full section anchorage tested, at an independent laboratory. Each production rod shall be cut into a 2-meter long sample, re-threaded and re-marked as necessary for the full section tensile and anchorage testing. Full section tensile and anchorage tests shall be completed within 20 days of sampling by the Engineer. Should any full section tensile and anchorage test fail to meet the characteristic breaking load of 4311 kN, the entire heat treatment batch represented by the failed test will be rejected. All documentation and test results from Macalloy, the independent laboratory, and any subcontractor involved in the fabrication of the rods and anchorages shall be submitted to the Engineer at the time of sampling.

CONSTRUCTION

High strength prestressing rods shall be installed and stressed in accordance with the approved working drawings. After stressing, the Contractor shall provide for final inspection of the installed assemblies by the manufacturer. The Contractor shall submit written approval of the manufacturer’s final inspection to the Engineer.

Prestressing rods shall be protected prior to completion of all grouting against rust, corrosion, and physical damage in conformance with the provisions in Section 50, "Prestressing Concrete," of the Standard Specifications.

Grout from construction operations shall not be permitted to flow into the bay or any drainage facilities and shall be contained and disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications and the requirements in "Non-Storm Water Discharges," of these special provisions.

Grout shall be injected at the low end of the void being filled and shall be expelled at the high end until there is no evidence of entrapped air, water or diluted grout being retained within the void area.

ALTERNATIVE HIGH STRENGTH PRESTRESSING RODS

At the Contractor's option, an alternative high strength prestressing rod assembly may be substituted for the Macalloy high strength prestressing rod provided the following requirements are met:

A. The quality of the alternative high strength prestressing rod system and its suitability for the intended application are at least equal to the Macalloy rod as specified in these special provisions, in the opinion of the Engineer.
B. Acceptable working drawings and supplemental calculations are furnished to the Engineer as specified herein.
C. The Contractor's written request for substitution of the alternative high strength prestressing rod is approved by the Engineer.
D. Submittal for alternative high strength prestressing rod system shall conform to the following requirements:

1. Due to the time constraints on this contract, only one alternative high strength prestressing rod request for substitution will be considered for review.
2. The acceptability, quality, and suitability of the alternative high strength prestressing rod system will be made in accordance with the provisions of Section 6-1.05, "Trade Names and Alternatives," of the Standard Specifications.
3. The complete written request for substitution shall include a description of the alternative high strength prestressing rod system; the name of the high strength prestressing rod manufacturer; verification that the qualifications specified herein have been met by the manufacturer for the alternative high strength prestressing rod system; written evidence that alternative high strength prestressing rod system conforms to all requirements specified in these special provisions, and a copy of the manufacturer's list of materials and standards used to manufacture the alternative high strength prestressing rod.
4. The Contractor shall provide to the Engineer, written documentation of the alternative manufacturer's experience in fabricating and supplying high strength prestressing rods and anchorages. This certification shall include the location of each bridge or structure, installation date, governmental agency or owner, and the name, address, and telephone number of each owner's or agency's representative.
5. Alternative high strength prestressing rods shall meet the size and strength requirements as shown on the plans.

Standard data and catalog cut sheets from the alternative high strength prestressing rod manufacturer will not be considered sufficient. The Engineer will not be responsible for seeking further data from the manufacturer, or for otherwise researching the alternative high strength prestressing rod. Failure to provide complete data will be cause for rejection of the alternative high strength prestressing rod.

Development of the Contractor's written request for substitution of the alternative high strength prestressing rod, preparation and submittal of complete working drawings and supplemental information, and testing will be at the Contractor's expense. No compensation nor extension of contract time will be allowed for the development and review processes to evaluate the proposed substitution of an alternative high strength prestressing rod.

The Contractor shall be responsible for any additional costs and time delays associated with selection of the alternative high strength prestressing rod incurred as a result of noncompliance with these requirements, including the failure of the manufacturer to retest revised details or material substitutions of previously prequalified systems.

No alternative high strength prestressing rod shall be manufactured until the Engineer has reviewed and approved, in writing, the working drawings, the results of the proof testing, and the inspection of the system to be used.

PAYMENT

High strength prestressing rod (75 mm) will be paid for on a lump sum basis.

The contract lump sum price paid for high strength prestressing rod (75 mm) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the high strength prestressing rod (75 mm) including testing and grouting, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for modifications to bridge members or elements made necessary by the use of an alternative high strength prestressing rod system shall be considered as included in the contract lump sum price paid for high strength prestressing rod (75 mm) and no additional compensation will be allowed therefor.

10-1.44 CABLE TIE DOWN

Cable tie down anchors at Pier W2 consisting of monostrand tendons, sheathing, corrosion protection, and anchorage assemblies shall conform to the details shown on the plans, the provisions of Section 50, "Prestressing Concrete," of the Standard Specifications and these special provisions.

The Contractor shall design, furnish, and install the cable tie-down anchors. The cable tie-down system proposed for use shall conform to the details shown schematically on the plans.

Whenever "member" is referred to in Section 50, "Prestressing Concrete," of the Standard Specifications, it shall be considered to mean cable tie down anchor.

Working drawings shall conform to "Working Drawings," of these special provisions. After complete working drawings are submitted to the Engineer, the Contractor shall allow the Engineer 25 days to review and approve the working drawings.

In addition to the requirements in Section 50-1.02 "Drawings," of the Standard Specifications, cable tie-down anchor working drawings shall include, but are not limited to, the following:

1. Details of proposed corrosion protection measures.
2. Details and sequence of monostrand stressing operation to avoid mechanical interlocking between strands.
3. Details and sequence of operations for detensioning and replacing individual tendons.
4. Repair procedure for the sheathing.
5. Material specifications and calculations.

In fabricating, handling, shipping, and placing cable tie down anchors, adequate care shall be taken to avoid damage to the sheathing. All damage to the sheathing caused by handling and fabrication prior to cable tie down anchor installation shall be repaired or replaced as determined by the Engineer.

MATERIALS

Steel pipe and cable tie-down bearing plates shall conform to the provisions in "Steel Structures," of these special provisions including the requirements for cleaning and painting. Finish coats will not be required.

Precast access cover slabs and neoprene bearing pads shall conform to the provisions in "Concrete Structures," of these special provisions.

High strength non-shrink grout shall conform to the provisions in "High Strength Nonshrink Grout," of these special provisions.

Neoprene bearing pads and waterproof membrane shall conform to the requirements for neoprene in Section 51-1.14, "Waterstops," of the Standard Specifications.

Cast-in-place inserts shall conform to the requirements in "Miscellaneous Metal," of these special provisions.

High density polyethylene (HDPE) or high-density polypropylene (HDPP) may be used for the smooth sheathing encapsulating individual strands. HDPE and HDPP sheathing shall be produced by the extrusion process. Smooth sheathing for encapsulating strands shall have a minimum wall thickness of 1.25 mm and shall conform to the following:

Property	ASTM Test Method	Value
Density, (g/cm^3)	D1505	0.941-0.965
Melt Index, (g/10 min)	D1283	0.2-1.0
Flexural Modulus, (MPa)	D790	550-1100
Tensile Strength at Yield, (MPa)	D638	21-28
Elongation at Rupture	D638	500%-700%
Hardness	D2240	64-65
Low Temperature Brittleness	D746	-40 C at 50% flexibility (min)

The smooth sheathing for the individual strands shall have sufficient strength to prevent damage during construction operations, shall be watertight, chemically stable without embrittlement or softening, and nonreactive with concrete, steel or corrosion inhibiting grease.

HDPE pipe shall conform to the requirements in ASTM Designation: F174 and the requirements of this section. HDPE pipe material shall meet the specific cell category requirements for class PE 324433C and class PE 335534C materials as defined by Table 1 of ASTM D3350 and the following:

Property	ASTM Test Method	Value
Density, (g/cm^3)	D1505	0.941-0.955
Melt Index, (g/10 min)	D1283	Max of 1.0
Flexural Modulus, (MPa)	D790	550-1100
Tensile Strength at Yield, (MPa)	D638	21-28
Environmental Stress Crack Resistance, F_{20}, hrs.	D1693 (Cond C)	192
Hydrostatic Design Basis, (MPa)	D2837	0.86-1.10

HDPE pipe shall have sufficient strength to prevent damage during construction operations, shall be watertight, nonreactive with concrete, steel or corrosion inhibiting grease and shall be free of water soluble chloride. The maximum Standard Dimension Ratio (SDR) shall be 18. (SDR = ratio of outside diameter to minimum wall thickness.)

The individual strands of a tendon shall be fully coated with corrosion inhibiting grease and then encapsulated by a smooth sheath. The corrosion inhibiting grease shall fill all space between strand wires. The sheath shall be extruded onto the strand by an approved method that ensures that all spaces between the sheath and the strand and between the strand wires are filled with corrosion inhibiting grease.

The corrosion inhibiting grease shall provide a continuous nonbrittle film of corrosion protection to the prestressing steel and lubrication between the strand and the sheathing, shall resist flow from the sheathing, shall be chemically stable and nonreactive with the prestressing steel, sheathing material, and shall be organic with appropriate polar, moisture displacing, and corrosion inhibiting additives.

The corrosion inhibiting grease shall meet the requirements of Table 1 of the "Post-Tensioning Institute's Guide Specification – Specification for Unbonded Single Strand Tendons." Copies may be obtained from the Post-Tensioning Institute at the following website:

http://www.post-tensioning.org/

At least 90 days before use, a sample from the lot to be used and test results shall be provided for the corrosion inhibiting grease.

A Certificate of Compliance conforming to the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications, shall be furnished to the Engineer certifying that the materials provided comply with the requirements herein.

CONSTRUCTION

Cable tie down anchors shall be installed in accordance with the manufacturer's recommendations. In case of a conflict between the manufacturer's recommendations and these special provisions, these special provisions shall prevail.

Steel pipes and bearing plates shall be protected against rust, corrosion and physical damage, prior to encasement in concrete.

Cable tie downs shall be designed and installed to facilitate strand replacement and tendon adjustment. The capability for replacement and adjustments shall sufficiently reduce the force in the cable tie down without releasing the anchorage component devices.

PAYMENT

Cable tie downs will be paid for on a lump sum basis.

The contract lump sum price paid for cable tie down shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing cable tie downs, complete in place, including neoprene bearing pads, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.45 CONCRETE STRUCTURES

Portland cement concrete structures shall conform to the provisions in Section 51, "Concrete Structures," of the Standard Specifications and these special provisions.

Shotcrete shall not be used as an alternative construction method for reinforced concrete members.

When a roughened concrete surface is shown on the plans, the existing concrete surface shall be roughened to a full amplitude of approximately 6 mm by abrasive blasting, water blasting, or mechanical equipment.

The concrete temperature during curing shall not exceed 65°C.

CONCRETE CAP BEAM AND CROSSBEAM

Concrete cap beam at Pier W2 and concrete crossbeam at Pier E2 shall conform to the following requirements:

The concrete mix for the cap beam and crossbeam concrete shall be designed to achieve the following additional properties:

A. Modulus of Elasticity: The modulus of elasticity of portland cement concrete shall be at least 35,600 MPa at 28 days when tested in accordance with the requirements in California Test 522. The samples shall be moist-cured for 7 days, followed by air drying at 23°C and 50% relative humidity until test age. The modulus shall also be reported at 3, 7, 56 and 90 days. Test specimen size shall be same as that required for compressive strengths. Test results shall be based on the average of three test specimens at each age.

B. Creep: The specific creep coefficient, as determined in accordance with the requirements in ASTM Designation C 512, after 365 days of loading, shall not exceed 75 millionths/MPa. Test specimens shall be 152 x 305 mm cylinders and shall be moist-cured for 7 days, followed by air drying at 23°C and 50% relative humidity. Test cylinders shall be loaded at 28 days to a stress of 20% to 40% of the 56-day design compressive strength shown on the plans but not less than 20% nor greater than 40% of the measured strength at 28 days. For submittal of prequalification data, coefficients after 28, 56 and 90 days of loading shall be submitted and used to predict the coefficient at 365 days based on the procedures of CEB-FIP Model Code for Concrete Structures, by the Comite Euro-International de Beton. Mix design approval shall be contingent upon the 365-day creep coefficient satisfying the stated requirement.

C. Shrinkage: The shrinkage strain of Portland cement concrete shall not exceed 0.045% after 180 days of drying in accordance with the requirements in ASTM Designation: C 157. Sample size shall be 100 x 100 x 285 mm. Samples shall be moist-cured for 7 days followed by air drying at 23°C and 50% relative humidity. Shrinkage strain shall be calculated as the change in strain from the beginning of drying at 7 days.

Concrete testing shall be performed by the Contractor's independent test laboratory. The laboratory shall be accredited or inspected for conformance to the requirements in ASTM Designation: C 1077 and approved by the Engineer. All testing shall be performed by ACI certified technicians. In addition to the requirements of Section 90-9, "Compressive Strength," of the Standard Specifications, concrete for the superstructure shall have the following additional testing performed by the Contractor's independent testing laboratory:

Shrinkage shall be less than or equal to 0.03 percent after 28 days of air storage per ASTM C 157. Sample size shall be 100x100x285 mm. The samples shall be moist cured for 7 days by air drying at 23°C and 50% relative humidity. Shrinkage strain shall be calculated as the change in strain from the beginning of drying at 7 days.

The Contractor's proposed concrete mix design submittals shall include test results for ball penetration (or slump), air content, freshly mixed concrete unit weight, and the results of compressive strength at 1, 3, 7, 28, 56, and 90 days, modulus of elasticity at 3, 7, 28, and 56 days, shrinkage after 1, 3, 7, 14, and 28 days of air storage, and creep coefficients after 28, 56 and 90 days of loading.

At the Contractor's option, shrinkage-reducing admixtures may be used.

MASS CONCRETE

Portions of structure that are mass concrete include the Pier W2 cap beam and Pier E2 cross beam. Mass concrete shall conform to the requirements of Section 90, "Portland Cement Concrete," of the Standard Specifications and "Concrete Structures" of these special provisions. Mass concrete construction shall include modeling, providing temperature control and monitoring during placement.

After the mass concrete pour has been topped out and finished, it shall be revibrated and refinished. Revibration shall extend below the top mat of reinforcement and shall be done as late as the concrete will again respond to vibration. For concrete pours without top reinforcement, revibration shall extend to a depth of 150 mm.

The Contractor shall control the internal and surface temperature of mass concrete during curing in accordance with the Thermal Control Plan specified herein. Temperature modeling and temperature monitoring shall be required for the placement of mass concrete. The maximum internal temperature of the mass concrete once placed shall not exceed 65°C, and the maximum temperature difference between any surface of the mass concrete and the calculated hottest point shall be controlled as described in the Thermal Control Plan.

The concrete temperature shall be monitored by thermocouples placed into the concrete, as required in the Thermal Control Plan. Use of ice, liquid nitrogen, insulated curing blankets, insulated forms, cooling pipes and other measures may be necessary to satisfy the temperature requirements.

Thermal Control Plan

Prior to commencing any mass concrete placement, the Contractor shall submit a Thermal Control Plan to the Engineer for approval for each mass concrete structure component. The Thermal Control Plan shall be based on the design assumption that cracking of the concrete as a result of heat of hydration shall not occur. Analysis shall be performed to determine the maximum allowable temperature differentials between the hottest point of the concrete and the exterior faces. The Thermal Control Plan shall include the following:

A. Dimensions of each typical mass concrete placement, including all locations in the structure to be represented by that placement.

B. Types and dimensions of materials to be used for mass concrete forms and insulation, and time frames for when the concrete forms and insulation will be removed, including time periods for removal and reinstallation of insulation where required as part of the thermal control plan.

C. Assumptions for average ambient air and initial concrete temperatures for time period of placement and curing of each typical mass concrete element.
D. If multiple lifts with time delay are proposed, provide lift height and define time delay between lifts.
E. Include a placing diagram showing the typical mass concrete placement sequence and construction joint locations, if any.
F. Identify areas where steep cooling gradients may occur, and how cracking will be avoided.
G. Predict peak temperature, peak differential temperatures and at what approximate times they will occur.
H. Define allowable time periods for placing or removing insulation and or forms.
I. A summary of the modeling assumptions used in the analysis.
J. Identify contingency operations to be implemented to control the internal temperature of the concrete should the maximum allowable or the maximum allowable differential temperature be exceeded. For post cooling systems after the peak internal temperature is reached, include the maximum cooling rate at which cracking will not occur.

Temperature modeling for each typical placement shall be included with each thermal control plan submittal. As a minimum, the modeling for each typical placement shall consist of performing a two-dimensional finite-difference analysis (see ACI 207.1R-96). The analysis shall be based on the Contractor's actual mix designs. The coefficient of thermal expansion of the concrete used in the modeling shall be determined by testing of the proposed mixes in accordance with US Army Corps of Engineer's Method CRD-C39-81, "Test Method for Coefficient of Linear Thermal Expansion of Concrete." The heat of hydration used in the modeling for the cementitious blend used in the proposed mix designs shall be tested at 1, 3, 7, and 28 days in accordance with the requirements in ASTM Designation: C 186, "Heat of Hydration of Hydraulic Cement".

The concrete temperature shall be monitored at the calculated hottest point of the concrete, on at least two vertical faces and at the center of the top and bottom faces of each pour. The air temperature shall be measured and recorded. If a post-cooling system is used, inlet and outlet water temperatures shall be measured and recorded. Temperature readings shall be automatically recorded on an hourly basis. A redundant set of sensors shall be installed near the primary set. Provision shall be made for recording the redundant set, but records of the redundant sensors need not be made if the primary set is operational. Temperature monitoring may be discontinued when the maximum allowable temperature difference is greater than the difference between the interior concrete temperature and the average daily temperature for three consecutive days. Wiring from thermocouples that must be cast into the concrete shall be protected to prevent damage. Wire runs shall be as short as possible. Temperature monitoring equipment shall be capable of printing and data storage and shall be able to download monitoring data to a computer. Data shall be downloaded and submitted daily to the Engineer. During monitoring, should the specified maximum internal temperature of the mass concrete be exceeded or the maximum allowable temperature difference between any surface of the mass concrete and the hottest point be exceeded, the Contractor shall take immediate measures to correct the situation as specified in the Thermal Control Plan. If the measures in the Thermal Control Plan fail to correct the situation, the Thermal Control Plan shall be revised and submitted for approval before further concrete placement. Failure to meet the temperature requirements of the specifications and the Thermal Control Plan will be cause for rejection of concrete, except if the maximum internal temperature of the mass concrete once placed exceeds 65°C, but remains less than 70°C, the concrete in that placement will be accepted and the Contractor shall pay to the State $100 for each in place cubic meter of concrete.

If the post-cooling system is required by the Contractor's thermal control plan, the Contractor shall design and install a post-cooling system. Cooling pipes may be polyvinyl chloride (PVC) or steel pipes. Aluminum, copper, or any other dissimilar metal that can cause a corrosion cell with the steel reinforcing shall not be used as cooling pipes. Surface connections to the cooling pipes shall be removable to a depth of 100 mm after they are no longer needed. Cooling pipes shall be secured to bar reinforcing steel to prevent movement or damage during concrete placement.

The Contractor may use sea water as cooling water provided that the final temperature of the seawater before discharging back into the bay does not exceed the regulatory requirements of 2.2 degrees Celsius (4 degrees Fahrenheit) above the original water temperature. Holding tanks may be used to cool the water to the required temperature before discharging back into the bay.

The Contractor shall house the pump intake in a manner that prevents injury to fish or other aquatic species and prevents fish entrapment.

Prior to the placement of the mass concrete, the cooling pipe system shall be pressure tested by the Contractor in the presence of the Engineer for leaks at 120 percent of the maximum service pressure. The test pressure shall be held for 15 minutes. All leaks shall be repaired and the cooling pipe system shall be retested by the Contractor until the system is free of leaks.

After cooling is completed and the cooling pipes are no longer needed, the cooling water shall be discharged, and the cooling pipes shall be thoroughly flushed with potable water and filled with the grout. Cooling water and wash water shall be discharged in conformance with "Non-Storm Water Discharges," of these special provisions.

At the completion of monitoring, the actual readings for the mass concrete element shall be compared with those predicted by the modeling and a summary report prepared by the Contractor's engineer. The report shall include all supplementary or contingency measures implemented and suggested corrections to any future modeling or monitoring to be performed. The summary report shall contain all the temperature data collected for each instrument, both in hard copy and in digital form on diskette. Digital data shall be in Microsoft Excel format or as otherwise approved by the Engineer. The summary report shall also have the data shown in a graphical format with all instruments for a given mass concrete element shown on the same page with time as the horizontal axis. The summary report shall be submitted within one week of completing the monitoring of the mass concrete element.

Concrete temperatures shall be monitored on all mass concrete components.

After completion of the mass concrete element, the Contractor shall remove all formwork, equipment and materials from the mass concrete element and clean the surface for the Engineer to measure the crack intensity. Surface crack intensity will be determined after monitoring shows the maximum allowable temperature difference, as specified in the Thermal Control Plan, is greater than the difference between the interior concrete temperature and the average daily temperature for three consecutive days. Interior concrete temperature and average daily temperature determinations shall conform to the requirements of the Thermal Control Plan and these specifications. Cracking shall be considered excessive if a surface crack intensity on any face of a concrete surface where cracks greater than 0.15 mm in width measure more than 1.0 m in cumulative length within any 2 m square area or where individual cracks greater than 0.15 mm in width measure more than 300 mm in length.

Cracks greater than 0.15 mm in width shall be repaired. Cracks greater than 0.15 mm in width and longer than 300 mm shall be filled with pressure-injected epoxy. Cracks to be filled shall be cleaned and filled by pressure injection methods so that all portions of the crack are completely filled with epoxy. No repairs shall begin until the Engineer has approved the repair plan.

Core drilling may be necessary, as determined by the Engineer and at the Contractor's expense, to sample and examine the extent of the cracking and crack filling. The minimum depth of core sampling for mass concrete shall be 0.6 m and the number of cores taken per mass concrete element shall be in accordance with ASTM Designation: C 823. Prior to coring, the Contractor shall identify the location of the main reinforcing steel. The holes shall be cored by methods that will not shatter or damage the concrete adjacent to the holes. Water for core drilling operations shall be fresh water. The coring water shall be disposed in conformance with the requirements in "Non-Storm Water Discharges" of these special provisions. Immediately after coring, the concrete cores shall be identified by the Contractor with a description of the core locations and submitted to the Engineer for inspection.

If any reinforcement is cut during coring, coring operations shall be terminated, and the Contractor shall submit to the Engineer for approval, the procedure proposed to repair the cut reinforcement and to prevent further cutting of reinforcement. All cored holes shall be filled with nonshrink grout. Cracks not showing full penetration with epoxy shall be reinjected.

Demonstration Pours

The Contractor shall cast at least one mock-up each for the Pier W2 cap beam and Pier E2 cross beam, including concrete, reinforcement, and all concrete embedment as shown on the plans to demonstrate adequacy of hydration and thermal properties of concrete predicted by the Thermal Control Plan. The mock-ups shall demonstrate that the procedures defined in the Thermal Control Plan meet the performance criteria as specified in the Thermal Control Plan and these special provisions. The mock-ups shall not be part of the permanent structure and shall become the property of the Contractor. They shall be removed from the work site and shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

After the final Thermal Control Plans are submitted, the Contractor shall allow the Engineer 20 days for review and approval.

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

FALSEWORK

The Contractor shall remove forms within the W2 cap beam to the limits shown on the plans.

Falsework shall conform to the provisions in Section 51, "Concrete Structures," of the Standard Specifications and these special provisions.

In addition to the provisions in Section 51-1.06A, "Falsework Design and Drawings," of the Standard Specifications, the time to be provided for the Engineer's review of the working drawings for specific structures, or portions thereof, shall be as follows:

Structure or Portion of Structure	Total Review Time
Pier W2 Cap Beam Construction	50 Days
Pier E2 Crossbeam Construction	50 Days

Welding and Nondestructive Testing

Welding of steel members, except for previously welded splices and except for when fillet welds are used where load demands are less than or equal to 175 N/mm for each 3 mm of fillet weld, shall conform to AWS D1.1 or other recognized welding standard. The welding standard to be utilized shall be specified by the Contractor on the working drawings. Previously welded splices for falsework members are defined as splices made prior to the member being shipped to the project site.

Splices made by field welding of steel beams at the project site shall undergo nondestructive testing (NDT). At the option of the Contractor, either ultrasonic testing (UT) or radiographic testing (RT) shall be used as the method of NDT for each field weld and any repair made to a previously welded splice in a steel beam. Testing shall be performed at locations selected by the Contractor. The length of a splice weld where NDT is to be performed, shall be a cumulative weld length equal to 25 percent of the original splice weld length. The cover pass shall be ground smooth at the locations to be tested. The acceptance criteria shall conform to the requirements of AWS D1.1, Section 6, for cyclically loaded nontubular connections subject to tensile stress. If repairs are required in a portion of the weld, additional NDT shall be performed on the repaired sections. The NDT method chosen shall be used for an entire splice evaluation including any required repairs.

For all field welded splices, the Contractor shall furnish to the Engineer a letter of certification which certifies that all welding and NDT, including visual inspection, are in conformance with the specifications and the welding standard shown on the approved working drawings. This letter of certification shall be signed by an engineer who is registered as a Civil Engineer in the State of California and shall be provided prior to placing any concrete for which the falsework is being erected to support.

For previously welded splices, the Contractor shall determine and perform all necessary testing and inspection required to certify the ability of the falsework members to sustain the stresses required by the falsework design. This welding certification shall be in writing, shall be signed by an engineer who is registered as a Civil Engineer in the State of California, and shall be provided prior to placing any concrete for which the falsework is being erected to support.

The Contractor's engineer who signs the falsework drawings shall also certify in writing that the falsework is constructed in conformance with the approved drawings and the contract specifications prior to placing concrete. This certification shall include performing any testing necessary to verify the ability of the falsework members to sustain the stresses required by the falsework design. The engineer who signs the drawings may designate a representative to perform this certification. The designated representative for the Contractor's engineer shall be qualified to perform this work, shall have at least three years of combined experience in falsework design or supervising falsework construction, and shall be registered as a Civil Engineer in the State of California. The Contractor shall certify the experience of the designated representative in writing and provide supporting documentation demonstrating the required experience if requested by the Engineer.

ELASTOMERIC BEARING PADS

Elastomeric bearing pads shall conform to the provisions in Section 51-1.12H, "Elastomeric Bearing Pads," of the Standard Specifications.

DRILL AND BOND DOWELS

Drilling and bonding dowels shall conform to the details shown on the plans, the provisions in Section 83-2.02D(1), "General," of the Standard Specifications, and these special provisions.

Dowels shall conform to the provisions for bar reinforcement in "Reinforcement" of these special provisions.

If reinforcement is encountered during drilling before the specified depth is attained, the Engineer shall be notified. Unless the Engineer approves coring through the reinforcement, the hole will be rejected and a new hole, in which reinforcement is not encountered, shall be drilled adjacent to the rejected hole to the depth shown on the plans.

Unless otherwise provided, dowels to be bonded into drilled holes will be paid for as bar reinforcing steel (bridge).

MEASUREMENT AND PAYMENT

Measurement and payment for concrete in structures shall conform to the provisions in Section 51-1.22, "Measurement," and Section 51-1.23, "Payment," of the Standard Specifications and these special provisions.

Full compensation for roughening existing concrete surfaces to a full amplitude of approximately 6 mm, where shown on the plans, shall be considered as included in the contract price paid per cubic meter for structural concrete, bridge and no separate payment will be made therefor.

Full compensation for nonshrink grout where shown on the plans, shall be considered as included in the contract prices paid for the various items of work involved and no separate payment will be made therefor.

Precast access cover slabs shall be measured and paid for as structural concrete, bridge.

Full compensation for drilling holes, including coring through reinforcement when approved by the Engineer, and bonding dowels shall be considered as included in the contract price paid per cubic meter for structural concrete, bridge and no separate payment will be made therefor.

10-1.46 PRECAST CONCRETE FENDER MODULES

Precast concrete fenders shall conform to the provisions in Section 51, "Concrete Structures," of the Standard Specifications and these special provisions.

Attention is directed to "Precast Concrete Quality Control," of these special provisions.

The precast fender installation procedure shall not overstress the fenders and shall allow for adjustment of final grades, as shown on the plans.

Concentrated erection loads, other than the precast fender dead load rib reactions, applied to the corbel ledge shall not exceed 160 tonnes at a minimum spacing of 1.0 m from the fender rib centerline. The minimum spacing between sequential concentrated erection loads shall be 1.50 m.

At the option of the Contractor, alternate erection loads and configurations may be used provided the Contractor submits detailed structural calculations for the revised loading and configuration for the Engineer's approval.

WORKING DRAWINGS

The Contractor shall submit working drawings for precast fenders in conformance with the provisions in "Working Drawings," of these special provisions.

Working drawings shall include complete details and substantiating calculations for the precast fender modules including the method, materials, equipment, and installation procedure the Contractor proposes to use.

Working drawing submittals shall include the following:

A. Complete details of the precast fenders.
B. Methods for transporting, storing, lifting and installing precast fenders.
C. Complete details and calculations for the precast fender temporary support system.
D. Methods for placing the closure pour.

After complete working drawings and supplement are received by the Engineer, the Contractor shall allow the Engineer 20 days to review the submittal.

At the option of the Contractor, the precast fender closure pour may be placed under water. If the Contractor elects to place the precast fender closure pour under water, the Contractor shall demonstrate the adequacy of the placement procedure by constructing and testing a full-size mock-up of the fender closure joint. Approval of the Contractor's proposed placement plan is contingent on approval and successful testing of the full size mock-up, as determined by the Engineer.

The mock-up shall replicate the production placement operation conditions. The Contractor's methods and procedures shall be fully documented on the approved working drawings.

After placement, the mockup shall be tested by the Contractor. Testing shall consist of taking 2 core samples, at locations selected by the Engineer. Core samples shall be examined for voids, density, concrete strength, and shall be of equal quality to concrete placed in a dry condition.

MATERIALS

High-strength steel bars shall conform to the requirements of Section 50-1.05, "Prestressing Steel," of the Standard Specifications. High-strength bars shall be installed as shown on the plans.

The bearing plate of the high-strength prestressing bar shall effectively distribute the design force uniformly to the top of the footing. The size and thickness of the bearing plate shall be such that the bending stress does not exceed 0.9 f_y.

Neoprene pads shall conform to the requirements in Section 51-1.145 "Strip Waterstops," of the Standard Specifications.

Non-shrink grout shall be commercial quality.

CONSTRUCTION

The Contractor shall take all precautions necessary to minimize cracking of the precast concrete elements.

Precast concrete fender modules will be jointly inspected by the Engineer and the Contractor after casting, after moving to storage, and before and after erection. Crack widths larger than 0.15 mm shall be repaired. Cracks longer than 300 mm shall be filled with pressure-injected epoxy. Cracks to be filled shall be cleaned and filled by pressure injection methods so that all portions of the crack are completely filled with epoxy. No repairs shall begin until the Engineer has approved the repair plan.

Fender slab shrinkage cracks along the interface with the tower base concrete shall be treated with a low viscosity concrete repair compound such as methacrylate or approved equal in accordance with the manufacturer's recommendations.

The Contractor shall remove and dispose of the protective cover and cement-stabilized sand.

Surfaces of precast fenders and footing interface shall be cleaned as specified for construction joints in Section 51-1.13, "Bonding," of the Standard Specifications.

Upon completion of the precast fender installation, the Contractor shall remove the erection dowels inserted into the pin hole blockouts and fill the pin holes with non-shrink grout.

MEASUREMENT AND PAYMENT

The contract price paid per cubic meter for furnish precast concrete fender modules shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, including reinforcing steel as required, and for doing all the work involved in furnishing precast concrete fender modules at the site of the work complete and ready for erection, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract unit price paid for erect precast concrete fender modules shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in erecting precast concrete fender modules, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for removing and disposing of the protective covering and cement stabilized sand, plastic plugs, sealing cracks in precast fender slabs, and for filling pin holes with non-shrink grout shall be considered as included in the contract unit price paid for erect precast concrete fender modules and no additional compensation will be allowed therefor.

Full compensation for furnishing and installing high-strength steel bars in precast fenders shall be considered as included in the contract price paid per cubic meter for furnish precast concrete fender modules and the contract unit price paid for erect precast concrete fender modules, respectively, and no additional compensation will be allowed therefor.

10-1.47 SPHERICAL BUSHING BEARING (PIER E2)

This work shall consist of fabricating and installing the spherical bushing bearing on Pier E2 in conformance with details shown on the plans and the requirements of these special provisions.

The spherical bushing bearing consists of spherical bushing assembly, bearing top housing, bearing bottom housing, bearing hold down assembly, retaining ring plates, solid shaft, dust cover, base plate, bearing plate, anchor bolts, and assembly bolts. The lubricant shall be self-lubricated and shall be provided for all bronze surfaces and other surfaces as shown on the plans. Bearings shall be anchored in place with high strength non-shrink grout.

Spherical bushing bearings shall be furnished and installed at Pier E2.

GENERAL

Attention is directed to "Steel Structures," of these special provisions for steel casting requirements.

Attention is directed to "Shear Key (Pier E2)," of these special provisions for additional installation requirements.

Attention is directed to "Lubricant and Test," of these special provisions.

The design loads, design rotations, design displacements, and alignment tolerances shall conform to the values as shown on the plans.

WORKING DRAWINGS

The Contractor shall submit working drawings in conformance with the provisions in "Working Drawings," of these special provisions.

Working drawings shall include complete details, information, drawings, and substantiating calculations of the spherical bushing bearing and its components and the method, materials, equipment, and procedures of fabrication and installation that the Contractor proposes to use including the placement of high strength non-shrink grout.

Working drawing submittals shall include the following:

A. Bearing fabrication plans for all bearings including complete details for each component.
B. All ASTM, AASHTO, or other material designations including dust cover and its connection to other bearing components, and retaining ring plates.
C. The bushing wall thickness, fits, and tolerances.
D. Storage and shipping plans including details of handling and supporting of the bearings. Each bearing shipment shall be accompanied by a Certificate of Compliance in conformance with the provisions in Section 6-l.07, "Certificates of Compliance," of the Standard Specifications. The certificate shall state that the materials and fabrication involved comply in all respects to the specifications and data submitted in obtaining approval.
E. Installation plans including the following:

    1. Method, materials, equipment, sequence, detailed procedures, and temporary support details that the Contractor proposes to use for installation of the spherical bushing bearing. The Contractor's proposed spherical bushing

bearing installation including the solid shaft force fit shall not damage the lubricant at any given time during the installation. The Contractor's proposed spherical bushing bearing installation procedures and sequences shall be detailed in the superstructure construction sequences as specified in these special provisions.

2. The Contractor's calculated relative distances for a) relative distance between the centerline of E2 floor beam at box girder (normal to vertical profile) and the centerline of Pier E2 (vertical); distance is measured in the longitudinal direction along the top horizontal surface of concrete crossbeam, and b) relative distance between centerline of longitudinal shear plates (normal to cross slope) and centerline of Pier E2 (vertical); distance is measured in the transverse direction along the top sloped surface of the concrete crossbeam.

F. Details of lifting locations and mechanisms.

A supplement to the working drawings shall include the following:

A. The quality control plan (QCP). The QCP of the spherical bushing bearings shall conform to the requirements in "Quality Control" of these special provisions and shall include descriptions, details, and procedures for the fabrication and installation of the spherical bushing bearings, except that the portion of the QCP for welding shall be submitted separately in conformance with "Welding" in these special provisions.

B. The manufacturer of the spherical bushing bearing shall submit to the Engineer a manual for the bearing inspection, maintenance, and replacement. This manual shall include:

1. A record of spherical bushing bearing for each component including the tracing of all components during the fabrication and installation of spherical bushing bearing.
2. Recommended life expectancy for each bearing component.
3. Recommended frequency for bearing inspection and maintenance schedule.
4. Procedures and details to perform the bearing inspection and maintenance.
5. List of indication of bearing defects and the associated repair methods, if applicable.
6. Procedures and sequences for bearing replacement including locations of temporary support, estimate of jacking load for each temporary support location, sequences and methods of detensioning anchor bolts, method of debonding between concrete and base plates and anchor bolts, method of removing and replacing bearings, a list of equipment to be used for bearing replacement, and traffic, safety, and environmental impact.

Each working drawing and calculation sheet shall be signed by an engineer who is registered as a Civil Engineer or Mechanical Engineer in the State of California. After complete working drawings and supplement are received by the Engineer, the Contractor shall allow the Engineer 40 days to review the submittal

Upon completion of installation, the Contractor shall submit to the Engineer certification stating that each spherical bushing bearing has been installed in accordance with the approved working drawings and supplements installation procedure.

MATERIALS

The materials specifications of spherical bushing bearing components shall conform to the following table:

Component	ASTM Specifications
Anchor Bolts	A354, Grade BD
Assembly Bolts	A240, Type 316
Bearing Plate	B22-C86300
Spherical Housing	A744, Grade CF-8M
Spherical Ball	B271-C86300
Solid Shaft	Structural Casting, Grade 550
Bearing Bottom Housing	Structural Casting, Grade 550
Bearing Top Housing	Structural Casting, Grade 345
Bearing Hold Down Assembly	Structural Casting, Grade 345

Attention is directed to "Welding" and "Audits" of these special provisions.

Attention is directed to "Lubricant and Test" of these special provisions.

Prestressing operation of anchor bolts shall conform to the requirements in "Prestressing Concrete," elsewhere in these special provisions.

High strength nonshrink grout shall conform to the requirements in "High Strength Nonshrink Grout," elsewhere in these special provisions.

Steel components including plates and anchor bolts shall conform to the details shown on the plans, the provisions in "Steel Structures," of the Standard Specifications, and these special provisions.

Clean and paint spherical bushing bearing shall conform to the requirements in "Clean and Paint Structural Steel (Seismic Joint, Spherical Bushing Bearing, and Shear Key)," of these special provisions.

The bronze alloy for the spherical ball and ring bushing shall be high strength manganese bronze centrifugally cast conforming to the requirements of ASTM Designation: B271-C86300. The stainless steel for the spherical housing shall be centrifugally cast conforming to the requirements of ASTM Designation: A744 Grade CF-8F. All items integral to and for the assembly of the bearing shall be stainless steel conforming to ASTM Designation: A 240, Type 304 or Type 316.

The bushing wall thickness, fits, and tolerances shall be as recommended by the manufacturer and specified in the working drawings and supplement.

QUALITY CONTROL

Quality Control (QC) shall be the responsibility of the Contractor. Quality Control shall be performed by an entity having a line of responsibility distinctly different from that of the manufacturer's fabrication department. As a minimum, the Contractor shall perform inspection and testing prior to fabrication, during fabrication, and after fabrication as specified herein and additionally as necessary to ensure that materials and workmanship conform to the requirements of the contract documents. Quality Control shall apply to each component of the spherical bushing bearing in addition to the assembly, shipping and installation of the bearing.

The QC Inspector shall be the duly designated person who acts for and on behalf of the Contractor for inspection, testing, and quality related matters for all fabrication.

Quality Assurance (QA) is the prerogative of the Engineer. The QA Inspector is the duly designated person who acts for and on behalf of the Engineer.

Each QC Inspector shall be responsible for quality control acceptance or rejection of materials and workmanship.

The Contractor shall provide sufficient number of QC Inspectors to ensure continuous inspection.

The Contractor shall designate in writing a Quality Control Manager (QCM). The QCM shall be responsible directly to the Contractor for the quality of the fabrication, including materials and workmanship, performed by the Contractor and subcontractors.

The QCM shall be the sole individual responsible to the Contractor for submitting and receiving all correspondences, required submittals, and reports to and from the Engineer.

The Contractor shall submit to the Engineer 3 copies of Quality Control Plan (QCP), in conformance with the requirements in "Working Drawings," of these special provisions. As a minimum, each QCP shall include the following:

A. A manual including equipment, testing procedures, and code of safe practices.
B. The names, qualifications, and documentation of certifications for the QCM and all QC Inspectors.
C. An organizational chart showing all QC personnel and their assigned QC responsibilities.
D. The methods and frequencies for performing all required quality control procedures, including QC inspection forms to be used, as required by the specifications including:

    1. All visual inspections.
    2. Tests.
    3. Calibration procedures and calibration frequency for all equipment.

E. Forms to be used for Certificates of Compliance, monthly production logs, and monthly reports.
F. Mill certificates and material certificates.
G. Shipping plan.
H. Installation plan.

Prior to submitting the QCP, a pre-fabrication meeting between the Engineer, Contractor, and fabricator, any entity performing spherical bushing bearing component fabrication or subcontractor to the Fabricator, shall be held to discuss the requirements for the QCP. The pre-fabrication meeting shall be held in San Francisco Bay Area.

After a complete QCP is submitted, the Contractor shall allow the Engineer 10 days to review the submittal. An amended QCP or addendum shall be submitted to, and approved in writing by the Engineer, for proposed revisions to the approved QCP. The Contractor shall allow the Engineer 10 days to complete the review of the amended QCP or addendum.

After final approval of the QCP, amended QCP, or addendum, the Contractor shall submit 7 copies to the Engineer of each of these approved documents.

It is expressly understood that the Engineer's approval of the Contractor's QCP shall not relieve the Contractor of any responsibility under the contract for the successful completion of the work in conformity with the requirements of the plans and specifications. The Engineer's approval shall not constitute a waiver of any requirement of the plans and specifications nor relieve the Contractor of any obligation thereunder, and defective work, materials, and equipment may be rejected notwithstanding approval of the QCP.

A monthly production log for fabrication shall be kept by the QCM for each day that fabrication is performed. The monthly report from each QC Inspector shall be included in the log.

The QCM shall sign and furnish to the Engineer, a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for each spherical bushing bearing. The certificate shall state that all of the materials and workmanship incorporated in the work, and all required tests and inspections of this work have been performed in conformance with the details shown on the plans and approved working drawings and the provisions of the Standard Specifications and these special provisions.

FABRICATION AND INSTALLATION

Attention is directed to "Steel Structures," of these special provisions for fabrication and installation of spherical bushing bearings at Pier E2. The Contractor shall also conform to the requirements specified herein.

Conformance with the requirements in SSPC-QP 1, SSPC-QP 2, and SSPC-QP 3 of the "SSPC: The Society for Protective Coatings" will not be required for spherical bushing bearings.

Finish coats will not be required on the bearings.

Each bearing shall be marked for location and orientation in conformance with the approved working drawing and supplement. Bearings shall be secured to shipping skids in a manner that assures protection during transportation and off-loading. Each skid shall be wrapped in moisture proof and dust proof covers at all times until immediately before installation.

After completion of spherical bushing bearing fabrication, the Contractor shall assemble all bearing components, except high strength bearing grout, at the Contractor's bearing manufacturer's facility to demonstrate to the Engineer that all bearing components and parts will be installed properly as shown on the plans, and each spherical bushing bearing is capable of rotating ±8 degrees about its solid shaft axis and ±2 degrees about each of the other two orthogonal axes. Bearing assembly shall be witnessed by the Engineer. The Contractor shall notify the Engineer 20 days before bearing assembly begins.

Damaged bearings shall be replaced.

Qualified representatives from manufacturers of spherical bushing assembly, bearing top housing, bearing bottom housing, bearing hold down assembly, and solid shaft shall be present during installation of all spherical bushing bearings.

Prior to bearing installation, the Contractor shall measure the relative longitudinal distances between the centerline of E2 floor beam at box girder and the centerline of Pier E2 and relative transverse distances between the centerline of longitudinal shear plates and the centerline of Pier E2. The distances shall be measured and compared with the calculated values as specified in the approved working drawings and supplement. If the longitudinal difference between the centerline of E2 floor beam at box girder and the centerline of Pier E2 is greater than 20 mm or the transverse difference between the centerline of longitudinal shear plate and the centerline of Pier E2 is greater than 5 mm, the Contractor shall suspend bearing installation process, and submit to the Engineer a mitigation plan for approval. The mitigation plan shall include the necessary measures to be taken to compensate for the difference. After the Contractor submits the mitigation plan, the Contractor shall allow the Engineer 10 days for review. Bearing installation shall not be resumed until the Engineer has reviewed and approved, in writing, the Contractor's mitigation plan.

The Contractor shall install the force fit solid shaft to the spherical bushing. The lubricated surface and lubricant shall not be damaged as a result of force fit installation.

Spherical bushing bearing base plates shall be temporarily supported during grout operations. Temporary supports shall prevent the rotation or displacement of the bearing during grout operation. Temporary supports shall not inhibit the functioning of the spherical bushing bearing after grout has set. Temporary supports shall not restrict the movement at bridge joints due to temperature changes and shortening from prestressing forces. Materials for temporary supports within the limits for placing concrete shall conform to the requirements for form fasteners.

Prior to grouting, all bearings and shear keys shall be surveyed to ensure center of rotations of all bearings and shear keys are aligned in the same axis.

High strength nonshrink grout placement shall conform to the requirements in "High Strength Nonshrink Grout," of these special provisions.

BEARING STORAGE

Spherical bushing bearings shall be transported to and stored at the bearing storage facility as designated by the Engineer. Said location will be within 25 km of the San Francisco-Oakland Bay Bridge Toll Plaza. The Contractor shall notify the Engineer at least two months prior to delivery of the spherical bushing bearings.

MEASUREMENT AND PAYMENT

Furnish and install spherical bushing bearing (Pier E2) will be measured and paid for by the unit. The number of bearings for payment will be determined by the actual count in the completed work.

The contract unit price paid for furnish and install spherical bushing bearing (Pier E2) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the bearing, temporary supports, installing in final position, including bearing high strength nonshrink grout, and cleaning and painting of spherical bushing bearing, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for the qualified representative of the manufacturer of bushing bearing components to be present during installation of all spherical bushing bearings shall be considered as included in the contract unit price paid for furnish and install spherical bushing bearing (Pier E2) and no additional compensation will be allowed therefor.

If a portion or all of spherical bushing bearings are fabricated at a site more than 480 air line kilometers from both Sacramento and Los Angeles, additional shop inspection expenses will be sustained by the State. Payment to the Contractor for furnishing spherical bushing bearings will be reduced $5,000 for any fabrication site located more than 480 air line kilometers from both Sacramento and Los Angeles, or in the case where a fabrication site is located more than 4800 air line kilometers from both Sacramento and Los Angeles, payment will be reduced $20,000.

10-1.48 FURNISH SPHERICAL BUSHING RING BEARING (HINGE K)

This work shall consist of fabricating and assembling the spherical bushing ring bearing for Hinge K in conformance with details shown on the plans and the requirements of these special provisions.

The installation of spherical bushing ring bearings at Hinge K will not be required. The spherical bushing ring bearings of Hinge K shall be stored for future installation as specified in these special provisions.

The spherical bushing ring bearing shall be sliding and rotating type of bearing consisting of segmented anchor rings, anchor studs, spherical housing, anchor bolts, assembly bolts, and spherical bushing ring. Lubricant shall be provided for all bronze surfaces as shown on the plans.

GENERAL

Attention is directed to "Steel Structures," of these special provisions for hinge pipe beam and steel casting requirements.

Attention is directed to "Lubricant and Test," of these special provisions.

The design loads, design rotations, and uplift-inside bearing gap shall conform to the values as shown on the plans.

WORKING DRAWINGS

The Contractor shall submit working drawings in conformance with the provisions in "Working Drawings," of these special provisions.

Working drawings shall include complete details, information, drawings, and substantiating calculations of the spherical bushing ring bearing and its components and the method, materials, equipment, and procedures of fabrication that the Contractor proposes to use.

Working drawing submittals shall include the following:

A. Bearing fabrication plans for all bearings including complete details for each component.
B. All ASTM, AASHTO, or other material designations.
C. Storage and shipping plans including details of handling and supporting of the bearings. Each bearing shipment shall be accompanied by a Certificate of Compliance in conformance with the provisions in Section 6-l.07, "Certificates of Compliance," of the Standard Specifications. The certificate shall state that the materials and fabrication involved comply in all respects to the specifications and data submitted in obtaining approval.
D. Assembly plans including methods, materials, equipment, sequence, procedures, and temporary support details that the Contractor proposes to use for assembly of the spherical bushing ring bearing at the Contractor's bearing manufacturer's facility.
E. Details of lifting locations and mechanisms.

A supplement to the working drawings shall include the following:

A. The quality control plan (QCP). The QCP of the spherical bushing ring bearings shall conform to the requirements in "Quality Control" of these special provisions and shall include descriptions, details, and procedures for the fabrication of the spherical bushing ring bearings, except that the portion of the QCP for welding shall be submitted separately in conformance with "Welding" of these special provisions.
B. The manufacturer of the spherical bushing ring bearing shall submit to the Engineer a manual for the bearing installation, inspection, maintenance, and replacement. This manual shall include:

1. Method, materials, equipment, sequence, detailed procedures, and temporary support details for installation of the spherical bushing ring bearing. The installation plan shall include the measures to protect lubricant on all lubricative surfaces and stainless steel cladding on the pipe beams from damage during installation.
2. A record of spherical bushing ring bearing for each component including the tracing of all components during the fabrication of spherical bushing ring bearing.
3. Recommended life expectancy for each bearing component.
4. Recommended frequency for bearing inspection and maintenance schedule.
5. Procedures and details to perform the bearing inspection and maintenance.
6. List of indication of bearing defects and the associated repair methods, if applicable.
7. Procedures and sequences for bearing replacement including locations of temporary support and estimate of jacking load for each temporary support location.

Each working drawing and calculation sheet shall be signed by an engineer who is registered as a Civil Engineer or Mechanical Engineer in the State of California.

After complete working drawings and supplement are received by the Engineer, the Contractor shall allow the Engineer 40 days to review the submittal.

MATERIALS

The materials specifications of spherical bushing ring bearing components shall conform to the following table:

Component	ASTM Specifications
Segmented Anchor Ring	A709, Grade 50
Anchor Studs	A449, Type 1
Spherical Housing	A747, Stainless Steel
Anchor Bolts	A490
Assembly Bolts	A240, Type 316
Spherical Bushing Ring	B22-C86300

Attention is directed to "Welding" and "Audits" in these special provisions.

Attention is directed to "Lubricant and Test" of these special provisions.

Steel components including segmented anchor rings and anchor bolts shall conform to the details shown on the plans, the provisions in "Steel Structures," of the Standard Specifications, and these special provisions.

Clean and paint spherical bushing ring bearing shall conform to the requirements in "Clean and Paint Structural Steel (Seismic Joint, Spherical Bushing Bearing, and Shear Key)," of these special provisions.

QUALITY CONTROL

Quality Control (QC) shall be the responsibility of the Contractor. Quality Control shall be performed by an entity having a line of responsibility distinctly different from that of the manufacturer's fabrication department. As a minimum, the Contractor shall perform inspection and testing prior to fabrication, during fabrication, and after fabrication as specified herein and additionally as necessary to ensure that materials and workmanship conform to the requirements of the contract documents. Quality Control shall apply to each component of the spherical bushing ring bearing in addition to the assembly and shipping of the bearing.

The QC Inspector shall be the duly designated person who acts for and on behalf of the Contractor for inspection, testing, and quality related matters for all fabrication.

Quality Assurance (QA) is the prerogative of the Engineer. The QA Inspector is the duly designated person who acts for and on behalf of the Engineer.

Each QC Inspector shall be responsible for quality control acceptance or rejection of materials and workmanship.

The Contractor shall provide sufficient number of QC Inspectors to ensure continuous inspection.

The Contractor shall designate in writing a Quality Control Manager (QCM). The QCM shall be responsible directly to the Contractor for the quality of the fabrication, including materials and workmanship, performed by the Contractor and subcontractors.

The QCM shall be the sole individual responsible to the Contractor for submitting and receiving all correspondences, required submittals, and reports to and from the Engineer.

The Contractor shall submit to the Engineer 3 copies of Quality Control Plan (QCP), in conformance with the requirements in "Working Drawings," of these special provisions. As a minimum, each QCP shall include the following:

A. A manual including equipment, testing procedures, and code of safe practices.
B. The names, qualifications, and documentation of certifications for the QCM and all QC Inspectors.
C. An organizational chart showing all QC personnel and their assigned QC responsibilities.
D. The methods and frequencies for performing all required quality control procedures, including QC inspection forms to be used, as required by the specifications including:

    1. All visual inspections.
    2. Tests.
    3. Calibration procedures and calibration frequency for all equipment.

E. Forms to be used for Certificates of Compliance, monthly production logs, and monthly reports.
F. Mill certificates and material certificates.
G. Shipping plan.

Prior to submitting the QCP, a pre-fabrication meeting between the Engineer, Contractor, and fabricator, any entity performing spherical bushing ring bearing component fabrication or subcontractor to the Fabricator, shall be held to discuss the requirements for the QCP. The pre-fabrication meeting shall be held in San Francisco Bay Area.

After a complete QCP is submitted, the Contractor shall allow the Engineer 10 days to review the submittal. An amended QCP or addendum shall be submitted to, and approved in writing by the Engineer, for proposed revisions to the approved QCP. The Contractor shall allow the Engineer 10 days to complete the review of the amended QCP or addendum.

After final approval of the QCP, amended QCP, or addendum, the Contractor shall submit 7 copies to the Engineer of each of these approved documents.

It is expressly understood that the Engineer's approval of the Contractor's QCP shall not relieve the Contractor of any responsibility under the contract for the successful completion of the work in conformity with the requirements of the plans and specifications. The Engineer's approval shall not constitute a waiver of any requirement of the plans and specifications nor relieve the Contractor of any obligation thereunder, and defective work, materials, and equipment may be rejected notwithstanding approval of the QCP.

A monthly production log for fabrication shall be kept by the QCM for each day that fabrication is performed. The monthly report from each QC Inspector shall be included in the log.

The QCM shall sign and furnish to the Engineer, a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for each spherical bushing ring bearing. The certificate shall state that all of the materials and workmanship incorporated in the work, and all required tests and inspections of this work have been performed in conformance with the details shown on the plans and approved working drawings and the provisions of the Standard Specifications and these special provisions.

FABRICATION AND ASSEMBLY

Attention is directed to "Steel Structures," of these special provisions for fabrication of spherical bushing ring bearings at Hinge K. The Contractor shall also conform to the requirements specified herein.

Conformance with the requirements in SSPC-QP 1, SSPC-QP 2, and SSPC-QP 3 of the "SSPC: The Society for Protective Coatings" will not be required for spherical bushing ring bearings.

Finish coats will not be required on the bearings.

Each bearing shall be marked for location and orientation in conformance with the approved working drawing and supplement. Bearings shall be secured to shipping skids in a manner that assures protection during transportation and off-loading. Each skid shall be wrapped in moisture proof and dust proof covers at all times.

After completion of spherical bushing ring bearing fabrication, the Contractor shall assemble all bearing components at the Contractor's bearing manufacturer's facility to demonstrate to the Engineer that all bearing components and parts will be installed properly as shown on the plans. Bearing assembly shall be witnessed by the Engineer. The Contractor shall notify the Engineer 20 days before bearing assembly begins.

Damaged bearings shall be replaced.

BEARING STORAGE

Spherical bushing ring bearings shall be transported to and stored at the bearing storage facility as designated by the Engineer. Said location will be within 25 km of the San Francisco-Oakland Bay Bridge Toll Plaza. The Contractor shall notify the Engineer at least two months prior to delivery of the spherical bushing ring bearings.

MEASUREMENT AND PAYMENT

Furnish spherical bushing ring bearing (Hinge K) will be measured and paid for by the unit. The number of bearings for payment will be determined by the actual count of completed bearings in the bearing storage facility as specified in these special provisions.

The contract unit price paid for furnish spherical bushing ring bearing (Hinge K) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the bearing, temporary supports, cleaning and painting, assembling at bearing manufacturer's facility, and transporting of spherical bushing ring bearing, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

If a portion or all of spherical bushing ring bearings are fabricated at a site more than 480 air line kilometers from both Sacramento and Los Angeles, additional shop inspection expenses will be sustained by the State. Payment to the Contractor for furnishing spherical bushing ring bearings will be reduced $5,000 for any fabrication site located more than 480 air line kilometers from both Sacramento and Los Angeles, or in the case where a fabrication site is located more than 4800 air line kilometers from both Sacramento and Los Angeles, payment will be reduced $20,000.

10-1.49 TOWER CROSS BRACING SPHERICAL BUSHING BEARING

This work shall consist of fabricating and installing tower cross bracing spherical bushing bearing in conformance with details shown on the plans and the requirements of these special provisions.

GENERAL

Attention is directed to "Steel Structures," of these special provisions for steel casting and tower cross bracing installation requirements.

Tower cross bracing spherical bushing bearing shall accommodate the pin diameter, maximum angle of rotation, and maximum dynamic load as shown on the plans.

WORKING DRAWINGS

The Contractor shall submit working drawings in conformance with the provisions in "Working Drawings," of these special provisions.

Working drawings shall include complete details, information, drawings, and substantiating calculations of the tower cross bracing spherical bushing bearing and its components and the method, materials, equipment, and procedures of fabrication and installation that the Contractor proposes to use.

Working drawing submittals shall include the following:

A. Bearing fabrication plans for all bearings including complete details for each component or bearing models and manufacturer's name and technical specifications. The bearing details shall include the rubber covers to seal the bearings.
B. All ASTM, AASHTO, or other material designations.
C. The bushing wall thickness, fits, and tolerances.
D. Storage and shipping plans including details of handling and supporting of the bearings. Each bearing shipment shall be accompanied by a Certificate of Compliance in conformance with the provisions in Section 6-l.07, "Certificates of Compliance," of the Standard Specifications. The certificate shall state that the materials and fabrication involved comply in all respects to the specifications and data submitted in obtaining approval.
E. Installation plans including method, materials, equipment, sequence, detailed procedures, and temporary support details that the Contractor proposes to use for installation of the tower cross bracing spherical bushing bearing. The Contractor's proposed tower cross bracing spherical bushing bearing installation procedures and sequences shall be detailed in the tower cross bracing installation sequences as specified elsewhere in these special provisions.

A supplement to the working drawings shall include the following:

A. The manufacturer of the tower cross bracing spherical bushing bearing shall submit to the Engineer the verification that the spherical bushing bearings have been used for 3 similar projects for at least 3 years of each project.
B. The manufacturer of the tower cross bracing spherical bushing bearing shall submit to the Engineer a manual for the bearing inspection, maintenance, and replacement. This manual shall include:

    1. A record of tower cross bracing spherical bushing bearing for each component at each location including the tracing of all components during the fabrication and installation of tower cross bracing spherical bushing bearing.
    2. Recommended life expectancy for each bearing component.

3. Recommended frequency for bearing inspection and maintenance schedule.
4. Procedures and details to perform the bearing inspection and maintenance.
5. List of indication of bearing defects and the associated repair methods, if applicable.
6. Procedures and sequences for bearing replacement including locations of temporary support, estimate of jacking load for each temporary support location, direction of loading, method of removing and replacing bearings, a list of equipment to be used for bearing replacement, and traffic, safety, and environmental impact.

Each working drawing and calculation sheet shall be signed by an engineer who is registered as a Civil Engineer or Mechanical Engineer in the United States of America. This registered Civil Engineer or Mechanical Engineer shall be a full-time employee of the tower cross bracing spherical bushing bearing manufacturer.

After complete working drawings and supplement are received by the Engineer, the Contractor shall allow the Engineer 40 days to review the submittal.

Upon completion of installation, the Contractor shall submit to the Engineer certification stating that each tower cross bracing spherical bushing bearing has been installed in accordance with the approved working drawings and supplements installation procedure.

MATERIALS

Attention is directed to "Welding" and "Steel Audits" in these special provisions.

Steel components including plates shall conform to the details shown on the plans, the provisions in "Steel Structures," of the Standard Specifications, and these special provisions.

Clean and paint tower cross bracing spherical bushing bearing shall conform to the requirements in "Clean and Paint Structural Steel (Seismic Joint, Spherical Bushing Bearing, and Shear Key)," of these special provisions.

The bushing wall thickness, fits, and tolerances shall be as recommended by the manufacturer and specified in the working drawings and supplement.

The retainer ring, boss plate, pin, and spacer pipe shall conform to ASTM Specifications as shown on the plans.

FABRICATION AND INSTALLATION

Attention is directed to Section, "Steel Structures," of these special provisions for fabrication and installation of tower cross bracing spherical bushing bearings. The Contractor shall also conform to the requirements specified herein.

The coefficient of friction for bearing lubricant shall be equal or less than 0.10.

Conformance with the requirements in SSPC-QP 1, SSPC-QP 2, and SSPC-QP 3 of the "SSPC: The Society for Protective Coatings" will not be required for tower cross bracing spherical bushing bearings.

Finish coats will not be required on the bearings.

The Contractor shall provide the rubber covers to tower cross bracing spherical bushing bearings to seal the bearings with the details in the approved working drawings and supplement.

Each bearing shall be marked for location and orientation in conformance with the approved working drawing and supplement. Bearings shall be secured to shipping skids in a manner that assures protection during transportation and off-loading. Each skid shall be wrapped in moisture proof and dust proof covers at all times until immediately before installation.

Damaged bearings shall be replaced.

A qualified representative of the manufacturer shall be present during installation of all tower cross bracing spherical bushing bearings.

Full compensation for fabricating tower cross bracing spherical bushing bearing shall be considered as included in the contract prices paid per kilogram for furnish structural steel (bridge) (tower), and no separate payment will be made therefor.

Full compensation installing tower cross bracing spherical bushing bearing shall be considered as included in the contract prices paid per kilogram for erect structural steel (bridge) (tower), and no separate payment will be made therefor.

10-1.50 SHEAR KEY (PIER E2)

This work shall consist of fabricating, testing, and installing the shear key on Pier E2 in conformance with details shown on the plans and the requirements of these special provisions.

The shear key consists of shear key housing, shear key stub with spherical ball, spherical housing, cover plates, dust cover, anchor bolts, and threaded bolts. The lubricant shall be self-lubricated and shall be provided for all bronze surfaces and other surfaces as shown on the plans. Shear keys shall be anchored in place with high strength non-shrink grout.

The shear key assembly consists of shear key housing, shear key stub with spherical ball, and spherical housing with lubricant.

Shear keys shall be furnished and installed at Pier E2.

GENERAL

Attention is directed to "Steel Structures," of these special provisions for steel casting requirements.

Attention is directed to "Spherical Bushing Bearing (Pier E2)," of these special provisions for additional installation requirements.

The design loads, design rotations, design displacements, and alignment tolerances shall conform to the values shown on the plans.

WORKING DRAWINGS

The Contractor shall submit working drawings in conformance with the provisions in "Working Drawings," of these special provisions.

Working drawings shall include complete details, information, drawings, and substantiating calculations of the shear key and its components and the method, materials, equipment, and procedures of fabrication and installation that the Contractor proposes to use including the placement of high strength non-shrink grout.

Working drawing submittals shall include the following:

A. Shear key fabrication plans including complete details for each component.
B. All ASTM, AASHTO, or other material designations including dust cover and its connection to other shear key components.
C. Storage and shipping plans including details of handling and supporting of the shear keys. Each shear key shipment shall be accompanied by a Certificate of Compliance in conformance with the provisions in Section 6-l.07, "Certificates of Compliance," of the Standard Specifications. The certificate shall state that the materials and fabrication involved comply in all respects to the specifications and data submitted in obtaining approval.
D. Installation plans including the following:

    1. Method, materials, equipment, sequence, detailed procedures, and temporary support details that the Contractor proposes to use for installation of the shear key. The Contractor's proposed shear key installation procedures and sequences shall be detailed in the superstructure construction sequences as specified elsewhere in these special provisions.
    2. The Contractor's calculated relative distances for a) relative distance between the centerline of Pier E2 floor beam at box girder (normal to vertical profile) and the centerline of Pier E2 (vertical); distance is measured in the longitudinal direction along the top horizontal surface of concrete crossbeam, and b) relative distance between centerline of box girder (normal to cross slope) and centerline of Pier E2 (vertical); distance is measured in the transverse direction along the top sloped surface of the concrete crossbeam.

E. Details of lifting locations and mechanisms.

A supplement to the working drawings shall include the following:

A. The quality control plan (QCP). The QCP of the shear keys shall conform to the requirements in "Quality Control" of these special provisions and shall include descriptions, details, and procedures for the fabrication and installation of the shear keys, except that the portion of the QCP for welding shall be submitted separately in conformance with "Welding" of these special provisions.
B. The Contractor shall submit to the Engineer a manual for the shear key inspection, maintenance, and replacement. This manual shall include:

    1. A record of shear key for each component including the tracing of all components during the fabrication and installation of shear key.
    2. Recommended life expectancy for each shear key component.
    3. Recommended frequency for shear key inspection and maintenance schedule.
    4. Procedures and details to perform the shear key inspection and maintenance.
    5. List of indication of shear key defects and the associated repair methods, if applicable.
    6. Procedures and sequences for shear key replacement including locations of temporary support and estimate of jacking load for each temporary support location, sequences and methods of detensioning anchor bolts, method of debonding between concrete and shear key stub and anchor bolts, method of removing and replacing shear keys, a list of equipment to be used for shear key replacement, and traffic, safety, and environmental impact.

Each working drawing and calculation sheet shall be signed by an engineer who is registered as a Civil Engineer or Mechanical Engineer in the State of California.

After complete working drawings and supplement are received by the Engineer, the Contractor shall allow the Engineer 40 days to review the submittal.

Upon completion of installation, the Contractor shall submit to the Engineer certification stating that each shear key has been installed in accordance with the approved working drawings and supplements installation procedure.

MATERIALS

The materials specifications of shear key components shall conform to the following table:

Component	ASTM Specifications
Shear Key Housing	Structural Casting, Grade 550
Shear Key Stub with Spherical Ball	Structural Casting, Grade 345
Spherical Housing	High Strength Manganese Bronze Centrifugally Cast, B271-C86300
Anchor Bolts	A354, Grade BD
Threaded Bolts	A240, Type 316

Attention is directed to "Welding" and "Steel Audits" of these special provisions.

Attention is directed to "Lubricant and Test" of these special provisions.

Prestressing operation of anchor bolts shall conform to the requirements in "Prestressing Concrete" of these special provisions.

High strength nonshrink grout shall conform to the requirements in "High Strength Nonshrink Grout" of these special provisions.

Steel components including plates and anchor bolts shall conform to the details shown on the plans, the provisions in "Steel Structures," of the Standard Specifications, and these special provisions.

Clean and paint shear key shall conform to the requirements in "Clean and Paint Structural Steel (Seismic Joint, Spherical Bushing Bearing, and Shear Key)," of these special provisions.

The bronze alloy for the spherical housing shall be high strength manganese bronze centrifugally cast conforming to the requirements of ASTM Designation: B271-C86300. The mating surfaces of the spherical ball shall be stainless steel weld overlay conforming to the requirements of ASTM Designation: A240 Type 316. All items integral to and for the assembly of the shear key shall be stainless steel conforming to ASTM Designation: A 240, Type 304 or Type 316.

QUALITY CONTROL

Quality Control (QC) shall be the responsibility of the Contractor. Quality Control shall be performed by an entity having a line of responsibility distinctly different from that of the manufacturer's fabrication department. As a minimum, the Contractor shall perform inspection and testing prior to fabrication, during fabrication, and after fabrication as specified herein and additionally as necessary to ensure that materials and workmanship conform to the requirements of the contract documents. Quality Control shall apply to each component of the shear key in addition to the assembly, shipping and installation of the shear key.

The QC Inspector shall be the duly designated person who acts for and on behalf of the Contractor for inspection, testing, and quality related matters for all fabrication.

Quality Assurance (QA) is the prerogative of the Engineer. The QA Inspector is the duly designated person who acts for and on behalf of the Engineer.

Each QC Inspector shall be responsible for quality control acceptance or rejection of materials and workmanship.

The Contractor shall provide sufficient number of QC Inspectors to ensure continuous inspection.

The Contractor shall designate in writing a Quality Control Manager (QCM). The QCM shall be responsible directly to the Contractor for the quality of the fabrication, including materials and workmanship, performed by the Contractor and subcontractors.

The QCM shall be the sole individual responsible to the Contractor for submitting and receiving all correspondences, required submittals, and reports to and from the Engineer.

The Contractor shall submit to the Engineer 3 copies of Quality Control Plan (QCP), in conformance with the requirements in "Working Drawings," of these special provisions. As a minimum, each QCP shall include the following:

A. A manual including equipment, testing procedures, and code of safe practices.
B. The names, qualifications, and documentation of certifications for the QCM and all QC Inspectors.
C. An organizational chart showing all QC personnel and their assigned QC responsibilities.

D. The methods and frequencies for performing all required quality control procedures, including QC inspection forms to be used, as required by the specifications including:

   1. All visual inspections.
   2. Tests.
   3. Calibration procedures and calibration frequency for all equipment.

E. Forms to be used for Certificates of Compliance, monthly production logs, and monthly reports.
F. Mill certificates and material certificates.
G. Shipping plan.
H. Installation plan.

Prior to submitting the QCP, a pre-fabrication meeting between the Engineer, Contractor, and fabricator, any entity performing shear key component fabrication or subcontractor to the Fabricator, shall be held to discuss the requirements for the QCP. The pre-fabrication meeting shall be held in San Francisco Bay Area.

After a complete QCP is submitted, the Contractor shall allow the Engineer 10 days to review the submittal. An amended QCP shall be submitted to, and approved in writing by the Engineer, for proposed revisions to the approved QCP. The Contractor shall allow the Engineer 10 days to complete the review of the amended QCP.

After final approval of the QCP, or amended QCP, the Contractor shall submit 7 copies to the Engineer of each of these approved documents.

It is expressly understood that the Engineer's approval of the Contractor's QCP shall not relieve the Contractor of any responsibility under the contract for the successful completion of the work in conformance with the requirements of the plans and specifications. The Engineer's approval shall not constitute a waiver of any requirement of the plans and specifications nor relieve the Contractor of any obligation thereunder, and defective work, materials, and equipment may be rejected notwithstanding approval of the QCP.

A monthly production log for fabrication shall be kept by the QCM for each day that fabrication is performed. The monthly report from each QC Inspector shall be included in the log.

The QCM shall sign and furnish to the Engineer, a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for each shear key. The certificate shall state that all of the materials and workmanship incorporated in the work, and all required tests and inspections of this work have been performed in conformance with the details shown on the plans and approved working drawings and the provisions of the Standard Specifications and these special provisions.

FABRICATION AND INSTALLATION

The Contractor's attention is directed to "Steel Structures," of these special provisions for fabrication and installation of shear keys at Pier E2. The Contractor shall also conform to the requirements specified herein.

Conformance with the requirements in SSPC-QP 1, SSPC-QP 2, and SSPC-QP 3 of the "SSPC: The Society for Protective Coatings" will not be required for shear keys.

Finish coats will not be required on the shear keys.

Each shear key shall be marked for location and orientation in conformance with the approved working drawing and supplement. Shear keys shall be secured to shipping skids in a manner that assures protection during transportation and off-loading. Each skid shall be wrapped in moisture proof and dust proof covers at all times until immediately before installation.

After completion of shear key fabrication, the Contractor shall assemble all shear key components, except high strength nonshrink grout, at the Contractor's shear key manufacturer's facility to demonstrate to the Engineer that all shear key components and parts will be installed properly as shown on the plans. Shear key assembly shall be witnessed by the Engineer. The Contractor shall notify the Engineer 20 days before shear key assembly begins. After the shear key assembly is successfully completed, the Contractor shall disassemble the shear key into the parts that are designed for transportation. The Contractor shall take measures to ensure that the shear key shall not be damaged during the assembly and disassembly processes.

Damaged shear keys shall be replaced.

Qualified representatives from manufacturer of the shear key assembly shall be present during installation of all spherical bushing bearings.

Prior to shear key installation, the Contractor shall measure the relative longitudinal distance between the centerline of E2 floor beam at box girder and the centerline of Pier E2 and relative transverse distance between the centerline of box girder and the centerline of Pier E2. The distances shall be measured and compared with the calculated values specified in the approved working drawings and supplement. If the longitudinal difference between the centerline of E2 floor beam at box girder and the centerline of Pier E2 is greater than 20 mm or the transverse difference between the centerline of box girder

and the centerline of Pier E2 is greater than 5 mm, the Contractor shall suspend shear key installation process, and submit to the Engineer a mitigation plan for approval. The mitigation plan shall include the necessary measures to be taken to compensate for the difference. After the Contractor submits the mitigation plan, the Contractor shall allow the Engineer 10days for review. Shear key installation shall not be resumed until the Engineer has reviewed and approved, in writing, the Contractor's mitigation plan.

Shear key shall be temporarily supported during grout operations. Temporary supports shall prevent the rotation or displacement of the shear key during grout operation. Temporary supports shall not inhibit the functioning of the shear key after grout has set. Temporary supports shall not restrict the movement at bridge joints due to temperature changes and shortening from prestressing forces. Materials for temporary supports within the limits for placing grout shall conform to the requirements for form fasteners.

Prior to grouting, survey shall be taken to ensure centers of rotation of all bearings and shear keys are aligned in the same transverse axis.

High strength nonshrink grout placement shall conform to the requirements in Section, "High Strength Nonshrink Grout," elsewhere of these special provisions.

SHEAR KEY STORAGE

Shear keys shall be transported to and stored at the shear key storage facility as designated by the Engineer. Said location will be within 25 km of the San Francisco-Oakland Bay Bridge Toll Plaza. The Contractor shall notify the Engineer at least two months prior to delivery of the shear keys.

MEASUREMENT AND PAYMENT

Furnish and install shear key (Pier E2) will be measured and paid for by the unit. The number of shear keys for payment will be determined by the actual count in the completed work.

The contract unit price paid for furnish and install shear key (Pier E2) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the shear key, testing including fixtures, temporary supports, installing in final position, including shear key high strength nonshrink grout, and cleaning and painting of shear key, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for the qualified representative of the manufacturer to be present during installation of all shear keys shall be considered as included in the contract unit price paid for furnish and install shear key (Pier E2) and no additional compensation will be allowed therefor.

If a portion or all of shear keys are either fabricated or tested at a site more than 480 air line kilometers from both Sacramento and Los Angeles, additional shop inspection expenses will be sustained by the State. Payment to the Contractor for furnishing shear keys will be reduced $5,000 for any fabrication and testing site located more than 480 air line kilometers from both Sacramento and Los Angeles, or in the case where a fabrication or testing site is located more than 4800 air line kilometers from both Sacramento and Los Angeles, payment will be reduced $20,000.

10-1.51 LUBRICANT AND TEST

This work shall consist of furnishing and testing lubricant for spherical bushing bearing (Pier E2), spherical bushing ring bearing (Hinge K), and shear key (Pier E2) in conformance with details shown on the plans and the requirements of these special provisions.

The Contractor's attention is directed to "Spherical Bushing Bearing (Pier E2)," "Spherical Bushing Ring Bearing (Hinge K)," and "Shear Key (Pier E2)," of these special provisions.

WORKING DRAWINGS

The Contractor shall submit working drawings in conformance with the provisions in Section, "Working Drawings," elsewhere in these special provisions and these special provisions.

Working drawing submittals shall include the following:

A. Documentation of the Contractor's proposed lubricant to be used for spherical bushing bearing, spherical bushing ring bearing, and spherical housing for shear key. The lubricant shall have a minimum of 3 years history and shall have been used for a minimum of 3 projects of similar application.
B. Details, procedures, and schedules of friction tests of the lubricant conforming to "Testing" of this section. The Contractor shall submit written verification that the testing laboratory is available to perform the friction tests within the specified schedules. The friction testing plan shall include design and drawings of test fixtures, and details of the testing apparatus and equipment included in the testing program. The friction testing plan shall also include certifications that all testing equipment have been calibrated no longer than 12 months prior to start of testing.

Each working drawing and calculation sheet shall be signed by an engineer who is registered as a Civil Engineer or Mechanical Engineer in the United States of America.

Complete working drawings and supplement shall be submitted to the Engineer within one year after the contract is awarded. After complete working drawings and supplement are received by the Engineer, the Contractor shall allow the Engineer 40 days to review the submittal. No fabrication of test specimen and test fixtures shall begin until complete working drawings and supplement are reviewed and approved, in writing, by the Engineer.

Within 10 days after the tests have been successfully completed, the Contractor shall submit to the Engineer 4 copies of the test records, results, certified test reports, and all other relevant test information for review and approval.

The Contractor shall allow the Engineer 30 days to review each of the certified test reports for the tests. Lubricant shall not be used until the Engineer has approved all certified test reports.

MATERIALS

The lubricant shall consist of a combination of solids having non-deteriorating characteristics as well as inherent lubricating qualities. The lubricant shall be capable of withstanding the effects of long-term atmospheric exposure and submersion in seawater, fresh water, and most solvents. Graphite, molybdenum disulfide or other ingredients that tend to promote electrolytic or chemical action shall not be used in the lubricant. The use of shellac, tars, solvents or other non-lubricating binder materials shall not be permitted. The lubricant shall have a minimum durometer hardness of 90 on the Shore 'A' scale when tested in accordance with ASTM Designation: D2240.

The lubricant shall be integrally molded and compressed into recesses provided for containment of the lubricant. The recesses shall be of sufficient depth to properly contain the lubricant and shall comprise not less than 30 percent of the total bearing area. The recesses shall be arranged in an overlapping geometric pattern with successive rows overlapping in the direction of motion. Trepan recesses or drilled holes shall be used for diameters 250 mm and larger. The lubricant shall cover 100 percent of the sliding bearing area and shall be dense. The lubricant shall not be scraped or machined in any way after manufacture. The surface roughness of the lubricated surface and its mating surface shall not exceed 0.003 mm.

The following manufacturers have stated that they have the lubricant products that meet the requirements of these special provisions:

A. Cosmec, Inc.
   Lubricant Product Name: XL-10
   Address: P.O. Box 390
   70 South Street
   Walpole, Massachusetts 02081
   Tel: (508) 668-6600
   Fax: (508) 660-1022
   Contact Person: Matt McAndrews

B. Lubrite Technologies
   Lubricant Product Name: G10
   Address: 145 Webster Street, Suite J
   Hanover, Massachusetts 02339
   Tel: (781) 871-1420
   Fax: (781) 871-1492
   Contact Person: John Gunn/James Moy

C. Lubron Bearing Systems
Lubricant Product Name: AQ100
Address: 17611 Metzler Lane
Huntington Beach, California 92647
Tel: (714) 841-3007
Fax: (714) 841-3507
Contact Person: Jim James

TESTING

The Contractor shall perform friction tests on the specimens as shown on the plans at the laboratory designated in the approved working drawings and supplement.

The fabrication of all components of the test specimens including material specifications, fabrication procedures, workmanship, and quality control program shall be the same as that used in the production of spherical bushing bearings or shear keys. Specimens that are subject to tests shall not be installed in the bridge and shall become the property of the State. The Contractor shall transport tested specimens to a location as designated by the Engineer. Said location will be within 25 km of the San Francisco-Oakland Bay Bridge Toll Plaza. The Contractor shall notify the Engineer at least 30 days prior to delivery of tested specimens to allow the Engineer to inspect tested specimens in the Contractor's testing laboratory. The tested specimens shall not be damaged during transportation.

The Contractor shall notify the Engineer, in writing, at least 20 days prior to the start of each test.

The Contractor shall provide the necessary access and assistance to the Engineer to observe the tests, monitor the process, and take measurements. The Contractor shall also provide space in the testing facility to accommodate the Engineer's monitoring equipment.

After completion of each test, the Contractor shall inspect the test specimen, in the presence of the Engineer, to identify any damage that may have occurred to the test specimen components.

Test Fixtures

The test fixture elements including all connection components and details shall be fabricated to match the surface of the tested bearing specimens as shown on the plans and as specified elsewhere in these special provisions. The materials and tolerances of the fixture mating surfaces shall be the same as those specified for the box girders in "Steel Structures," of these special provisions.

The test fixture elements shall be subject to the same quality control and inspection requirements as spherical bushing bearings and box girders as specified in "Steel Structures," of these special provisions.

Friction Tests

The Contractor shall fabricate the specimens as shown on the plans and as specified herein. The Contractor shall also fabricate the test fixtures for the specimens to perform the friction tests at the loading conditions in the order prescribed in the tables as shown on the plans. For each test, applied bearing pressure to the specimen shall conform to the values in the table as shown on the plans.

The test results shall be certified correct and signed by the testing laboratory personnel who conducted the test and interpreted the results.

After friction tests have been successfully completed, all certified test reports are reviewed, and the final approval is given, in writing by the Engineer, the Contractor may start the fabrication of spherical bushing bearings, spherical bushing ring bearings, and spherical housings for shear keys.

Testing Requirements

Prior to the start of the first test of each specimen all steel sliding surfaces shall be cleaned using alcohol. No greasing or lubricating agents shall be applied to any part of the sliding interfaces.

For each test specimen, the first test shall be completed after conditioning specimens for 12 hours at 20°±8°C. All tests shall be conducted at an ambient temperature of 20°±8°C.

The Contractor shall record downwards load, shear force for computing the coefficient of friction, and time for every test. Readings shall be taken at sufficiently close intervals to detect the force peak that may occur at the reversal of direction but not less than 200 readings per cycle. The zero for force shall be taken as the mid-point between the forces at zero displacement during sliding in the two different directions. Friction forces shall be measured from this zero value. A record of readings shall be kept for all cycles of all tests.

Test loadings shall be applied at a rate between 10 and 20 MPa per minute and shall be released at a rate not exceeding 20 MPa per minute.

Acceptance Criteria

The friction tests shall be performed to verify the coefficient of friction between the lubricated surface and the mating surface at different bearing pressures. The friction tests shall conform to the following procedures and requirements:

A. The friction test shall be conducted in such a way that all of the shear movement of the test specimens occurs at the sliding interface.
B. The test load shall be applied without any relative movement of the sliding surfaces for a minimum of 1 hour prior to the application of relative displacements

The acceptance criteria for friction tests shall be the following:

A. The coefficient of friction value shall be computed by dividing the force parallel to the sliding surface, which corresponds to sliding or rotating movement by the force normal to the sliding surface.
B. The coefficient of friction for all tests shall meet the requirements as specified in the tables as shown on the plans.

MEASUREMENT AND PAYMENT

Full compensation for lubricant and testing including test specimens, test fixtures, and transportation of tested specimens to the location as designated by the Engineer shall be considered as included in the various contract items of work involved and no separate payment will be made therefor.

10-1.52 INSTALL CIRCULAR SEGMENTED BEARING (HINGE A)

This work shall consist of inspection, delivery, and installation of circular segmented bearings at Hinge A in conformance with details shown on the plans and the requirements of these special provisions.

Attention is directed to "State-Furnished Materials," of these special provisions.

Each circular segmented bearing consists of 8 individually fabricated bearing segments, which are assembled to form a cylindrical surface. Bearing segments consist of anchor plates, mounting plates, keyed bottom plates, keyed top edge plates, bearing plates, steel anchor bolts, elastomer, and woven polytetrafluoro-ethylene (PTFE) fabric.

Circular segmented bearings shall be of 2 types:

1. Fixed type (Type III and Type IV as shown on the plans), a curved steel laminated elastomeric unit with concentric curved steel anchor plate.
2. Sliding type (Type I and Type II as shown on the plans), a curved steel laminated elastomeric unit with concentric curved steel anchor plate and an inner woven PTFE fabric on the sliding surface.

Circular segmented bearings of the types listed will be furnished by the State and shall be installed by the Contractor at the following hinge locations:

Hinge Location	Sliding Type Bearings	Fixed Type Bearings
Hinge AW, AE	Type I and Type II	Type III and Type IV

GENERAL

The Contractor's attention is directed to "Steel Structures," of these special provisions for hinge pipe beam requirements.

WORKING DRAWINGS

The Contractor shall submit working drawings in conformance with the provisions in "Working Drawings," of these special provisions.

Working drawings shall include complete details, information, drawings, and substantiating calculations of the circular segmented bearing and its components and the method, materials, equipment, and procedures of inspection, delivery, and installation that the Contractor proposes to use including the placement of bearing grout.

Working drawing submittals shall include the following:

A. Bearing shipping plans including details of handling and supporting of the circular segmented bearings.
B. Installation plans including the following:

    1. Method, materials, equipment, sequence, procedures, and temporary support details that the Contractor proposes to use for installation of the circular segmented bearings.

2. Measures that will protect the stainless steel surface of the pipe beam from damage during shipping and installation.
3. Bearing grout mix design and method of placement and curing. Bearing grout shall conform to the section "High Strength Nonshrink Grout" of these special provisions.

C. Details of lifting locations and mechanisms.

A supplement to the working drawings shall include the following:

A. Bearing inspection report as specified in these special provisions. The bearing inspection report shall include the condition of circular segmented bearings and any existing damages that may have occurred prior to the Contractor's delivery. If no damage is found, the Contractor shall include a statement in the bearing inspection report to state that the circular segmented bearings are in good conditions and acceptable for delivery and installation.

After complete working drawings and supplement are received by the Engineer, the Contractor shall allow the Engineer 20 days to review the submittal. No delivery or installation of the bearing shall begin until the Engineer has reviewed and approved the working drawing and supplement submittal.

Upon completion of installation, the Contractor shall submit to the Engineer certification stating that each circular segmented bearing has been installed in accordance with the approved working drawings and supplements installation procedure.

MATERIALS

Steel components including plates and anchor bolts shall conform to the details shown on the plans, the provisions in "Steel Structures," of these special provisions.

Welding to any part of bearing segment shall not be permitted.

INSTALLATION

Prior to transporting the circular segmented bearings to the bridge site, the Contractor shall inspect the bearings at the bearing storage location as specified elsewhere in these special provisions. The Contractor shall furnish to the Engineer a bearing inspection report as specified in the working drawing and supplement.

Each bearing segment has been marked for location and orientation when furnished to the Contractor by the State. Segments shall be secured to shipping skids in a manner that assures protection during transportation, on-loading, and off-loading. Each skid shall be wrapped in moisture proof and dust proof covers and in addition the woven PTFE surface shall be fully covered with opaque material at all times until immediately before placement.

Damaged bearings during loading, shipping, and installation shall be replaced by the Contractor at the Contractor's expense as specified in Section 6-1.02, "State-Furnished Materials," of the Standard Specification. No extension of time or compensation will be made for manufacturing, furnishing, testing, and installing replaced circular segmented bearings as a result of damaged bearings.

A qualified representative of the manufacturer shall be present during installation of all circular segmented bearings.

The Contractor shall protect the pipe beam stainless steel surface during the installation of the circular segmented bearings. No damage to the stainless steel surface shall be permitted.

MEASUREMENT AND PAYMENT

Install circular segmented bearing (Hinge A) will be measured and paid for by the unit. The number of bearings for payment will be determined by the actual count in the completed work.

The contract unit price paid for install circular segmented bearing (Hinge A) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in inspection, delivery, and installation of the bearing including a qualified representative of the manufacturer and high strength nonshrink grout placement, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.53 SEALING JOINTS

Joints between columns at Pier W2 and concrete cover slabs, and joints in the bikepath overlay shall be sealed in conformance with the details shown on the plans, the provisions in Section 51, "Concrete Structures," of the Standard Specifications, and these special provisions.

Where polyurethane seals are shown on the plans, a silicone sealant conforming to the provisions in Section 51–1.12F, "Sealed Joints," of the Standard Specifications may be used.

When ordered by the Engineer, a joint seal larger than called for by the Movement Rating shown on the plans shall be furnished and installed. Payment to the Contractor for furnishing the larger seal and for saw cutting the increment of additional depth of groove required will be determined as provided in Section 4-1.03, "Changes," of the Standard Specifications.

Full compensation for sealing joints shall be considered as included in the various contract items involved and no separate payment will be made therefor.

10-1.54 SEISMIC JOINT

Seismic joints shall consist of steel deck plates, channel assemblies, support plates, self-consolidating concrete, sealing elements, gutter, and anchorage components and shall be fabricated and installed at Hinges AW and AE in conformance with the details shown on the plans and as specified in the Standard Specifications and these special provisions.

Attention is directed to "Cooperation," of these special provisions.

Unless otherwise directed by the Engineer, prior to submitting working drawings, the Contractor shall inspect the Hinge A blockouts in the adjacent Skyway Structures constructed by others in Contract No. 04-012024. The Contractor shall submit to the Engineer an inspection report for review and approval. This inspection report shall be titled "Skyway Blockouts Inspection Report" and shall include the actual blockout sizes; potential interference with the blockout reinforcement and seismic anchorages shown on the plans; any conflicts with the details shown on the plans; and recommendations to resolve the conflicts. The Contractor shall allow the Engineer 10 days to review and approve the "Skyway Blockouts Inspection Report".

WORKING DRAWINGS

The Contractor shall submit working drawings in conformance with the provisions in "Working Drawings" of these special provisions, and the requirements specified herein.

Working drawings shall include complete details, information, and drawings of the seismic joints and anchorage components and the method, materials, equipment, and procedures for fabrication and installation that the Contractor proposes to use.

Working drawing submittals shall include the following:

A. Fabrication plans including all details, elevations, and sections of the seismic joint as shown on the plans. All dimensions and design tolerances shall be specified. Fabrication plans for the sizes of deck plates and support plates shall consider roadway super elevations and longitudinal gaps between the plates for sealing elements. Unless otherwise directed by the Engineer, fabrication plans shall conform to the actual blockout sizes and recommendations specified in the approved "Skyway Blockouts Inspection Report."
B. All ASTM or other material designations.
C. Sections showing all materials comprising the seismic joint with complete details of all individual components including welded splices and connections, welding procedures, and the measures to be taken to prevent steel plate from distortion due to the heat of traction welding.
D. Joint installation plans including methods, materials, equipment, sequence, lifting mechanisms and locations, details of temporary anchorage during setting, temperature adjustment devices, method for maintaining full contact between deck plates and support plates during and after installation, installation details at curbs, seal installation details, and other procedures that the Contractor proposes to use for installation of the seismic joints.
E. Self-consolidating concrete mix design and placement procedures. The Contractor's proposed self-consolidating concrete mix design submittals shall include test results for slump flow, slump flow time to a 500 mm diameter, stability of the concrete mixture, and compressive strengths at 7 and 28 days.
F. Details and procedures of the mock-up construction to demonstrate self-consolidating concrete.
G. List of coating system for seismic joints identifying cleaning and painting of all steel components as specified in "Clean and Paint Structural Steel (Seismic Joint, Spherical Bushing Bearing, and Shear Key)" of these special provisions.
H. Anchorage components including concrete blockout details and any additions or rearrangements of the reinforcing steel from that shown on the plans.
I. Storage plans for manufacture storage, interim storage, and on-site storage details including temporary support for the seismic joints.
J. Shipping plans including handling of the seismic joints during transportation. Each shipment of the seismic joint materials shall be accompanied by a Certificate of Compliance in conformance with the provisions in Section 6-l.07, "Certificates of Compliance," of the Standard Specifications. The certificate shall state that the materials and fabrication involved comply in all respects to the specifications and data submitted in obtaining approval.

After complete working drawings are received by the Engineer, the Contractor shall allow the Engineer 20 days to review the submittal. No fabrication of the seismic joint shall begin until complete working drawings are reviewed and approved, in writing, by the Engineer.

The final approval of the Contractor's mix design for self-consolidating concrete is contingent upon the successful mock-up construction as specified in "Demonstration Pours" herein.

MATERIALS

Attention is directed to "Welding" and "Audits" of these special provisions. Welding of seismic joint shall conform to AWS D1.5.

Structural steel shall conform to "Steel Structures" of these special provisions. Structural steel shall conform to the requirements of ASTM Designation: A 709M, Grade 345. Bolts, nuts and washers shall conform to the requirements of ASTM Designation: A 325 or A 325M and Section 75-1.03, "Miscellaneous Bridge Metal," of the Standard Specifications.

Sealing elements shall be 2 component silicone sealant that meets the requirements of Type A and AL seal in Section, 51-1.12F(3), "Materials and Installation," of the Standard Specifications. Sealing elements shall conform to the details shown on the plans and shall be continuous without splices.

Reinforcing steel shall conform to the provisions in "Reinforcement" of these special provisions.

Gutter shall conform to the provisions in "Miscellaneous Metal (Bridge)," of these special provisions.

Neoprene sheet shall conform to Section 51-1.145, "Strip Waterstops," of the Standard Specifications.

Elastomeric washers shall conform to the requirements specified in Section 51-1.12H(1), "Plain and Fabric Reinforced Elastomeric Bearing Pads," of the Standard Specifications.

Self-consolidating concrete shall be flowing concrete capable of spreading without segregation to a level state without the use of internal or external vibrators. Self-consolidating concrete shall conform to "Concrete Structures" of these special provisions and the requirements specified herein.

In addition to the chemical admixtures listed on the Department's current list of approved brands of admixtures that may be used, the Contractor may use a viscosity modifying admixture made by a chemical admixture manufacturer for the purpose of producing a self-consolidating concrete. The use of the viscosity modifying admixture shall be in accordance with the manufacturer's recommendations. The combined aggregate grading shall be any of the four maximum size grading limits specified in Section 90-3.04, "Combined Aggregate Gradings," of the Standard Specifications.

The Contractor's proposed mix design shall be pre-qualified for use in the demonstration pour by trial batch reports in conformance with Section 90-9 "Compressive Strength" of the Standard Specifications except that the consistency shall be measured by the slump flow test and bleeding shall be measured by ASTM Designation, C 232, Method A. The slump flow test shall conform to the requirements in ASTM Designation: C 143 except the following:

A. The cone shall be filled in one lift without rodding. The cone shall be placed on a flat, moist, nonabsorbent, rigid base plate that is at least 700x700 mm. The base plate shall have concentric circle marks showing 200-mm and 500-mm diameter circles.
B. Measure the time it takes for the concrete to reach 500 mm diameter circle. Report this as "Slump Flow Time" to the nearest 0.5 seconds.
C. After the concrete ceases to flow, measure the diameter in 2 perpendicular directions. Report this as "Slump Flow" to the nearest 5 mm.
D. Visually inspect the concrete spread to observe the distribution of coarse aggregate throughout the spread. Measure and record the radial width of any mortar ring without coarse aggregate. If no mortar ring without coarse aggregate exists, report as zero.

Consistency of the self-consolidating concrete shall be determined using the slump flow test method. The self-consolidating concrete shall have a minimum slump flow of 550 mm without segregation. The slump flow shall be selected by the Contractor based on the concrete constituent materials and placement procedures as specified in the approved working drawings.

The percent bleeding shall not exceed 1.5% when determined by ASTM Designation, C 232, Method A except that the container shall be filled in one lift without rodding.

Amendment to California Test 540

The following amendments to California Test 540, "Method of Making, Handling, and Storing Concrete Compressive Test Specimens in the Field," shall only apply to self-consolidating concrete. The Items "a" and "b" under "2. Test Specimen Fabrication" of "C. Preparation of Test Specimens" of California Test 540 shall be amended to read:

a. Place test molds on a firm, flat surface to prevent distortion of the bottom surface. When more than one specimen is to be made from the same batch, make all specimens simultaneously. Fill the mold in one lift with a circular motion

of the scoop to distribute the concrete evenly in the mold. Pat sides of the mold lightly by hand, or jig by rocking the mold from side to side.

b. After the sides of the mold have been patted, strike off the surface of the concrete even with the top edge of the mold. Wipe the sides of the mold free of excess concrete and press the lid on to prevent evaporation.

Demonstration Pours

Prior to placing self-consolidating concrete, the Contractor shall construct at least one mock-up to demonstrate that the concrete will flow for the distance required by the proposed construction procedure. The placement of the self-consolidating concrete in the mock-up shall be witnessed by the Engineer.

The mock-up shall have a depth and length equal to that of the blockout detailed on the plans. The width of the mock-up shall be selected by the Contractor based on the distance that the concrete is required to flow according to the proposed construction procedure but shall not be less than 2 meters. The mock-up shall include concrete, reinforcement, and all concrete embedments as shown on the plans and approved working drawings, except that all reinforcement and embedments shall stop 300 mm from both longitudinal ends of the blockout so that concrete can be removed later and tested for segregation. The mock-up shall have a removable 27 mm plus or minus 3 mm thick transparent plastic top plate. The plastic top plate shall have vent holes of the same size and spacing as those in the support plate.

Acceptance criteria of the self-consolidating concrete shall be as follows:

A. Self-consolidating concrete shall flow under the plastic top plate and shall completely fill the void in the blockout.
B. After consolidation against the plastic top plate is verified, the Contractor shall remove the plastic top plate and shall take a sample of at least 45 kg of concrete from each end of the blockout to check for segregation by comparing coarse aggregate content with mix design values. The coarse aggregate content of each sample shall be determined using California Test 529 and shall not differ from the mix design value by more than 110 kg/m^3.
C. The percent bleeding shall not exceed 1.5% when determined by ASTM Designation, C 232, Method A except that the container shall be filled in one lift without rodding.

If the concrete fails to meet any of the acceptance criteria as determined by the Engineer, additional mock-ups shall be constructed at the Contractor's expense.

The mock-up shall not be part of the permanent structure and shall become the property of the Contractor. The mock-up shall be removed from the work site and shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

FABRICATION

The seismic joint shall be fabricated in conformance with the details, dimensions, material specifications, and procedures shown in the approved working drawings.

The surfaces between deck plates and support plates shall be in full contact. The contact surfaces between deck plates and support plates shall be within one millimeter in 300 mm and within 2 mm over the longest dimension of the plate.

All plate welds shall be ground smooth. The welds shall not protrude into the sliding surface of the deck plates or support plates.

Cleaning and painting of all new metal surfaces of the seismic joints, except where embedded in concrete, shall conform to the requirements specified in "Clean and Paint Structural Steel (Seismic Joint, Spherical Bushing Bearing, and Shear Key)" of these special provisions.

Damage to the seismic joint during shipping or handling shall be cause for rejection of the seismic joint.

Damage to the corrosion protection system shall be repaired to the satisfaction of the Engineer prior to installation.

INSTALLATION

Each seismic joint shall be installed in accordance with the approved working drawings.

The maximum gap between sliding surfaces shall not exceed 2 mm in any loaded or unloaded position.

Each installed seismic joint shall match the finished roadway profile and grades as shown on the plans.

The Contractor shall protect the seismic joint from damage. The Contractor shall protect concrete blockouts and support systems from damage and construction traffic prior to installation of the seismic joints.

Sealing elements not fully bonded to the steel extrusions shall be replaced by the Contractor at the Contractor's expense.

The bridge deck surface shall conform to the provisions in "Epoxy Asphalt Concrete Surfacing" of these special provisions after installation of seismic joints.

MEASUREMENT AND PAYMENT

The contract lump sum price paid for seismic joint at the locations listed in the Engineer's Estimate shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in

fabricating, furnishing, transporting, storing, and installing the seismic joints, including self-consolidating concrete, bar reinforcing steel, neoprene sheets, gutter, anchorage components, mock-up construction, protecting, repairing, cleaning and painting, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Epoxy asphalt concrete will be measured and paid for separately as specified in "Epoxy Asphalt Concrete Surfacing" of these special provisions.

Furnishing and erecting bikepath expansion joints including cover plates will be measured and paid for as furnish structural steel (bridge) (bikepath) and erect structural steel (bridge) (bikepath), respectively.

Steel barrier will be measured and paid for separately as specified in "Steel Barrier" of these special provisions.

10-1.55 POLYESTER CONCRETE OVERLAY (13MM)

GENERAL

This work shall consist of constructing a polyester concrete overlay, including application of a prime coat, in conformance with the details shown on the plans and these special provisions. Polyester concrete for the bikepath shall be colored as shown on the plans. Referee samples of Federal Color No. 26099, "Charcoal Gray" and Federal Color No. 26440, "Light Gray" are available for viewing. Referee samples are available for inspection by contacting the Toll Bridge Duty Senior at the office of the Toll Bridge Duty Senior at the District 4 Office, 111 Grand Avenue, Oakland California, 94612, email duty_senior_tollbridge_district04@dot.ca.gov, telephone (510)-286-5209.

Before starting deck overlay work on the project, the Contractor shall submit for approval by the Engineer, a program for public safety associated with the use of methacrylate resin and polyester concrete during the construction of the project. This program shall identify materials, equipment, and methods to be used. The Contractor shall not perform any deck overlay work on the project, other than that specifically authorized in writing by the Engineer, until the program has been approved.

If the measures being taken by the Contractor are inadequate to provide for public safety associated with the use of methacrylate resin and polyester concrete, the Engineer will direct the Contractor to revise the operations and public safety program. These directions will be in writing and will specify the items of work for which the Contractor's program for public safety associated with the use of methacrylate resin and polyester concrete is inadequate. No further work shall be performed on these items until the public safety measures are adequate, and if required, a revised program for public safety associated with the use of methacrylate resin and polyester concrete has been approved.

The Engineer will notify the Contractor in writing of the approval or rejection of any submitted or revised program for public safety associated with the use of methacrylate resin and polyester concrete in not more than 10 days following submittal.

The State will not be liable to the Contractor for failure to approve all or any portion of an originally submitted or revised program for public safety associated with the use of methacrylate resin and polyester concrete, nor for any delays to the work due to the Contractor's failure to submit an acceptable program for public safety associated with the use of methacrylate resin and polyester concrete.

MATERIALS

Polyester concrete shall consist of polyester resin binder and dry aggregate. The resin shall be an unsaturated isophthalic polyester-styrene co-polymer conforming to the following:

POLYESTER RESIN BINDER		
PROPERTY	REQUIREMENT	TEST METHOD
* Viscosity	0.075 to 0.200 Pa·s (RVT, No. 1 Spindle, 20 RPM at 25°C)	ASTM D 2196
* Specific Gravity	1.05 to 1.10 at 25°C	ASTM D 1475
Elongation	35 percent, minimum Type I at 11.5 mm/min. Thickness = 6.5±1 mm	ASTM D 638
	Sample Conditioning: 18/25/50 + 5/70	ASTM D 618
Tensile Strength	17.5 MPa, minimum Type I at11.5 mm/min. Thickness = 6.5±1 mm	ASTM D 638
	Sample Conditioning: 18/25/50 + 5/70	ASTM D 618
* Styrene Content	40 percent to 50 percent (by weight)	ASTM D 2369
Silane Coupler	1.0 percent, minimum (by mass of polyester styrene resin)	
PCC Saturated Surface-Dry Bond Strength	3.5 MPa, minimum at 24 hours and 21±1°C	California Test 551
* Static Volatile Emission	60 gram per square meter, loss, maximum	South Coast Air Quality Management District, Standard Method
* Test shall be performed prior to adding initiator.		

The silane coupler shall be an organosilane ester, gammamethacryloxypropyltrimethoxysilane. The promoter shall be compatible with suitable methyl ethyl ketone peroxide (MEKP) and cumene hydroperoxide (CHP) initiators.

Aggregate for polyester concrete shall conform to the provisions in Section 90-2.02, "Aggregates," of the Standard Specifications and either of the following combined aggregate gradings:

COMBINED AGGREGATE		
Sieve Size	Percentage Passing	
	9.5-mm Max.	4.75-mm Max.
12.5-mm	100	100
9.5-mm	83 - 100	100
4.75-mm	65 - 82	62 - 85
2.36-mm	45 - 64	45 - 67
1.18-mm	27 - 48	29 - 50
600-µm	12 - 30	16 - 36
300-µm	6 - 17	5 - 20
150-µm	0 - 7	0 - 7
75-µm	0 - 3	0 - 3

Aggregate retained on the 2.36-mm sieve shall have a maximum of 45 percent crushed particles when tested in conformance with California Test 205. Fine aggregate shall consist of natural sand only. The Contractor may modify any of the following three requirements provided that the proposed modifications produce polyester concrete with a resin content of no more than 14 percent by mass of dry aggregate:

1. Aggregate gradation including modified gradation limits.
2. Maximum percentage of crushed particles used in the mix.
3. The use of natural sand for fine aggregate. Optional materials may include slag, fly ash, sands manufactured from larger aggregate, or manmade aggregate.

The polyester resin binder in the concrete shall be approximately 12 percent by mass of the dry aggregate; the exact percentage will be determined by the Engineer.

Aggregate absorption shall not exceed one percent as determined by California Tests 206 and 207.

At the time of mixing with the resin, the moisture content of the aggregate, as determined by California Test 226, shall not exceed one half of the aggregate absorption.

The prepared surface shall receive a wax-free, high molecular weight methacrylate prime coat conforming to the following:

High Molecular Weight Methacrylate (HMWM) Resin		
PROPERTY	REQUIREMENT	TEST METHOD
* Viscosity	0.025 Pa·s, maximum, (Brookfield RVT with UL adaptor, 50 RPM at 25°C)	ASTM D 2196
* Specific Gravity	0.90, minimum, at 25°C	ASTM D 1475
* Flash Point	82°C, minimum	ASTM D 3278
* Vapor Pressure	1.0 mm Hg, maximum, at 25°C	ASTM D 323
Tack-free time	400 minutes, maximum at 25°C	California Test 551
PCC Saturated Surface-Dry Bond Strength	3.5 MPa, minimum at 24 hours and 21±1°C	California Test 551
* Test shall be performed prior to adding initiator.		

The promoter/initiator system for the methacrylate resin shall consist of a metal drier and peroxide. If supplied separately from the resin, at no time shall the metal drier be mixed with the peroxide directly. The containers shall not be stored in a manner that will allow leakage or spillage from one material to contact the containers or material of the other.

A Material Safety Data Sheet shall be furnished prior to use for each shipment of polyester resin binder and high molecular weight methacrylate resin.

The Contractor shall allow 14 days for sampling and testing of the polyester resin binder and high molecular weight methacrylate resin prior to proposed use.

If bulk resin is to be used, the Contractor shall notify the Engineer in writing 10 days prior to the delivery of the bulk resin to the jobsite. Bulk resin is any resin that is stored in containers in excess of 209 liters.

CONSTRUCTION

Prior to constructing the overlay, one or more trial overlays shall be placed on a previously constructed steel plate to determine the initial set time and to demonstrate the effectiveness of the mixing, placing, and finishing equipment proposed. Each trial overlay shall be 3.6-m wide, at least 1.8-m long, and the same thickness as the overlay to be constructed. Conditions during the construction of the trial overlays and equipment used shall be similar to those expected and those to be used for the construction of the polyester concrete overlay.

A trial overlay is required for each color of polyester concrete overlay.

The trial overlay for each color approved by the Engineer shall be used as the standard of comparison in determining acceptability of color for the polyester concrete surfaces.

All materials used in the trial overlays, including the concrete base, shall become the property of the Contractor and shall be removed and disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Right of Way," of the Standard Specifications.

When magnesium phosphate concrete is placed prior to the deck overlay, the magnesium phosphate concrete shall be placed at least 72 hours prior to placing the prime coat.

When modified high alumina based concrete is placed prior to the deck overlay, the prime coat shall not be placed on the concrete until at least 30 minutes after final set.

Expansion joints shall be adequately isolated prior to overlaying, as approved by the Engineer. Prior to applying the prime coat, the area to receive the prime coat shall be dry and blown clean by compressed air to remove accumulated dust and any other loose material. The surface temperature shall be at least 10°C and the relative humidity less than 85 percent when the prime coat is applied.

The prime coat shall be uniformly applied to completely cover the surface to receive the polyester concrete. The rate of spread shall be approximately 2.5 square meters per liter.

The prime coat shall be allowed to cure a minimum of 30 minutes before placing polyester concrete. If the primed surface becomes contaminated or otherwise damaged, the contaminated or damaged area shall be repaired and cleaned by abrasive blasting and reprimed at the Contractor's expense.

Polyester concrete shall be mixed in mechanically operated mixers. Mixer size shall be limited to a 0.25-cubic meter capacity, unless approved by the Engineer.

A continuous mixer, employing an auger screw/chute device, may be approved for use by the Engineer upon demonstrating its ability to produce a satisfactory product. The continuous mixer shall 1) be equipped with a metering device that automatically measures and records the aggregate volumes and the corresponding resin volumes, and 2) have a readout gage, visible to the Engineer at all times, that displays the volumes being recorded. The volumes shall be recorded at no greater than 5 minute intervals along with the time and date of each recording. A printout of the recordings shall be furnished to the Engineer at the end of each workshift.

The amount of initiator used in polyester concrete shall be sufficient to produce an initial set time between 30 and 120 minutes during placement. The initial set time will be determined by using an initial-setting time Gillmore needle in conformance with the requirements in ASTM Designation: C 266. Accelerators or inhibitors may be required to achieve proper set times and shall be used as recommended by the resin supplier.

The resin binder shall be initiated and thoroughly blended just prior to mixing with aggregate. The polyester concrete shall be mixed a minimum of 2 minutes prior to placing.

Polyester concrete shall be placed prior to gelling and within 15 minutes following addition of initiator, whichever occurs first. Polyester concrete that is not placed within this time shall be discarded.

The surface temperature of the area to receive polyester concrete shall be the same as specified above for the prime coat. The finishing equipment used shall strike off the polyester concrete to the established grade and cross section. Finishing equipment shall be fitted with vibrators or other means of consolidating the polyester concrete to the required compaction.

The polyester concrete shall be consolidated to a relative compaction of not less than 97 percent in conformance with California Test 552.

The finished surface of the polyester concrete overlay shall conform to the provisions in Section 51-1.17, "Finishing Bridge Decks," of the Standard Specifications and these special provisions.

The finished surface of the polyester concrete overlay for the bikepath surfaces (13 mm) shall be broomed transversely to the line of traffic. At the option of the Contractor, clean dry sand may be thrown on the surface and used to aid in the broomed surface texturing.

Polyester concrete surfaces shall receive an abrasive sand finish. The sand shall be commercial quality blast sand conforming to the quality and dryness requirements for polyester concrete aggregate as specified in these special provisions. Ninety-five percent of the sand shall pass the 2.36-mm sieve, and 95 percent shall be retained on the 850-µm sieve.

The sand finish shall be uniformly applied immediately after overlay strike-off and before gelling occurs to provide a minimum uniform coverage of 0.4-kilogram per square meter.

The surface texture of polyester concrete overlay surfaces shall be uniform and shall have a coefficient of friction of not less than 0.35 as measured by California Test 342. Any portions of surfaces that do not meet the above provision shall be ground or grooved parallel to the centerline in conformance with the provisions of Section 42, "Groove and Grind Pavement," of the Standard Specifications until the above tolerance is met.

Traffic and equipment shall not be permitted on the overlay for a minimum of 4 hours following final finishing. Overlays shall be protected from moisture for not less than 4 hours after finishing.

MEASUREMENT AND PAYMENT

Furnish polyester concrete overlay of the thickness listed in the Engineer's Estimate will be measured by the cubic meter. The volume to be paid for will be determined from calculations based on the quantity of resin binder used and the yield of the specified mix design. The Contractor shall furnish suitable measuring devices to assure correct proportioning of materials and accurate measurements for calculating pay quantities. The pay quantity shall be the calculated quantity of polyester concrete overlay used in the work, exclusive of material used in trial overlays, and any wasted or unused material.

Place polyester concrete overlay of the thickness listed in the Engineer's Estimate will be measured by the square meter. The area to be paid for will be based on the dimensions shown on the plans.

The contract price paid per cubic meter for furnish polyester concrete overlay of the thickness listed in the Engineer's Estimate shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in furnishing polyester concrete, including polyester resin binder, promoter/initiator, and aggregate, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for furnishing and mixing color shall be considered as included in the contract price paid per cubic meter for furnish polyester concrete overlay (13 mm) and no additional compensation will be allowed therefor.

The contract price paid per square meter for place polyester concrete overlay of the thickness listed in the Engineer's Estimate shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the polyester concrete overlay, complete in place, including application of prime coat and furnishing, constructing, and disposing of trial overlays and base, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for compliance with the requirements for a program for public safety associated with use of methacrylate resin and polyester concrete shall be considered as included in the contract prices paid for the items of work involving polyester concrete overlay and no additional compensation will be allowed therefor.

10-1.56 HIGH STRENGTH NONSHRINK GROUT

This work shall consist of furnishing and placing nonshrink, nonexpansive grout at locations as shown on the plans. High strength nonshrink grout shall be placed in accordance with the details shown on the plans and the requirements of these special provisions.

WORKING DRAWINGS

The Contractor shall submit working drawings and supplement in conformance with the provisions in "Working Drawings," of these special provisions.

Working drawings and supplement shall include the following:

A. Complete details, information, method, materials, equipment, and procedures that the Contractor proposes to use for placement of grout.
B. Specific printed grout manufacturer's product data.
C. Method and details of cleaning the surface and keeping the surface wet prior to grout application for each grout location.
D. Method, details, and duration of curing after grout application.
E. High strength nonshrink grout mix design.
F. A minimum of 20 kilograms of grout material shall be submitted to the Engineer for testing.

After complete working drawings and supplement are submitted to the Engineer, the Contractor shall allow the Engineer 35 days for review and the testing.

MATERIALS

Grout shall be high strength, nonshrink grout and shall be a nonmetallic and non-gas-forming flowable fluid containing natural aggregate, portland cement and additives and requiring only the addition of water. Grout shall contain a minimum of 390 kg of cement per cubic meter. Grout shall be pre-measured and prepackaged by the manufacturer, and shall be suitable for baseplate and foundation grouting. Aggregate shall show no segregation or settlement at fluid consistency at specified times or temperatures. One hour after mixing, the grout shall pass through a flow cone with continuous flow. Grout shall conform to the requirements of ASTM Designation: C1107, Grade C, and the following additional requirements:

Property	Requirement	Test
Shrinkage	0.0%	ASTM C827
Expansion	0.0%min., 4.0% max.	ASTM C827
Fluid Consistency	20-30 seconds at 5°C to 38°C	CORPS-CRD-611-81
1 day compressive strength	24 MPa	ASTM C109
3 day compressive strength	35 MPa	ASTM C109
28 day compressive strength	60 MPa	ASTM C109

Grout properties shall not be based on gas or gypsum expansion.

Grout shall be formulated for minimum initial set time of 4 hours and minimum final set time of 6 hours at 21°C. Prior to use, the materials shall be stored in a cool, dry environment. Grout shall be free from chlorides and other corrosion-causing chemicals. Grout shall be designed for an air content of 4 to 6 percent.

Mix water shall conform to the requirements of Section 90-2.03, "Water," of the Standard Specifications. Cold water shall be used in hot weather conditions to maintain the mixed grout temperature within the range of 7°C to 32°C.

Grout shall be mixed and placed in accordance with the requirements of the manufacturer and these special provisions.

The quantity of water to be blended with the dry component shall be within the limits recommended by the manufacturer. The quantity of water used shall be the least amount required to produce a flowable fluid that can be pumped.

The Contractor shall construct full scale mock-ups of the following items to demonstrate grout placement methods:

A. Tower base plate (minimum 1/4 of tower base)
B. Pier E2 shear key
C. Pier E2 bearing
D. West deviation saddle (if the grouted option is selected by the Contractor)

Where the plans show steel surfaces, mock-ups shall be made of steel or other material exhibiting similar surface roughness, as approved by the Engineer. Mock-up surfaces in contact with grout shall be prepared in accordance with the approved working drawings.

For each mock-up, the Contractor shall take six 150 mm diameter core samples at locations selected by the Engineer. Core samples shall exhibit at least 90% surface area contact between the grout and the mock-up material. The Contractor shall revise the placement method, as required, and shall not place grout in the work until the placement method has been approved by the Engineer.

The mock-ups shall not be part of the permanent structure and shall become the property of the Contractor. They shall be removed from the work site and shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

CONSTRUCTION

Prior to placing grout, the contact surfaces of previously cast concrete shall be cleaned by abrasive blasting to clean the concrete and any exposed reinforcing steel, as necessary, and to remove all rust, paint, grease, asphalt or other foreign materials. A minimum of 3 mm of concrete shall be removed. Steel contact surfaces shall be cleaned by methods shown in the approved working drawings and supplement to remove all rust, paint, grease, or other foreign materials. Immediately prior to placing the grout, the surfaces shall be recleaned by air blasting, or by other approved means, as necessary to remove any debris that has accumulated during construction or after abrasive blast cleaning. Prior to grouting, all concrete contact surfaces shall be kept constantly wet for a period of 24 hours. The surface temperature of the areas to be covered shall be between 7°C and 32°C when the grout is placed. Methods proposed to heat said surfaces are subject to approval by the Engineer. The condition of the concrete contact surface shall be saturated surface-dry when the grout is placed.

Forms shall be nonabsorbent and watertight, and shall conform to the requirements of Section 51-1.05, "Forms," of the Standard Specifications. Forms shall extend 50 mm higher than the top surface of the grout to be placed.

Grout shall be continuously agitated until pumped. Grout shall be pumped continuously and shall fill the entire space provided for grouting. The Contractor shall provide injection and ejection vents with positive shut-offs. Grout shall be allowed to flow from the ejection vent until all entrapped air has been removed, at which time the vent shall be capped or otherwise closed.

Grout shall be cured in accordance with the method specified in the approved working drawing and supplement. Immediately after placement, grout shall be wet cured by covering all the exposed grout with wet rags. Burlap shall not be used to cover the exposed grout surface. The grout surface shall be kept moist until final set. Following removal of damp rags, the grout shall be sprayed with two coats of curing compound (1) as specified in Section 90-7.01B, "Curing Compound Method," of the Standard Specifications.

The Contractor shall provide a flow cone and cube molds with restraining plates onsite for field evaluation of grout. Three 50 mm by 50 mm cubes shall be made by the Contractor for each 0.5 cubic meter of grout used. Restraining caps shall be provided for the cube molds in accordance with CRD-C-621-83. Cubes shall be stored at 21°C. Test reports for cubes shall be submitted to the Engineer for approval.

PAYMENT

Full compensation for high strength nonshrink grout including furnishing, placing, and demonstrating grout methods to the Engineer shall be considered as included in the contract prices paid for the various items of work and no separate payment will be made therefor.

10-1.57 REINFORCEMENT

Reinforcement shall conform to the provisions in Section 52, "Reinforcement," of the Standard Specifications and these special provisions.

Attention is directed to the "Headed Bar Reinforcement," of these special provisions.

Exposed portion of reinforcement at the top of columns shall be cleaned and painted. Dirt, loose rust and mill scale shall be removed in conformance with the requirements in Surface Preparation Specification No. 2, "Hand Tool Cleaning," of the "SSPC: The Society for Protective Coatings." One application of a zinc-rich primer shall be applied to the exposed surface of the reinforcement in conformance with the provisions in Section 59-2.13, "Application of Zinc-Rich Primer," of the Standard Specifications.

The Department's mechanical splices prequalified list can be found at the following internet site:

http://www.dot.ca.gov/hq/esc/approved_products_list/

The provisions of "Welding Quality Control" of these special provisions shall not apply to resistance butt welding.

At the option of the Contractor, sample splices and control bars shall be either 1) removed from the completed lot, or 2) prepared using the same splice material, position, operators, location, equipment, and following the same procedure as used in the work.

EPOXY-COATED PREFABRICATED REINFORCEMENT

Bar reinforcement to be epoxy-coated shall conform to the ASTM Designation and grade required or permitted by Section 52-1.02A, "Bar Reinforcement," of the Standard Specifications, for the location or type of structure involved. The coated bar reinforcement shall conform to the requirements in ASTM Designation: A 934/A 934M except as provided herein.

Wire reinforcement to be epoxy-coated shall conform to the ASTM Designation and grade required or permitted by Section 52-1.02D, "Reinforcing Wire," of the Standard Specifications, for the location or type of structure involved. The coated wire reinforcement shall conform to the requirements for Class A, Type 2 coating of ASTM Designation: A 884/A 884M except as provided herein. The coated welded wire fabric shall conform to the requirements for Class A, Type 1 coating of ASTM Designation: A 884/A 884M.

Appendices X1 and X2, "Guidelines For Job-Site Practices," of ASTM Designation: A 884/A 884M and A 934/A 934M, respectively, shall apply except as provided herein. The term "shall" shall replace the term "should" in these appendices. Section X1.2 of Appendix X1 and Section X2.2 of Appendix X2 shall not apply.

All coatings shall be purple or gray in color.

Except for field welding of butt splices, all welding of reinforcement shall be complete prior to epoxy coating the reinforcement.

Prior to epoxy coating, all resistance butt welds shall have the weld flash removed to produce a smooth profile free of any sharp edges that would prevent proper coating of the bar. The flash shall be removed such that the ultimate tensile strength and elongation properties of the bar are not reduced, and the outside radius of the flash, at any point along the circumference of the bar, is 1) not less than the nominal radius of the bar, nor 2) greater than 5 mm beyond the nominal radius of the bar.

A proposed weld flash removal process shall be submitted to and approved by the Engineer in writing, prior to performing any removal work. The submittal shall demonstrate that the proposed flash removal process produces a smooth profile that can be successfully epoxy-coated in conformance with the requirements specified herein.

Bending of epoxy-coated reinforcement after the coating has been applied will not be allowed.

When any portion of a reinforcing bar or wire requires epoxy coating, the entire bar or wire shall be coated, except, when the bar or wire is spliced outside of the limits of epoxy coating shown on the plans, epoxy coating will not be required on the portion of bar or wire beyond the splice.

Within areas where epoxy-coated reinforcement is required, tie wire and bar chairs or other metallic devices used to secure or support the reinforcement shall be plastic-coated or epoxy-coated to prevent corrosion of the devices or damage to the coated reinforcement.

Prior to coating, the Contractor shall furnish to the Transportation Laboratory a representative 110 g sample from each batch of epoxy coating material to be used. Each sample shall be packaged in an airtight container identified with the manufacturer's name and batch number.

Two 700-mm long samples of coated bar or wire reinforcement from each size and from each load shipped to the jobsite shall be furnished to the Transportation Laboratory for testing. These samples shall be representative of the material furnished. These samples, as well as any additional random samples taken by the Engineer, may be tested for specification compliance. Additional sampling, and all tests performed by the Engineer, may be performed at any location deemed appropriate by the Engineer. Failure of any sample to meet the requirements of the specifications will be cause for rejection.

If any bar tested for coating thickness or for adhesion of coating fails to meet the requirements for coated bars in Section 9 of ASTM Designation: A 934/A 934M, 2 retests on random samples taken from bars represented by the failed test will be conducted for each failed test. If the results of both retests meet the specified requirements, the coated bars represented by the samples may be certified as meeting the test requirements.

If any wire reinforcement tested for coating thickness or for flexibility fails to meet the requirements for coated wire in Section 8 of ASTM Designation: A 884/A 884M, 2 retests on random samples taken from wire represented by the failed test will be conducted for each failed test. If the results of both retests meet the specified requirements, the coated wire represented by the samples may be certified as meeting the test requirements.

Epoxy-coated reinforcement shall be covered with an opaque polyethylene sheeting or other suitable protective material to protect the reinforcement from exposure to sunlight, salt spray, and weather. For stacked bundles, the protective covering shall be draped around the perimeter of the stack. The covering shall be adequately secured; however, it should allow for air circulation around the reinforcement to prevent condensation under the covering. Epoxy-coated reinforcement shall not be stored within 300 m of ocean or tidal water for more than 2 months.

All visible damage to coatings caused by shipping, handling, or installation shall be repaired as required for repairing coating damaged prior to shipment conforming to the requirements in ASTM Designation: A 934/A 934M for bar reinforcement or ASTM Designation: A 884/A 884M for wire reinforcement. When the extent of coating damage prior to repair exceeds 2 percent of the bar or wire surface area in any 300-mm length, repair of the bar or wire will not be allowed, and the coated bar or wire will be rejected.

The patching material and process shall be suitable for field application. The patching material shall be prequalified as required for the coating material and shall be either identified on the container as a material compatible with the reinforcement coating, or shall be accompanied by a Certificate of Compliance certifying that the material is compatible with the reinforcement coating. Damaged areas shall be patched in conformance with the patching material manufacturer's recommendations.

Except for lap splices, all splices for epoxy-coated reinforcement shall be coated with a corrosion protection covering that is on the Department's list of approved products. The covering shall be installed in conformance with the manufacturer's recommendations and as directed by the Engineer. The list is available from the Transportation Laboratory.

A Certificate of Compliance conforming to the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications, shall be furnished for each shipment of epoxy-coated bar or wire reinforcement certifying that the coated bars or wire conform to the requirements in ASTM Designation: A 934/A 934M for bars or A 884/A 884M for wire and Section 52-1.02B, "Epoxy-coated Reinforcement," of the Standard Specifications. This Certificate of Compliance shall include all the certifications specified in ASTM Designation: A 934/A 934M for bars or ASTM Designation: A 884/A 884M for wire and a statement that the coating material has been prequalified by acceptance testing performed by the Valley Forge Laboratories, Inc., Devon, Pennsylvania.

Any portion of bar or wire reinforcement extending beyond the limits for epoxy-coated reinforcement shown on the plans will be measured and paid for as bar reinforcing steel (bridge).

MEASUREMENT AND PAYMENT

Measurement and payment for reinforcement in structures shall conform to the provisions in Section 52-1.10, "Measurement," and Section 52-1.11, "Payment," of the Standard Specifications and these special provisions.

Full compensation for removing corrosion protection from existing reinforcement, as shown on the plans, shall be considered as included in the contract prices paid for the various contract items of work involved and no additional compensation will be allowed therefor.

10-1.58 HEADED BAR REINFORCEMENT

Headed bar reinforcement shall consist of bar reinforcement with heads attached to one or both ends. The type of headed bar reinforcement to be used on this project shall be on the Department's current prequalified list prior to use, and shall conform to the provisions of Section 52, "Reinforcement," of the Standard Specifications, the details shown on the plans, and these special provisions.

Where shown on the plans, headed bar reinforcement shall be epoxy-coated in the same manner specified for bar reinforcing steel.

The Department maintains a list of prequalified headed bar reinforcement types. The prequalified list can be obtained by contacting the Transportation Laboratory and is available at the Department's internet site at:

http://www.dot.ca.gov/hq/esc/approved_products_list/

GENERAL

Prior to manufacturing, the Contractor shall submit to the Engineer the manufacturer's Quality Control (QC) manual for the fabrication of headed bar reinforcement. As a minimum, the QC manual shall include the following:

1. The pre-production procedures for the qualification of materials and equipment.
2. The methods and frequencies for performing QC procedures during production.
3. The calibration procedures and calibration frequency for all equipment.
4. A system for the identification and tracking of all friction welds. The system shall have provisions for permanently identifying each weld and the parameters used to perform it.
5. The welding procedure specification (WPS) for friction welded headed bar reinforcement.
6. A system for marking headed bar reinforcement.

The provisions of "Welding" of these special provisions shall not apply to headed bar reinforcement.

The Contractor shall perform inspection and testing prior to, during, and after manufacturing headed bar reinforcement and as necessary to ensure that materials and workmanship conform to the requirements of the specifications.

A daily production log for the manufacture of headed bar reinforcement shall be maintained by the manufacturer for each production lot. The log shall clearly indicate the production lot numbers, the heats of bar material and head material used in the manufacture of each production lot, the number of bars in each production lot, and manufacturing records, including tracking and production parameters for welds or forgings. The data from the daily production log shall be available to the Engineer upon request.

A production lot of headed bar reinforcement is defined as 150 reinforcing bars, or fraction thereof, of the same bar size, with heads of the same size and type, and manufactured by the same method, produced from bar material of a single heat number and head material of a single heat number. If one reinforcing bar has a head on both ends, it will be counted as two reinforcing bars for the purposes of establishing and testing production lots. A new production lot shall be started if the heat number of either the bar material or the head material changes before the maximum production lot size of 150 is reached.

The Contractor shall furnish Certificates of Compliance accompanied by a copy of the mill test report, the Production Tests Reports specified herein, and the corresponding daily production logs to the Engineer in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for each shipment of headed bar reinforcement delivered to the jobsite.

Welding, welder qualifications, and inspection of welding shall conform to the requirements for friction welding in ANSI/AWS C6.1.

Equipment used to perform friction welding shall be fitted with an effective in-process monitoring system to record essential production parameters that describe the process of welding the head onto the reinforcement. The parameters to be recorded shall include friction welding force, forge force, rotational speed, friction upset distance and time, and forge upset distance and time. The data from this in-process monitoring shall be recorded and preserved by the manufacturer until acceptance of the contract and shall be provided to the Engineer upon request.

PRODUCTION TESTS

Production tests shall be performed at the Contractor's expense, at an independent qualified testing laboratory, and in the presence of the Engineer, unless otherwise directed in writing. The independent qualified testing laboratory used to perform the testing of headed bar reinforcement samples shall not be employed or compensated by any subcontractor, or by other

persons or entities hired by subcontractors who will provide other services or materials for the project, and shall have the following:

A. A tensile testing machine capable of breaking the largest size of reinforcing bar to be tested.
B. Operators who have received formal training for performing the testing requirements of ASTM Designation: A 970/A 970M.
C. A record of annual calibration of testing equipment performed by an independent third party that has 1) standards that are traceable to the National Institute of Standards and Technology, and 2) a formal reporting procedure, including published test forms.

The Engineer shall be notified in writing when any lots of headed bar reinforcement are ready for testing. The notification shall include the number of lots to be tested and the location where the tests are to be conducted. After notification has been received, test samples will be randomly selected by the Engineer from each production lot of headed bar reinforcement which is ready for shipment to the jobsite. If epoxy coating is required, test samples will be taken after the headed bar reinforcement has been prepared for epoxy coating. The Engineer will be at the testing site within a maximum of one week after receiving written notification that the samples are at the testing site and ready for testing. In the event the Engineer fails to be present at the testing site within the time allowed, and if, in the opinion of the Engineer, completion of the work is delayed or interfered with by failure of the Engineer to be present at the testing site, the Contractor will be compensated for any resulting loss in the same manner as provided for in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

A minimum of 3 samples from each production lot shall be tested. One tensile test shall be conducted on each sample.

Tensile tests shall conform to the requirements specified in ASTM Designation: A 970/A 970M, Section 7, except that at rupture, there shall be visible signs of necking in the reinforcing bar 1) at a minimum distance of one bar diameter away from the head to bar connection for friction welded headed bar reinforcement, or 2) outside the affected zone for integrally forged headed bar reinforcement.

The affected zone for integrally forged headed bar reinforcement is the portion of the reinforcing bar where any properties of the bar, including the physical, metallurgical, or material characteristics, have been altered during the manufacturing process.

If one of the test specimens fails to meet the specified requirements, one retest shall be performed on one additional sample, selected by the Engineer, from the same production lot. If the additional test specimen, or if more than one of the original test specimens fail to meet these requirements, all headed bar reinforcement in the lot represented by the tests will be rejected in conformance with the provisions in Section 6-1.04, "Defective Materials," of the Standard Specifications.

A Production Test Report for all testing performed on each lot shall be prepared by the independent testing laboratory and submitted to the Engineer as specified herein. The report shall be signed by an engineer who represents the laboratory and is registered as a Civil Engineer in the State of California. The report shall include the following information for each set: contract number, bridge number, lot number, bar size, type of headed bar reinforcement, physical conditions of test sample, any notable defects, limits of affected zone, location of visible necking area, and the ultimate strength of each headed bar.

Each unit of headed bar reinforcement in a production lot to be shipped to the site shall be tagged in a manner such that production lots can be accurately identified at the jobsite. All unidentified headed bar reinforcement received at the jobsite will be rejected.

MEASUREMENT AND PAYMENT

Full compensation for headed bar reinforcement shall be considered as included in the contract price paid per kilogram for bar reinforcing steel (bridge) and no separate payment will be made therefor.

Full compensation for epoxy-coated headed bar reinforcement shall be considered as included in the contract price paid per kilogram for bar reinforcing steel (epoxy-coated) (bridge) and no separate payment will be made therefor.

10-1.59 STEEL STRUCTURES

Construction of steel structures shall conform to the provisions in Section 55, "Steel Structures," of the Standard Specifications and these special provisions.

Fabricators and suppliers shall be certified under the AISC Quality Certification Program, Category Cbr, Major Steel Bridges, with endorsement F, Fracture Critical members, except that certification will not be required for fabrication of the tower strut façade and tower skirt.

Details of box girder and crossbeam connections shall conform to the AASHTO Standard Specifications for Highway Bridges, unless otherwise shown on the plans.

Attention is directed to "Accelerated Working Drawings Submittal," of these special provisions.

The bikepath shall be considered part of the bridge and not an ancillary structure.

GENERAL

Attention is directed to "Construction Surveying," of these special provisions. The entire top surface of the completed orthotropic deck shall be constructed true to the required grade within a tolerance of one millimeter per meter of span length. Span lengths are defined as follows:

A. 180 meters between panel points 8 and 42
B. 385 meters between panel points 43 and 119
C. 45 meters between panel points 120 and 128

In addition, the deviation from the cross-slope measured between girder lines W2 and E2 shall not exceed 1:500.

Attention is directed to "Progress Schedule (Critical Path Method)" of these special provisions.

Attention is directed to "State-Furnished Materials," of these special provisions regarding pipe beam restraint brackets.

Attention is directed to "Prestressing," of these special provisions for post-tensioning provisions within the box girder.

Attention is directed to "Welding" and "Audits" in Section 8, "Materials," of these special provisions.

Members shown on the plans with Seismic Performance Critical Member (SPCM) designations, including welds connecting SPCMs to other members shall conform to the requirements in ANSI/AASHTO/AWS D1.5, Section 12, "AASHTO/AWS Fracture Control Plan (FCP) for Non-Redundant Members" as modified herein.

DEFINITIONS

"Box girder" is defined as the two suspended roadway structures, including all internal structures.

"Orthotropic deck" is defined as the top plate of the box girder along with the ribs.

"Segment" is defined as a structural subassembly that has the full cross section of the tower shaft, box girder or cross beam, but is smaller than a lift.

"Lift" is defined as a structural subassembly that is field erected.

"Suspended structure" is comprised of the box girder, crossbeam and bikepath. The weight of the suspended structure is defined as the weight of the box girder, crossbeam, and bikepath, as well as the weight of the cable system, pipe beams, deck overlay, utilities, platforms, barrier counter weight, and all other components that contribute to the superstructure weight.

The "Seismic Performance Critical Member" ("SPCM") designation identifies structural elements, including welds connecting SPCMs to other members, that are critical to the seismic performance of the bridge and that are fabricated and inspected to the requirements of AWS D1.5, Section 12, as modified by these special provisions.

WORKING DRAWINGS

Attention is directed to "Working Drawings," and "Accelerated Working Drawing Submittals" in these special provisions.

Attention is directed to subsection "FABRICATION," subsection "Fabrication/Erection Procedure and Mock-Ups," of this section. Approval of working drawings for components where mock-ups are required will be contingent on successful completion of the mock-up and approval of the fabrication and erection procedure and nondestructive examination procedure. The Contractor shall revise and resubmit to the Engineer for approval working drawings affected by changes resulting from successful completion of the mock-ups, unless otherwise approved by the Engineer..

Section 55-1.02 "Drawings," of the Standard Specifications shall not apply.

Working drawings shall contain all information required for the fabrication of structural steel, including, at a minimum, the following:

1. Design geometry lines and fabrication geometry working lines, including vertical, longitudinal and transverse. Each working drawing shall reference the Contract Plan sheet(s) from which fabricable dimensions are derived;
2. Panel, segment and lift designations, erection sequence and locations of field connections;
3. Details of temporary fabrication in plan, elevation and section, material specification and grades, weld details and all tolerances;
4. Details of permanent fabrication in plan, elevation and section, material cuts and camber deformations, and tolerances of the fabricated panel structure. The scale of each panel plan and section shall not be less than 1: 50. Full detail scales shall be larger;
5. Material and weld designations including the ASTM material specification, processes of shop fabrication including forming, heat treating and welding, weld symbols as required by AWS D1.5, and for each weld, either the "Joint Designation" as listed in figures 2.4 or 2.5 of AWS D1.5 or the WPS number for non-standard joints;
6. Distortion control plan in accordance with AWS D1.5, Section 3.4;
7. Details of shop and field welding, and shop and field-drilled holes for all ancillary attachments to the box girder, crossbeam, tower, and pipe beams.

Supplemental calculations shall include, but not be limited to, the following:

A. Calculations for each panel showing how the camber for extension, angular change and profile affects the cutting and assembly of the plate material.

For box girder, crossbeam, tower, and pipe beam fabrication, shop practices shall be described in the working drawings and shall include the following:

A. Method of rib or pipe beam fabrication, including forming, bending, equipment, and procedures;
B. Details of fabrication jigs and measurement templates (orthotropic box girder only);
C. Lifting points and support details;
D. Details of temporary lugs or brackets and methods of handling large elements;
E. Details of tack welds and the sequence of all welding; The welding sequences and processes and specified NDT of shop fabrication shall be summarized in a separate shop drawing or fabrication procedure for each welded joint.
F. Details of removal of temporary connections and repair of material where these connections were installed;
G. Methods of repair of elements that exceed specified tolerances; and
H. Fabrication schedule.

The Contractor shall allow the Engineer 50 days to review the structural steel working drawings submittal.
The shop practices and the working drawings need not be submitted at the same time.

TEMPLATE

The State will furnish to the Contractor working drawings for the as-fabricated tower footing, in accordance with "Order of Work" of these special provisions. Working drawings shall include the following:

A. A plan view of the tower footing at Elevation 3.00m of sufficient scale showing the labeled location of the following items:

    1. As-fabricated tower anchorage anchor bolt pipe sleeves
    2. As-fabricated tower anchorage anchor bolts
    3. As-fabricated dowels

B. A summary of locations and corresponding coordinates of the following items in tabular form using the Global Positioning System (GPS) consistent with the requirements of "Construction Surveying" of these special provisions. Coordinates shall be provided for the following elevations:

1. As-fabricated tower anchorage anchor bolt pipe sleeves. Elevation 3.00m
2. As-fabricated tower anchorage bolts. Elevation 3.00m and Elevation 5.50 m (approximate top of tower anchorage anchor bolts)
3. As-fabricated dowels. Elevation 3.00m and 3.24m

C. Location and coordinate summaries segregated by item type.

The State will furnish to the Contractor a steel template with holes that correspond to the as-fabricated location of the tower anchorage anchor bolt pipe sleeves and dowels, in accordance with "Order of Work" of these special provisions. The steel template will be comprised of four (4) match-marked pieces or as otherwise furnished by the State.

The Contractor shall use the steel template to locate the holes in the tower base plate for the tower anchorage anchor bolts and dowels.

The Contractor shall verify the location of the holes by physically matching the steel template to the tower base plate. The Contractor shall demonstrate that the holes in the tower base plate match the steel template, as witnessed by the Engineer, by physically matching the as-fabricated tower base plate. The Contractor shall notify the Engineer at least 7 days prior to matching the steel template.

Prior to erecting the tower base, the Contractor shall field verify the as-built location of the tower anchorage anchor bolts and dowels, by physically lowering the steel template onto the pile cap, as witnessed by the Engineer. Lowering of the template shall be done in the same manner and same number of pieces that are planned for setting the tower base plate. The Contractor shall notify the Engineer at least 7 days prior to the fitting of the steel template.

SEA TRANSPORTATION

Steel segments for the tower, box girder, crossbeams and bikepath shall be adequately supported, fastened and braced during transportation to prevent damage and fatigue.

At least sixty days prior to loading the segments for shipment, the Contractor shall submit to the Engineer a transportation plan for the steel segments. The transportation plan shall include details of the support and tie down system, analysis and design calculations for the segments, the interaction between the vessel and the segments and the assumed sea conditions used to develop the transportation plan. At a minimum, sea conditions shall include wave height, speed, frequency and direction, wind speed and direction and the route to be taken by the transport vessel. In addition, the transportation plan submittal shall include a letter of certification signed by the fabricator of the steel segments certifying that he has reviewed and concurs with the transportation plan. The calculations shall show that the segment stresses are within the allowable stresses during construction as specified in Section 2.8 of the San Francisco-Oakland Bay Bridge Design Criteria, available in "Project Information" of these special provisions, and the fatigue stress levels are within the constant-amplitude fatigue threshold per AASHTO Bridge Design Code. The transportation plan shall be signed by a licensed Naval Architect or a certified Naval Architect with a graduate degree in Naval Architecture and minimum 5 years of qualifying professional experience practicing Naval Architecture.

Upon arrival at the project site, the Contractor shall submit to the Engineer a daily log of actual sea conditions corresponding to those used in developing the transportation plan for the route taken by the transport ship as published by the National Oceanic and Atmospheric Administration. In addition, the submittal shall include the route taken by the transport ship and shall also state whether or not the actual sea conditions exceeded the assumed sea conditions used in the transportation plan.

After arrival at the project site, the Contractor's welding Quality Control Manager (QCM) shall perform a visual inspection of the steel segments for loose bolts, cracks or other damage. The QCM shall provide a verbal inspection report to the Engineer after completing inspection of each segment and shall submit a written inspection report prior to erection of the steel segments or within 14 days of the inspection, whichever comes first.

The Engineer will perform a visual inspection of the steel segments. The Contractor shall notify the Engineer at least 5 days before the segments are ready for inspection. The Contractor's inspection of each segment shall be complete prior to the Engineer's inspection. The Contractor shall provide all necessary and safe access for the Engineer's inspection including removal of bracing and fastening members. The Engineer will perform a visual inspection of the steel segments for loose bolts, cracks or other damage. If cracks are discovered, the Engineer will have the discretion of verifying the cracks using magnetic particle (MT) or liquid penetrant (PT) testing. The Contractor shall allow 3 days for the Engineer’s inspection for each shipment of steel segments.

If cracks are discovered, the damaged segments will be rejected and the Contractor shall submit to the Engineer a repair plan to repair the damage. The repair plan shall include the cause of the cracks, a log identifying each crack by marking and location, an analysis of the extent of the damage in the segments and a repair plan for all damaged segments documenting the proposed method for repair. The Contractor shall allow 14 days for the Engineer’s review and approval of the repair plan. All repair work shall be completed on each segment prior to erection. The Contractor shall also submit a mitigation plan to the Engineer for approval. The mitigation plan shall include measures to be taken by the Contractor to prevent damage from occurring in the remaining segments. The Contractor shall allow 21 days for the Engineer’s review and approval of the mitigation plan.

Should actual sea conditions be more severe than those used in the transportation plan analysis, the steel segments will be rejected unless the Contractor can demonstrate through submittal of a revised transportation plan that stresses are within the allowable stresses during construction as specified in Section 2.8 of the San Francisco-Oakland Bay Bridge Design Criteria and the fatigue stress levels are within the constant-amplitude fatigue threshold per AASHTO Bridge Design Code. The Contractor shall allow 30 days for the Engineer’s review and approval of the revised transportation plan. Should the Engineer approve the Contractor’s revised transportation plan, the Engineer will perform a visual inspection of the steel segments as stated above.

The Engineer's approval of the mitigation plan and revised transportation plan in no way relieves the Contractor of his responsibility to transport the steel segments without damage and without exceeding the fatigue stress levels as specified herein.

Full compensation for transportation of the steel segments without damage, including transportation plan, mitigation plan, repair of rejected segments and providing access for the Engineer’s inspection shall be considered as included in the contract prices paid for the items of work involved and no additional compensation will be allowed therefor.

FALSEWORK

Falsework and attachments used for the erection of structural steel shall be fabricated in accordance with AWS D1.1, Section 55-1.05 "Falsework," of the Standard Specifications and the requirements for Falsework in "Concrete Structures," of these special provisions, except that dead loads shall consist of the mass of the structural steel and any other portions of the structure which are supported by the falsework.

The seismic and wind load design requirements for falsework, connections, and permanent structures during construction shall conform to "Temporary Towers," of these special provisions.

ERECTION PLAN

The Contractor shall submit working drawings and supplemental calculations for the erection of structural steel in accordance with the requirements in "Working Drawings," of these special provisions.

The bridge is designed as a completed structure to carry loadings from permanent service conditions and seismic events. Temporary construction loading was not considered in the design. The Contractor shall perform construction engineering to ensure temporary construction loading does not overstress any part of the permanent structure at any stage of construction.

The Contractor shall develop a preliminary erection plan prior to submitting the erection plan. The preliminary erection plan shall include the following:

A. The sequence and limits of segments to be erected.
B. Proposed attachment locations for transportation and lifting of each section.
C. Methods for transportation and lifting of each section.
D. Methods for aligning adjacent sections during erection.
E. Locations of temporary supports and reinforcing.
F. Methods for dimensional checks.
G. Methods for analyzing the box girders and crossbeams for moments, stresses, deflections, and cambers throughout the proposed erection sequence.
H. Methods for analyzing the suspension system for deflections and tensions throughout the proposed erection sequence.
I. Milestone date when updates to the Hinge A (Contract No. 04-012024) and Hinge K (Contract No. 04-0120P4) reactions are required to finalize camber values for PP95 to Hinge A. This milestone shall be included in the Contractor's Progress Schedule. The Contractor shall demonstrate to the Engineer that this milestone is the controlling operation. At this milestone, the Contractor shall have developed a sufficiently accurate weight estimate in accordance with the approved weight control procedure.

The Contractor shall develop the preliminary erection plan using the reactions from Hinges A and K shown on the plans.

The Engineer will provide the reactions required at the milestone specified in the approved preliminary erection plan and the approved Progress Schedule in the event that these reactions cannot be measured. Reactions provided by the Engineer shall be used by the Contractor for the purposes of fabrication and erection until the reactions at Hinge A can be measured by the Contractor and the measured reaction at Hinge K can be furnished by the Engineer.

The Contractor shall readjust the suspender lengths by shimming at all panel points based on a final erection analysis that includes the measured reactions from Hinges A and K or as directed by the Engineer.

The Contractor's preliminary erection plan shall demonstrate to the Engineer that the Contractor has a sufficient understanding of the structural system and is able to perform all required erection analyses and designs, to adequately detail and fabricate the temporary and permanent structures, and to account for varying conditions due to changes in installed weight, and changes in the specified hinge reactions.

At the option of the Contractor, the preliminary erection plan for the tower and box girder may be submitted separately.

The Contractor shall allow the Engineer 30 days to review and approve the preliminary erection plan.

Erection of each box girder from Pier W2 to Hinge A shall be completed with a maximum of 20 lifts.

At the option of the Contractor, lifting attachments may be welded or bolted to structural steel to assist in hoisting the load, except as noted herein. Welds attaching these devices shall conform to the requirements of field welding specified herein. Such attachments shall not interfere with the holes shown on the plans. Open holes shall not remain in the permanent structure, unless otherwise shown on the plans.

Lifting attachments shall not be attached to the orthotropic deck. For the tower struts, no additional bolt holes will be allowed for temporary works. Tower strut holes may be used in temporary works, as approved by the Engineer. No welding to the tower struts for temporary works will be permitted.

The erection plan shall contain all information required for the erection of structural steel, including, at a minimum, the following:

A. Details and limits of each section to be erected;
B. Details of attachments to each section for transportation and lifting including location, welding and removal procedures;
C. Methods for transportation and lifting of each erected section;
D. Method of aligning adjacent sections during erection;
E. Details of temporary work platforms and other aids required for field welding;

F. Locations and methods for all tack and final welds;
G. Timing and methods for dimensional checks;
H. Timing and methods for visual and nondestructive examination
I. Methods for connection and removal of supports and lifting attachments.
J. Methods for measuring the reactions at Hinge A (Contract No. 04-012024). If the measured reactions per box girder exceed 2.25 MN at Hinge A , the Contractor shall immediately notify the Engineer in writing. The Engineer may direct the Contractor to make modifications to the erection plan based on the measured reactions. Modifications to the erection plan will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications.
K. Complete details and substantiating calculations of the method and materials the Contractor proposes to use in prestressing high-strength bolts, including the method and sequence of stressing, working stresses and anchoring stresses.

Supplemental calculations shall include, but not be limited to, the following:

A. Calculations indicating the stresses imposed on sections of the permanent structure due to attachments, and stresses imposed during erection, including but not limited to the effects of wind speed, local topography, and adjacent structures.
B. Calculations indicating the stresses imposed on sections of the permanent structure during transportation.
C. Estimates of final dimensions, including camber, based on dimensional measurements during the trial fit under support conditions that differ from those of the in-place condition.

The Contractor shall allow the Engineer 50 days to review and approve the erection plan.

Attention is directed to the Alternative Camber Method shown on the plans. At the option of the Contractor, the Alternative Camber Method may be used to facilitate early fabrication of the box girder in accordance with the requirements shown on the plans and in this section.

Use of the Alternative Camber Method shall in no way relieve the Contractor from completing the erection plan as specified in these special provisions. The final approved erection plan shall incorporate all conditions of the as-built structure, including the measured reactions at Hinge A and Hinge K, the weight of all material, the fabricated box girder cambers, and the calculated tension and fabricated length of all suspenders and cable strands. The Contractor's final approved erection plan shall include all effects on the suspension system and the box girders from panel 95 to Hinge A resulting from use of the Alternate Camber Method. No additional compensation will be allowed because of the use of the Alternative Camber Method.

After erection, all lifting attachments shall be removed. Removal of welds shall not damage the permanent steel structure materials. All remaining welds shall be ground flush and damaged areas shall be repaired in accordance with the requirements of ANSI/AASHTO/AWS D1.5. Areas of damaged paint shall be cleaned and painted as specified in "Clean and Paint Structural Steel," of these special provisions.

WEIGHT CONTROL

The Contractor shall submit written, detailed procedures to monitor and control the actual weight of the suspended structure during fabrication and construction.

The weight control procedure shall include the following:

A. Methods for determining the installed weight at various stages of the fabrication and erection.
B. Estimated range of error of weight determination for each weight component at each stage.
C. Identification of milestones on the working drawing submittal schedule when actual installed weight components will be determined by quantity calculations of completed fabrication drawings.

The Contractor shall allow the Engineer 20 days to review the weight control procedure.

Weight reports shall be submitted using a format described in the approved weight control procedure. These reports shall include the weight of all installed components including utilities, platform barriers, counter weight and roadway wearing surfaces including the range of uncertainty in the estimated final weight. The design weights used in the Contractor's erection analysis shall consist of the nominal weights taken off the fabrication drawings increased by 3%.

This weight control procedure shall be used in conjunction with the cable erection described in the section "Cable System," of these special provisions. Attention is directed to the allowable range for target dead load moment in the box girder shown on the plans.

PIPE BEAM INSTALLATION

Pipe beams at Hinges AW and AE shall be moved from their temporary supports and installed into their final positions in accordance with the details shown on the plans and in accordance with the requirements of this section.

Pipe beam temporary supports were designed and constructed as part of Contract No. 04-012024.

Working drawings and supplemental calculations for pipe beam temporary supports are included in the Information Handout available to the Contractor as provided for in "Project Information" of these special provisions, and Section 2-1.03, "Examination of Plans, Specifications, Contract, and Site of Work," of the Standard Specifications.

A pipe beam installation system shall be designed to adequately support the pipe beams without exceeding allowable stresses or damaging the pipe beam or stainless steel cladding.

Welded attachments will only be permitted on soffit plate intermediate T-stiffeners.

Bolted connections will not be permitted on any steel element.

Allowable stresses for timber and steel shall not exceed those listed in Section 51-1.06A(2) "Design Stresses, Loadings, and Deflections," of the Standard Specifications. The Contractor shall submit to the Engineer working drawings and supplemental design calculations for the pipe beam installation system, in conformance with the requirements in "Working Drawings," of these special provisions.

Working drawings for pipe beam installation system shall include the following:

A. Complete details of the pipe beam installation system
B. A step-by-step pipe beam installation procedure including the following:

    1. Method of lifting and installing the pipe beams into final position
    2. Method of supporting the pipe beams during bearing installation

C. A complete description of methods and materials designed to protect the pipe beam stainless steel surface from damage during lifting, installation and support.

A supplement to working drawings shall include the following:

A. Pipe beam installation system design calculations

The Contractor shall allow the Engineer 25 days for review of pipe beam installation system working drawings and supplemental design calculations.

MATERIALS

Structural steel shall conform to ASTM Designation: A709M with Supplementary Requirement S84 "Fracture-Critical, F, Material; Toughness Testing and Marking" for members shown on the plans as SPCMs, as well as box girder and crossbeam shell plating, as modified below. Supplementary Requirement S83 "Non-Fracture-Critical, T, Material; Toughness Test and Marking" shall be specified for other members, as modified below. Charpy V-notch (CVN) impact values for steel procurement shall be reported on the mill test report and shall conform to ASTM Designation: A 709M for Zone 2 except as stated in this section "Materials."

Steel plates designated as Grade 345 in thicknesses exceeding 100 mm shall conform to ASTM Designation: A572M (modified), Grade 345, with Supplementary Requirements: S5 Charpy V-Notch Impact Test (34 J at -12 degrees C with longitudinal specimen orientation and "H" heat frequency of testing); S28 Fine Grain Practice; S31 Maximum Carbon Equivalent for Weldability (0.50); and S90 Type (Type 1, 2 or 3 only).

Material conforming to ASTM Designation: A 709M, Grade 345W or 690W shall not be substituted for ASTM Designation: A 709M, non-weathering steel grades.

The following structural elements shall include Supplementary Requirements S28 "Fine Grain Practice" and S29 "Fine Austenitic Grain Size" of ASTM Designation: A 709M:

A. Box girders, including internal floor beams
B. Crossbeams
C. Tower struts links
D. Pipe beams

Steel used in the fabrication of the orthotropic deck shall not contain sulfur in excess of 0.01 % by weight.

Steel designated as Pipe Beam Grade 690 on the plans shall conform to the requirements in ASTM Designation: A 709M, Grade 690 with Supplementary Requirement S8, "Ultrasonic Examination," Supplementary Requirement S84 "Fracture-Critical, F, Material; Toughness Testing and Marking" tested for Zone 3; and Supplementary Requirement S93,

"Limitations on Weld Repair (Fracture Critical Material Only)." The steel shall be made using a low nitrogen and low hydrogen practice such as vacuum degassing. The nitrogen content shall not exceed 0.009%. Charpy V-Notch tests for the as-fabricated pipe beam and heat affected zone (HAZ) shall meet 48 joules (J) minimum average, and 38 J minimum individual at –18˚ C. Weld metal shall meet the requirements of AWS D1.5, Table 12.1.

Steel designated as Pipe Beam Grade 485 and Shear Link Grade 485 on the plans shall conform to the requirements in ASTM Designation: A 709M, Grade HPS485W with Supplementary Requirement S8, "Ultrasonic Examination," Supplementary Requirement S84 "Fracture-Critical, F, Material; Toughness Testing and Marking" tested for Zone 3; and Supplementary Requirement S93, "Limitations on Weld Repair (Fracture Critical Material Only)." Charpy V-Notch tests for the as-fabricated pipe beam tubular and the pipe beam and shear link heat affected zone (HAZ) shall meet 48 joules (J) minimum average at –18˚ C.

Steel designated as Shear Link Grade 345 on the plans shall conform to the following:

A. The steel shall conform to ASTM Designation: A 709M requirements for Fracture Critical Grade 345 with Supplementary Requirements S60 "Frequency of Tension Tests," such that tension tests shall be taken from each end of each as-rolled or as-heat treated plate, and S93, "Limitations on Weld Repair (Fracture Critical Material Only)," as modified herein.
B. The sulfur content shall not exceed 0.01% by weight. The Carbon Equivalent (CE) shall not exceed 0.47%, where $CE = C + (Mn)/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15$.
C. The steel shall be fully killed and made to fine grain practice in conformance with the requirements in ASTM Designation: A 709M, Supplementary Requirement S28 "Fine Grain Practice" and S29 "Fine Austenitic Grain Size."
D. The steel shall be made using a low nitrogen and hydrogen practice such as vacuum degassing. The nitrogen content shall not exceed 0.012%, except vanadium nitride strengthened alloys shall not exceed 0.018%.
E. The plates may be heat treated as required to meet the properties specified herein. If tempered, the tempering temperature shall not be less than 593 C.
F. The Tensile Strength shall be within the range of 450 through 600 Mpa.
G. The Yield Point or Yield Strength shall be within the range of 345 through 450 Mpa.
H. The ratio of Yield Strength to Ultimate Strength shall not exceed 0.90.
I. The tensile elongation shall be not less than 19% for a 200 mm gauge length specimen or 22% for a 50 mm gauge length specimen.
J. The reduction of area in the tensile test shall be not less than 35%.
K. Charpy V-Notch (CVN) tests for the base plate shall meet 41 J minimum average at – 40°C. CVN test for the as-fabricated heat affected zone and weld metal shall meet the requirements of AWS D1.5, Table 12.1.
L. Tensile and toughness tests shall be performed on a per-plate basis.
M. The stress vs. strain curve from all tensile tests shall be recorded and submitted to the Engineer for information with the test reports.
N. Subsequent Check Test results shall not be cause for rejection of Shear Link Grade 345 unless testing at the mill is invalidated, for reasons such as equipment out of calibration, improper sampling, or other similar reasons.

Full traceability between the material test report and the final location in the structure shall be maintained for all Shear Link and Pipe Beam grades of steel.

Where Supplementary Requirement S8 is specified above, each plate shall be ultrasonically examined and shall meet the acceptance criteria in conformance with the requirements in ASTM Designation: A578, Level C

Ducts for prestressing high-strength ASTM Designation: A 354 bolts shall be galvanized Schedule 40 steel pipe conforming to the requirements in ASTM Designation: A 53 or galvanized rigid steel conduit conforming to UL Publication 6 for Rigid Metallic Conduit, unless otherwise shown on the plans.

Galvanizing for rigid steel conduit or steel pipe shall be tested in conformance with the requirements in ASTM Designation: A 239. Adjacent sections of steel conduit or pipe shall be connected with galvanized standard couplings.

Joints in the ducts shall not leak during grouting operations. Tape, clamps or other devices used outside the ducts to prevent leaks shall be removed after grouting and shall become the property of the Contractor.

Grouting of high strength A354 bolts and base plates shall conform to the provisions in Section 50-1.09 "Bonding and Grouting," of the Standard Specifications.

Pourable seals used with structural steel shall conform to the provisions in Section 51-1.12F(3) "Materials and Installation," of the Standard Specifications.

Expandable foam used at the tower strut facade shall be a commercial quality closed-cell polyurethane foam. Polyurethane foam shall be applied in accordance with the manufacturer's recommendations.

Where shown on the plans, drain pipe and fittings shall be manufactured from high density polyethylene (HDPE) and suitable for transmission of non-potable water. Joints in HDPE pipe shall be butt-fused.

Ducts, fasteners, and grout caps for prestressing ASTM Designation: A354 bolts shall be considered structural steel (bridge).

CHECK TESTING

Structural steel shall conform to the designated ASTM Standard and the check testing requirements of this section.

Check samples shall be furnished for the following:

A. Each heat of maximum thickness of members designated as SPCM, as shown on the plans.
B. One out of each five heats of steel for box girder shell plate and tower skin plate.
C. Each mother plate of Shear Link Grade 345, Shear Link Grade 485, Pipe Beam Grade 485, and Pipe Beam Grade 690.

Steel plates, shapes, or bars containing check samples shall be furnished from the mill with extra length in order to provide for removal of material for check samples at the point of fabrication. Check samples may be cut from either end of the designated plate, shape, or bar.

At the option of the Contractor, check samples may be removed at the rolling mill rather than at the point of fabrication. The sample will be removed from the mill plate that will be stripped by the fabricator to produce the designated plate and may be taken from any location within that plate. The mill plate from which samples are removed shall be marked with the same identifying numbers as are used on the samples.

Material for check samples shall be removed by the Contractor in the presence of the Engineer. Check samples for plates wider than 610 mm shall be 355 mm wide and 460 mm long with the long dimension transverse to the direction of rolling. Check samples for all other products shall be 460 mm long, taken in the direction of rolling, and the width shall be the product width. Check samples shall be removed and delivered to the Engineer before the material is fabricated into components. The direction of rolling, heat numbers, and plate numbers shall be marked on the samples with paint or other indelible marking material or may be steel stamped in one corner of the plate. Certified Material Test Reports complying with the requirements in these special provisions shall accompany the check sample.

Check samples shall be delivered to the Transportation Laboratory at the Contractor's expense. The check samples will be tested by the Transportation Laboratory for compliance with the requirements specified in ASTM and these special provisions. Check sample test results will be reported to the Contractor within 3 weeks of delivery to the Transportation Laboratory. In the event several samples are submitted on the same day, an additional day will be added for every 2 samples submitted. The test report will be made for the group of samples.

The results of the tensile and impact tests shall not vary more than 5 percent below the specified minimum or 5 percent above any specified maximum requirements. If the initial check test results vary more than 5 percent but not more than 10 percent from the specified requirements, a retest may be performed on another sample from the same heat and thickness. The results of the retest shall not vary more than 5 percent from the original specified requirements. If the results of check tests exceed these permissible variations, material planned for use from the heat represented by said check samples shall be subject to rejection.

THROUGH-THICKNESS QUALITY

Where through-thickness quality steel is shown on the plans, the steel shall meet the low sulfur and reduction of area requirements of AWS D1.5, Section 12.4.4.1. Additionally, each plate shall be ultrasonically examined and shall meet the acceptance criteria in conformance with the requirements in ASTM Designation: A578, Level C. At the option of the Contractor, through-thickness quality steel may be specified at any additional location at no additional cost to the State.

CASTINGS

Castings shown on the plans as "Structural Casting Grade 345," "Structural Casting Grade 415," and "Structural Casting Grade 550" shall conform to the requirements of these special provisions. Castings for cable system components shall conform to the requirements in "Cable System" of these special provisions.

AISC certification will not be required for foundries and forge shops producing castings and forgings to the requirements of this section. Casting and forging vendors shall maintain a comprehensive quality control system conforming to an established guideline such as ISO 9000 series documents or equal.

At the option of the Contractor, the remaining portions of the casting components may be redesigned as castings in accordance with the requirements of this section. Any use of castings for other structural components shall follow the requirements of this section, and a detailed, written proposal shall be submitted to the Engineer for prior approval. The Contractor shall submit for the approval of the Engineer, working drawings for castings in accordance with the requirements of "Working Drawings," of these special provisions. Working drawings for castings shall include, at a minimum, detail drawings of the redesigned cast configuration showing equivalency to the details shown on the plans.

The Contractor shall perform finite element complex heat flow analysis for each pattern including all risers and gates that demonstrates that final solidification will occur outside of the final casting. This analysis shall also be used to confirm inspection procedures by identifying the locations of likely defects such as shrinkage, hot tears and porosity. The analytical solid model shall be sufficiently detailed and accurate to demonstrate complete coverage of ultrasonic examination by including the ability to superimpose ultrasonic beam paths on the model. Coverage may be demonstrated by drawing beam paths on printed sections of the solid model. The analytical model and supporting calculations shall be submitted to the Engineer for approval in accordance with the "Working Drawings" section above.

The Contractor shall submit a manufacturing procedure to the Engineer for approval that shall specify all chemical, heat treatment, testing, visual and nondestructive inspection and quality control requirements. Quality control requirements and manufacturing facilities shall be subject to a quality audit as specified in Section 8-4 "Steel Audits" of these special provisions and include the additional requirements of this section.

Castings shall be manufactured to the requirements in ASTM Designation: A148 with the following Supplementary Requirements as modified herein: S1, S4, S5, S6, S7, S8 (Individually marked), S9, S12, and S16.

The manufacturing procedure shall define the specific chemistry, including tolerances for each element. The alloy shall conform to the general limits in the following table, except alternative alloys that meet the required mechanical properties and other requirements herein, that have similar or better weld–ability, and that have a documented history of successful application may be submitted for approval by the Engineer. The steel shall be fully killed and made to fine grain practice.

ELEMENT (Max.or range)	BASE GRADE	C	Si	Mn	P	S	Ni	Cr	Mo
Structural Casting Grade 345	A148M, Gr.550-345	0.20	0.60	1.50	0.025	0.025	1.2	0.50	0.25
Structural Casting Grade 415	A148M, Gr.620-415	0.28	0.80	1.00	0.025	0.025	1.40-2.00	0.55-0.90	0.20-0.40
Structural Casting Grade 550	A148M, Gr.725-585	0.24	0.50	0.55-0.75	0.025	0.025	2.50-3.50	1.35-1.85	0.30-0.60

ELEMENT (Max.or range)	BASE GRADE	Al	Cu	V	Cb	Ti	CE**
Structural Casting Grade 345	A148M, Gr.550-345	.010 – .060	0.30	0.03	0.03	0.05	0.65
Structural Casting Grade 415	A148M, Gr.620-415	.010-.030	0.50*	0.03*	0.03	0.05	0.90
Structural Casting Grade 550	A148M, Gr.725-585	.010-.030	0.20*	0.03*	0.03	0.05	-

Notes: * means not intentionally added.

**The CE limit is only required for "Welded Cast Components" that are not fabricated by the foundry.

CE = C + (Mn+Si)/6 + (Cr + Mo + V)/5 + (Cu + Ni)/15

"Welded Cast Components" are defined as structural components that are fabricated by welding plates or other steel to castings designated by structural grade as shown on the plans.

Each casting shall be given either a double normalized heat treatment or a normalized plus quench and temper heat treatment at temperatures and times specified in the manufacturing procedure except the final tempering temperature shall not be less than 565 C. Specimens for mechanical testing shall be taken from a representative casting, a prolongation to the casting or a keel block. The test specimen block shall be in accordance with S15 of ASTM Designation: A148 (ASTM Designation: A781, Paragraph S15.3.1 option for a 375 mm by 375 mm by 125 mm maximum cast coupon size is acceptable), be poured from the same ladle and heat treated along with the castings that it represents. The test specimens shall meet the requirements in the table below:

	STRUCTURAL CASTING GRADE 345	STRUCTURAL CASTING GRADE 415	STRUCTURAL CASTING GRADE 550
Tensile Strength:	550 MPa – 690 MPa	620 MPa – 795 MPa	680 MPa – 840 MPa
Yield Strength:	345 MPa, Minimum	415 MPa, Minimum	550 MPa, Minimum
Elongation:	22%, Minimum	20%, Minimum	18%, Minimum
Reduction of Area:	35%, Minimum	35%, Minimum	30%, Minimum
Charpy V-Notch:	42 J, Minimum at 0°C	42 J, Minimum at 0°C	65 J, Minimum at 0°C

Each casting shall be visually examined 100% on all surfaces and shall be free of adhering sand, scale, cracks, shrinkage, unfused chills and hot tears and meet the Manufacturing Standardization Society of the Valve and Fittings Industry Inc. Publications (MSS) specification MSS-SP-55, "Quality Standard for Steel Castings for Valves, Flanges and Fittings and Other Piping Components - Visual Method". Machined surfaces shall be free of voids or other discontinuities that exceed the following: A maximum of one discontinuity within a radius of 150 mm that has a diameter not exceeding 3 mm within the saddle troughs or 5 mm elsewhere, a maximum depth of one half of the diameter, and a rounded shape with no sharp corners. Voids within the saddle troughs shall be filled during metallizing. All areas that are not shown as machined, but are designated as Level 1 on the plans shall be ground to a finish suitable for the magnetic particle, liquid penetrant and ultrasonic examinations required below.

Each casting shall be examined 100% on all surfaces by visible contrast, wet magnetic particle method to ASTM Designation: E709 on the final, as-finished surface. Visible contrast, dry powder method to ASTM Designation: E709 may be used on as-cast surfaces outside of Level 1 zones where no machining is required. The prod method shall not be used. Liquid penetrant examination to ASTM Designation: E165 may be used as an alternate to magnetic particle examination of the casting.

Linear indications, defined as having a ratio of maximum to minimum dimensions greater than 3, tears and cracks will not be permitted. Indications less than 3mm for Level 1 zones and 6 mm elsewhere may be disregarded.

Each casting shall also be volumetrically examined 100% by ultrasonic (UT) methods in accordance with a written procedure submitted with the manufacturing procedure. The procedure shall define calibrations, equipment and materials and shall include part-specific shooting sketches that demonstrate complete coverage of the full volume from two perpendicular directions. Coverage shall be compatible with locations identified as possible locations for defects based on the finite element heat flow analysis and the foundry practice. Ultrasonic procedures shall be based on ASTM Designation: A 609, "Standard Specification for Longitudinal Beam Ultrasonic Inspection of Carbon and Low-Alloy Steel Castings," using Procedure A, except supplementary angle beam examination to Supplementary Requirement S1 shall be performed on castings to ensure coverage from two perpendicular directions and on areas of castings where a back reflection cannot be maintained during straight beam examination, or where the angle between the front and back surfaces of the castings exceeds 15 degrees. The Distance Amplitude Curve (DAC) method shall be used for both straight and angle beam examinations. The DAC shall be constructed using a 3.0 mm diameter reference reflector hole for areas designated as Level 1 on the plans, and a hole diameter as specified in ASTM Designation: A 609M shall be used elsewhere. At each facility producing castings, ultrasonic test calibration blocks shall be poured from the first casting heat produced for this contract. Alternatively, reference blocks may be made from cast steel that has an acoustic response similar to the castings being examined as determined by the Engineer. The calibration blocks shall be made available to the Engineer for use in QA testing of the castings and to any subcontractors that perform ultrasonic testing on the castings. All calibration details shall be defined in the procedure.

The ultrasonic examination acceptance criteria shall be as follows: Within 30 mm of any final surface, unless otherwise noted on the plans, and at locations designated as Level 1 on the plans, indications that provide a response equal to or greater than the DAC and that are planar or that exceed the area specified in ASTM Designation: A 609, Table 2 for ultrasonic testing quality Level 1 will not be permitted. At all other locations, indications that provide a response equal to or greater than the DAC and that are planar or that exceed the area specified in ASTM Designation: A 609, Table 2 for ultrasonic testing quality Level 3 will not be permitted. The method for determining whether a reflector is planar shall be defined in the written procedure and shall be based on the high directionality of amplitude response for planar reflectors or other established technique.

Each casting shall be stenciled with its heat number and serial number.

Before casting, the Contractor shall produce 1/10 scale model of the tower saddle in wood or other material approved by the Engineer. The model shall show all details of the saddle including the location of weld, cast and plate materials and cast component parting lines. The model and manufacturing procedure shall be approved by the Engineer before the start of foundry production.

All areas of steel castings that will be in contact with other elements by welding, bolting or direct contact pressure shall be machined. The finish and surface texture of faying surfaces for bolted connections shall be suitable to obtain a Slip Critical bolted connection at Class B as defined by the RCSC specification.

Unless noted otherwise on the plans, the tolerance for linear dimensions of unmachined sections shall have a plus and minus tolerance (i.e., one half of the total tolerance range) in accordance with the following table:

Tolerance For Linear Dimensions (mm) Unaffected By Machined Surfaces

LINEAR DIMENSION, L	L < 60	60 ≤ L < 120	120 ≤ L < 250	250 ≤ L < 400	400 ≤ L < 630	630 ≤ L < 1000	1000 ≤ L< 1600	1600 ≤ L < 2500	2500 ≤ L < 4000	4000 ≤ L
TOLERANCE	4.5	5.5	7.0	9.0	11.0	13.0	16.0	19.0	31.0	47.0

Unless noted otherwise on the plans, the thickness tolerance of unmachined ribs shall have a minus tolerance of 3 mm and a plus tolerance in accordance with the following table:

Plus Tolerance For Thickness Of Ribs (mm) Where Both Faces Are Not Machined

THICKNESS RANGE	t < 18	18 ≤ t < 30	30 ≤ t < 50	50 ≤ t < 80	80 ≤ t < 120	120 ≤ t < 180	180 ≤ t < 250	250 ≤ t < 315	315 ≤ t < 400	400 ≤ t
PLUS TOLERANCE	6.0	9.0	10.0	11.0	12.0	13.0	15.0	19.0	27.0	35.0

No coating or oil preservative shall be applied to a casting until that casting has been inspected and approved by the Engineer.

Minor defects may be removed by grinding or chipping without welding repair, in accordance with the following requirements:

A. The removal of metal does not affect the strength, integrity or functionality of the casting, as determined by the Engineer.
B. The remaining wall thickness is equal to or greater than the required minimum wall thickness.
C. The surrounding metal is ground to a smooth contour with the elimination of apparent stress raisers.
D. Specified tolerances on machined surfaces are satisfied.

Weld repairs may be permitted if qualified welding procedures are used that demonstrate Charpy V-Notch toughness of 34J at –30 C in the weld metal and 34J for Structural Casting Grades 345 and 415, or 60J for Structural Casting Grade 550, at 0 C in the heat-affected zone in the final delivery condition. Weld procedure tests shall be qualified on 50 mm thick plates poured from the same heat as a production casting. Weld repairs shall be given a post weld stress relief heat treatment after all welding is complete. All proposed repair or upgrading welding procedure specifications (WPSs) shall conform to the requirements of ASME Boiler and Pressure Vessel Code, Section IX, as modified herein. Additional essential variables required for WPSs other than SMAW shall include welding travel speed (limited to ±10%), heat input(limited to +10%, -30%), and, for FCAW, the brand name of the electrode. Weld procedures with all supporting procedure qualification records (PQRs) shall be submitted in writing to the Engineer for each welding location, and shall include a description of the defect or other need for welding, the size and the shape of the excavation, the welding procedure specification, preheat and post weld heat treatment. If a second repair to base metal or heat affected zone is required at the same location, the Contractor shall include a metallurgical evaluation for the cause of the rejection in the submittal package to the Engineer for review and approval.

No welding or heat treatment will be permitted except with the specific written approval of the Engineer. In addition, the Contractor shall give the Engineer at least 12 hours notice prior to performing the work.

The exterior surfaces of the castings, after acceptance, shall be coated as specified in "Clean and Paint Structural Steel" and "Metallized Steel Surfaces" of these special provisions. The castings shall be carefully masked to avoid coating any high strength fastener contact surface, interior or other machine finished surface.

At the time of assembly, the contact surfaces of the castings shall meet the machine finish requirements shown on the plans.

Forging Alternative to Structural Castings

At the option of the Contractor, castings shown on the plans as "Structural Casting Grade 345," "Structural Casting Grade 415," and "Structural Casting Grade 550" may be substituted with a hot-worked forging alternative conforming to the

requirements for Structural Castings specified above, as modified herein. The manufacturing procedure shall be approved by the Engineer before any work commences.

GRADE	BASE SPECIFICATION	CHEMISTRY
Structural Casting Grade 345	ASTM A668	Structural Casting Grade 345
Structural Casting Grade 415	ASTM A668	Structural Casting Grade 415
Structural Casting Grade 550	ASTM A508M	Grade 4N, Class 1

Mechanical testing for tensile and toughness properties shall be performed for each heat and heat treatment lot on prolongations of production forgings or to separate forgings that are made from the same heat of steel, have received the same reduction and type of hot working, are of the same nominal thickness, and are heat treated in the same furnace charge as the forging(s) they represent. Properties shall be as specified for the Structural Casting grade.

Each casting shall be examined 100% by MT and by UT as described above with the following exceptions.

A. MT shall conform to ASTM Designation: A788, S18 (no linear indication permitted that exceed 2 mm, where linear is defined as a maximum length to width ratio exceeding 3.0) and ASTM Designation: A275.
B. UT shall conform to ASTM Designation: A788, S20 (method DA in 2 perpendicular directions) and ASTM Designation: A388.

Fabrication of Welded Cast Components

The Contractor shall submit to the Engineer for approval a document containing specific requirements for welding any casting that has an actual CE, as defined above, that exceeds 0.55. The submittal shall address welding heat input limitations, minimum preheat/interpass temperatures and post weld stress relief heat treatment (PWHT) temperature and time ranges.

Any fabrication of Welded Cast Components by the foundry, excluding repairs and upgrading as specified above, shall use welding procedures qualified to ASME Section IX, as modified above, or to AWS D1.5, as modified below, using both cast and ASTM Designation: A709 plates for the qualification welds. If the foundry fabricates a component by welding plate steel prior to final properties heat treatment, the weld procedure qualifications shall demonstrate that the properties of the plate, weld, and weld heat affected zone meet the requirements for the specified Structural Casting grade in the final delivery condition.

For fabrication of Welded Cast Components by a facility other than the foundry, the foundry shall provide cast test plates to be used in weld procedure qualification testing in accordance with AWS D1.5, as modified herein and by the approved welding requirements document. The weld procedure test plates shall be the maximum thickness of plate to be welded or 50 mm, whichever is less, and shall conform to AWS D1.5, Figure 5.1. Unless otherwise specified, the tensile, bend, and Charpy V-Notch requirements shall meet those specified in AWS D1.5 for the plate steel. Charpy V-Notch tests shall be taken from the weld heat affected zone on the casting side and shall meet 34 J, minimum at 0° C. PWHT shall be performed on each Welded Cast Component after completion of all welding. The welding procedure specification shall conform to the AWS D1.5 Section 5.13 limitations of essential variables.

All complete joint penetration welds in Welded Cast Components shall be inspected 100% with UT and MT in accordance with AWS D1.5. All partial joint penetration and fillet welds shall be inspected 100% by MT in accordance with AWS D1.5.

FABRICATION

Mill to Bear

Where mill to bear surfaces are specified on the plans or in these special provisions, the surfaces shall conform to the requirements of AWS D1.5, Section 3.5.1.9.

Quality of Workmanship

Attention is directed to "Clean and Paint Structural Steel" of these special provisions.

All bridge elements shall be cut, trimmed, fabricated and erected to be true at the average bridge temperature, as shown on the plans. All corners of members shall be chamfered to remove sharp edges, unless otherwise shown on the plans. Chamfering is defined as a process by which a sharp corner is flattened by passing a grinder or other suitable device along the corner, normally in a single pass. Chamfering is not required for corners of contacting plates.

The Engineer may inspect fabrications for dimensional accuracy, fabrication practices, welding requirements and compliance with these special provisions.

Shop Size

The shop or yard shall be of sufficient size and shall have adequate facilities to permit checking and controlling of the alignment of the box girder and tower lifts before they are shipped to the site. Shop or yard size shall be sufficient to join any three contiguous segments or any two adjacent lifts, whichever is larger.

Fabrication/Erection Procedure and Mock-Ups

The Contractor shall submit to the Engineer for approval in accordance with the requirements in "Working Drawings" of these special provisions, written, detailed procedures for the fabrication and erection of the complex assemblies listed below. Procedures shall include the assembly and welding sequence, and bolt tightening procedure and shall be of sufficient detail to demonstrate the proposed fabrication procedure and verify the inspectability of welds.

Attention is directed to "Bolted Connections," of this section regarding bolt tensioning requirements.

Fabrication and erection procedures are required for all locations where a mock-up is required and for the following additional locations:

A. Tower Anchorage
B. Tower Shaft Segment, including Shell Plating Sequence
C. Box Girder Segment
D. Crossbeam to Box Girder Connection
E. West Deviation Saddle Assembly
F. Box Girder Connection PT Strand End Block to Pier W2 Cap Beam
G. East Cable Anchorage Overall Assembly
H. East Saddle Assembly
I. Tower Diaphragm Types 1A and 1B
J. Hinge A Assembly
K. Tower Strut Assembly including connection to Tower Diaphragm
L. Tower saddle grillage
M. West Jacking Frame box
N. West Jacking Saddle
O. Box girder reinforcement at East Saddle and Pier E2 bearing and Shear Key
P. Pier E2 Bearing and Shear Key
Q. Box lift erection connection

The Contractor shall prepare steel mock-ups, unless otherwise noted, of the following details to demonstrate the proposed fabrication procedure and verify the inspectability of each weld:

A. Tower Saddle (steel mock-up not required)
B. Tower Diaphragm Type 3B
C. Tower lift erection splice – bolted or welded
D. Hinge K Assembly (steel mock-up not required)
E. Deck plate section – (For welding requirements of closed ribs to deck plate, see "Welding of Closed Ribs to Box Shell Plates" below.)"
F. Tower section

Each mock-up shall comprise a complete fabrication of the specified detail as shown on the plans, but with member lengths that need not extend beyond the joint more than 0.5m.

For each mock-up, the Contractor shall prepare a written fabrication and welding sequence and a preliminary mock-up made of wood, plastic, dense Styrofoam or other material approved by the Engineer. The preliminary mock-up shall be sufficiently large to demonstrate the assembly sequence, but need not exceed one-half scale. These shall be submitted for review by the Engineer, and approval shall be given before the full-scale mock-up is fabricated in steel. The Engineer shall witness all fit-up and welding for each steel mock-up.

The completed steel mock-up shall be examined visually and by UT or RT and by Magnetic Particle (MT) using the nondestructive examination procedures that are proposed for production. Mock-up assemblies shall then be sectioned as directed by the Engineer to produce three macroetch samples per weld type that shall be evaluated per AWS D1.5. Approval of the fabrication and erection procedure and the nondestructive examination procedures shall be contingent on satisfactory results from the mock-up examination and destructive tests. Satisfactory mock-ups shall be defined as follows.

A. For the rib to deck PJP connections, satisfactory mock-ups shall be defined as mock-ups that meet the UT verification of depth of penetration and the macroetch criteria specified under "Welding of Closed Ribs to Box Shell Plates" below. No repairs of the rib to deck PJP connections will be allowed in the mock-up. Failure to achieve a satisfactory mock-up will require the Contractor to make any necessary adjustments to his fabrication procedures and then fabricate a new mock-up that will be subject to the same criteria.
B. All other mock-ups shall be defined as satisfactory when, either before or after repair as permitted herein, the mock-ups are free of defects as defined in the special provisions including all relevant sections of AWS D1.5 and demonstrate a procedure that will meet the requirements of the special provisions as determined by the Engineer. Minor weld repairs will be allowed except for the following circumstances:
   1. A crack, as defined by AWS D1.5, is found visually or by MT.
   2. Defects, as defined by AWS D1.5, that are found by UT or RT occur in greater than 10 percent of the cumulative length of any weld.
   3. Distortion is caused that, in the opinion of the Engineer, cannot be repaired within the specifications and good engineering practice.
   4. The mock-up, in the opinion of the Engineer, fails to demonstrate a procedure that will meet the specifications or fails to demonstrate a procedure that is repeatable in actual production.
   5. Repair to the welds may not be made after macroetching. Cracks, lack of fusion, and lack of penetration, as defined in AWS D1.5, that are found during macroetch examination will result in an unsatisfactory mockup.

Should the Engineer deem the mock-up unsatisfactory, the Contractor shall revise and resubmit the Fabrication/Erection Procedure to correct the deficiency identified by the first mock-up. A new mock-up, or partial mock-up, as determined by the Engineer, will be required after approval of the revised Fabrication/Erection Procedure.

Mock-ups shall not be part of the permanent structure and shall become the property of the Contractor. Mock-ups shall be removed from the work site and shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Hinge K Pipe Beam

The Contractor shall fabricate pipe beams in accordance with the approved fabrication procedure conforming to the requirements of these special provisions. Welding of the pipe beam longitudinal and circumferential groove welds and stainless steel cladding shall be made using the SAW process unless otherwise approved by the Engineer.

Pipe beams shall be formed in sections that are welded with one or two longitudinal seams. Forming shall be performed at ambient temperature unless approved and qualified at elevated temperature, which shall not exceed 590˚ C or the maximum temperature recommended by the steel manufacturer, whichever is less. Metal forming at temperatures between 150˚C and 425˚C will not be permitted. Prior to machining, the formed pipe beam shall have a smooth surface with local roundness variations less than 5 mm, as measured against a template with the theoretical curvature and length of 20 degrees, and out-of-roundness (maximum diameter minus minimum diameter) less than 8 mm.

Welding and welding procedure qualification for Pipe Beam Grade 485 and Pipe Beam Grade 690 shall conform to "Welding of HPS485W Steels" and "Welding of Grade 690 Steels" sections below, respectively, in addition to the following. Welding procedures for the longitudinal and circumferential welds shall be qualified by welding test pieces with the maximum thickness to be welded in production in the as-formed condition representing the maximum strain. Testing shall include all tests required by AWS D1.5 Section 5.7.1 for Test Plate A and the additional tests described herein. Charpy V-Notch test specimens shall be removed from the weld metal and coarse grain heat affected zone for longitudinal and circumferential welds. Heat affected zone toughness test specimens shall be removed from the inner and outer surfaces of the formed member. Charpy V-Notch test results for both weld metal and heat affected zone shall meet the requirements specified under "Materials" above.

The AISI 316L stainless steel overlay shall be welded over the full specified pipe beam thickness using a procedure qualified for the Pipe Beam Grade 690 in accordance with AWS D1.6. Chemical analysis shall be performed on the qualification overlay 5 mm above the substrate and shall meet the chemical limits for grade 316L. After overlay welding, the stainless steel surfaces shall be machined to a root mean square surface finish of 0.8 µm, with no gouges or indentations, and an out-of-roundness on the machined surface (max. OD – min. OD) not exceeding 1 mm.

The cylinder defined by the machined stainless steel surface shall be straight and concentric to the pipe beam axis within 1 mm.

The extent of nondestructive testing shall be as defined under Inspection and Testing below. Acceptance shall be based on the criteria for tension welds in primary members. Visual and nondestructive examination of welds shall be accepted before cladding is started. Finish machined stainless steel surfaces, plus 100 mm of the pipe beam on either side of the stainless steel surfaces, shall be examined 100% by liquid penetrant testing (PT) in accordance with ASTM Designation: E165, and the standards of acceptance shall be in accordance with AWS D1.5, Section 6.26.

Spare Pipe Beam Fuses

The Contractor shall fabricate spare pipe beam fuses in accordance with the details shown on the plans and the requirements of this section. Spare pipe beam fuses shall conform to the requirements of this section, including the requirements for cleaning and painting in the section "Clean and Paint Structural Steel," of these special provisions.

The Contractor shall deliver the spare pipe beam fuses to the Engineer at a location to be determined by the Engineer. Said location will be within 25 km of the San Francisco-Oakland Bay Bridge Toll Plaza. Spare pipe beam fuses shall be delivered to the Engineer within six months prior to completion of the work. The Contractor shall notify the Engineer at least two months prior to delivery of spare pipe beam fuses.

Spare pipe beam fuses shall be packaged for the protection of the steel against physical damage and corrosion during shipping and storage. The shipping package shall be clearly marked with a statement that the package contains spare pipe beam fuses for the San Francisco-Oakland Bay Bridge and show the hinge location, the serial number, grade of steel, and the date packaged.

Spare Tower Struts

The Contractor shall fabricate spare tower struts in accordance with the details shown on the plans and the requirements of this section. Spare tower struts shall conform to the requirements of this section, including the requirements for cleaning and painting in the section "Clean and Paint Structural Steel," of these special provisions.

The Contractor shall deliver the spare tower struts to the Engineer at a location to be determined by the Engineer. Said location will be within 25 km of the San Francisco-Oakland Bay Bridge Toll Plaza. Spare tower struts shall be delivered to the Engineer within six months prior to completion of the work. The Contractor shall notify the Engineer at least two months prior to delivery of spare tower struts.

Spare tower struts shall be packaged for the protection of the steel against physical damage and corrosion during shipping and storage. Spare tower struts shall be packaged individually and include their associated attachment plates, angles, and bolts. The shipping package shall be clearly marked with a statement that the package contains spare tower struts for the San Francisco-Oakland Bay Bridge, the strut type, the serial number, and the date packaged.

Bikepath at Pier W2

A portion of the bikepath at Pier W2 will be furnished by the Contractor and installed by others, as shown on the plans. This portion of bikepath shall conform to the requirements of this section, including the requirements for cleaning and painting in section "Clean and Paint Structural Steel," of these special provisions.

The Contractor shall deliver this portion of bike path to the Engineer at a location to be determined by the Engineer. Said location will be within 25 km of the San Francisco-Oakland Bay Bridge Toll Plaza. The Contractor shall notify the Engineer at least two months prior to delivery of this portion of the bike path.

This portion of bikepath shall be protected against physical damage and corrosion during shipping and storage.

Mechanical Cutting

Mechanical shearing of material of thickness greater than 8 mm is prohibited. Mechanically sheared edges shall be ground smooth. All cracks emanating from these edges shall be removed.

Flame, Plasma and Arc Cutting

All cut edges in SPCMs and steel grades greater than grade 345 shall be ground to remove dross, slag and hardened material. The treatment of cut edges for other grades shall conform to the requirements of AWS D1.5.

Bent Plate

Cold-bent steel plates except closed ribs for the box girder shall conform to the following:

A. The axis of bending shall be perpendicular to the direction of plate rolling. The entire length of bend shall be formed simultaneously.
B. The radius of bend shall be as shown on the plans.
C. Before bending, the plate corners that are perpendicular to the axis of the bend shall be rounded to a radius of 2 mm.

Rib Plates

Cold-bent steel closed rib plates for the orthotropic deck shall conform to the following:

A. The axis of bending shall be parallel to the direction of plate rolling. The entire length of rib shall be formed simultaneously. Progressive forming methods such as roll forming will not be permitted.
B. The radius of bend of closed rib plates, measured to the concave face of the metal shall be as shown on the plans.

C. Before bending, the corners of the plate perpendicular to the axis of the bend shall be rounded to a radius of 2 mm. The Contractor's proposed method shall be capable of bending the plates without introducing cracks at the edges or along the bent section. The Contractor shall demonstrate to the Engineer that the proposed method results in satisfactory bends. The Engineer will determine if the proposed method is acceptable. Acceptance of the Contractor's proposed bending method will be based on nondestructive tests on ten ribs and macroetches on three of the ribs previously tested nondestructively. Ribs shall be a minimum of 10m long. The Contractor shall perform the following tests:

1. Visual examination of the bends using a 5x magnifying lens.
2. Magnetic Particle testing of all termination edges at rib ends and 15% of the bent parts of the ribs at locations selected by the Engineer. No cracks will be permitted.
3. Destructive testing of up to three ribs, with 5 macroetches per rib, at locations selected by the Engineer.

The Contractor shall bend and trim ribs and shell plating to ensure that the geometric tolerances shown on the plans are met.

The Contractor’s proposed method shall be capable of bending the plates without introducing cracks at the edges or along the bent section. The Contractor shall demonstrate to the Engineer that the proposed method results in satisfactory bends. The Engineer will determine if the proposed method is acceptable. Acceptance of the Contractor’s proposed bending method will be based on nondestructive tests on ten ribs and destructive tests on three of the ribs previously tested nondestructively. Ribs shall be a minimum of 10 m long. The Contractor shall perform the following tests:

A. Visual examination of the bends using a 5x magnifying lens.
B. Magnetic Particle testing of all termination edges at rib ends and 15% of the bent parts of the ribs at locations selected by the Engineer. No cracks will be permitted.
C. Destructive testing of up to three ribs, with 5 samples per rib, at locations selected by the Engineer.

The Contractor shall bend and trim ribs and shell plating to ensure that the geometric tolerances shown on the plans are met.

Match-Marking

Match markings shall be made with low stress die stamps or other method that will not notch the steel.

Bolted Connections

Bolted connections in structural steel joints, unless otherwise shown on the plans or specified in the special provisions, shall be made with high-strength steel fastener assemblies. Fastener assemblies shall consist of a high-strength steel bolt, nut and hardened washer.

The provisions of Section 8-1.01 "SUBSTITUTION OF NON-METRIC MATERIALS AND PRODUCTS," will not be permitted for high-strength fastener assemblies, unless noted otherwise on the plans. Tightening of bolted connections shall be completed in a set pattern with a minimum of two cycles: snug tight and full tension.

The method for determining bolt tension shall include calibration using a calibrated bolt tension calibrator. The tightening pattern and the calibration and tightening procedure shall be included in the fabrication/erection procedure and submitted to the Engineer for approval.

Alignment and contact for the tower shaft bolted splice shall conform to the requirements of AWS D1.5, Section 3.5.1.14, except that filler plates will not be permitted between the exterior face of the skin plates and the exterior splice plates. At the option of the Contractor, tower lift ends may be milled to bear or shimmed. Shimming of up to 5 mm thickness will be permitted in increments of 1 mm or tapered. At any given location, the shim shall be a single thickness of steel. Gaps between shims and skin plates shall be filled with silicone caulk prior to installation of the exterior splice plates. The Contractor shall prepare a work plan that describes the procedure for meeting these requirements and that shall be approved by the Engineer before use. The work plan shall be demonstrated on the mock-up required above. The mating segments of each lift shall be mated at the fabrication site, and the required fit demonstrated, before moving each lift to the final assembly site. Bolted connections shall conform to the requirements in the Research Council on Structural Connections, "Specification for Structural Joints Using ASTM A325 or A490 Bolts," 2000 (RCSC Specification), with the following revisions:

A. Reference to A325 bolts shall mean A325M bolts.
B. Reference to A490 bolts shall mean A490M bolts.
C. Reference to A563 nuts shall mean A563M nuts.
D. Reference to F436 washers shall mean F436M washers.

E. Reference to F959 direct tension indicators shall mean F959M direct tension indicators.
F. Reference to F1852 twist-off type tension control bolts shall not apply.
G. Reference to ANSI B18.2.6 (for bolt dimensions) is replaced with B.18.2.3.7M.
H. Reference to ANSI B18.2.6 (for nut dimensions) is replaced with B.18.2.4.6M.
I. Replace Table 2.1 of the RCSC Specification with Table 8.1 of the AISC "Manual of Steel Construction, Load & Resistance Factor Design, Metric Conversion of the Second Edition" (AISC Specification).
J. Replace Table C-2.1, Figure C-2.2, and Table C-2.2 of the RCSC Specification with Table 8.2 of the AISC Specification.
K. Replace Table 3.1 of the RCSC Specification with Table J3.3 of the AISC Specification.
L. Section 6.2.3. of the RCSC is deleted.
M. Table 6.1 of the RCSC Specification is replaced with the following:

Table 6.1. Washer Requirements for Bolted Joints with Oversized and Slotted Holes in the Outer Ply

<table>
<tr><th rowspan="2">ASTM Designation</th><th rowspan="2">Nominal Bolt Diameter db, mm</th><th colspan="3">Hole Type in Outer Ply</th></tr>
<tr><th>Oversized</th><th>Short-Slotted</th><th>Long-Slotted</th></tr>
<tr><td>A325</td><td>12-36</td><td colspan="2" rowspan="2">ASTM F436M</td><td rowspan="2">8 mm thick plate washer or continuous bar[a,b]</td></tr>
<tr><td rowspan="2">A490</td><td>≤ 25</td></tr>
<tr><td>>25</td><td colspan="2">ASTM F436M with 8 mm thickness[a]</td><td>8 mm thick hardened plate washer or hardened continuous bar[a]</td></tr>
<tr><td colspan="5">[a] Multiple washers with a combined thickness of 8 mm or larger do not satisfy this requirement.
[b] The plate washer or bar shall be of structural-grade steel material, but need not be hardened.</td></tr>
</table>

N. Replace Table 8.1 of the RCSC Specification with the following:

Minimum Bolt Tension, N*

Bolt Size, mm	A325M Bolts	A490M Bolts
M16	91 000	114 000
M20	142 000	179 000
M22	176 000	221 000
M24	205 000	257 000
M27	267 000	334 000
M30	326 000	408 000
M36	475 000	595 000
*Equal to 0.70 of minimum tensile strength of bolts, rounded off to nearest kN and converted to N, as specified in ASTM specifications for A325M and A490M bolts with UNC threads.		

O. Table 8.2 of the RCSC Specification is replaced with the following:

Table 8.2. Nut Rotation from Snug-Tight Condition for Turn-of-Nut Pretensioning [a,b]

Bolt Length[c]	Disposition of Outer Face of Bolted Parts		
	Both faces normal to bolt axis	One face normal to bolt axis, other sloped not more than 1:20[d]	Both faces sloped not more than 1:20 from normal to bolt axis[d]
Not more than $4d_b$	1/2 turn	1/2 turn	2/3 turn
More than $4d_b$ but not more than $8d_b$	1/2 turn	2/3 turn	5/6 turn
More than $8d_b$ but not more than $12d_b$	2/3 turn	5/6 turn	1 turn

[a] Nut rotation is relative to bolt regardless of the element (nut or bolt) being turned. For required nut rotations of ½ turn, the tolerance is plus 30 degrees; for required nut rotations of 2/3 turn and more, the tolerance is plus 45 degrees.
[b] Applicable only to joints in which all material within the grip is steel.
[c] When the bolt length exceeds 12dh, the required nut rotation shall be determined by actual testing in a suitable tension calibrator that simulates the conditions of solidly fitting steel.
[d] Beveled washer not used.

P. Sections 8.2.2, 8.2.3, 9.2.2, and 9.2.3 of the RCSC Specification are deleted.

Where the DTI method is used, the DTI shall be collapsed to 0.075mm (3 mils), and the gap in the DTI shall be caulked after acceptance by the Engineer. The method of bolt tightening shall be as specified below:

LOCATION	BOLT TYPE	COATING	TIGHTENING METHOD
Tower	A325	Mechanical galvanizing	Turn-of-Nut or Direct Tension Indicator (DTI) collapsed to 3mils (0.075mm
Box Girder	A325	Mechanical galvanizing	Turn-of-Nut, TC or DTI collapsed to 3mils (0.075mm)
All Locations	A490	Dacromet 320 P	Turn-of-Nut or DTI collapsed to 3mils (0.075mm)
All Locations	A307	Hot Dip Galvanized	Snug-Tight plus 1/4 turn
All Locations	A449	Hot Dip Galvanized	Snug-Tight plus 1/4 turn with a lock nut"

The bolt orientation shown on the plans may be reversed to facilitate installation as approved by the Engineer.

High-strength fastener assemblies, and other bolts attached to structural steel with nuts and washers shall be zinc-coated as shown. When direct tension indicators are used in these assemblies, the direct tension indicator and all components of the fastener assembly shall be zinc-coated by the mechanical deposition process. Stripping and re-dipping of galvanized high strength fasteners is prohibited.

After installation, all exposed areas of galvanized bolts shall be cleaned in accordance with the requirements of SSPC-SP 2, and coated with two applications of unthinned organic zinc-rich primer that is compatible with the polysiloxane finish coats within 96 hours of installation. Where polysiloxane finish coats are to be applied within 96 hours, this requirement need not apply.

After installation, all accessible exposed areas of bolts coated with Dacromet, as determined by the Engineer shall be coated with a primer recommended by the manufacturer of the polysiloxane finish coat. Surface preparation shall be as recommended by the manufacturer of the primer or finish coat. Where polysiloxane finish coats will be applied within 6 months, this requirement need not apply.

At least 60 days prior to beginning turn-of-nut bolting operations, the Contractor shall perform the following tests to verify turn-of-nut installation procedures:

A. Minimum tension shall be verified using the "Pre-Installation Verification Turn-of-the-Nut Method," of the "Structural Bolting Handbook," published by the Steel Structures Technology Center, Incorporated, except that the required rotation shall be as given in Table 8.2. of this section and the required tension shall be as shown in the following table:

Pre-Installation Verification
Required Tension, N*

Bolt Size, mm	A325M Bolts	A490M Bolts
M16	96 000	120 000
M20	149 000	188 000
M22	185 000	232 000
M24	215 000	270 000
M27	280 000	351 000
M30	342 000	428 000
M36	499 000	625 000
*The above values are 5% higher than the required pretension values used for design, actual installation and inspection, rounded to the nearest kN.		

B. Rotational-capacity tests in accordance with the requirements in Section 11.5.6.4.2 "Rotational-Capacity Tests," of the AASHTO LRFD Bridge Construction Specifications, except that Table 11.5.6.4.1-2 "Nut Rotation from the Snug Condition," is replaced by Table 8.2. of this section.

Test results shall confirm both the minimum bolt tension and the rotational capacity of the bolts. If either test fails, the Contractor shall modify the nut rotation in Table 8.2. of this section until the requirements of both tests are satisfied. No adjustment in compensation will be allowed for modifications to the nut rotations as necessary to satisfy test requirements. Revisions to Table 8.2. shall be approved by the Engineer prior to bolting operations.

The Engineer will randomly sample and perform quality assurance testing of high strength fasteners. Samples will be obtained at locations chosen by the Engineer. The Contractor shall provide the number of bolts specified below to the Engineer for quality assurance testing:

Bolt Sampling Size

Lot Size (No. of Bolts)	Sample Size (No. of Bolts)
2 to 15	3
16 to 25	4
26 to 50	5
51 to 90	7
91 to 150	8
151 to 280	9
281 to 10,000	12
10,001 to 500,000	16
500,001 and over	20

Steel fasteners, designated on the plans as A 354, Grade BC, and A 354, Grade BD, shall conform to the requirements of ASTM Designation: A 354. Steel fastener components for steel fasteners designated as A 354 shall include a bolt, nut and hardened washer. Nuts for steel fasteners designated as A 354 shall conform to Section 55-2.01, "Description," of the Standard Specifications.

Steel fasteners designated on the plans as A 354, Grade BD shall be dry blast cleaned in accordance with the provisions of Surface Preparation Specification No. 10, "Near White Blast Cleaning," of the "SSPC: The Society for Protective Coatings.

Steel fasteners designated on the plans as A 354, Grade BC, and A 354, Grade BD, shall be galvanized in accordance with the requirements in Section 75-1.05, "Galvanizing," of the Standard Specifications and shall conform to the requirements in ASTM Designation: A123 for bolts and ASTM Designation: A153 for nuts and hardware. Steel fastener assemblies designated as A354, Grade BD, shall be galvanized within 4 hours of being dry blast cleaned.

The Contractor shall submit certified test reports showing that the A 354, Grade BD fasteners conform to the provisions in ASTM Designation: A 143.

Steel fasteners, designated on the plans as A 354, Grade BC, and A 354, Grade BD, shall conform to the requirements of ASTM Designation: A 354. Steel fastener components for steel fasteners designated as A 354 shall include a bolt, nut and hardened washer. Nuts for steel fasteners designated as A 354 shall conform to Section 55-2.01, "Description," of the Standard Specifications. Nuts shall be zinc coated and be furnished with a dry lubricant conforming to Supplementary Requirement S1 and S2 in ASTM Designation: A 563.

Steel fasteners designated on the plans as A 354, Grade BD shall be tensioned not less than the value shown on the plans. Prior to installation, the Contractor shall submit to the Engineer for approval the methods and equipment to be used to tension steel fasteners designated as A354, Grade BD in accordance with Section 55-1.02, "Drawings," of the Standard Specifications. Working drawings shall include methods and equipment to be used to evaluate: 1) the presence of a lubricant, 2) the efficiency of the lubricant, and 3) the compatibility of the high strength steel bolt, nut and hardened washer.

Except where sub-punching is permitted, bolt holes shall be drilled or reamed, unless otherwise shown on the plans.

Punching

The first paragraph of Section 55-3.14A(1) "Punching," of the Standard Specifications shall not apply.

Punching or sub-punching of Grade 250 structural steel where the material is thicker than 16 mm will not be permitted. Punching or sub-punching of high-strength structural steel where the material is thicker than 12 mm will not be permitted.

Prestressing High-Strength Bolts

High-strength A354 bolts shall be tensioned by means of hydraulic jacks so that the force in the bolts shall not be less than the value shown on the plans.

The maximum temporary tensile stress (jacking stress) in high-strength bolts shall not exceed 75 percent of the specified minimum ultimate tensile strength of the material. Prestressing forces in high-strength bolts shall consider all losses, including creep of steel, losses due to sequence of stressing, and other losses specific to the method or system of prestressing used by the Contractor.

Hydraulic jacks used for prestressing high-strength bolts shall be calibrated in accordance with the requirements in Section 50-1.08, "Prestressing," of the Standard Specifications.

Final prestressing high strength A354 bolts at the tower anchorage shall be performed after the full dead load is transferred to the cable system.

ASSEMBLY

The method of erection of the suspended structure and tower shall be determined by the Contractor to meet the seismic design load criteria and ensure control of box girder and tower deflections due to wind induced oscillations.

The Contractor shall carry out the necessary structural analyses for the erection procedure to demonstrate the adequacy of the procedure. Details of these analyses and of any supplementary damping or other measures shall be submitted to the Engineer for review and approval.

Wind pressure effects during erection shall be calculated using a gust wind appropriate to a return period of not less than 25 years and shall allow for variation of speed with height per ANSI ASCE 7-95. The 25-year wind corresponds to a 77 mph one-hour average wind speed (and a corresponding 3-second gust wind speed of 100 mph) at deck elevation of 50 meters, as well as a critical flutter wind speed threshold of 112 mph based on a 1000-year return period. The Contractor shall provide temporary connections between adjacent lift sections in order to ensure sufficient torsional stiffness of the suspended structure. The Contractor shall also provide the proper support of the suspended structure during all stages of erection. The Contractor shall similarly ensure control of tower deflections due to wind-induced oscillations at all stages of erection and shall provide holdback stays or other damping devices as necessary. All such temporary measures shall be approved by the Engineer.

Wind design loads may be reduced during lifting operations.

Seismic loading during erection shall conform to the seismic loading requirements specified in "TEMPORARY TOWERS," subsection "TEMPORARY TOWER DESIGN," subsection "Seismic Design Loads," of these special provisions.

The erection procedure shall be such that the maximum stresses in any part of the permanent structure do not cause any permanent deformation or damage. Appropriate values of loads and safety factors for erection loading conditions shall be submitted by the Contractor to the Engineer for review and approval.

The details of any fastenings which the Contractor may require in any part of the permanent works for erection, and the procedure for their removal, shall be submitted to the Engineer for approval.

Tower

Tower lifts shall be in lengths as indicated on the plans. Exterior plates of the tower shafts shall be fabricated with direction of rolling aligned along the vertical direction of the tower. Within each lift, the number of transverse splices of the

plates shall be minimized. Tower skin plate vertical seams shall be located a minimum of 100 mm away from longitudinal stiffeners unless otherwise shown on the plans"

The ends of each lift shall meet the dimensional requirements given under "Shop Welding," subsection "Design Details" of these special provisions. Each end shall be in a horizontal plane. When standing on its lower end, the top corners of each lift shall remain within specified limits in both horizontal directions. To limit cumulative displacements, ends of the higher lift shall be shimmed or milled to compensate for the actual elevation of the lower lift, if the cumulative displacements are not within specified limits.

The fillet reinforcement required by Note 6 of Figures 2.4 and 2.5 of AWS D1.5 will not be required for PJP welds in the tower.

The tower interior corner splice plates shall be beveled 6 mm to clear weld beads on inside joint of tower corner skin plates subject to approval of the Engineer.

The ends of adjacent lifts shall be abutted together in the shop to ensure proper fit.

Shear stresses shall not be induced in the tower struts at any time during the tower erection. At the option of the Contractor, cross bracing and shear links may be used to obtain the required tolerances between shafts provided the axial loads in the cross bracing or shear links, after complete erection of tower, do not exceed 1 MN per member and the locked-in stresses along the entire length of each shaft does not exceed 5% of yield stress. The Contractor shall estimate the force and stresses in these members, including the locked-in stresses in each shaft after complete erection of tower, based on the approved erection plan and submit the calculations to the Engineer for review and approval. Bolt holes for the shear link connection plates may be field drilled subject to review and approval by the Engineer. The pin holes for the cross bracing may be bored in the shop to match field measurements subject to review and approval by the Engineer. The layout of the bolt holes shall be submitted to the Engineer for approval.

Box Girder

Box girder sections shall be fabricated in segments as shown on the plans. Box girder shell plates shall be fabricated with the direction of rolling aligned with the longitudinal axis of the bridge. Splices within segments shall be welded unless otherwise noted on the plans. Segments and lifts shall be dimensionally checked for matching, alignment, and camber, and shall not be shipped to the job site without prior approval of the Engineer.

Before shipping, segments and lifts shall be straight and square in accordance with the dimensions and tolerances shown on the plans and these special provisions, except as required by camber. Segments shall be measured in the shop for compliance with geometry requirements. As a minimum, the preassembly procedure shall consist of assembling three contiguous segments accurately adjusted for line and camber. Successive assemblies shall consist of at least one section of the previous assembly plus two or more sections added at the advancing end. This requirement shall also apply to segments shipped from the fabrication site to an assembly site where the segments will be joined into lifts. The support conditions shall be the same as those in the final installed condition; alternative support conditions may be proposed with details submitted under the erection plan and supported by calculations showing the effect of the support conditions on dimensional tolerances and segment-to-segment fit-up tolerances.

For the splices at the East Anchorage crossbeam, the Contractor shall field drill the bolt holes in one or both sides of each splice during final erection to ensure fit up, to accommodate the 15 mm deflection due to the transverse jacking of the box girders.

The Contractor shall develop the camber diagram of the box girder consistent with his proposed erection procedure. Shimming, forcing or prying will not be permitted.

Crossbeams

Crossbeams shall be connected to the suspended structure prior to transferring dead load to the suspension system.

The Contractor shall develop the camber diagram of the crossbeam consistent with his proposed erection procedure. Shimming, forcing or prying will not be permitted.

SURFACE PREPARATION

For all bolted connections, the contact surfaces and inside surfaces of bolt holes shall be cleaned and coated before assembly in conformance with the provisions for cleaning and painting structural steel of these special provisions.

WELDING OF STEEL STRUCTURES

Table 2.2 of ANSI/ AASHTO/AWS D1.5 is superseded by the following table:

Base Metal Thickness of the Thicker Part Joined, mm	Minimum Effective Partial Joint Penetration Groove Weld Size, * mm
Over 6 to 19 inclusive	6
Over 19 to 38 inclusive	8
Over 38 to 57 inclusive	10
Over 57 to 150 inclusive	13
Over 150	16

* Except the weld size need not exceed the thickness of the thinner part

Dimensional details and workmanship for welded joints in tubular and pipe connections shall conform to the provisions in Part A, "Common Requirements of Nontubular and Tubular Connections," and Part D, "Specific Requirements for Tubular Connections," in Section 2 of AWS D1.1.

Backing for welds that are subject to computed stress which are left in place in the completed structure as shown on the plans or approved by the Engineer shall be a single length. Single lengths of backing shall be obtained by using a continuous strip, or may consist of lengths of backing joined by complete joint penetration butt welds. Butt welds in the backing material shall be tested in conformance with the requirements in AWS D1.5, Section 3.13.2. Butt welds in backing material shall be ground flush as necessary to obtain proper inspection and for proper fit-up in the weld joint with which the backing is to be used.

WELDING OF HPS485W STEELS

Welds between and to HPS485W steels shall conform to the requirements in this section. All welding procedures shall be qualified by testing in accordance with the requirements in AWS D1.5 as modified herein and shall be used within the qualified limits of heat input. Previously qualified welding procedures witnessed by the State may be submitted for review based on these specification requirements. Regardless of qualification range, the heat input, preheat temperature and maximum interpass temperature shall conform to the requirements of this section.

Consumables for welding HPS485W shall be low hydrogen with H2 or H4 designators as shown below. The Contractor shall test the actual level of hydrogen for each consumable using the proposed welding procedure and maximum exposure conditions anticipated during production as specified below. The level of hydrogen shall not exceed the limits specified below.

The following additional requirements shall apply when welding to HPS485W steel:

A. Only submerged arc and shielded metal arc welding are pre-approved for welding HPS485W steel. Consumable handling requirements shall be in accordance with the requirements of AWS D1.5-96, Section 12.6.
B. Filler Metal Requirements:

1. Filler metals for welds joining Grade HPS485W to Shear Link Grade 345 steels shall conform to the requirements listed in paragraph 2 below. Filler metals for welds between Grade HPS 485W and all other grades shall match the lower strength of the materials joined, unless noted otherwise on the plans.
2. Filler metals for matching fillet welds, and all groove welds connecting Grade HPS485W plates shall conform to the following requirements:

(a) Submerged Arc Welding (SAW) Consumables;
SAW consumables shall meet AWS Electrode/Flux Classification F9A4 EXXX-X with supplementary moisture resistance designators -H4 or -H2, in conformance with AWS A5.23, with 1% Nickel minimum in the weld deposit.

(b) Shielded Metal Arc Welding (SMAW) Consumables; E9018-RHZ* with 1% nickel minimum in the weld deposit.
(* the Designator 'R', for moisture resistant coating, is required for all SMAW electrodes used for welding HPS485W steels. HZ shall be either H2 or H4)

(c) Other Processes

No other processes will be permitted unless approved by the Engineer. Proposals shall include consumables and welding parameters. The use of other processes will be subject to approval by the Engineer based on proposed consumables and welding parameters and conformance to the testing requirements in the AISI/AASHTO Guide for Welding HPS Steel. Filler metals for other processes shall provide the properties specified below. Consumables shall have a low hydrogen designation of H2 or H4 and shall be moisture resistant. The Contractor shall perform the full ranges of tests required by AWS D1.5, Section 12.6 and diffusible hydrogen testing in accordance with AWS A4.3, "Standard Methods for Determination of the Diffusible Hydrogen Content of Martensitic, Bainitic and Ferritic Steel Weld Metal Produced by Arc Welding" to demonstrate that successful welds can be achieved with a maximum level of 4mL/100g of hydrogen. The diffusible hydrogen test is a required part of the procedure qualification testing for the project for consumable combinations that have not been successfully demonstrated in the AISI/AASHTO Project for Welding HPS 70W Steel for Bridges.

3. Except for single pass fillet welds, or welds that will be fully consumed in a finished weld with satisfactory weathering characteristics, welding consumables and electrodes shall produce weld deposits that meet the requirements of AWS D1.5, Table 4.3.
4. Qualification Testing: Weld procedure qualification test requirements for HPS485W groove welds shall be evaluated using Welding Procedure Specification (WPS) Test Plates from the greatest thickness to be welded in production and, for formed members, the as-formed base metal representing the highest forming strain, i.e., lowest ratio of diameter to thickness of a tubular, to be used in fabrication. Testing shall conform to AWS D1.5 qualification requirements, except fillet weld procedures shall be qualified in each position used, macroetch specimens shall be taken and additional sets of Charpy V-Notch specimens shall be taken within one millimeter of both the inside and outside tubular surfaces and centered on the coarse-grain heat affected zone (HAZ). The test results shall meet the following properties:

   Transverse tensile ultimate strength: ≥ 620 MPa
   All-Weld-Metal: yield strength: ≥ 485 MPa
   All-Weld-Metal: ultimate tensile strength: ≥ 620 MPa
   All-Weld-Metal: percent elongation: ≥ 19% in 50 mm
   Charpy V-Notch: as specified under Materials above.

5. In addition to the requirements for WPS qualification in accordance with AWS D1.5, diffusible hydrogen (Hd) tests shall be performed on weld metal that does not have H2 or H4 certification from the manufacturer. The deposited weld metal shall have a diffusible hydrogen level equivalent to 4 mL/100 g or less. Hd test specimens shall be prepared at the fabrication plant. Specimens shall be tested in accordance with AWS A4.3. Test results in excess of the specified limit are unacceptable, and a retest is required, with a revised welding or consumable control procedure. AWS D1.5, Section 5.7.6, "Exemption from Further Testing," is applicable, but WPS or Hd results are not transferable from fabricator to fabricator. Fabricators with multiple plants under a common umbrella of welding equipment, welding training, and supervision will be required to perform the Hd testing only once per combination of consumables for each location. Plants audited as a single facility by the American Institute of Steel Construction (AISC) as a part of their Quality Certification Program, or other Engineer approved equal Quality Assurance program, shall be considered one location. Multiple plants not falling under the AISC, or other 'single facility' audit definition, are considered separate facilities and additional WPS and Hd tests are required.

C. Preheat and Interpass Temperature:

1. The minimum preheat and interpass temperatures shall be in accordance with AWS D1.5, Table 4.4.

   If satisfactory results are not achieved with the above minimum preheat and interpass temperatures during development of the Welding Procedure Specification (WPS), and an increased preheat temperature is used to provide a satisfactory Procedure Qualification Record (PQR), the higher preheat temperature shall be used during fabrication as the required minimum.

   The minimum preheat or interpass temperature required for a joint composed of different base metals and/or different thickness shall be based on the highest of the minimum preheats required by AWS D1.5, Section Table 4.4.
2. The maximum interpass temperature for welding HPS485W steel is 230 ˚C.

D. Heat Input (HI);
1.5 kilojoules per mm (kJ/mm), minimum
3.5 kJ/mm, maximum
as determined using AWS D1.5, Section 5.12.

E. Backing; AWS D1.5, Section 5.4.5 is modified to allow steel backing material for WPS test plates to be of grade 34550W (Sulfur = 0.025 max.) or HPS485W material.

WELDING OF GRADE 690 STEELS

Welds in Grade 690 steels shall conform to the requirements of AWS D1.5, as modified herein. All welding procedures shall be qualified by testing in accordance with the requirements in AWS D1.5 as modified herein and shall be used within the qualified limits of heat input. Previously qualified welding procedures witnessed by the State may be submitted for review based on these specification requirements. Regardless of qualification range, the heat input, preheat temperature and maximum interpass temperature shall conform to the requirements of this section.

Consumables for welding Grade 690 shall be low hydrogen with H2 or H4 designators. The Contractor shall test the actual level of hydrogen for each consumable using the proposed welding procedure and maximum exposure conditions anticipated during production. The level of hydrogen shall not exceed the limits specified below.

The following additional requirements shall apply when welding to Grade 690 steel:

A. Only submerged arc and shielded metal arc welding are pre-approved for welding Grade 690 steel. Consumable handling requirements shall be in accordance with the requirements of AWS D1.5-96, Section 12.6.
B. Filler Metal Requirements:

1. Filler metals for welds between Grade 690 steels shall conform to the requirements of AWS D1.5 for fracture critical members, as modified by paragraph 2 below. Filler metals for welds between Grade 690 and all other grades shall match the lower strength of the materials joined, unless noted otherwise on the plans.
2. Filler metals for matching fillet welds, and all groove welds joining Grade 690 steel shall conform to the following requirements:

(a) Submerged Arc Welding (SAW) Consumables;
SAW consumables shall meet AWS Electrode/Flux Classification F11A4 EXXX-X with supplementary moisture resistance designators -H4 or -H2, in conformance with AWS A5.23, with 1% Nickel minimum in the weld deposit.
(b) Shielded Metal Arc Welding (SMAW) Consumables; E11018-RHZ* with 1% nickel minimum in the weld deposit.
(* the Designator 'R', for moisture resistant coating, is required for all SMAW electrodes used for welding Grade 690 steels. HZ shall be either H2 or H4.
(c) Other Processes
The use of other processes will be subject to approval by the Engineer based on proposed consumables and welding parameters. Filler metals for other processes shall provide the properties specified below. Consumables shall have a low hydrogen designation of H2 or H4 and shall be moisture resistant. The Contractor shall perform the full ranges of tests required by AWS D1.5, Section 12.6 and diffusible hydrogen testing in accordance with AWS A4.3, "Standard Methods for Determination of the Diffusible Hydrogen Content of Martensitic, Bainitic and Ferritic Steel Weld Metal Produced by Arc Welding" to demonstrate that successful welds can be achieved with a maximum level of 4mL/100g of hydrogen. The diffusible hydrogen test is a required part of the procedure qualification testing for the project for consumable combinations that do not have H2 or H4 certification from the manufacturer.
3. Qualification Testing: Weld procedure qualification test requirements for Grade 690 groove welds shall be evaluated using Welding Procedure Specification (WPS) Test Plates from the greatest thickness to be welded in production and, for formed members, the as-formed base metal representing the highest forming strain, i.e., lowest ratio of diameter to thickness of a tubular, to be used in fabrication. Testing shall conform to AWS D 1.5 qualification requirements, except macroetch specimens shall be taken and additional sets of Charpy V-Notch specimens shall be taken within one mm of both the inside and outside tubular surfaces and centered on the coarse grain heat affected zone (HAZ). The test results shall meet the following properties:

Transverse tensile ultimate strength: 760-900 MPa
All-Weld-Metal: yield strength: ≥ 680 MPa
All-Weld-Metal: ultimate tensile strength: ≥ 760 MPa

All-Weld-Metal: percent elongation: ≥ 19% in 50 mm
Charpy V-Notch: As specified under Materials above.

4. In addition to the requirements for WPS qualification in accordance with AWS D1.5, diffusible hydrogen (Hd) tests shall be performed on weld metal that does not have H2 or H4 certification from the manufacturer. The deposited weld metal shall have a diffusible hydrogen level equivalent to 4 mL/100 g or less. Hd test specimens shall be prepared at the fabrication plant. Specimens shall be tested in accordance with AWS A4.3. Test results in excess of the specified limit are unacceptable, and a retest is required, with a revised welding or consumable control procedure. AWS D1.5, Section 5.7.6, "Exemption from Further Testing," is applicable, but WPS or Hd results are not transferable from fabricator to fabricator. Fabricators with multiple plants under a common umbrella of welding equipment, welding training, and supervision will be required to perform the Hd testing only once per combination of consumables for each location. Plants audited as a single facility by the American Institute of Steel Construction (AISC) as a part of their Quality Certification Program, or other Engineer approved equal Quality Assurance program, shall be considered one location. Multiple plants not falling under the AISC, or other 'single facility' audit definition, are considered separate facilities and additional WPS and Hd tests are required.

C. Preheat and Interpass Temperature:

1. The minimum and maximum preheat and interpass temperatures shall be in accordance with AWS D1.5, Table 4.4.

   If satisfactory results are not achieved with the above minimum preheat and interpass temperatures during development of the Welding Procedure Specification (WPS), and an increased preheat temperature is used to provide a satisfactory Procedure Qualification Record (PQR), the higher preheat temperature shall be used during fabrication as the required minimum.

2. The minimum preheat or interpass temperature required for a joint composed of different base metals and/or different thickness shall be based on the highest of the minimum preheats required by AWS D1.5, Table 4.4 Section 12.14.
3. The maximum interpass temperature for welding Grade 690 steel is 240 ˚C.

D. Heat Input (HI);
The heat input shall conform to the recommendations of the manufacturer, but is limited to the range qualified per AWS D1.5.

SHOP WELDING

Except as specified herein, welding, welder qualifications, and inspection of welding work shall conform to the requirements of AWS D1.5.

General Provisions

A. Steel fabrication shall conform to the requirements of AWS D1.5, except members designated on the plans as SPCMs, including welds connecting SPCM's to other members, shall be fabricated according to Chapter 12 of the AWS D1.5, "AASHTO/AWS Fracture Control Plan (FCP) for Nonredundant Members", except as modified in these special provisions.
B. To the extent that air movement may be harmful to welding procedures, ventilation in welding areas both during fabrication and erection shall be controlled to levels consistent with qualification procedures.
C. Welding of ancillary products – Connections of ancillary products, such as bikepath railings, to the main bridge elements shall be done by bolting. No structure which is welded to the box girder section or main elements of the bridge shall be considered ancillary. The provisions of AWS D1.5, Section 1.3.6, "Welding of Ancillary Products," shall not apply. The bikepath deck, and all its members shall be fabricated as a main element of the bridge and not as an ancillary product.
D. Welding of temporary fixtures such as lifting lugs or temporary shear enhancement devices shall be shown on the working drawings and shall conform to AWS D1.5. After removal, the structure shall be repaired as necessary to meet the requirements of these special provisions and AWS D1.5.
E. Gas Metal Arc Welding (GMAW), but not with short-circuiting transfer, will be permitted only for tack welding of structural members.
F. Electroslag (ESW) or electrogas (EGW) welding will not be permitted unless approved in writing by the Engineer. If the Contractor proposes to use electroslag or electrogas welding process at any location within the structure, a

"Feasibility Review" proposal shall be submitted to the Engineer that includes the location, WPS, drawings of the joint fit-up, all welding aids, and documented evidence that the process has met the required mechanical properties, including toughness, and soundness criteria. If the Engineer approves the Feasibility Review proposal, then the Contractor shall submit to the Engineer for approval a complete ESW/EGW welding plan that includes the following.

1. WPS
2. PQR qualification test piece per AWS D1.5; Charpy V-Notch specimens shall be tested representing both the weld metal and coarse grain heat affected zone.
3. Mock-up qualification test piece; A mock-up weld is required for each type of joint geometry as determined by the Engineer. Evaluation of the mock-up weld shall comprise NDT using the procedure that will be used in production, mechanical testing per Test Piece A of AWS D1.5 and 3 additional macroetch specimens taken at locations determined by the Engineer.
4. All tolerances including finished weld profile
5. All QC inspection hold points and report format
6. Welding operator qualification reports
7. All NDT procedures complete with details illustrating how the entire weld and heat affected zone shall be examined.
8. Repair procedures for minor and major repairs.
   The NGI-ESW process, as developed in the Federal Highway Administration (FHWA) project, is the only ESW process that will be considered. Restarts in ESW or EGW welds will not be permitted.

Design Details

A. Unless otherwise shown on the plans or specifically approved in writing by the Engineer, all complete joint penetration (CJP) welds shall be back-gouged. Where backing bars are used, the backing bars shall be removed and the weld back-gouged and re-welded. The back gouged areas shall be ground to bright metal.
B. Weld backing shall conform to the requirements in AWS D1.5 and these special provisions.
C. Weld matching: Weld electrodes shall match the lower strength of the materials joined, except where otherwise noted.
D. Tightly adhering weld spatter shall be removed by power brush or grinding.
E. Gouging for back gouging or for repair shall be done by an approved arc method and /or by grinding. Oxygen cutting will not be permitted for any form of gouging. Procedures to avoid retention of carbon deposits, slag or dross shall be used. Air-carbon-arc gouged surfaces shall be ground or filed to bright metal.
F. Weld repairs – In addition to the provisions in AWS D1.5, Section 3.7.4, re-repair of welds or base metal requires prior approval of the Engineer. Repairs to SPCMs , including welds connecting SPCM's to other members, shall be as specified in AWS D1.5, "AASHTO/AWS Fracture Control Plan (FCP) for Nonredundant Member," Section 12.17, as modified herein.
G. Dimensional Tolerances

Dimensional control shall be performed in accordance with a written procedure that is approved by the Engineer before use. The dimensional control procedure shall describe how the required tolerances will be checked and achieved during fabrication and erection, including the sizing and use of dimensional control templates. Calculations shall be included to provide the basis for acceptance of interim dimensions of structures erected under temporary loading conditions, such as the box sections before installing the bikepath.

Approval of the dimensional control procedure will in no way relieve the Contractor of full responsibility for dimensional control.

1. Dimensional tolerances shall conform to AWS D1.5 as modified on the plans and in these special provisions.
2. Where a discontinuous member provides a continuous load path on either side of a through member, the method of marking and ensuring alignment shall be described in the dimensional control procedure. Misalignment between discontinuous members shall not exceed 10% of the thickness of the thinner member or 3 mm, whichever is less.
3. Dimensional tolerances for the box girder, including the crossbeam, shall conform to the tolerances in AWS D1.5, AASHTO Standard Specification For Highway Bridges, Sixteenth Edition 1996, Division II – Construction, Section 11.4.13 – "Orthotropic Deck Superstructures," and the following:

a. The tolerance on the depth of the box girder and crossbeam shall conform to AWS D1.5, Section 3.5.1.8.

b. Component walls of box girder shall be straight within 1:1000, measured in the direction of the axis of the girder or crossbeam, where the girder axis is defined to be in the longitudinal direction of the bridge and the crossbeam axis is defined to be along the transverse axis of the bridge. Local panel flatness between stiffeners shall conform to the requirements in AASHTO Standard Specifications For Highway Bridges, Sixteenth Edition 1996, Division II – Construction, Section 11.4.13.2.
c. The vertical web plates, transverse diaphragms and floor beam webs shall be within the plumbness and straightness tolerance in AWS D1.5 at any point along the member in the as-installed condition.
d. The maximum offset of members restrained against bending shall be as specified in AWS D1.5, Section 3.3.3.
e. At the floorbeam locations the box girder ribs shall be within 4 mm of their theoretical locations. At the end of each box girder segment, corresponding ribs shall align within 4 mm and surfaces to be in contact shall have an offset no greater than 2 mm after shimming. The alignment of shell plates, ribs, and other matching plates of each box girder segment or lift to the adjacent segment or lift shall be checked during fabrication using a rigid steel template or other equally positive method, as approved by the Engineer. In addition, the tolerance of the shell plates and ribs at each floor beam shall be checked using the floor beam or other rigid steel template, as approved by the Engineer.
f. Rib sweep in the plane of the shell plate shall not exceed 1:480 of the floorbeam or bulkhead spacing.

4. The dimensional tolerances for the fabrication, assembly, and erection of the tower, measured prior to cable erection, shall conform to the tolerances in AWS D1.5 and the following:

a. The centerline of the tower shall be plumb to within 1 mm in 2500 mm in any direction. The plumbness shall be verified at the strut elevations and at the top of the tower saddle grillage. For a given elevation, the location of the centerline of the tower shall be determined as the average of the surveyed locations of corner AE of the four shafts at that elevation. In addition, the out-of-plumbness of each tower lift, measured at corner AE, shall not exceed 1 mm in 1000 mm. The rotation relative to the theoretical orientation of each tower shaft about a vertical axis at corner AE, measured at the top of each lift and at the tower saddle grillage, shall not exceed 0.01 radian.
b. The tolerance for longitudinal, transverse and diagonal distances between any two tower shaft corners AE shall not exceed the greater of 1 mm in 250 mm or 10mm. This tolerance shall be measured at elevation 28.0 m, at all tower cross bracing elevations, and at the tower saddle grillage elevation. The tolerance for distances between opposing faces A and opposing faces E of tower shafts measured at all strut locations shall not exceed the greater of 1 mm in 250 mm or 10 mm.
c. The cross-sectional fabrication tolerance on the length of any chord connecting any two corners of a tower shaft shall not exceed the greater of 1:500 or 5 mm. This tolerance shall apply to the ends of fabricated segments. Shaft corners at elevation 3.125 m shall be fabricated to within 5 mm of the working points.
d. At each tower strut location, the relative vertical location of the tower diaphragms between adjacent tower shafts shall not exceed 20 mm. Shear links shall be level to within 1 mm in 1000 mm after connection to the tower shafts. Shim plates may be used at the flange splice plates. At each location, a single shim plate of up to 10 mm in thickness may be used. The tolerance in elevation of each diaphragm shall be 1.0 mm per 2000 mm of elevation or 10 mm, whichever is greater. All modified connections shall be subject to review and approval by the Engineer.
e. The tolerance on the location of the tower base plate is 10 mm with respect to the as-built foundation.
f. The misalignment of longitudinal stiffeners at bolted splices shall not exceed 4 mm. At welded splices, the misalignment of tower skin plates and the misalignment of longitudinal stiffeners shall not exceed 10% of the thinner plate thickness or 4 mm, whichever is smaller. The alignment of skin plates and stiffeners of any tower segment or lift to the adjacent segment or lift shall be checked during fabrication using a rigid steel template or other equally positive method, as approved by the Engineer. In addition, the tolerance of the skin plates and stiffeners at each diaphragm shall be checked using the diaphragm or other rigid steel template as approved by the Engineer.
g. The top surface of the tower saddle grillage top plate shall be level to within a tolerance of 1:1000.
h.. The tolerance for the height of the tower measured at the top of the tower saddle grillage is 75 mm and shall be taken after tower construction is completed and before cable erection.
i. The tolerance on the diameter of the tower anchorage anchor bolt holes shall be –0/+2 mm.
j. The tolerance for the locations of anchor bolt holes in the tower base plate is 2 mm. This tolerance is relative to the template of the as-fabricated tower footing provided by the State.
k. The tolerance for the location of the tower anchorage stiffeners Types 1 and 2 is ±3 mm.
l. The tolerance of the gap in the vertical direction for longitudinal stiffener bolted splice is –0/+4 mm.
m. The straightness of each tower lift, tower segment and tower skin plate/longitudinal stiffener between diaphragms shall satisfy the requirements of AWS D1.5-02 Section 3.5.

n. The tolerance on the location of longitudinal stiffeners in the tower shaft between diaphragms shall be 1:480 of the diaphragm spacing. The tolerance on the location of longitudinal stiffeners at tower shaft diaphragms shall be 2 mm for stiffeners along face A or adjacent to corners of the shaft, and 5 mm for all other stiffeners.

Welding of Closed Ribs to Box Shell Plate

A. Welding of closed ribs to box shell plates shall be accomplished with a welding process and procedure that achieves a minimum of 80% penetration of the rib thickness. Only SAW automated welding process shall be used. Closed ribs shall be clamped or tack welded in place, and both stems welded to the deck plate simultaneously. The Contractor's proposed process and rib groove detail shall undergo trials to obtain the optimum joint detail as defined below. In addition to these tests, the qualification procedure required by AWS D1.5 shall be followed. Production welding, with any of the processes tried, will not be permitted without the approval of the Engineer. Repair welding methods and procedures shall be approved by the Engineer.

B. Weld Procedure Trials– For closed rib welds to the deck plate, the Contractor shall perform weld trials on the mock-up using the mechanized SAW welding system that will be used in production. The qualification trial shall be run with the same number of ribs that will be run in production. The full number of macro specimens defined below shall be taken from a rib selected by the Engineer. All other ribs shall have 3 macros taken from each weld at locations selected by the Engineer.

Tack welding shall be considered as part of the weld qualification, including size and location of tacks, limits on essential variables and other qualification limitations.

The trials shall be conducted with welding machines, parameters, root openings and bevels as shown in the approved WQCP. Pre-bending, or other measures that will be used to control distortion during production, shall be defined and used during the trials. The weld trial shall be performed on the ribs of the mock-up. If tack welds will be used during production, tack welds shall be made at the maximum spacing to be used in production and prepared as will be done during production. During these trials, the welding shall be stopped at every 2.0 meters, and then restarted.

At completion of welding of all closed ribs to deck plate, the welded panels shall be checked for straightness and other production tolerances. The welded, unstraightened panel shall be flat within 3 in 1000. If the unstraightened panel is not flat within 3 in 1000, new measures such as different prebending or fixturing, shall be proposed, and new trial panels welded. If the flatness requirement is satisfied, all remaining plates of the deck plate section shall be welded on to complete the steel mock-up. Testing of the closed rib welds shall be conducted after welding of all components of the mock-up have been completed.

For panels that meet the visual and dimensional tolerance requirements, the welds shall be 100% ultrasonically tested to verify the required 80% penetration. The rib shall then be split in two and both stems shall be examined, after cutting and macroetching at anomalies as determined by UT and selected by the Engineer, but at least at the ends of the rib, at each tack weld and re-start locations and at intermediate points. At two tack weld locations on each weld, three macrosections shall be taken that represent the start, middle and end of the tack weld. Hardness tests shall be performed on these macrosections.

The evaluation criteria for the macroetched sections is as follows:

1. The minimum depth of penetration shall be 80% of the rib thickness, except that a depth of penetration not less than 70% of the rib thickness is permitted for isolated locations not exceeding 5% of the weld length, or 10% of the number of macro specimens, providing the effective weld size exceeds 80% of the rib thickness and all other requirements are satisfied.
2. The minimum partial penetration groove effective weld size shall be 80% of the rib thickness. For this evaluation, the effective weld size shall be defined as the smallest distance from any point at the root to an outside weld or plate surface, as measured in a macroetch section.
3. No gross notches or burn-through will be permitted at the rib inside surface, although uniform melt-through of reinforcement is acceptable. Melt-through or root reinforcement internal to the closed rib may have overlap not exceeding 2 mm. A gross notch is defined as an abrupt change of internal root reinforcement reentrant angle that is less than 90 degrees in any direction.
4. A uniform reinforcement fillet of between 2 mm and 5 mm shall be included.
5. The exterior surface profile shall meet AWS D1.5, Section 6.26.1 for a weld in a primary member with tension transverse to the weld axis. A maximum of 0.25 mm undercut is permitted.

6. Tack welds shall be incorporated into the final weld and shall not result in hard spots; uneven transverse notches; cracks or tears; or excessive thickness that results in local weld thickness variations greater than 3 mm.

Hard spots shall be determined by Vickers hardness measurements taken at 2 mm centers in the tack weld heat affected zones of both base plate and rib on the tack weld macrosections specified above. A hard spot shall be defined as a hardness value in the tack weld HAZ that exceeds 15% of the adjacent heat affected zone.

The worst of these macrosections that is acceptable to the Engineer will be considered qualified welds and will be used as standards for acceptance of production welds as monitored during fabrication.

C. Monitoring of Production Welds – During fabrication, weld monitoring tests shall be conducted for each operator on each welding machine at the start of each work shift. Test specimens shall consist of a separate piece of deck plate and rib. The rib shall be tack welded to the test piece the same as on the panel. Run-on and run-off tabs may be used if used in the production plates. If the equipment is used in production to simultaneously weld multiple ribs, then at least two ribs shall be welded during the test. The specimen shall be at least 500 mm long, and shall be examined 100% by UT. The specimen shall be macroetched 25 mm from each end, at a tack weld, and at two intermediate locations, as determined by the Engineer, immediately after welding.

In the event that the monitoring test specimens do not provide quality similar to those originally developed and accepted, fabrication shall cease. The welding parameters shall then be adjusted and production of qualified welds verified through two consecutive successful additional specimen trials approved by the Engineer before fabrication of deck panels is allowed to continue with the welding machine being monitored.

D. Panel Production – The dimensions of production panels of box shell plating shall be checked after welding. The welded panel, after straightening, if any, shall be flat within 5 mm in each 5 m length of box panels. Panels may be straightened using a written procedure that is in conformance to AWS D1.5 and is approved by the Engineer.

Ultrasonic technician shall be qualified using a mock-up weld with flaws that is approved by the Engineer.

If the flatness of more than one panel in five exceed 6 in 1000 after welding, the Contractor shall propose a revised assembly procedure, such as a different amount of pre-bending, and shall demonstrate the revised method by welding a new panel in the presence of the Engineer.

Production panels shall be nondestructively tested at the rate specified in these special provisions except that ultrasonic testing of the first two production panels shall include 100% of the tack welds. Ultrasonic testing of tack weld areas shall continue until no more than one in ten tack welds are rejected, after which random ultrasonic testing shall proceed at the rate indicated in the table specified in these special provisions. Ultrasonic testing of the PJP weld shall be in accordance with a written procedure that includes representative calibration standards with a 1.5 mm notch on the rib side and the plate side of the weld; that is demonstrated on a prototype panel segment that includes known flaws; and that is approved by the Engineer before use. Each ultrasonic technician shall be qualified using a mock-up weld with flaws that is approved by the Engineer.

WELDING PROCEDURE QUALIFICATION

A. Qualification of Welding Procedure – Qualification testing shall be conducted for all welds and weld details as specified hereunder. Procedure qualification records (PQR) pertaining to tests conducted within the last 30 months, witnessed by Caltrans, and certified to be accurate will be accepted if the test material thickness was equal to or greater than the material to be used on the project, and the properties and qualification details meet the requirements of these special provisions. Otherwise, new tests shall be conducted. Qualification tests shall be performed in accordance with AWS D1.5 except that the thickness of the test plate shall not be less than the maximum thickness to be welded using the qualified procedure or 100 mm, whichever is less. Groove weld macroetch tests per AWS D1.5 are required for qualification of all complete joint penetration and partial joint penetration weld joint details not specified in AWS D1.5, Figure 2.4 or Figure 2.5.

Unless otherwise specified herein, the ductility requirements shall be 22% elongation for a gage length of 50 mm in the reduced section of the reduced section tension specimens. The Charpy V-Notch impact toughness requirements for weld metal are stipulated above under "Materials" or in AWS D1.5 if not specified therein. Charpy V-Notch impact tests shall also be taken from the coarse grain heat affected zone (HAZ) for steels with HAZ toughness requirements stipulated above under "Materials."

INSPECTION AND TESTING

The Contractor shall provide the Engineer with work schedules, and expected readiness of work for quality assurance (QA) inspection by the Engineer. The Contractor shall maintain records of all QC testing and measurements specified and such records shall be made available to the Engineer upon request, unless otherwise specified.

Full access shall be provided for the Engineer to conduct VT for not less than 60 hours from the time the weld is completed.

Magnetic particle examination shall be performed using the yoke method for all steel grades with a specified minimum yield strength of 485 MPa or more.

All welds shall receive 100% visual examination. Visual inspection shall not be considered a NDT method. The extent of non-destructive examination is specified below, unless specified elsewhere in these special provisions.

This table supercedes AWS D1.5, Sections 6.7.1 and 6.7.2.

COMPONENT	Weld Type			Extent & Type of Testing			Notes
	CJP	PJP	Fillet	RT	UT	MT	
1.BOX GIRDER 1.1 Box Shell							
Transverse splice weld shop (Deck plate: A) field	X X			5% 5%	100% 100%	 100%	
Transverse splice weld shop (Side plate: B,F) field	X X			5% 5%	100% 100%	 100%	
Transverse splice weld shop (Bottom plate: D) field	X X			5% 5%	100% 100%	 100%	
Transverse splice weld shop (Side plate: C,E,G,H,I,L,M,N,"K" &"Vertical") field	X X				** **		
Transverse splice weld shop (Bottom plate: D) field	X X			5% 5%	100% 100%	 100%	
Transverse splice weld shop (Side plate: B,C,E,F,G,H,I,L,M,N, "K" &"Vertical") field	X X				** **		
Longitudinal weld: Deck plate: A	X			15%	100%		
Longitudinal splice weld (Bottom plate: D)	X				100%		
Longitudinal splice weld (Side plate: C,E,G,H,I,L,M,N,"K" &"Vertical")	X				100%		(B & F are n/a)
Box corner welds	X	 X	 X		100%	 100%	
Closed rib splice	X				100%		
Closed rib to shell plate:		X			15 %	2 5%	UT Shall include at least 15% of the tack welds
Open rib to box plate			X			15%	
Floorbeam to Deck plate	X		 X		100%	 50%	
Floorbeam to Deck plate			X			25%	
Floorbeam to other box shell plates At Crossbeam penetrations	X	 X	 X		100%	 25%	

	Weld Type			Extent & Type of Testing			
Elsewhere			X			10%	
Longitudinal Shear Plate to Deck Plate			X			25%	
Longitudinal Shear Plate to other Box shell plates			X			10%	
Deck plate to drain plates	X				15%		
Deck plate transverse splice at Seismic Joint	X	X			100% 100%		
Diaphragm plate to closed rib	X	X			100%	100%	Tension acceptance criteria for PJP weld
1.2. Box Internal Stiffening							
Floorbeam splice: Bottom 1 m Remainder of lower half Upper half	 X X X				 100% 50% 15%		
Floorbeam Diaphragm to rib	X	X	X			100% 25%	
Floorbeam Vertical splice: Lower half Upper half	 X X				** 100% 15%		
Floorbeam Diaphragm to rib	X		X		100%	25%	
Ground end of diaphragm to closed rib weld for full length of grinding plus 50mm each end	X	X	X			100%	Additional to NDT specified for weld
Longitudinal Shear Plate to Floorbeam	X	X	X		100%	15%	
Longitudinal Shear Plate Vertical splice	X				**		
Longitudinal Shear Plate to top and bottom plate	X		X			15% 15%	
1.3. Girder at Piers							
All SPCM welds	X	X	X	15%*	100% 100%	100%	* RT+UTfor butt welds (% shown) & butt repairs (100%)
Non-SPCM Welds	Per Sections 1.1, 1.2 & 1.5 of this Table						
Saddle Grillage welds	X	X	X		25%	25%	
Saddle welds	X	X	X		25%	25%	
1.4 Hinge K							
1900 dia tube Longitudinal & Girth welds	X			100%	100%	100%	

	Weld Type			Extent & Type of Testing			
Ring Stiffener & End Plate to 1900 dia tube	X				100%	100%	
Radial Bearing Plates to 1900 dia tube	X				100%	100%	
Other Hinge and Hinge back-up welds	X	X	X		100%	25% 25%	
Stainless steel overlay plus 100mm of tube at each end of overlay							100% PT per AWS D1.6
1.5 Other box welds							
SPCM Cable Bracket welds	X	X	X	15%*	100% 100%	100%	* RT+UTfor butt welds (%) & butt repairs (100%)
Deviation & Jacking Frame Saddles: Plates to Castings	X	X	X		100%	100% 25%	
Deviation & Jacking Frame Saddles: Plate welds	X	X	X		100%	100% 25%	
Other Welds in SPCMs	X	X	X	15%*	100% 100%	100%	* RT+UTfor butt welds (% shown) & butt repairs (100%)
Other welds	X	X	X		25%	10% 10%	
Ends of welds at locations of required grinding for full length of grinding plus 50 mm each end	X	X	X			100%	Additional to NDT specified for weld
2. CROSSBEAM							
All SPCM Welds	X	X	X	15%*	100% 100%	100%	* RT+UTfor butt welds (% shown) & butt repairs (100 %)
Other welds	X	X	X		25%	10% 10%	
Ends of welds at locations of required grinding for full length of grinding plus 50 mm each end	X	X	X			100%	Additional to NDT specified for weld

	Weld Type			Extent & Type of Testing			
3. TOWER							
Skin plate butt welds: Horizontal	X				100%		
Skin plate butt welds: Vertical	X				100%		
Longitudinal Stiffener butt welds	X				100%		
Longitudinal stiffener to skin plate	X	X	X		100% 50%	25%	
Diaphragm butt welds	X				100%		
Diaphragm to Skin Plate	X	X	X		100% 50%	25%	
Diaphragm to Longitudinal Stiffener (incl. Fit Lugs)	X	X	X		100% 25%	25%	
Tower Strut Welds & Cross Bracing Welds	X	X	X	15%*	100% 100%	100% 100% 100%	* RT+UTfor butt welds (% shown) & butt repairs (100%)
Grillage welds	X	X	X		100% 25%	25%	
Tower Saddle welds	X	X	X		100%	100% 100% 100%	
Skin Plate to Tower Base Plate	X				100%		
Bearing Stiffener Welds at Tower Base Anchor Bolt Assemblies	X	X	X		25%	25%	
Other SPCMcomponents	X	X	X	15%*	100% 100%	100% 100% 100%	* RT+UTfor butt welds (% shown) & butt repairs (100%)
Other Tower welds	X	X	X		25%	10% 10%	
Tower Base Shear Plates to the Skin Plate	X				100%		
OTHER WELDS NOT SPECIFIED ABOVE							
Welds in SPCMs	X	X	X	15%*	100% 100%	100% 100% 100%	* RT+UTfor butt welds (% shown) & butt repairs (100%)
Other welds	X	X	X		25%	10% 10%	

	Weld Type			Extent & Type of Testing			
Ends of welds at locations of required grinding for full length of grinding plus 50mm each end	X	X	X			100%	Additional to NDT specified for weld

Notes:

1) Vertical butt joints marked ** in the table shall be tested as follows:
   (a) 1/6 of the web depth beginning at each end of weld, unless otherwise noted, shall be tested 100 %
   (b) 25 % of the remainder shall be tested.
2) If unacceptable discontinuities are found in a joint with 100% NDT, the repairs shall be completed and then re-examined by the same NDT method along with an additional 50 mm at each end of the weld repair, for a minimum total additional length of 100 mm.
3) If unacceptable discontinuities are found in a joint with a specified percentage of testing of NDT less than 100 %, including RT examination of butt weld repairs, the repairs shall be completed and then re-examined by the same NDT method along with an additional 50mm at each end of the weld repair, for a minimum total additional length of 100mm for the repair re-examination. Two additional previously untested segments, each at least 10% of the total weld length, on each side of the repair, for a total additional length of 20%, shall be tested with the same NDT method. If additional unacceptable discontinuities are found as a result of this testing, then 100% of the remaining untested portion of the weld shall be tested with the same NDT method. All weld repairs shall be tested with the same NDT method that located the original defect.
4) Where the specified percentage of testing is greater than 25%, the specified length of each weld shall be tested.
5) Where the specified percentage of testing is 25 %, each weld that is 1.5 m long or more shall be examined over 25 % of the weld length. Welds under the same table category in the same component that are less than 1.5 m long may be lot examined by testing one weld 100 % for each lot of four welds.
6) Where the specified percentage of testing is 15 %, each weld that is 2.5 m long or more shall be tested over 15 % of the weld length. Welds under the same table category in the same component that are less than 2.5 m long may be lot examined by testing one weld 100 % for each lot of seven welds.
7) Where the specified percentage of testing is 10 %, each weld that is 4.0 m long or more shall be examined over 10 % of the weld length. Welds under the same table category in the same component that are less than 4.0 m long may be lot examined by testing one weld 100 % for each lot of ten welds.
8) For lot examination, if unacceptable discontinuities are found in the weld tested, the remainder of that weld shall be tested, and a second weld in the lot will be chosen by the Engineer and shall be tested. If unacceptable discontinuities are found in the second weld, the entire lot shall be tested.
9) UT examination of PJP welds shall confirm the specified weld size and, for weld sizes greater than 15mm, shall also evaluate the accessible weld volume to the requirements of AWS D1.5 for welds in compression.
10) Welds, and adjacent parent material within 10 mm of all accessible areas surrounding the weld, in grades with strength levels of 485 and above shall be tested 100% by MT in addition to other specified inspection. The timing of visual and any method of NDT for welds in these steels shall be in accordance with AWS D1.5, Section 12.16.4.
11) Welds made by either the electroslag or electrogas processes shall be examined 100% by both radiographic and ultrasonic testing.
12) Scanning for ultrasonic examination of corner, tee and cruciform welds in thicknesses greater than 50 mm shall include base metal behind and adjacent to the welds. Lamellar tearing discontinuities that exceed 3 mm or that lie within 10 mm of the surface shall be repaired.
13) SPCMs shall include welds connecting SPCM's to other members."

Acceptance

For purposes of acceptance, all CJP welds shall be considered to sustain tension, except for those otherwise shown on the plans. PJP and fillet welds shall meet the acceptance criteria for welds in compression, except as specified for the orthotropic deck.

Pressure Test

Where a pressure test is specified on the plans, such as to verify the integrity of closed rib sections, the air tightness of the enclosed area shall be pressure tested. The air pressure used for the test shall be 0.2 bar. The enclosed area shall be pressurized, and then isolated by closing the fill valve. Valves shall be placed in the end diaphragm of the rib. A calibrated pressure gage with suitable precision shall be monitored over a period of 2 hours. The pressure shall not drop by more than 10%. Compensation for pressure variations due to temperature changes shall be permitted within a range of 5 degrees Centigrade.

Five percent of ribs between bolted splices shall be leak tested. If leaks are detected, all of the rib spaces within the panel shall be subjected to leak testing. The Contractor shall repair the defects at the Contractor's expense.

FIELD WELDING

Field fabricators and erectors shall be certified under the AISC Quality Certifications Program, Category CASE, Certified Advanced Steel Erector.

Field welding shall comply with all provisions under "Shop Welding," of these special provisions.

All joints that are to be field welded shall be protected from corrosion and contaminants during storage, shipping, and until the joints are ready to be welded.

For the field transverse orthotropic box girder welds, the following shall apply:

The Contractor shall perform all trial welding and procedure development prior to production field welding of transverse welds of the orthotropic box girder. During production field welding of the transverse joint, the Contractor shall completely weld, inspect and perform the NDT required at the first joint and submit the results to the Engineer for approval prior to proceeding to the next joint. If the NDT rejection rate exceeds 30% of the weld length, the Contractor shall revise his procedure and submit a formal report to the Engineer stating the reason for the defects and a plan to prevent these defects from recurring and to reduce the rejection rate to less than 10 percent of the entire welded length in subsequent welds. The Contractor will then be allowed to proceed to completely weld, inspect and perform the NDT required at the second joint with the revised procedures. If the NDT testing indicates that defects are present in less than 10 percent of the entire transverse weld length, the Contractor will be allowed to weld multiple transverse joints simultaneously. If during the welding of the second transverse weld joint, there are defects found in 10 percent or more of the weld joint length, the Engineer shall have the authority to stop work and request a formal report from the Contractor stating the reason for the defects and a plan to prevent these defects from recurring. No additional compensation will be made to the Contractor for any delays caused by this stoppage of work. If after completion of a weld joint with less than 10 percent defects, the Contractor chooses to change any essential variables in the welding process, and that process is approved by the Engineer, the Contractor may not weld multiple weld joints until one weld joint is successfully welded and NDT testing of the joint is performed that reveals defects in less than 10 percent of the length of the weld.

The Contractor shall provide suitable enclosures to permit field welding during inclement weather, which includes local wind speeds in the vicinity of the weld exceeding that specified in AWS D1.5, or 30 kilometer per hour, whichever is less. Field welds for the tower, box girder and crossbeams shall be performed in suitable enclosures that protect the weld area from winds and other deleterious environmental exposure, as approved by the Engineer. Provisions shall be made to control atmospheric conditions inside the enclosures with limits suitable for field welding in accordance with the requirements of AWS D1.5 and "Welding" of these special provisions.

No extension of contract time will be granted and no additional compensation will be allowed as a result of weather conditions which exceed the limits for field welding designated herein, except as approved by the Engineer.

GMAW for field welding will not be permitted.

Field welding of tower, crossbeam and box lifts shall conform to the following.

A. Mechanized processes such as SAW or automated FCAW shall be used for field welding of the tower skin and crossbeam and box shell plates. At locations where the Engineer determines that mechanized processes are not feasible or practical, an alternative process may be used as approved by the Engineer.
B. The sequence of welding and bolting shall follow the approved fabrication procedure.
C. For welds with required preheat temperatures greater than 65° C, preheat temperatures shall be achieved and maintained using electric resistance heating bands for the entire length of the weld. The heaters shall be controlled by attached thermocouples at spacing not exceeding 2 m. For these welds, the minimum preheat temperature shall be maintained continuously from beginning to completion of the entire weld, even if welding is interrupted.
D. Steel backing shall be removed, and the back side cleaned to sound metal and welded, unless shown otherwise on the Plans or approved by the Engineer.
E. The final weld surface shall be ground smooth and flush. The direction of final grinding marks shall be parallel to the axis of the tower or bridge.
F. The timing of final visual and nondestructive examination shall be in accordance with AWS D1.5, Section 12.16.4.
G. Welding procedures for field welding of deck/shell plating for box and crossbeam lifts shall be qualified with a minimum of three strongbacks that are a minimum of 20 mm thick to simulate the restraint during the field welding.

MEASUREMENT AND PAYMENT

Payment for structural steel shall conform to the provisions in Section 55-4.02, "Payment," of the Standard Specifications and these special provisions.

Structural steel for use in bridge structures will be paid for at the contract price per kilogram for furnish structural steel and the contract price per kilogram for erect structural steel of the types listed in the Engineer's Estimate, except as noted.

The contract price paid per kilogram for furnish structural steel of the types listed in the Engineer's Estimate shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in furnishing, fabricating and delivering structural steel to the job site, ready for erection, including furnishing all bolts, nuts and washers, stud connectors, welding materials, asbestos sheet packing, preformed fabric pads and elastomeric bearing pads, or other materials required for the erection and connection or splicing of the structural steel; galvanizing the structural steel when galvanizing is required by the specifications or plans; and conforming to the qualification and testing requirements associated with member fabrication; as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Costs for preparing working drawings in excess of amounts allocated in "Accelerated Working Drawings Submittal" item shall be considered as included in contract prices paid for the various items of work and no additional compensation will be allowed therefor.

The contract price paid per kilogram for erect structural steel of the types listed in the Engineer's Estimate shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in erecting the structural steel, complete in place, including connecting and splicing the structural steel; installing stud connectors; placing asbestos sheet packing, preformed fabric pads and elastomeric bearing pads; furnishing and applying caulk; furnishing and placing mortar for masonry or bearing plates and anchor bolts; checking bolt tension; and conforming to qualification and testing requirements associated with member erection, connection or splicing; as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Furnish structural steel (bridge) and erect structural steel (bridge) shall include the following items of work:

A. West jacking frame
B. Closure Joint
C. West deviation saddle housing
D. Extra-strong steel pipe for the cable tie-down
E. East saddle housing
F. Pier E2 bearing anchor rods

Light support materials and luminaire support boxes attached to the box girder will be measured and paid for as furnish structural steel (bridge)(box girder) and erect structural steel (bridge)(box girder).

Light support materials and luminaire support boxes attached to the bikepath will be measured and paid for as furnish structural steel (bridge)(bikepath) and erect structural steel (bridge)(bikepath).

Installation of metal benches at the East-end belvedere of the bikepath will be measured and paid for as erect structural steel (bridge)(bikepath).

Spare tower struts will be measured by the unit as furnish structural steel (bridge) (tower strut).

The contract unit price paid for furnish structural steel (bridge) (tower strut) shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in furnishing, fabricating and delivering spare structural steel tower struts to the location specified by the Engineer, including cleaning and painting, and conforming to the qualification and testing requirements associated with member fabrication, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract price paid per kilogram for furnish structural steel (bridge) (saddle) shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in furnishing, fabricating and delivering structural steel to the job site, ready for erection, including furnishing all bolts, nuts and washers, tie-rods, studs, welding materials, and any other materials required for the erection and connection or splicing of the structural steel saddles and conforming to the qualification and testing requirements associated with saddle fabrication; as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract price paid per kilogram for erect structural steel (bridge) (saddle) shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in erecting the structural steel saddles, complete in place, including connecting and splicing the structural steel saddles; installing bolts; checking bolt tension; and conforming to qualification and testing requirements associated with member erection, connection or splicing; as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Spare pipe beam fuses will be measured by the unit as furnish structural steel (bridge) (pipe beam fuse).

The contract unit price paid for furnish structural steel (bridge) (pipe beam fuse) shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in furnishing, fabricating and delivering spare structural steel pipe beam fuses to the location specified by the Engineer, including cleaning and painting, and conforming to the qualification and testing requirements associated with member fabrication, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Installation of pipe beams for Hinges AW and AE will be measured by the unit as install structural steel (bridge) (pipe beam).

The contract unit price paid for install structural steel (bridge) (pipe beam) (Hinges AW and AE) include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in installing structural steel pipe beams at Hinges AW and AE, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for providing and maintaining enclosures to permit field welding shall be considered as included in the contract prices paid per kilogram for furnish structural steel, of the types listed in the Engineer's Estimate, and no additional compensation will be allowed therefor.

Full compensation for mock-ups and welding qualification procedures and testing shall be considered as included in the contract prices paid per kilogram for furnish structural steel, of the types listed in the Engineer's Estimate, and no additional compensation will be allowed therefor.

Full compensation for furnishing and installing HDPE pipe shall be considered as included in the contract prices paid per kilogram for furnish structural steel, of the types listed in the Engineer's Estimate, and no additional compensation will be allowed therefor.

Full compensation for repairing damaged paint surfaces shall be considered as included in the contract prices paid per kilogram for erect structural steel, of the types listed in the Engineer's Estimate, and no additional compensation will be allowed therefor.

Full compensation for prestressing high-strength A354 bolts shall be considered as included in the contract price paid per kilogram for erect structural steel, of the types listed in the Engineer's Estimate, and no separate payment will be made therefor.

The sixth paragraph of Section 55-4.02 "Payment," of the Standard Specifications shall not apply.

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

If a portion or all check samples are removed at a mill more than 480 air line kilometers from both Sacramento and Los Angeles, shop inspection expenses will be sustained by the State which are in addition to expenses incurred for fabrication site inspection. Payment to the Contractor for furnishing structural steel will be reduced $2,000 for each mill located more than 480 air line kilometers from both Sacramento and Los Angeles.

10-1.60 CABLE SYSTEM

GENERAL

Description

Cable system shall consist of construction of the shop prefabricated parallel wire strand (PWS) cable system and the suspender system, in accordance with the details shown on the plans, the provisions in Section 55, "Steel Structures," of the Standard Specifications and these special provisions.

The PWS cable system shall consist of furnishing, fabricating, and erecting the shop prefabricated parallel wire strands, strand sockets, strand anchor rods, shims and nuts, cable wrapping wire, zinc paste, cable bands, cable-band bolts, cable-band caulking, cable shrouds, cable hand ropes, hand-rope anchors, hand-rope supports, hand-rope gates, and appurtenances.

The suspender system shall consist of furnishing, fabricating, and erecting the suspender ropes, suspender rope sockets, suspender rope separators, suspender rope anchor rods and nuts, split collars, elastomeric collars, keeper angles, keeper bolts, shims, suspender clamps, and appurtenances.

Cable saddles shall conform to "Steel Structures" of these special provisions.

The Cable System shall be cleaned and painted in accordance with "Clean and Paint Cable System" of these special provisions.

Prequalification

Attention is directed to "Pre-Award Information/Questionnaire," of these special provisions.

Cable System Quality Control

The Contractor shall designate in writing a Cable System Quality Control Manager (CQCM). The CQCM shall be responsible to the Contractor for the quality control of furnishing and fabricating the Cable System including the materials testing program.

The CQCM shall not be employed by or compensated by any subcontractor, or by other persons or entities hired by subcontractors who will provide services or materials for the project. The CQCM may be an employee of the Contractor.

The CQCM shall be the individual solely responsible to the Contractor for submitting and receiving all correspondence, submittals, and reports regarding the furnishing and fabricating of the cable system sent to and received from the Engineer.

The CQCM shall review, guide, and monitor the shop inspection and shop quality control program, make shop visits at various stages of fabrication as required, and issue certificates of compliance to the Engineer for the materials and fabrication of the cable system.

The CQCM shall prepare test procedures and programs for testing the materials in the Cable System for compliance with the requirements in these special provisions. The CQCM shall review the materials test results, obtain and review certificates of compliance from the suppliers of materials for the Cable System, and submit these results to the Engineer.

Working Drawings

The Contractor shall submit working drawings for the construction of the cable system to the Engineer for approval in conformance with the provisions in "Working Drawings" and "Accelerated Working Drawing Submittals" of these special provisions.

The working drawings shall contain all information required for furnishing, fabricating, and erecting the cable system including, but not limited to, the following:

A. Complete PWS cable system fabrication engineering documents and supporting calculations for the manufacture of cable wire and fabrication of the shop fabricated parallel wire strands (PWS) including, but not limited to, the following:

   1. Complete cable wire manufacturing drawings showing the cable wire drawing process, cable wire galvanizing process, cable wire coiling process, storage of the completed cable wires, and transportation methods for delivering the cable wire to the strand fabrication shop.
   2. Written procedures for the cable wire drawing process, cable wire galvanizing process, coiling the cable wires, protection and storage of the coiled cable wire, and transportation methods for delivering the cable wire to the strand fabrication shop.
   3. Written procedures for quality control and testing during the cable wire manufacturing procedures.
   4. Fabrication drawings showing the shop layout for the fabrication of the shop prefabricated parallel wire strand, procedures for measuring strand length for cutting and socketing, procedures for socketing strands, storage of the shop prefabricated strands, and transportation methods for delivering the shop prefabricated strands to the bridge site.
   5. Written procedures for the fabrication of the shop prefabricated parallel wire strands, storage of the cable wires, storage of the shop prefabricated strands, and transportation methods for delivering the shop prefabricated strands to the bridge site.
   6. Written procedures for quality control and testing during the fabrication of the shop prefabricated parallel wire strands.

B. Complete suspender system fabrication engineering documents and supporting calculations for furnishing and fabricating the suspender system including, but not limited to, the following:

   1. Suspender ropes manufacturing procedures.
   2. Written procedures for quality control and testing during suspender rope manufacturing procedures.
   3. Written procedures and drawings for stretching, measuring, and socketing the suspender ropes.

C. Complete cable system construction engineering documents and supporting calculations for erection and monitoring of the cable system including, but not limited to, the following:

   1. Erection drawings, written procedures, and calculations showing the temporary works required for the cable system construction, including, but not limited to, footbridges, cross walks, hand ropes, storm restraint system, tramway hauling system, strand storage, unreeling equipment, and temporary cranes.
   2. The Contractor shall develop and verify, as part of his Erection Plan, a set of weights, reactions, cambers, cable profiles, and suspender forces, which are consistent with a moment diagram that lies within the range of the allowable moments shown on the plans. The computed as-built suspender forces of the Contractor's Erection Plan shall henceforth be referred to as suspender load.

3. Erection drawings and written procedures showing each sequence for each stage of construction of the cable system and transfer of the suspender load to the cable system, including the method of transferring the load through the suspender system to the PWS cable system.
4. Calculations for each sequence of each stage of construction of the cable system and transfer of the suspender load to the cable system.
5. Establishing three-dimensional coordinate geometric control points for surveying and measuring the self-anchoring suspension structure for each stage of construction of the cable system and transfer of the suspender load to the cable system.
6. Calculations for the three-dimensional geometric control points for surveying and measuring the self-anchoring suspension structure for each stage of construction including positioning of the tower saddle and the jacking saddle and transfer of the suspender load to the cable system.
7. Substantiating calculations for the forces and stresses in the cable system and in the steel box girders and cross beams during the cable system construction including the final set of forces and stresses after the completion of cable system construction and transfer of the suspender load to the cable system.
8. Written procedures and drawings showing the cable compaction procedures.
9. Written procedures and drawings for cable wrapping procedures.
10. Erection drawings for installation of the handropes.
11. Written procedures and drawings for installation of cable bands, tightening cable band bolts, and cable band caulking.
12. Written procedures and drawings of the procedures for the friction test of the cable bands.
13. Erection drawings showing the installation of the suspender system.
14. Calculations indicating the void ratio within the saddles.

D. Record of Project Tests

At the completion of testing, the Contractor shall gather all test data and submit it to the Engineer in a final report. The final report shall include the following:

1. Laboratories where tests were conducted
2. Certificates of calibration
3. Names of standard tests
4. Photographs of the test apparatus
5. A brief description of what is being tested and all test data, including stress strain curves or load deformation curves, and test data from manufacturers.

The report shall be submitted in a format approved by the Engineer. A draft copy shall be reviewed and approved by the Engineer before the final report is submitted. Twenty bound hard copies and two electronic copies of the approved final report shall be submitted to the Engineer.

The Contractor shall allow the Engineer 60 days to review and approve the cable system working drawings.

Shipping, Handling and Storing Materials

Each heat of steel used for the rod stock used for manufacturing the cable wire shall be identified by a reference number indicating the name of the supplier and date of production, and shall have attached a copy of the mill report for that heat number. The cable wire manufacturer shall track each heat number of the rod stock used in the cable wire drawing process and shall tag each production lot of cable wire with the heat number in such a manner that each production lot of cable wire can be traced back to the original heat numbers.

After drawing and galvanizing, the cable wire shall be formed into coils with a barrel diameter not less than 1500 mm. The finished coil shall be wrapped to protect the wire from damage during shipping and storage. Each coil shall be tagged with a serial number that indicates the heat numbers of the steel that was used to produce the cable wire, and the length and weight of cable wire. The serial number shall be transferred and attached to any wire specimen cut from the coil for testing. Cable wire shall be coiled in such a manner that it can be continuously uncoiled without damage.

After manufacturing, individual shop prefabricated parallel wire strands shall be reeled onto shipping reels with a barrel diameter not less than 2000 mm. Each reel shall be tagged with a strand serial number for that reel that indicates the serial numbers of the coils of cable wire that were used to produce the shop prefabricated parallel wire strand on the reel, the length and location within the cross section of the strand, and the weight of the strand and the total weight of the reeled package. Shop prefabricated parallel wire strands shall be reeled in such a manner that the strand can be continuously unreeled without damage to the strand. The reels shall be wrapped to protect the strand from damage during shipping and storage. Prior to strand shipping, sockets shall be securely fastened to the reel flanges. Sockets shall not bear against the strand wires. Reels

shall be stored within clean, dry enclosures until incorporated into the work. The Contractor shall provide suitable enclosures to prevent moisture from accumulating on the strands. Reels shall be lifted from suitable lifting points located on each flange.

MATERIALS AND FABRICATION

General

Material used for the permanent structure shall be purchased new specifically for this contract. The Contractor shall purchase sufficient quantities of material considering the requirements for supplementary material testing, including material for testing as specified herein.

Cable system materials inspection shall conform to the provisions of Section 55-1.03, "Inspection," of the Standard Specifications.

Cable Wire

Cable wire shall be manufactured from steel produced by the basic oxygen or electric furnace process. Wire rod shall be rolled on a rod mill and coiled for shipment to the wire mill. Rods, bright wire, and galvanized wire shall be marked and kept segregated for identification of heat and serial numbers during manufacture.

Where the wire is manufactured from two or more rods joined by welding, the wire mill shall tension test the weld to demonstrate that the weld, after the wire drawing operation, develops mechanical properties consistent with the minimum specified strength and ductility for the wire. The wire mill shall produce test evidence from a minimum of 20 tests performed in the past attesting to the record of performance of the welding procedure. In addition, the Contractor shall conduct a minimum of three tests on welded joints on the drawn wire, using the proposed welding procedure. All three tests shall produce the minimum specified properties for yield strength, ultimate strength, percent elongation, and torsional ductility.

If any weld fails to produce the minimum specified properties, the cable wire manufacturer shall stop wire drawing production, investigate the cause of the low-strength weld, correct the welding process and perform additional tension testing before resuming wire drawing production. The batch of wire manufactured from the last successful tension test to the stoppage of production will be rejected until proof is submitted that the wire does meet the specifications.

After drawing is completed, wire shall be hot dip galvanized in molten zinc of purity not less than 99.90 percent conforming to the requirements of ASTM Designation: B6 - High Grade.

A chemical analysis to determine the composition of the steel shall be made by the manufacturer during the pouring of each heat of steel. A copy of this analysis, certified by the manufacturer, shall be furnished to the Engineer immediately on the completion of the analysis. The steel shall conform to the following requirements for chemical composition on cast analysis:

	Percent
Carbon	0.78 to 0.85
Silicon	0.15 to 1.00
Manganese	0.60 to 0.90
Phosphorus	Not Exceeding 0.025
Sulfur	Not Exceeding 0.025
Copper	Not Exceeding 0.10
Nickel	Not Exceeding 0.10
Chromium	Not Exceeding 0.10
Other Elements	Not Exceeding 0.07

Product analyses shall be performed on the finished cable wire or rod. The samples for product analyses shall be taken from any portion of the material, as directed by the Engineer. The steel shall conform to the following requirements for chemical composition variance:

	Over Max.	Under Min.
Carbon	0.01	0.02
Silicon	0.05	0.0
Manganese	0.02	0.02
Phosphorus	0.004	
Sulfur	0.004	
Copper	0.0	
Nickel	0.0	
Chromium	0.0	

Product analysis tests shall be conducted on a minimum of 10 samples of random heats. Material from the heat for which test samples do not meet the specified requirements shall be rejected. The Contractor shall provide additional testing, as directed by the Engineer, to ensure the steel quality in other cable wire produced from the same heat as the failed specimen. For each failed specimen, testing shall consist of a minimum of 2 additional samples from the same heat. If either of the additional samples do not meet the specified requirements, the heat will be rejected. Additional testing shall be completed at the Contractor's expense as approved by the Engineer.

Galvanized cable wire shall have the following mechanical properties measured on the gross cross-sectional area:

Tensile Strength:	1760 $N/mm^2 < Fu < 1960$ N/mm^2
Yield Stress:	The 0.2 percent elongation yield stress shall be not less than 1350 N/mm^2 in a 250 mm gauge length and with a tensioning speed of 30 mm/min
Proportional Limit	Shall be measured and reported
Modulus of Elasticity	200,000 $N/mm^2 \pm 5$ percent
Elongation:	Not less than 4 percent in a 250 mm gauge length
Reduction in Area:	Not less than 35 percent with a clear cup and cone fracture
Torsional Ductility	Not less than 14 revolutions in a gauge length of 100 times the wire diameter and with a torsional speed of 20 rpm
Wire Diameter Tolerance	The bare wire shall be measured at the minimum diameter and at a diameter perpendicular to the minimum. The area of the bare wire so measured and calculated as an ellipse shall be not less than 95.6 % of the nominal wire area. The galvanized wire diameter shall be measured with a micrometer sensitive to 0.01 mm. At a measuring point, the largest diameter shall be measured first and the second measurement shall be taken at 90 degrees from the first. Each of the two readings shall be repeated twice and averaged. The average of the two readings shall be within plus 0.08 mm and minus 0.04 mm from the nominal diameter shown on the plans. The difference of the two readings shall not be greater than 0.08 mm.
Zinc Coating:	The zinc coating shall be uniform and have a weight of not less than 300 g/m^2 when measured in accordance with the requirements of ASTM Designation: A90
Uniformity of Zinc Coating	4 one minute immersions in accordance with the requirements of ASTM Designation: A239
Zinc Adhesion	Wrap 2 close turns around a cylindrical mandrel with a diameter of 5 times the wire diameter without cracking the zinc coating in accordance with the requirements of ASTM Designation: A586
Wire Straightness	a) A maximum of 230 mm arc-to-chord offset in a 3.0 m chord length measured on a cable wire under no tension resting on a smooth, flat surface. b) No kinks, bends, or wavy conditions under tension (see test description below.

The minimum number of tests to be carried out for the various properties of the cable wire is as follows:

Test	Minimum Number of Tests
Tensile Strength, Yield Stress, Proportional Limit, Percent Elongation and Modulus of Elasticity	One test piece taken from each end of every coil or fraction thereof
Elongation and Reduction in Area	One test piece taken from each end of every 10th coil or fraction thereof
Torsional Ductility	One test piece taken from one end of every 10th coil or fraction thereof
Diameter	One test piece taken from one end of every coil
Zinc Coating	One test piece taken from one end of every 5th coil or fraction thereof
Uniformity of Zinc Coat	One test piece taken from one end of every 5th coil or fraction thereof
Zinc Adhesion	One test piece taken from one end of every 10th coil or fraction thereof
Wire Straightness	One test piece taken from one end of every 5th coil or fraction thereof

If the wire fails in the first test to meet any requirement of this section, two additional tests shall be made on samples of wire from the same coil. If failure occurs in either of these tests, the coil of wire shall be rejected.

A stress-strain curve shall be obtained to determine the proportional limit, the yield stress using the 0.2 percent offset strain method, the ultimate strength and the elastic modulus. Extensometer readings shall be taken continuously or at every 50 microstrains or less. The gauge length shall be 250 mm and the extensometer shall be sensitive to 0.125 mm. The load shall be applied steadily at a rate not greater than 5 mm per minute.

To test for elongation and for reduction in area, a 250-mm gauge length shall be marked on the specimen and the load applied until the specimen breaks and the ultimate load recorded. Tests in which fracture occurs outside the central 200 mm of the gauge length shall be discarded and the test repeated on an additional sample from the same coil until a fracture is obtained within the central 200 mm. The broken parts of the test lengths shall be reassembled to obtain proper contact between the broken parts and the distance between gauge marks shall be measured. The extension of this distance from the original 250 mm shall be not less than 10 mm.

The reduction in area shall be determined on this same specimen by measuring the diameter of the reduced section at the break in two directions and calculating the area. The reduction in area from the original measured area of the cable wire shall be not less than 35 percent.

Zinc coated cable wires shall be tested for specified weight, uniformity, and adhesion of the zinc coating in conformance with the requirements of ASTM Designations A 90 and A 239. The uniformity of zinc coating shall be visually inspected on the finished coils. Coils will be rejected if discontinuities in the zinc coating are present.

For testing straightness, a 10-m length of cable wire shall be placed under a tension of 1500 N and shall not exhibit any kinks, bends, or wavy conditions.

During the production of cable wire, the Contractor shall avoid any manufacturing processes after galvanizing. If the Contractor proposes any manufacturing processes after galvanizing, the Contractor shall demonstrate to the Engineer that zinc coating will not be damaged as a result of any proposed manufacturing processes after galvanizing.

Shop Prefabricated Parallel Wire Strand (PWS)

The shop fabrication of PWS shall account for the angle changes occurring at cable saddles and within the cable geometry as shown on the plans. Wire length within a strand shall be calculated according to the assigned radii. The top or side of a strand shall be marked for the purpose of orienting it in the field.

Parallel wire strands shall be shop fabricated by bundling cable wires in parallel and drawing through a former that shapes and compacts the cable wires into a hexagonal shape strand. Strands shall be made with continuous wires without

mechanical splices. The cable wires shall be arranged parallel with each other within the strand and the strand shall be free of intersections or wire crossings. The strand shall be free of loose wires, flaws, or other defects.

Each strand shall be banded with reinforced plastic tape at approximately 1.5-m intervals. Plastic bands shall be sufficient in strength and ductility to maintain the strand wires in a compact group during strand fabrication, reeling, storage, transportation, and erection. Strand clamps shall be used at appropriate locations where the strand must conform to saddle curvatures to firmly clamp the cable wires from moving longitudinally to each other. Plastic bands and strand clamps shall not prevent proper compaction of the cable.

One outside gauge wire at an apex of the hexagonal cross section of each strand shall be colored and precision-measured for its entire length. Based on the gauge wire, circumferential marks shall be placed on each strand at the theoretical centerline positions of tower saddles, deviation saddles, jacking saddle and splay saddles. The theoretical length is the total cable length calculated based on the dead load state of the bridge as established by the erection plan developed by the Contractor and approved by the Engineer.

Each end of the strand shall be socketed with zinc or zinc-copper alloy. The strand sockets shall conform to ASTM Designation: A148M Grade 620-415. Zinc for socketing the strands shall conform to ASTM Designation: B6, High Grade. At the point of socketing, strand wires shall be tightly clamped together. The actual end-to-end length of each socketed strand shall be socketed to an accuracy within plus or minus 1/15,000 of its theoretical length.

The Contractor shall submit the strand socket details and socketing procedure specification, which is proposed as the standard of his operation. The Contractor shall submit a strength test procedure to the Engineer for approval. The procedure shall consist of tensioning the assembly of strands, sockets, and strand anchor rods. The Contractor shall prepare five specimens in accordance with the stated procedure. The specimen shall then be strength tested as follows:

A. The load shall be increased at a slow rate as approved by the Engineer up to 50% of the breaking strength. The Contractor shall keep records of load and elongation for at least 15 load points, if not continuously. While the loading is stopped, measure the extent that the cones have pulled through the mouth of the socket (pull-out).
B. The load shall be continued to failure. The load deformation shall be recorded by recording the distance between the sockets with each load, until the strand reaches the ultimate strength.

The average pull-out at 50 % of breaking strength shall not be greater than 8 mm with a maximum pull-out not greater than 12 mm.

The pull-out at failure shall not exceed 20 mm nor shall any wire fail or pull-out of the socket before the minimum specified capacity of the strand has been attained. Failure to meet these conditions may be cause for rejection of the socketing procedure, pending further evaluation of the cones.

The Contractor shall remove all the cones from the socket shells and cut them in any direction that the Engineer deems necessary to evaluate the voids in the cones or wire slippage.

Upon an evaluation of the cones, the Engineer may require an improved socketing procedure before production of the strands is allowed to proceed. Two additional specimens shall be manufactured to test the revised socketing procedure and both strands shall meet the stated requirements. Production strands shall not proceed without an approved socketing procedure.

The Contractor shall submit the revised socketing procedure to the Engineer in accordance with the requirements in "Working Drawings" of these special provisions.

The sockets shall be manufactured in accordance with the approved socketing procedure. The end sections of socketed strands shall be proof tested by loading to 900 MPa to ensure no socket slippage and no damage to strand zinc coating. Each proof test shall include the socket plus a minimum of 3 meters of the socketed strand. The Contractor shall demonstrate to the satisfaction of the Engineer that proof testing will not damage strand zinc coating.

Strands shall be wound on reels with a minimum diameter of 2.0 m. The strands shall be wound transversally in a manner that will permit unreeling continuously without damage to the strand. The reels shall be constructed to withstand shipping and strand reeling and unreeling, without damage to the strand.

Cable Wrapping Wire

Cable wrapping wire shall be S-shaped low carbon steel wire conforming to the requirements of Japanese Industrial Standard (JIS) G3505 and shall be hot dip galvanized to the requirements of ASTM Designation: A 475, Class A or equal.

The S-shaped cable wrapping wire shall be manufactured by the following supplier:

VENDOR ADDRESS AND PHONE NUMBER
NIPPON STEEL CORPORATION 6-3 OTEMACHI 2-CHROME CHIYODA-KU, TOKYO 100-8071 JAPAN TEL: 81-3-3275-6384 FAX: 81-3-3275-5971 CONTACT: HAJIME HOSOKAWA

The galvanized wire shall have the following mechanical properties measured on the gross cross-sectional area:

Test	Minimum Number of Tests
Tensile Strength:	Fu > 540 N/mm2
Elongation	Not less than 1.5 percent in a 150 mm gauge length
Wire Size Tolerance	Width +- 0.15 mm, Thickness +- 0.08 mm, Gap of Lock +- 0.2 mm
Zinc Coating:	The zinc coating shall be uniform, show good ductility and adherence to the wire, and have a mass of not less that 280 g/m^2.
Wire Straightness	No transverse kinks upon visual observations

Cable wrapping wire shall be wound in coils or on reels for protection and for shipping.

The following measurements and tests shall be performed on each coil of cable wrapping wire from each heat delivered. Selection of wires for testing shall be as directed by the Engineer and as follows:

Test	Minimum Number of Tests
Tensile Strength	One test piece taken from each end of every coil or fraction thereof
Elongation	One test piece taken from each end of every coil or fraction thereof
Wire Size Tolerance	One test piece taken from one end of every coil
Zinc Coating	One test piece taken from one end of every 5th coil or fraction thereof
Uniformity of Zinc Coat	One test piece taken from one end of every 5th coil or fraction thereof
Zinc Adhesion	One test piece taken from one end of every 5th coil or fraction thereof
Wire Straightness	One test piece taken from one end of every coil or fraction thereof

Cable wrapping wire shall be supplied to the job site in manufacturer's packaging. Open or damaged containers shall be removed from the job site. Cable wrapping wire shall be stored in accordance with the requirements in "GENERAL," subsection "Shipping, Handling, and Storage," of this section.

The price quoted by the manufacturer for S-shaped cable wrapping wire is $6.20 per kilogram. The manufacturer's charge for a technical supervisor is $1,400 per person per day, and $28,000 per person per month (20 days per month). These charges apply from the day of departure from Japan to the day of return back to Japan. The daily allowance for a technical supervisor, including accommodations, shall be $125 per person per day. The charge for round trip airfare between Japan and San Francisco, California, United States, shall be $4,200 per person. The FOB location is Yokohama, Japan. Quoted prices are in United States dollars.

The prices quoted will be firm for all orders placed on or before December 31, 2005, provided delivery is accepted within 120 days after the order is placed. The total price will be increased three (3) percent for orders placed after December 31, 2005, provided delivery is accepted within 120 days after the order is placed. The above prices include Japanese taxes, but do not include other taxes, freight, and insurance.

Suspender Ropes

Wire for suspender ropes shall conform to the requirements of ASTM Designation: A 603 with Class A galvanizing. The wire rope construction shall be 6x37 with an independent wire rope core (IWRC) or center fit rope core (CFRC). The wires within a suspender rope shall not be spliced. The suspender ropes shall have an ultimate tensile strength of not less than 1,350 N/mm^2 and shall be prestretched to obtain a modulus of elasticity not less than 138,000 N/mm^2. The prestretching test may be performed by the wire rope supplier. The wire rope supplier shall provide certified test results to show the required minimum modulus of elasticity has been achieved.

Each rope from which suspenders are manufactured shall be tested to ascertain the specified capacity of the rope. Only one specimen per rope need be tested. The minimum length of the specimen shall be 3.0 meters. The Contractor shall prepare socketed specimens to conduct the tests. These strength tests shall also be used to evaluate and qualify the socketing procedure.

The Contractor shall prepare and submit to the Engineer suspender socket details and a socketing procedure, which shall be tested and witnessed by the Engineer. The socketing procedure shall include as a minimum:

A. Preparation of the broom.
B. Method of cleaning of the wires and of the shell including EPA approved detergent.
C. Description of the apparatus to hold the rope and shell in place before casting.
D. Temperature of the zinc before casting.
E. Temperature of the socket before casting.
F. Length of time of the operation and when the heating agents are turned on a and off.

A minimum of five specimens shall pass the strength tests to approve the socketing procedure.

Each specimen shall be loaded to failure and slip (pull-out of rope) shall be measured. During the test, the assembly of suspender, socket, and socket anchor rods shall be tensioned. A record shall be kept of load deformation up to the value where the rope deformation deviates from a linear behavior. The modulus of elasticity shall be measured at service load for each of the five specimens.

The average pull-out shall not exceed 0.16 times the rope diameter and the maximum pullout shall not exceed 0.2 times the rope diameter. Exceeding these values may be cause for rejection of the socketing procedure, pending observation of the cones.

The Contractor shall remove the cones and cut them as required by the Engineer. Upon evaluation of the voids and possible wire slip the Engineer may request an improved socketing procedure specification and testing of two additional specimens, including removal and cutting of the cones if deemed necessary, until the socketing procedure is approved. No production socketing will be permitted without an approved socketing procedure.

All wires shall fail after the nominal strength of the suspender is reached and there shall be no pull-out or loosening of wires within the socket, when the cones are observed.

Sockets used for testing capacity of the rope may be reused, but sockets for qualifying the socketing procedure shall be new. Sockets used for testing shall not be incorporated into the permanent work.

Suspender rope sockets shall meet the requirements of ASTM Designation A148 grade 620-415. Suspender ropes shall be pre-stretched to 50% of their nominal ultimate capacity.

Measurement and marking shall be carried out under uniform temperature conditions, under cover or at night, and while the suspender is held under dead load tension. Allowance shall be made for the anticipated elongation in the sockets. The length of the socketed suspender ropes shall be cut within an accuracy of 1/5,000 or 6 mm, whichever is larger.

At the time the suspender ropes are measured, a paint stripe shall be placed along the length of each suspender rope. A circumferential paint mark shall be made on each suspender rope at the midpoint between sockets to match the centerline at the top of the cable bands. Zinc buttons shall be cast onto each suspender rope to correspond to the location of the suspender clamps.

Suspender ropes shall be packaged on reels with a minimum barrel diameter of 2.25 m. Suspender ropes shall be protected and stored in a clean, dry area.

Zinc button installation and procedure qualification shall be based on three tests. Specimens shall be fabricated from a pre-stretched 75 mm rope and tested to 30 kN. The procedure shall include method of cleaning the rope, temperature of the mold, temperature of the molten zinc, the apparatus for heating and for holding the rope and the mold in place before pouring.

Any cracks in the zinc buttons or separations from the rope shall be cause for rejection of the procedure and a new procedure shall be developed and tested until the buttons perform satisfactorily.

Zinc buttons shall be installed, after suspenders have been proof loaded, in strict adherence to the qualified installation procedure.

Steel components used to gather the suspenders at the zinc buttons shall conform to the requirements in ASTM Designation A 709 Grade 50. Bent parts shall be formed while the steel is heated to a temperature not to exceed 650 degrees Celsius. The fabrication procedure of bent parts shall be submitted to and approved by the Engineer.

Pipe separators shall conform to ASTM Designation: A 501 Grade 50. They shall be machined to fit inside the bent components. A tight fit is required after the bolt is drawn snug tight.

The bolts shall be as specified on the plans. Bolts shall be provided with a drilled hole along a diameter of the bolt to receive a cotter pin of 6 mm diameter. The cotter pin shall be of a soft steel acceptable to the Engineer.

Zinc saddles for the clamps shall be cast in molds by a procedure that does not produce planes of weakness or large flaws. The Contractor shall develop a casting procedure that produces zinc castings that meet these requirements. The first five zinc saddles produced according to the proposed procedure shall be UT tested and shall be free of voids or cracks. If these prototypes meet these requirements, production of zinc saddles may proceed. Otherwise, the casting procedure shall be revised until it meets these requirements. Quality checks shall be made every tenth saddle.

The Contractor shall demonstrate the proper fitting of suspender clamps by installing the clamps on a short suspender in the shop. The short suspender length shall be installed over a mock cable with the same diameter as the finished cable. While holding the suspender vertically with a nominal load of approximately 30 kN, the Contractor shall install the suspender clamp.

All zinc components shall be certified to have 99.90% zinc without traces of lead.

Handropes and Handrope Fittings

The materials for handropes and handrope fittings shall conform to Section 55 "Steel Structures," and Section 75 "Miscellaneous Metal," of the Standard Specifications and the following tabulation:

MATERIAL	SPECIFICATION
Handrope Strands	ASTM Designation: A 475/A 475M, Class A Galvanized 19 Wire High Strength Grade
Stanchions Clamping Plates and Bars	ASTM Designation: A709 Grade 50 Galvanized
Handrope Fittings	
Shoulder Bolts	ASTM Designation: A449, Type 1
Nuts	ASTM Designation: A563 Grade DH, Style Heavy Hex including Appendix X1
Washers	ASTM Designation: F844
Bolts for clamp plate	ASTM Designation: A 325, with nuts and washers
Lock Nuts	ASTM Designation: A563, Grade DH, Style Heavy Hex including Appendix X1 Appendix X1 or A563M including Appendix X1
Carbon steel forgings, swaged strand eyes, turnbuckle jaws, eyes, and bodies	ASTM Designation: A 576/A 576M, Grade 1035
Zinc-coated nuts that will be tightened beyond snug or wrench tight shall be furnished with a dry lubricant conforming to Supplementary Requirement S2 in ASTM Designation: A 563.	

All strands from which handropes are manufactured shall be tested. Four tests shall be made to determine the breaking strength of the handrope strand. The minimum breaking strength for the handrope strand shall be not less than 325 kN. Hot dip galvanizing for handrope fittings shall conform to the provisions in Section 75-1.05 "Galvanizing," of the Standard Specifications.

The handrope strand shall be pre-stretched to 50 percent of the specified minimum breaking strength and shall be held at the prestretched tension for a minimum of 5 minutes. After pre-stretching, the tension shall be lowered to 44 kN and the strand length shall be measured with a calibrated tape. While under measuring tension, a paint stripe shall be placed along

the full length of handrope strand. The handrope strands shall be measured and marked with the location of each stanchion. The measured total length shall be within an accuracy of plus or minus 1/5,000 of its theoretical length

Clamping plate fittings shall be forged into the design geometry shown on the plans. Alternately, the Contractor may propose a machined fitting subject to the approval of the Engineer.

Where clamps are to be used for holding a section of the handrope strand that will be part of the final work, all corner edges shall be ground to a radius of 2 mm minimum. The Contractor shall demonstrate to the Engineer that the clamp does not damage the strand nor the galvanized surface.

After attachment of the strand eyes, the strand and the strand eyes shall be proof loaded to 50 percent of the ultimate strength of the strand. The stem of the strand eye shall be shop painted after testing and prior to installation on the bridge. The fabricated handrope shall not be bent into a curve, coiled, or reeled to a diameter smaller than 28 times the diameter of the strand before placing it on the structure.

Steel castings

Steel castings shall include cable bands, cable strand sockets, suspender sockets, split collars, and suspender separators. Split collars may be machined entirely from billet steel conforming to ASTM Designation: A36 subject to the approval of the Engineer. Similarly, suspender rope separators may be fabricated from carbon steel or other structural steels subject to the approval of the Engineer.

Castings for cable bands, suspender separators and split collars shall conform to the requirements in ASTM Designation: A148M, Grade 550-345. Castings for suspender sockets and cable strand sockets shall conform to the requirements in ASTM Designation: A148M, Grade 620-415. Suspender rope sockets, cable strand sockets and suspender rope separators shall be galvanized in conformance to the requirements of ASTM Designation: A123.

The Contractor shall determine the galvanizing thickness based on the chemistry of the casting prior to oversizing the inner threads. Tapping of internally threaded sockets shall be done after galvanizing and shall conform to the requirements for thread dimensions shown on the plans and overtapping allowances in ASTM Designation A563.

Castings shall be radiographically inspected in accordance with the frequency listed in the table below.

Radiographic shot schedule for each pattern-type casting shall be submitted to the Engineer for approval.

Radiographic inspection shall be performed by the manufacturer and witnessed by the Engineer in accordance with the following ASTM Specifications, as applicable:

ASTM Designation: E94 - Standard Recommended Practice for Radiographic Inspection
ASTM Designation: E142 - Controlling Quality of Radiographic Testing
ASTM Designation: E186 - Standard Reference Radiographs for Heavy-Walled Steel Castings
ASTM Designation: E446 - Standard Reference Radiographs for Steel Castings up to 51 mm in Thickness
ASTM Designation: E 1030 – Standard Test Method For Radiographic Examination of Metallic Castings

Casting Type	Selection of Castings to be Radiographed
Cable Band Castings	One of each pattern type, 100 percent all surfaces
Sockets	1st, 10th, 30th, 70th, and every 50th casting thereafter

Note 1: Each cable band shall be considered to be composed of 2 castings.
Note 2: Repaired castings or castings fabricated to replace rejected castings shall be tested as directed by the Engineer at the Contractor's expense.

Defects exceeding the degree shown in the following table shall be cause for rejection of trial or production castings:

Category	Defect	Degree Permitted
A	Gas Porosity	3
B	Sand Slag Inclusions	3
C	Shrinkage:	
	Type 1	3
	Type 2	3
	Type 3	3
	Type 4	3
D	Crack	Not Permitted
E	Hot Tear	Not Permitted
F	Insert	Not Permitted
G	Mottling	Not Permitted

All castings shall be inspected after machining by the magnetic particle method conforming to the requirements of ASTM Designation: E109 and Acceptance Standard ASTM Designation: E125.

All castings except for sockets shall be stenciled with their heat number and sequence number. Machined surfaces shall have tolerances and roughness as shown on the plans.

Before casting of any production unit, the Contractor shall produce full-size models of all castings. The models shall be approved by the Engineer before the start of casting production units.

All unmachined dimension tolerances of castings shall be +4 mm and –2 mm, unless noted otherwise on the plans.

No paint or oil shall be applied to castings until the castings have been inspected and approved by the Engineer.

Any casting with defects that are deemed non-repairable by the Engineer shall be replaced at the Contractor's expense. Four additional tests on four different castings of the same heat and pattern-type shall be made at the Contractor's expense. If a casting is rejected, all other castings from the same heat shall be radiographically inspected at the Contractor's expense.

Machined surfaces shall be free of voids or other discontinuities that exceed the following:

A. A maximum of one discontinuity within a radius of 150 mm that has a diameter not exceeding 5 mm
B. A maximum depth of one half of the diameter, and a rounded shape with no sharp corners

Defects exceeding those defined above may be repaired by welding if approved by the Engineer.

Proposed welding repair procedures shall be submitted in writing to the Engineer for approval and shall include a description of the defects, the size and shape of the excavations, the welding specification, the preheating and post heating, welding consumables, and the welding procedure to be used.

The exterior surfaces of the cable band castings, after acceptance, shall be shop painted with the prime coat as specified in "Clean and Paint Cable System" of these special provisions. The castings shall be masked to prevent painting the machine finished surfaces, cable band bolt contact surfaces, or interior surfaces.

Cable Bands

The diameter of the cable bands shall be verified in the shop, after compaction of a short cable segment (mock cable) constructed to test the friction capacity of the band. Cable bands shall not be manufactured until such test has been conducted and evaluated by the Engineer.

Cable Band Friction Testing

To determine the frictional resistance between the cable bands and the cable, one sliding test shall be performed on a short cable segment in the shop.

The test arrangement shall be based on pushing a short compacted cable segment, no less than 3 meters long through a fixed or restrained type B4 cable band. The Contractor shall develop an apparatus for this test to be approved by the Engineer.

The mock cable shall be compacted to the nominal diameter, or less, and banded outside the confines of the cable band. Several compaction passes shall be conducted with the proposed compaction equipment, and the mock cable circumference and diameters in two orthogonal directions shall be measured and recorded with each pass. The mock cable compaction demonstrates that the cable may be compacted to the diameter shown on the plans. One end of the cable must be precisely squared relative to its length.

Interior surfaces of the cable bands shall be clean and free of any rust, lubricants, and moisture. The surface of the mock cable under the cable band shall be cleaned in accordance with the provisions of Surface Preparation Specification No. 1, "Solvent Cleaning," of the SSPC: The Society for Protective Coatings. Solvent cleaning shall be supplemented by hand tool

cleaning in accordance with the provisions of Surface Preparation Specification No. 2, "Wire Brushing, and Hand Washing, and Rinsing," of the SSPC: The Society for Protective Coatings to remove any non-adherent shop applied coating, or detrimental foreign matter unable to be removed by solvent cleaning. Brass wire brushes shall be used for this surface preparation. Steel wire brushes will not be permitted.

The cable band bolts shall be tightened to 35 % of the nominal bolt tension prescribed for the project. This shall be done through bolt length measurement with an extensometer.

The mock cable shall be jacked down through the cable band. Jacking head displacements shall be recorded along with load and cable slippage. The apparatus shall be such as to maintain stability of the cable and band specimen. The jacking head shall push against a rigid steel block that pushes against the cable uniformly. The block shall be endowed with a tight skirt that prevents the cable from moving away from under the load.

All movements shall be recorded simultaneously until the jacking force drops, or achieves a constant value, but not before the cable has moved through the band by at least 25 mm. The test shall be witnessed by the Engineer. All traces of instrumentation shall be reported.

The friction coefficient shall be calculated as the jacking force at slip divided by the sum of the tension forces in all the cable band bolts, multiplied by 2. If the friction coefficient is 0.28 or greater, no changes are necessary in the band diameter or internal grooves of the band. Otherwise, the Engineer will evaluate the test data, including the actual compacted diameter of the cable and may call for changes in the cable band diameter or internal roughness, or for increase in tension of the anchor bolts.

The cable band used for the sliding tests shall be removed, inspected, and may be reused if not damaged.

Cable band bolts

Cable band bolts shall conform to the requirements of ASTM Designation: A354, Grade BC. Nuts shall conform to the requirements of ASTM Designation: A563. Washers shall conform to ASTM Designation: F436. Cable band bolts, nuts and washers shall be galvanized. The cable band bolts shall have drilled recesses in the center of the bolt head and the center of the bolt shank for extensometer length measurements. All bolts shall receive heat treatment after final machining.

Tensile tests to failure on cable band bolts with nuts shall be performed on a minimum of 30 bolts, but not less than 6 per heat. If one bolt fails to meet the required strength two more bolts from the heat shall be tested. If both bolts meet the specified requirements, the heat will be accepted. If any two bolts from one heat fail to meet the requirements, the heat will be rejected.

Tensile tests, to obtain load-extension curves, shall be carried out on five cable band bolts, but not less than one per heat. The testing apparatus shall be proposed by the Contractor and approved by the Engineer. The load-extension curve shall be recorded continuously. The extension may be measured from the separation of the jaws of the test apparatus. The yield point of the tested specimen shall be compared to that of the specified yield point. If any of the tests does not meet the minimum requirements, two additional tests shall be conducted for that heat. Both tests shall pass the requirements or the heat will be rejected.

Cable Band Butylene Rubber Seal

The butylene rubber seal shall be manufactured to fit tightly within the cable band groove to provide a tight seal. It shall be manufactured from a mold designed for this purpose and shall account for shrinkage of the elastomer during cooling. A loose seal within the band groove will not be permitted.

Cable band caulking

The cable band caulking shall conform to Vulkem 921 or 922 as manufactured by Mameco International, Inc., Cleveland, Ohio, Dynatrol I or II as manufactured by Pekora Corporation, Harleysville, Pa., or Sikaflex 15LM or Sikaflex 2c NS as manufactured by Sika Corporation, Lyndhurst, New Jersey, or approved equal by the Engineer.

Zinc paste waterproof system

Waterproof paste shall be a single component GriKote Z-Complex 2C or equal. The GriKote Z-Complex 2C is a corrosion resistant multiple barrier paste. The paste shall be composed of a blend of zinc oxide, zinc dust and a water displacement corrosion preventing additive.

The GriKote Z-Complex 2C system shall be manufactured by the following supplier:

VENDOR ADDRESS AND PHONE NUMBER
GRIGNARD COMPANY 126 PASSAIC STREET NEWARK, NJ 07104 TEL: 973-412-8900 FAX: 973-412-8906 CONTACT: ETIENNE GRIGNARD

The zinc paste waterproofing system shall conform to the following physical requirements:

TEST METHOD	DESCRIPTION	RESULTS
ASTM D1403	Worked Penetration ½ Scale	300-400
FTM-321	Oil Separation 30 hrs @ 100°C	< 0.75%
PLTL-90	Specific Gravity @ 25°C	2.8 - 3.3 g/cc
ASTM D4048	Copper Corrosion 24 hrs. @ 100°C	Shiny 1a
FTM 5415 Modified	Resistance to Aqueous Solution 168 hrs @ 25 °C Distilled Water (Pass)	Passed: no Disintegration
	Color	Gray
	Workmanship	Smooth and homogeneous

All material components of the Grikote Z-Complex 2C zinc paste waterproofing system shall be supplied to the job site in manufacturer's packaging. Open or damaged containers shall be removed from the job site. The paste shall be delivered in 3.78 L, open head metal cans that contain 11.36 kg of GriKote Z complex 2C.

All material components of the zinc paste waterproofing system shall be stored in a sheltered and dry location out of direct sunlight, and in accordance with manufacturer's recommendations and Health and Safety regulations. The temperature of the product during storage shall be between 23°C and 70°C. Any materials stored for more than three years shall not be used and shall be removed from the job site.

The price quoted by the manufacturer for Grikote Z-Complex 2C is $11.89 per kilogram. The manufacturer's charge for a factory representative is $1,200 per day (minimum 4 day visit) for the 3-day periods at the beginning of the application and at the completion of the application. The manufacturer's charge for a factory representative during all other times will be negotiated with the manufacturer. Phone technical support will be provided without charge during normal working hours. The FOB location is Newark, New Jersey 07104. The manufacturer will maintain United States product liability insurance.

The prices quoted will be firm for all orders placed on or before December 31, 2005, provided delivery is accepted within 6 months after the order is placed. For orders placed after December 31, 2005, the total price will be increased 5 percent for each year thereafter, provided delivery is accepted within 6 months after the order is placed. The above prices do not include taxes, freight, and additional insurance.

The zinc paste waterproofing system price includes all materials and technical advice and does not include inspection by a qualified representative of the manufacturer.

Anchor rods

Anchor rods shall conform to the requirements of ASTM Designation: A 354, Grade BC or BD and as specified in these special provisions. Nuts shall conform to the requirements of ASTM Designation: A 563. Washers shall conform to the requirements of ASTM Designation: F 436.

Anchor rods for PWS shall conform to grade BD and shall be mechanically galvanized.

Anchor rods for suspenders shall conform to grade BC and shall be hot-dip galvanized

Prior to shipment, all rods shall be fully threaded into their assigned mating component, including nuts, to ensure that the thread pitch has been fabricated without error and the process of turning does not strip any of the threads.

Elastomeric Collars

This work consists of the fabrication and installation of pre-molded split collars for the protection of suspender ropes inside steel collars.

Split collars shall be glued at the split surfaces and secured within the steel collar in a snug tight condition.

The gap between the upper end of the steel collar and suspender shall be caulked.

The Contractor is alerted to the fact that all suspenders shall meet with any of the planes where a collar is attached, in a perpendicular direction. There are no intended angles between the suspender and the flanges of the brackets at dead load.

Molds shall be manufactured from plaster molds taken on ropes subjected to dead load tension, and from molds of the steel collars. The molds used in casting shall be designed to compensate for shrinkage of the elastomer during cooling, such that the elastomer fits snugly between the steel rope and the steel collars.

Polymer – The polymer shall be a Thermoset Elastomer produced from Polytetramethylene Ether Glycol Toluene Diidocyanate (PT MEG TDI). The collar manufacturer shall be Steinmetz, Inc. Spencer Road, Moscow PA ; Tel (570) 842-6161 or approved equal.

Glue – The glue shall be as recommended by the manufacturer of the elastomeric collar and shall be demonstrated to bond to the elastomer.

Caulk material shall be SILPRUF as manufactured by General Electric Company, Silicon Products Division, Waterford, New York, or an approved equal.

Debonding films or backer materials shall be as recommended by the caulk manufacturer.

All materials in contact with the zinc coating shall not react with zinc. This shall be demonstrated by laboratory test or from literature describing previously conducted tests.

Caulking materials shall be tested to prove their ability to adhere to the substrates. Tests made by the manufacturer as part of product development are acceptable. The caulk seal shall not bond to the elastomeric collar or shall otherwise be installed with a de-bonding film over the elastomer.

The elastomer material shall be black and insensitive to ultraviolet rays.

The physical properties of the thermoset elastomer shall be as described in the following table:

Physical Property	Test Method	Capacity
Hardness	D2240	80 Shore A
Tensile strength	D412	31 MPa
Elongation at break	D412	580 %
!00 % tensile modulus	D412	4.8 MPa
300 % tensile modulus	D412	8.3 MPa
Bayshore Resilience	D2632	50%
Split tear	D470	1.52 kg/mm
Abrasion Resistance, NBS Index	D1630	200 %
Compression Set	D 395 (B)	35 %
Compression Modulus 5 %	D 575	1.45 MPa
Compression Modulus 10 %	D 575	2.59 MPa
Compression Modulus 15 %	D 575	3.65 MPa
Compression Modulus 20 %	D 575	5.10 MPa
Compression Modulus 25 %	D 575	6.89 MPa
Brittleness Temperature	D748	- 34°C

The Contractor shall obtain molds from two types of suspender ropes stretched to simulate suspender tension under dead load. A release primer may be required for removal of the molds from the ropes.

The exterior surface of the collar shall be produced from molds that mimic the interior surface of steel collars.

The production molds shall be manufactured to compensate for shrinkage of the elastomer upon cooling.

The slit in the collar shall be cut at an appropriate time in the manufacture without altering the volume of the collar.

The Contractor shall provide a written plan to the Engineer including the following:

A. Procedure for manufacture of the production molds
B. The expected shrinkage of the elastomer
C. The nominal geometry of the suspender and steel collar
D. The geometry of the production molds that include compensation for shrinkage.

As part of the written plan, the Contractor shall prepare a full-scale mock-up to demonstrate the fit around a tensioned rope. The Contractor shall modify the molds as necessary to produce a snug fit. The plan shall be approved by the Engineer before prior to production of split collars.

Elastomeric collars shall be installed, glued and caulked after the suspenders sustain dead loads of the bridge.

Neoprene

There are three components manufactured with neoprene: a) seal gaskets at saddle-to- flashing joints and along shrouds joints, b) Neoprene seals ,which are square rods at flashing-to-shrouds seals, and c) neoprene bearings where the cable is attached directly to special brackets.

Neoprene seal gaskets shall be elastomeric polychloroprene conforming to the following requirements:

	Requirement	ASTM Test Method
Tensile Strength	13.8 MPa minimum	ASTM Designation: D 412
Elongation at Break:	250 percent minimum	ASTM Designation: D 412
Hardness, Type A Durometer:	40 points	ASTM Designation: D 2240

Gaskets shall be manufactured from a sheet without a slit between exterior and interior hole.

Sealing rods shall be manufactured with the same material specified for the gaskets. They shall be circular to fit neatly the shape of the flashing and shroud. A single slit shall be placed at the bottom of the joint.

Elastomeric bearings shall be used to transfer the load of the suspended structure directly to the cable. They shall be manufactured and tested according to Standard Specification 51-1.12H(2) "Steel Reinforced Elastomeric Bearings". The bearings are curved and are manufactured with cylindrical reinforcement. The neoprene shall be vulcanized to the bearing block and to the cable band as shown on the plans.

A sample specimen shall be fabricated for testing. For fabrication of the specimen, end blocks may be fabricated with structural steel.

Keeper Angles, Keeper Bolts, Shims, Collars, Suspender Clamps

Keeper angles, keeper bolts, shims, collars and suspender clamps shall conform to the provisions in Section 55, "Steel Structures," of the Standard Specifications and these special provisions.

ERECTION

PWS Cables

To provide access to the cables during erection, the Contractor shall construct a footbridge system below the line of each cable before beginning cable erection. The footbridges shall be stiffened by a storm system and cross bridges between the footbridges shall be provided. The footbridge system and the storm system shall meet the requirements of ANSI/ASCE 7-95 Standard. The Contractor shall submit to the Engineer, for review and approval, complete cable system construction engineering documents in conformance with "Working Drawings" of this section.

Parallel wire strands shall be erected by towing across the footbridges using a hauling system. Rollers shall be provided along the footbridges, over the tower tops and around the deviation and jacking saddles to minimize disturbance of strand wires and to facilitate strand erection. Strands under tow shall not contact erected strands, nor shall they be subject to any treatment that could lead to kinking of wires or to damage of the zinc coating.

Strand reels shall be mounted in an unreeling machine, which shall control reel rotation to avoid excessive slack, excessive tension, or tangling. The colored gauge wire in each strand shall be monitored during the unreeling process to ensure there is no twist in the unreeled strand.

The forward end of a strand under tow shall be prevented from rotating. Upon completion of the towing operation for each strand, it shall be placed into the saddles by means of lifting beams so designed as to prevent kinking of the strand. While the strand is supported by the lifting beam, any twist of the strand within the length of the saddle, as determined by the colored gauge wire in each strand, shall be removed.

Should any portion of a strand be found to have insufficient plastic tapes for control of wires during strand erection and adjustment, tapes shall be added as necessary.

Circumferential saddle marks of the first erected strand shall be placed on-the-mark at the tower saddles, deviation saddles, jacking saddles and splay saddles and blocked with shims in between the saddle separating plates as necessary to hold it in position. At this stage, the Contractor shall shake-out the first strand in order to verify wire slippage. The allowable spread of wires in the first strand at any given location shall not exceed 500 mm. If the spread of the wire at any given location exceeds 500 mm, the Contractor shall investigate the cause of the wire slippage, propose corrective measures, and submit the corrective measures to the Engineer for approval prior to erecting additional strands. The Contractor shall then shake-out the second strand to verify the adequacy of the proposed corrective measures. At the option of the Contractor, the Contractor may submit to the Engineer for approval a procedure to monitor wire slippage in lieu of performing the first strand shake-out. This procedure shall demonstrate the relative wire slippage results in wire spread less than 500 mm. The

sag of the first erected strand shall be adjusted in each span to the proper bare-cable sag. The sag shall be surveyed and adjusted during a period when the strand and the air temperature are uniform. The strand shall be adjusted to the calculated sag to an accuracy of 50 mm. All other strands in the cable shall subsequently be adjusted to sag properly with respect to the surveyed strand, following the approved cable erection plan..

Temporary cable formers shall be used at suitable intervals in each span in order to maintain the adjusted strands in the correct relationship with one another. Cable formers shall not restrain the strand adjustment of the subsequently erected strands.

The cable shall be compacted with equipment that has been previously approved by the cable band friction test. The cable shall be compacted in several passes not less than 10 meter long along the cable. With every pass the cable shall be bound with industrial strapping and measured. Bindings shall be placed at spaces not greater than 1.5 cable diameters.

The orientation of the cable bands, when placed on the free hanging cable shall compensate for the rotation that the cable will undergo as the load is transferred. Therefore, the cable shall be marked, after compaction, where it is bisected by the plane of the suspension system when loaded. All rotation angles that the cable will undergo shall be calculated and surveyed.

The location of cable bands along the cable shall be determined by computer analysis, through unloading of the cable in the model and calculating the distance between unloaded panel points.

The Contractor shall prepare a plan for determining marking lines that includes analytical modeling and surveying techniques. Calculations shall be submitted and the cable band installation plan shall be approved by the Engineer. The survey shall be conducted under uniform temperature conditions and the cable band position shall be marked to the following accuracy compared to the calculated position:

A. For rope suspenders whose cable to deck surface distance is 5 m or less, the offset may cause a longitudinal angle whose tangent shall not exceed 1/200.
B. For rope suspenders whose cable to deck surface distance is between 5 and 8 m, the offset shall not exceed 25 mm.
C. For rope suspenders whose cable to deck surface distance is more than 8 m, the offset shall not exceed 40 mm.

Cable Bands

The bands shall be installed with cable band groves on the markings of the compacted cable.

Interior surfaces of cable bands shall be clean and free of any rust, lubricants, and moisture. The surface of the cable under cable bands shall be cleaned using the same procedures used for the approved cable band friction testing.

Immediately prior to placing each cable band, the cable-compacting bands shall be removed over the length of the cable band. The compaction bands on each side of the cable band zone shall remain until cable wrapping. The cable bands shall be installed without damaging the wires within the cable or the cable-compaction bands.

Cable band bolts shall be tensioned to the forces specified on the plans. The method of bolt tensioning shall be by bolt length measurement using an extensometer. The length of the bolt shall be considered the length of the shank between the head and halfway through the nut. The bolt shall be measured unstressed and after it is tensioned. The elongation of the bolt is the measure of its tension. After all bolts in the cable band have been installed they shall be re-measured. If, after the last measurement, the tension of any bolt is less than 80 percent of the tension specified, the bolt shall be re-tensioned.

After the design load of the steel box girder has been transferred to the cable system and before dismantling the footbridge system, the Contractor shall re-tension the cable band bolts to the minimum tension as shown on the plans. Cable band bolts may be re-tensioned prior to or during paving operations. The zero length, final length, and bolt location of each cable band bolt shall be recorded and submitted to the Engineer.

Suspenders

The suspender rope shall be placed over the cable band with the center mark on the suspender rope properly aligned with the cable bands. The suspender rope sockets shall be lashed together until the sockets are connected to the steel box girders.

During all stages of erection, the suspender ropes shall be protected from abrasion and sharp bending. The Contractor's attention is directed to the top of the suspender sockets and to the slots in the suspender brackets as points of special vulnerability. Wrapping the suspender ropes with zinc sheeting or temporary elastomeric collars is permitted.

The cable clamps shall be installed only after the cable is in its final position, using a method approved by the Engineer. Cable clamps shall lie within ½ degree of perpendicular to the lower portions of the suspender ropes. The Contractor shall ensure that the suspender ropes remain in their grooves on the cable bands during load transfer to the cable.

Continuity plates and split collars shall be installed after load transfer. Elastomeric collars shall be placed around the suspenders before installing the split collars. Bolts shall be tightened in accordance with the provisions in "Steel Structures," of these special provisions.

Wrapping of the Cable

After the design load of the steel box girder has been transferred to the cable system and before dismantling the footbridge system, the cable shall be wrapped with cable wrapping wire as specified herein. Wrapping wire tension shall be per the wrapping wire manufacturer's recommendation.

The wrapping shall be done over the zinc paste waterproofing system as specified herein.

The Contractor shall provide a power driven wrapping machine. It shall have the following features:

A. Capable of providing the specified force in the wrapping wire.
B. Whenever the machine is stopped it shall hold the tension in the wrapping wire.
C. The tension in the wire shall be measurable at any time. The exterior torque countering the torque of the pull of the wire shall be measured. The friction in tensioners, fairleeds or disks shall be calibrated and set for the required tension.
D. The machine shall align the grooves of the wrapping wire automatically.
E. The machine shall be capable of wrapping away from a band and toward a band, over wrapping wire.

Installation of wrapping wire shall begin at the lower band. When starting, there shall be sufficient wire behind the machine to wrap a minimum of two windings of wrapping within the band groove. The wire behind the machine shall be anchored to a fixed boundary. Wrapping shall proceed uphill. The first three windings shall be soldered together as soon as the wrapping machine is sufficiently distant. The anchored end of the wire shall then be wound, by hand, inside the band groove, and they shall also be soldered to the previously soldered wires.

The wires shall be machine-wrapped as close to the uphill band as practicable to solder three consecutive windings. The machine may then be removed and the wrapping inside the band may be completed by hand as described above for the lower band.

Wrapping wire splicing shall be done using electrical resistance welding. The welded product shall display sound weld and smooth groove transition.

Cable Band Sealing

Cable bands shall be sealed and caulked after the cable has been wrapped at that band, and before the field painting of the cable and cable bands has begun. The full depth of the opening between the 2 halves of the cable band and the full circumference of each end of the cable band shall be caulked with a sealing compound as specified herein. The opening across the top and each end of the cable band shall be fully sealed. The opening across the bottom of the cable band shall be only partly sealed as shown on the plans.

Zinc paste waterproofing system

Immediately before the application of the zinc paste waterproofing system, the cable surface shall be dry and all remaining dust or loose particles shall be removed by vacuuming methods. After vacuuming, the cable surface shall be cleaned with mineral spirits. The Contractor shall notify the Engineer at least 24 hours before the application of the zinc paste waterproofing system.

The Contractor shall arrange for the zinc paste waterproofing system manufacturer's representative to be present at all times during the application of the zinc paste waterproofing system until final acceptance of the zinc paste waterproofing system. The manufacturer's representative shall be qualified and experienced and shall certify to the Engineer as to the acceptability of every phase of the operation, which includes, but is not limited to, surface preparation of the cable surface, mixing of the components, method of application, and removal of excess paste from the wrapping wire surface.

Zinc paste waterproofing system shall not be applied when rain is forecast within 6 hours of the application.

The temperature of the cable wires shall be at least 3°C above the dew point.

The zinc paste shall be applied to the cable surface by brush, trowel, or grease mitt in excess such that a layer of zinc paste is forced out ahead of the wrapping wire and between the wrapping wires, both of which indicate that voids and crevices between cable wires and between the wrapping wire and cable wires have been completely filled with paste.

Excess paste that seeps out between wrapping wires shall be removed from the surface of the wrapping wires immediately using cloth rags moistened with mineral spirits. Excess paste that is forced out ahead of the wrapping wire may be collected and, if not contaminated, reapplied to the cable surface.

The cable wrapping wire shall be installed over the bed of zinc paste waterproofing system within six hours of the application of the zinc paste.

Handropes and handrope fittings

After the design load of the box girder has been transferred to the cable system and before dismantling the footbridge system, the handrope cables shall be installed and tensioned as shown on the plans. Handrope and utility support stanchions shall be plumb to a tolerance of 1:100 in any direction.

MEASUREMENT AND PAYMENT

Measurement for the cable system shall conform to the provisions in Sections 55-4.01, "Measurement," of the Standard Specifications and these special provisions.

No allowance will be made for the mass of the cable wrapping wire in computing the mass of metal to be paid for.

The PWS cable system will be paid for at the contract price per kilogram for furnish and erect PWS cable system.

The suspender system will be paid for at the contract price per kilogram for furnish and erect suspender system.

Costs for preparing working drawings in excess of amounts allocated in "Accelerated Working Drawings Submittal" item shall be considered as included in contract prices paid for the various items of work and no additional compensation will be allowed therefor.

The contract price paid per kilogram for furnish PWS cable system shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in furnishing, fabricating and delivering the PWS cable system to the job site, ready for erection, including conforming to the qualification and testing requirements associated with component fabrication, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract price paid per kilogram for erecting PWS cable system shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in erecting the PWS cable system, including conforming to the qualification and testing requirements associated with component erection; as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract price paid per kilogram for furnish suspender system shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in furnishing, fabricating and delivering the suspender system to the job site, ready for erection, including conforming to the qualification and testing requirements associated with component fabrication, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract price paid per kilogram for erect suspender system shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in erecting the suspender system, including conforming to the qualification and testing requirements associated with member erection, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

If a portion or all of the cable or suspender systems are tested at a site more than 480 air-line kilometers from either Sacramento or Los Angeles, additional shop inspection expenses will be sustained by the State. Payment to the Contractor for the cable or suspender systems will be reduced $5,000 for each testing site located more than 480 air line kilometers from either Sacramento or Los Angeles. If a portion or all of the cable or suspender systems are tested at a site more than 4,800 air-line kilometers from either Sacramento or Los Angeles, payment to the Contractor for the cable or suspender systems will be reduced $8,000 for each testing site.

10-1.61 TOWER SUSPENDER ASSEMBLY

This work shall consist of fabricating, furnishing, installing and tensioning aramid fiber ropes for the tower suspender assemblies as shown on the plans and as specified in these special provisions.

Each tower suspender assembly shall consist of the following:

A. 4 pieces of aramid fiber rope with polyester filler
B. Extruded polyurethane jackets
C. Type 1 suspender sockets
D. Potting resin.

WORKING DRAWINGS

Attention is directed to "Working Drawings," of these special provisions.

Working drawings shall contain all information required for the fabrication and installation of the tower suspender assemblies, including, at a minimum, the following:

A. Procedure for stretching the rope and controlling the length;
B. Procedure for measuring breaking strength;
C. Procedure to measure strain of rope (creep);
D. Design geometry lines and fabrication geometry working lines;
E. Details of temporary fabrications required for installation;

The Contractor shall allow the Engineer 20 days to review the tower suspender working drawings.

MATERIAL

Aramid Fiber Rope

Tower suspender ropes shall be approximately 75 mm outside diameter, aramid fiber core with polyester fiber filler, and shall conform to the following:

A. Ropes shall be covered in extruded polyurethane jackets with a UV protection rating recommended by the manufacturer for exterior use.
B. Aramid fiber ropes shall have a minimum breaking strength of 56,400 kg when tested in conformance with manufacturer standard operating procedures.

Sockets and Socketing

Tower suspender shall be socketted using a Type 1 suspender socket as shown on the plans.

Potting material shall be as recommended by the rope manufacture.

Split PVC sleeves shall be commercial quality.
Polyurethane glue shall be commercial quality.

TESTING

The finished aramid fiber rope shall be tested in accordance with the manufacturer's standard operating procedures.

Elastic modulus testing:

A. Testing performed on representative production samples of 1.5 m in length
B. Determination of intial creep behavior (48 hours)
C. Determination of load-elongation behavior up to 40% of breaking strength

The Contractor may submit certified test reports on previous rope testing.

Breaking tension test of one sample:

A. Elongation at break-The total elongation of the rope shall exceed three to six percent at the minimum breaking strength.

B. Load at break
C. Failure mechanisms – The failure mechanism shall consist of sequential rupturing of the individual strands.

APPROVED SUPPLIERS

The following are approved suppliers of aramid fiber ropes:

Cortland Cable
44 River Street
Box 330
Cortland, NY 13045
(607) 753-8276

Phillystran Inc.
151 Commerce Drive
Montgomery, PA 18936-9628
(215) 368-6611

Whitehill Manufacturing Corp.
2540 Green Street
Chester, PA 19013
(610) 494-2378

CONSTRUCTION

Tower suspenders shall not be installed and tensioned until after the deck, cables, steel suspenders, bikepath and counterweight, the removal of temporary towers and the placement of the final wearing surface.

Tower suspenders shall be installed with a tension of 150% of the specified dead load tension value shown on the plans.

PAYMENT

Tower suspender assemblies will be paid for on a lump sum basis.

The contract lump sum price paid for tower suspender assemblies shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in fabricating, furnishing, and erecting tower suspender assemblies, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.62 SERVICE PLATFORMS

Construction of service platforms shall conform to the details shown on the plans and to these special provisions.

Service platforms shall consist of the following major items:

1. Steel structures
2. Steel grating
3. Painting
4. Railing
5. Stairs
6. Guardrails
7. Handrails
8. All anchors, fastenings, hardware, accessories and other supplementary parts necessary to complete the work.

Painting shall conform to the provisions in "Clean and Paint Structural Steel" of these special provisions.

Railing, stairs, guardrails, handrails, anchors, fastenings, hardware, accessories and other supplementary parts shall conform to the provisions in "Miscellaneous Metal (Service Platforms)" of these special provisions.

STEEL STRUCTURES (SERVICE PLATFORMS)

Construction of steel structures for service platforms, shall conform to the provisions in "Steel Structures" of these special provisions.

Steel structures (service platforms) shall include furnishing, fabricating, and erecting the structural steel, construction and removal of the temporary construction, and all work required to complete the service platform structure.

PAYMENT

The contract unit price paid for service platforms, shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in service platforms, complete in place, including steel structures, steel grating, painting, railing, stairs, guardrails, handrails, anchors, fastenings, hardware, accessories and other supplementary parts, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.63 TRAVELER SCAFFOLDS

GENERAL

This work shall consist of furnishing, fabricating, testing and installing five under-deck traveler scaffolds in accordance with the details shown on the plans and the provisions of Section 55, "Steel Structures," Section 57, "Timber Structures," of the Standard Specifications, and these special provisions.

Attention is directed to "Welding" of these special provisions regarding welding of traveler scaffolds. Unless otherwise specified, welding of traveler scaffolds shall be in conformance with the requirements in AWS D1.1.The Contractor shall fully detail the travelers and all their components in accordance with the details shown on the plans and shall be responsible for verifying all dimensions and identifying any conflicts and bring these to the attention of the Engineer for resolution.

The Contractor shall confirm all dimensions, clearances and fit of the travelers to the permanent structure. Any conflicts shall be brought to the attention of the Engineer for resolution.

This work shall include all final component design, where applicable, shop and field testing, and operator instruction for mechanical and pneumatic systems.

Unless otherwise noted, exposed steel shall be painted in accordance with the provisions of Section 59, "Painting," of the Standard Specification. Exposed moving parts of the drive machinery shall be painted OSHA safety red, orange, yellow or green conforming to the requirements of ANSI Z54.2.

Attention is directed to "Relations with United States Coast Guard" of these special provisions.

The Contractor shall demonstrate experience in the design and installation of pneumatic systems, and shall have completed a minimum of 3 successful bridge traveler or similar underhung crane projects within the last 5 years.

A qualified technical representative of the manufacturer(s) shall be present during installation and testing of the travelers.

The Contractor shall provide one experienced service technician for a minimum of 8 working days to instruct personnel appointed by the Engineer on how to properly operate and maintain the travelers.

Stainless steel capacity plates shall be furnished and installed indicating the permitted live loading using the wording noted on each individual traveler assembly drawing. Attachments shall be by means of corrosion-resistant fasteners. The plates shall be mounted where they are visible to the personnel on the traveler.

Each traveler shall be provided with four navigation lights meeting minimum Coast Guard navigation requirements for inland waterways for visibility and color. The navigation lights shall be watertight and be capable of being maintained from the traveler. The navigation lights shall be equipped with 60 meter long extension chords for attachment to 110 volt power to be supplied by others.

Any materials damaged during shipment or handling shall be repaired or replaced at the Contractor's expense.

The fourth paragraph in Section 55-2.02, "Structural Steel," and the fourth paragraph in Section 55-2.07, "Unidentified Stock Material," of the Standard Specifications shall not apply.

MATERIAL AND WORKMANSHIP

Bolts, nuts and washers, except where specified to be stainless steel, shall be galvanized in accordance with the provisions in Section 75-1.05, "Galvanizing," of the Standard Specifications. Bolts, nuts and washers shall conform to the United States Standard Measures version of ASTM Designation: A325 unless noted otherwise on the plans.

Bolted connections shall conform to requirements in "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" (RCSC Specification) approved by the Research Council on Structural Connections of the Engineering Foundation.

Structural Steel

The specific requirements for grades of steel are shown on the plans.

Tubular or pipe connections

Dimensional details and workmanship for welded joints in tubular and pipe connections shall conform to the provisions in Part C, Structural Details; Part D, Special Provisions for Welding Tubular Joints; and Part E, Workmanship, in Section 10 of AWS D1.1.

Decking Plywood

Plywood panels for decking shall conform to or exceed the requirements of U.S. Product Standard PS-1-9S for APA Structural 1 AB Marine Grade. Plywood shall be pressure treated. Plywood decking shall be painted on all sides.

Deck – Expanded Metal Grating

Where expanded metal grating is called on the plans, it shall be expanded metal structural grating of the weight size and style shown on the drawings.

The grating shall be trimmed at its edges with U edging or flat bar edging as shown on the drawings. The edging material is to be welded to the grating.

The grating assemblies are to be hot dip galvanized in accordance with the specifications.

The grating has been specified using the designations generally employed by Dramex Corporation and McNichols Company. Grating by other manufacturers of equal thickness and strength and slip resistance is acceptable.

Wooden Toeboards and Curbs

Wooden toeboards and curbs shall be pressure treated S4S Douglas Fir. Toeboards shall be painted on all sides.

Pressure Treatment of Wood

Pressure treatment shall conform to AWPA Standard C1 to a retention of at least 1.95 kg/m3.

Hardware for wooden toeboards and curbs

Hardware shall consist of all fasteners, carriage bolts with attached washer used to attach decking to the steel structure, lag screws or bolts through the toeboards, blind rivets, oil impregnated bronze bars, stainless steel socket set screws, or any other hardware shown on the plans to attach the decking or toeboards to the traveler structure and shall conform to Section 75-1.02, "Miscellaneous Iron and Steel," of the Standard Specifications.

Rigging Hardware (Shackles etc.)

Rigging hardware shall be hot dip galvanized and shall meet the strength requirements shown on the specific plans.

The travelers have been detailed using the dimensions for Crosby material. Part numbers are given. Substitutions of equal strength are permitted. The Traveler supplier shall re-detail any parts affected by such substitutions.

Nylon

Nylon elements are to be made from Nylon 101, unfilled, Type 66 nylon, having the following physical characteristics:

Tensile Strength:	79 MPa
Modulus of Elasticity (Tensile):	2900 MPa
Hardness - Rockwell M:	85 MPa

Substitution of Nylatron GS Nylon, Type 66, MoS2 filled will be accepted.

The Contractor shall supply additional nylon parts for spares.

Chains

Chains shall be hot dip galvanized and shall have the minimum tensile strengths shown on the plans.

Blind Rivets

Blind rivets for connecting plywood deck to the traveler shall be stainless steel, 4.8 mm diameter and shall be installed at 305 mm maximum on center along edges of plywood sheets and at 610 mm on center on intermediate supports unless otherwise specified. Blind rivets are not to be installed into any tubular sections.

Teflon

Teflon for sliding bearings in the rail supports shall be commercial.

Non-destructive testing of the welds

Complete joint penetration (CJP) welds on all suspension components including links, suspension arms and lift plates, shall be 100 percent magnetic particle inspected and 100 percent radiographically or ultrasonically inspected. Partial joint penetration (PJP) and fillet welds on all suspension components including links, suspension arms and lift plates, shall be 100 percent magnetic particle inspected. Other CJP welds shall be 10% radiographically or ultrasonically inspected. Other PJP and fillet welds shall be 10% magnetic particle inspected.

Categories of welds not 100% tested shall be sampled at the specified rate by inspecting 100% of one weld out of each 10 similar welds within the production lot for a 10% rate. If any rejectable indications are found, an additional weld shall be 100% inspected by the same method. If any rejectable indications are found in the additional weld, all welds in the lot shall be inspected 100%. If any rejectable indications are found in the remainder, the sampling rate shall be doubled. All rejected welds shall be repaired, or replaced, and retested 100% by the same method.

The fabricator shall submit detailed magnetic particles and radiographic test procedures to the Engineer for review, and shall not proceed with the testing until the Engineer has approved the procedures.

Other welds are to be non-destructively tested at the frequency shown on the plans or described in other parts of these special provisions, whichever is the greater.

Marine Grade Epoxy Finish

Marine grade epoxy finish shall conform to the requirements of these special provisions.

Surfaces to be coated with marine grade epoxy shall be blast cleaned in accordance with the requirements in Section 59-2.03 "Blast Cleaning," of the Standard Specifications.

Marine grade epoxy shall be applied to two coats. The dry film thickness of the each coat shall not be less than 100 microns minimum nor more than 150 microns maximum.

The final coat color shall match Federal Standard No. 595B, No. 13432.

The target minimum total dry film thickness shall be 200 microns for smooth surfaces without major surface discontinuities. The target minimum total dry film thickness shall be 300 microns for mating surfaces.

Electroless Plating – Linear Actuators

Load screws and projecting shafts of the linear actuators shall be electroplated with an amorphous nanocrystalline composite of nickel tungsten and boron.

The coating shall be applied to prepared substrate in accordance with manufacturer's recommendations. Care shall be taken to remove all contaminants from the substrate prior to plating.

The coating shall be deposited to a minimum thickness of 0.001 inch. (0.025 mm).

The coating shall be demonstrated to be unaffected by ASTM Salt Spray Test B117 for a minimum period of 200 hours.

ERECTING, TESTING, AND WEIGHING OF THE COMPLETED TRAVELER

Erection of the Travelers

The Contractor shall be responsible for devising and executing an erection method for the travelers including the provision of all required calculations, the supply of any necessary temporary material, the development of appropriate method statements.

Unless otherwise approved by the Engineer, the requirements of the erection method shall not increase the weight of the traveler.

Weighing of Traveler

The Contractor shall carry out a detailed weight take off for all the travelers and shall submit this to the Engineer for his review prior to starting any fabrication.

Each traveler scaffold shall be weighed prior to installation on the bridge, with the method of weighing subject to approval by the Engineer. The weights for each traveler shall be taken and recorded at each trolley support; the total weight will be the sum of those individual weights.

The anticipated weights of the travelers are shown on the individual traveler assembly drawings. Should the actual weight measured deviate from these values by 10% or more, the actual weights shall be submitted to the Engineer for his review and determination of what action, if any, is required.

Pre-test requirements

Before starting or operating systems, the Contractor shall flush and clean equipment and check for proper installation, lubrication and servicing.

General requirements

The Contractor shall test and start up mechanical systems upon installation of the travelers on the bridge as hereinafter specified. The Contractor shall follow the equipment manufacturer's break-in procedure before full load testing for all equipment. Final adjustments and balancing of the systems shall be performed so they will operate as specified. The Contractor shall replace or revise any equipment, systems or work found deficient during tests. Particular care shall be used in lubricating bearings to avoid damage by overfilling with lubricant and blowing out seals.

The Contractor shall repair, or replace with new equipment, any equipment damaged during shipment, after delivery, during installation and during testing.

The Contractor shall perform tests after installing the hoses to insure the lines are airtight. The test shall be conducted for a period of one hour at the design pressure. Defective work shall be repaired at the Contractor's expense.

Field Tests

The Engineer shall be notified at least 3 days in advance of starting these tests.

Upon completion of mechanical work and pre-test requirements, or at such time prior to completion as determined by the Engineer, the Contractor shall operate and test the travelers and their installed mechanical systems as described below. Travelers which will cross expansion joints in service shall cross at least one expansion joint in each direction during this test.

Each of the completed travelers shall be field tested on the bridge as follows:

A. All traveler structural, mechanical and pneumatic components shall be completely installed and functional prior to commencement of these tests. All components shall be monitored during the testing to assure that no excessive heating per the manufacturer's guidelines occurs, and that no binding occurs.
B. Tests shall be conducted with the traveler fully loaded per the maximum design loading stated in the plans.
C. All tests shall be conducted in both the upgrade and downgrade directions.
D. For the SAS and E2/E3 travelers, the traveler shall be intentionally skewed up to the design value of 10% (5.7 degrees) in either direction. As the carriage is skewed, careful check shall be made for structural or other interferences, and correction made as necessary.
E. The traveler speed shall be tested.
F. All conditions that prevent the proper functioning of the travelers and appurtenances shall be corrected at the Contractor's expense, and as approved by the Engineer. All testing shall be performed in the presence of the Engineer.

The Contractor shall furnish, install and remove all apparatus necessary for performing the tests.

TRAVELER SCAFFOLD MECHANICAL

General

Traveler scaffold mechanical consists of furnishing, fabricating, and installing the traveler scaffold mechanical equipment, including the on board air lines, in accordance with the details shown on the plans, the provisions in Section 55, "Steel Structures," of the Standard Specifications and these Special Provisions.

The fourth paragraph in Section 55-2.07, "Unidentified Stock Material," of the Standard Specifications shall not apply.

Mechanical work shall include furnishing all detailed design, labor, materials, equipment and services required to provide operating travelers.

Equipment

All equipment shall be manufactured from material that is resistant to deterioration or corrosion in a marine environment or shall have a protective coating to provide such resistance. Seals and gasket material shall be suitable for air or non-corrosive gases and shall be resistant to deterioration in a marine environment and to hydrocarbons (air-entrained petroleum or vehicle exhaust).

Miscellaneous bolts, nuts, washers, fasteners, and springs shall be 18-8 stainless steel.

All equipment shall be capable of operating in a temperature range of –6º C to 95º C and shall be rated for operation in a pressure range 170 kPa gauge to 1,000 kPa gauge. (25 to 145 psig) unless otherwise noted. Operating pressure available on the bridge may vary from 490 kPa to 620 kPa. For the linear actuator air motors, pressure relief valves are to be supplied to prevent the application to the motors of pressures in excess of 690 kPa (100 psig) under any circumstances.

Traveler supplier is to verify that all components of the mechanical and pneumatic systems are compatible with each other and with the structural components.

Lubrication points shall be furnished with pressure type lubrication fittings. All bearings requiring greasing shall be equipped with grease fittings. Grease fittings shall all be one size and shall be located for easy access.

Codes

All work, including equipment, material and installation, shall conform to California Administrative Code, Title 8, Division of Industrial Safety.

The Contractor shall coordinate the supply of the quick disconnect fittings that are mounted on the bridge with those on the travelers.

Products

For the purposes of completing the detailing of the individual components of the travelers selection of specific mechanical equipment has been made. The product is component is named on the plans or in this specification.

The specific items named are suitable and acceptable for use on these travelers. The traveler supplier may substitute other items of equipment provided that the strength and performance of the proposed substitution is at least equal to the performance of the named item and that the durability of the substitution is at least equal to that of the named item.

Any such proposed substitutions shall be submitted to the Engineer with sufficient documentation to support their acceptance. The Engineer will determine the acceptability of the proposed substitution.

Should the substitution be found acceptable, the traveler supplier shall re-detail, at his expense, any components that require alteration as a result of this substitution.

A. **Piston motor driven trolley (motor trolley) -** Piston motor driven trolley shall be Ingersoll-Rand series ATE –MR 3/6 air driven trolley or approved equivalent and shall be installed in accordance with the details shown on the plans. The drive wheels shall be connected to the air motor by means of a geared speed reducing power train.
Piston motor driven trolleys shall be rated by the manufacturer to have a minimum Factor of Safety as follows:

Rated Load – 6000 kg @ 5:1 Factor of Safety

The manufacturer shall certify that the trolleys are structurally capable of carrying a Rated Load of 6000 kg with a Factor of Safety of at least 5.0. Note that the actual service loads on the trolleys are substantially less than the rated loads noted above.
The drive wheels shall be cast iron or ductile iron or mechanical steel and shall have a compound tread shape suitable for operation on the lower flange of the 127 mm wide flat flange rail and the 181 mm wide taper flange rail and shall provide adequate clearance from the splice plates and jumper assemblies.

The units shall have the "marine grade epoxy finish" in accordance with these Special Provisions.
The air motor shall be 4 cylinder reversible, radial piston-type having a remote control valve chest. Crank pin and connecting rods shall be drop forged construction. Bearings and shafting shall have dust shields.
Starting, reversing and stopping of the traveler scaffold shall be accomplished by means of remotely controlled throttle installed as shown on the plans and specified herein.
Wheel treads shall be hardened. Wheel tread hardness shall be 275 BHN.

B. **Passive trolley –** Passive trolley shall be Ingersoll Rand – Model BTP-MR 316 or approved equivalent. Trolleys shall have cast iron, ductile iron or surface hardened steel wheels hardened to BHN 269 with compound treads for operation on flat and tapered flanges and shall be equipped with thrust ball or roller bearings in hardened races and with dust seals. Trolley wheels shall be suitable for operation on the lower flange of the traveler rails. Trolley wheels shall have a Rated Load of 1500 kg each with a 5:1 minimum Factor of Safety.
The assembled trolley shall have a Rated Load of 6000 kg with a minimum factor of safety of 5:1.
Note that the actual applied load is substantially less than the Rated Load.
Trolley shall have a marine grade epoxy finish.

C. **Brake trolleys -** Brake trolleys shall be as shown on the plans. Brake trolleys shall have cast iron, ductile iron or surface hardened steel wheels with compound treads and shall be equipped with thrust ball or roller bearings in hardened races and with dust seals. Trolley wheels shall be suitable for operation on the lower flange of the traveler rails. Trolley wheels shall have a Rated Load of 1500 kg each with a minimum Factor of Safety of 5:1.
Brake trolley shall have a marine grade epoxy finish.

D. **Air Actuated Safety parking brake -** The brakes shall be spring-actuated to set the brake full stop. Brake release shall be by air pressure. Each brake shoe shall be operated by a brake chamber.

The position of the fabric-lined brake shoe shall be controlled by means of an operating cylinder having a bore of approximately 152 mm diameter and a single acting spring loaded piston. Stroke shall be 50 mm minimum.
The brake shall be rated at 590 kg clamping force at 58 mm and 840 kg at 0 mm stroke. The brake shall set at 25 mm stroke. Brakes shall release to 0 mm stroke under 480 kPa air pressure.
Brake shoe shall provide a minimum holding capacity of 2.7 kN on galvanized rail with a minimum factor of safety of 1.33.
Under a condition of zero gauge air pressure, the safety parking brake shall be in the "on" position preventing movement of the travelers.

E. **Foot-operated Poppet Valve. -** The foot-operated poppet valve shall be a 3-way foot-operated, spring return, normally closed poppet valve. The valve shall have a bronze body and NPT National Pipe Thread ports and shall be

suitable for the anticipated air flow at 860 kPa gauge minimum working pressure. Downstream side shall be at atmosphere when "off."

F. **Throttle control valve -** The throttle remote control valve shall be a lever operated disc or rotor type. Valve shall have mechanite body and National Pipe Thread ports and, when supplied with 690 kPa gauge inlet air, the valve shall be rated for the anticipated air flow capacity. Valve shall be suitable for at least 860 kPa working pressure.

G. **Compressed air piping -** Piping for air lines on the traveler shall be rigid pipe of the nominal size Imperial shown on the plans with flexible hose for no more than 750 mm connecting to the brakes and motors unless longer lengths of flexible hose are shown on the drawings.

H. **Ball valve -** Ball valves shall be Class 400 bronze body with bronze trim and threaded ends.

I. **Whistle -** Whistles shall be 38 mm bell diameter and produce 100 dB tone minimum at 690 kPa supplied air pressure.

J. **Whistle valve -** Whistle valve shall be a poppet valve, 2-way lever operated, normally closed type. The valve shall have brass steel body and NPT National Pipe Thread ports and, when supplied with 690 kPa gauge inlet air, the valve shall be rated for a flow capacity of 42 L/s, and shall be suitable for 1,000 kPa gauge minimum working pressure.

K. **Flexible Hose –** Flexible hose shall have a rubber core, 2 synthetic body plies and a weather and abrasion resistant cove. Hose shall have a minimum rated pressure of 2,000 kPa. All clamps, couplings, and other hardware used in conjunction with the hose shall be made of stainless steel and shall be rated for 2,000 kPa.

L. **Quick coupling -** Quick coupling shall be claw type, bronze body, with neoprene gasket. NPS threaded ends for pipe, and barb end for hose. This shall not apply to the quick disconnects specified in item U below.

M. **Pressure regulator assembly -** Pressure regulator assembly shall be combination type, with 50 micron filter element rating, automatic drain and plastic bowl, 0 kPa to 1,000 kPa pressure regulator with pressure gauge, and 500 ml lubricator. The filter and lubricator elements shall be similar in size and appearance and shall be supplied by the same manufacturer. A manual drain shall be supplied at the low point of the oil storage bowl. Port sizes for both elements shall be the line size.

N. **Pressure gages -** Pressure gages shall be included and shall be 50 mm dial type, Grade A, and National Pipe Thread back ported. Pressure gages shall have a range of 0 kPa to 1,350 kPa.

O. **Double check valve -** Double check valve shall be bronze body, NPT 1/2 inlets and NPT 1/2 outlet with a stainless steel ball. The valve shall be rated for at least 860 kPa operating pressure and shall be of the type used for truck braking systems.
The purpose of this valve is to supply pressure to the brake cylinders to release the brake when the foot operated poppet valve has been actuated and to vent the brake cylinders to atmosphere once the foot operated poppet valve is released.

P. **Compressed air piping –** Piping for on board air lines shall be Schedule 40 galvanized steel pipe conforming to ASTM Designation: A 53, Type S, Grade B. Fittings shall be extra heavy type, galvanized steel or malleable iron.

Q. **Dump (Quick Exhaust) Valve** - Dump valves are to be provided for each braking system to ensure quick operation of the brakes. Dump valve is to be pilot operated and spring loaded and suitable for quick exhausting of the brake cylinders.

R. **Linear Actuators** – Linear actuators shall be supplied by one of the following manufacturers, or equal:

VENDOR ADDRESS AND PHONE NUMBER
TEMPLETON KENLY SIMPLEX (A Division of Templeton Kenly) 2525 Gardner Road Broadview, IL 60155 Phone: 800-275-5225 Fax: 708-865-0894
NOOK INDUSTRIES, INC. 4950 East 49th Street Cleveland, Ohio 44125-1016 Phone: 216-271-7900 Fax: 216-271-7020 Contact: Ron Giovannone
JOYCE-DAYTON CORP. P.O. Box 1630 Dayton, Ohio 45401 Phone: 937-294-6261 Fax: 937-297-7173 Contact: Eric Claudepierre

For the purposes of completing the detailing of all associated components, a specific selection has been made for linear actuators. The units selected are Templeton Kenly, Unilift, M Series screw actuators. The specific unit descriptions are shown on the plans. Substitutions of equivalent performance may be proposed for review by the Engineer. Should such substitution be accepted, the traveler supplier shall re-detail, at his expense any components affected by the substitutions.

Ball screw actuators will not be accepted as a substitution due to potential backwards movement under load.

The actuator load screws and exposed shafts shall be steel that is electroplated as specified in these special provisions, that will withstand severe environmental exposure including salt-laden air.

The actuator screws for the M50 units shall be made from mechanical tubing to reduce weight.

Each actuator shall be supplied with a protective rubber boot as shown on the plans.

Actuators shall be marine grade epoxy coated.

S. **Actuator Drive Air Motors** - Actuator drive air motors shall be supplied by one of the following manufacturers, or equal

VENDOR ADDRESS AND PHONE NUMBER
INGERSOLL-RAND Ingersoll-Rand Tool and Hoist Division 11909 Telegraph Road Santa Fe Springs, CA 90670 Phone: 562-777-0808 Fax: 562-777-0818
COOPERTOOLS 2000 S. Santa Cruz Street Anaheim, CA 92805-6816 Phone: 714-712-5800 Fax: 714-712-5801 Contact: Glenn Anderson
PSI AUTOMATION P.O. Box 34486 Houston, TX 77234-4486 Phone: 800-392-3602 Fax: 281-280-8795 Contact: Bob Arnett

For the purposes of completing the detailing of all associated components, a specific selection has been made for the drive motors for the linear actuators. The units selected are Ingersoll Rand units. The specific model numbers are as shown on the plans.

Substitution of units with equivalent performance and durability may be proposed for review by the Engineer.

Should such substitutions be accepted, the traveler supplier shall re-detail, at his expense, all affected components.

Substitute air motors shall have starting, running and stall torque values within 10% of the values for the selected motors within the pressure range of 490 to 690 kPa.

The maximum force in the actuators at stall out of the motors must not exceed the current value by more the 10%.

The motor starting torque available at 490 kPa air pressure shall be sufficient to extend the proposed actuators under the following axial compressive loads:

Type	Axial Compressive Load
ACT 03, 04, 05, and 06 (M50)	40.0 kN, min
ACT 01 and 02 (M30)	31.5 kN, min

The ultimate column buckling strength of the proposed actuators shall meet or exceed the following values:

Unit Type	Unsupported Length, min	Ultimate Column Buckling Load
M30	3581 mm	176 kN
M50	4583 mm	170 kN

Ultimate column buckling load = (1.5 x dead load) + (10 x live load)

Drive motors shall be marine grade epoxy coated.

T. **Couplings and Shafts** - Couplings and shafts shall be of the type shown on the plans and shall be rated for the torque values shown on the plans.

U. **Quick Disconnect Couplings**
The description applies only to the quick disconnect couplings that are used on the E2/E3 travelers to change suspension systems at Hinge A.
The purpose of these couplings is to allow disconnection of the air supply to either trolley train as the suspension is changed from SAS rails to Skyway Rails.
The requirements are shown schematically on the plans.
The manufacturer is to propose a style and model of disconnect coupling that is suitable for this use, that can be disconnected and re-connected without the use of tools and that will close off the disconnected hose ends such that full operating air pressure can be applied against the disconnected free ends.

OPERATION

Each traveler shall be equipped with two control stations mounted in the positions shown on the plans. The control stations shall be a watertight and corrosion resistant enclosure. The controls for the travelers shall be equipped with deadman controls, which interrupts the air flow when the operator becomes incapacitated or cannot continue to operate the controls. This deadman control shall be knee or foot operated. Manually operated proportional control throttle valves shall be provided, one to control each side of the traveler.

When the distribution piping is connected to the bridge air system nominal (nominal 620 kPa gauge, 490 kPa gauge minimum), a single operator shall be able to operate the traveler by depressing the foot valve and moving the two hand throttles from the neutral position. The following shall be the sequence of operation for the traveler motors:

A. The foot-operated poppet valve is depressed.
B. Air is transmitted to release the brake and provide air to the throttle valves.
C. The hand controls of the throttle valves are moved to the desired port alignment to allow air flow to the motors. Flow shall be proportional to hand control movement.
D. When the throttle and control handle is returned to the neutral position air supply to the motors is cut off and the motors stop. The control handle shall return automatically to the neutral position when released.
E. When the foot valve is released, air to the brake and throttle valve is cut off, causing the spring-loaded brake to set and the throttle valve to become inoperative. The foot valve is a dead man safety control, which causes the brake to set whenever the pedal is released.

SUBMITTALS

Working Drawings

The Contractor shall submit working drawings to the Engineer for approval in accordance with the provisions in "Working Drawings," of these special provisions.

The Contractor shall allow 50 days for the review by the Engineer after complete drawings and all supplemental data, including calculations and calculated weights, are submitted. Fabrication shall not commence until the Engineer's approval is received.

The working drawings shall contain all information required for the quality control and proper construction of maintenance travelers.

Working drawings shall include the following:

A. Complete details, material specifications and schedules for fabrication and shop assemblies. Complete details shall include, but not be limited to, all components, materials, and methods to support, propel, and brake the travelers.
B. Details showing the fit and assembly of all steel and other elements required to complete the work.
C. Complete piping and control diagrams showing interconnection of all pneumatic apparatus and equipment.

Calculations for all mechanical components designed or detailed by the fabricator, and also the associated working drawings, shall be stamped and signed by an engineer who is registered as a Mechanical Engineer in the State of California.

The Contractor shall verify space availability, fit-up and compatibility for any and all component equipment and apparatus to be installed.

The Contractor shall confirm all dimensionings, clearances and fit of the travelers to the permanent structure. Any conflicts shall be brought to the attention of the Engineer for resolution.

Product data.

A list of materials and equipment to be installed, manufacturer's descriptive data, and such other data as may be requested by the Engineer shall be submitted for approval prior to purchase and fabrication.

Manufacturer's descriptive data shall include complete description, performance data and installation instructions for the materials and equipment specified herein.

The Contractor shall submit manufacturer's descriptive data to the Engineer for approval.

The Contractor shall allow 10 weeks for the review by the Engineer after all data are submitted.

Operation and Maintenance Manuals. Prior to the completion of the contract, 5 identified copies of the operation and maintenance instructions (with parts lists) shall be delivered to the Engineer. The instructions and parts lists shall be in a bound manual form and shall be complete and adequate for the equipment installed. Inadequate or incomplete material will be returned. The Contractor shall resubmit adequate and complete manuals at no expense to the State.

Manuals shall include, but not be limited to, the following:

A. Index
B. Vendor names, addresses and telephone numbers
C. Manufacturer's published literature describing equipment capacity and function
D. Complete operating and maintenance instructions with exploded views of assemblies and step by step sequence of assembly and disassembly.
E. Complete nomenclature of all parts, part numbers and current cost
F. Copies of all guarantees and warranties
G. Copies of approved shop drawings
H. Copies of "as-built" drawings
I. Copies of approved catalog cuts
J. Complete lubrication chart indicating location, type and frequency of lubrication
K. Trouble shooting information
L. Preventative maintenance requirements

Spare Parts

The Contractors shall supply the following items as spare parts. These shall be delivered to a location to be specified by the owner.

- 2 - piston motor driven powered trolleys
- 1 - passive trolley (complete)
- 4 - brake actuator cylinders
- 8 - trolley wheels
- 100 % extra quantity of nylon bearing for the large traveler suspension arms
- 100% extra quantity of nylon bearings for sliding rail connections for traveler rails crossing the Hinge A joint.
- 10% extra quantity of 6.4 and 9.5 mm thick teflon pads for sliding rail connections
- 4 - extra throttle valves for control of the air powered trolleys
- 1 – extra throttle valve for control of the linear actuator drive motor
- 1 - extra air motor for operation of the linear actuators

- 10% extra, (minimum quantity 2) – of every other pneumatic circuit component
- 1 - extra M50 actuator unit without load screw
- 1 - extra M30 actuator unit without load screw
- 100% extra quantity of the assembly pins for the large traveler suspension systems

Supply Only Items

The following items are to be supplied which are not specifically shown on the plans.

A. Two – 10 ton capacity chain falls for each of the E2/E3 travelers – total 4
B. A steel tool and storage box 1 m x 0.8 m x 0.8 m for each of the 5 travelers.

Trolley Units and Actuator.

The steel used for the support wheels, gears, axles, bushings, and other appurtenances shall be specified by the respective manufacturer or Contractor. Wheels shall be either cast or forged. The steel classification and specifications shall be submitted to the Engineer for approval prior to purchasing and fabrication.

All components of the mechanical and pneumatic systems shall be designed to be compatible with each other and with the structural components.

MEASUREMENT AND PAYMENT

Maintenance travelers, of the types shown on the Engineer's Estimate, will be measured and paid for on a lump sum basis.

The contract lump sum price paid for maintenance travelers of the types listed in the Engineer's Estimate shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in the maintenance travelers, complete in place, including, but not limited to, detailing, mechanical component selection, assembly, erection, shop and field testing, and operator instruction, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.64 TRAVELER SUPPORT RAILS

This work shall consist of furnishing and erecting new traveler rails in accordance with the details shown on the plans, the provisions in Section 55, "Steel Structures," of the Standard Specifications and these special provisions.

The work includes the detailing, supply and installation of all traveler rail support material and appurtenances necessary for rail support that are not part of the permanent main structure of the bridge including, but not limited to, connection angles, spacer plates, bolts and other material to be installed within or upon the structural box girder and cross beam.

The Contractor shall be responsible for locating and fully detailing all rail support connections, incorporating all the provisions of the typical and specific connections shown on the plans, and ensuring that these are compatible with the elements of the permanent bridge structure.

The fourth paragraph in Section 55-2.02, "Structural Steel," and the fourth paragraph in Section 55-2.07, "Unidentified Stock Material," of the Standard Specifications shall not apply.

Bolts, nuts and washers shall conform to the United States Standard Measures version of ASTM Designation: A325. Bolted connections shall conform to requirements in "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" (RCSC Specification) approved by the Research Council on Structural Connections of the Engineering Foundation.

Bolts, nuts and washers, except where these are specified to be stainless steel, shall be galvanized in accordance with the provisions in Section 75-1.05, "Galvanizing," of the Standard Specifications.

Traveler rails and other hardware items so designated shall be galvanized in accordance with the provisions in Section 75-1.05, "Galvanizing," of the Standard Specifications.

Traveler support rails will be measured and paid for by the kilogram.

The contract price paid per kilogram for traveler support rail shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in furnishing and installing the traveler support rails, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.65 SIGN STRUCTURES

Sign structures and foundations for overhead signs shall conform to the provisions in Section 56-1, "Overhead Sign Structures," of the Standard Specifications and these special provisions.

Before commencing fabrication of sign structures, the Contractor shall submit 2 sets of working drawings to the Engineer in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. The working drawings shall include sign panel dimensions, span lengths, post heights, anchorage layouts,

proposed splice locations, a snugging and tensioning pattern for anchor bolts and high strength bolted connections, and details for permanent steel anchor bolt templates. The working drawings shall be supplemented with a written quality control program that includes methods, equipment, and personnel necessary to satisfy the requirements specified herein and in the special provisions.

Working drawings shall be 559 mm x 864 mm or 279 mm x 432 mm in size and each drawing and calculation sheet shall include the State assigned designations for the contract number, sign structure type and reference as shown on the contract plans, District-County-Route-Kilometer Post, and contract number.

The Engineer shall have 30 days to review the sign structure working drawings after a complete submittal has been received. No fabrication or installation of sign structures shall be performed until the working drawings are approved in writing by the Engineer.

Should the Engineer fail to complete the review within the time allowance and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in reviewing the sign structure working drawings, the delay will be considered a right of way delay in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

A permanent steel template shall be used to maintain the proper anchor bolt spacing.

Attention is directed to Section 56-1.02A, "Bars, Plates and Shapes," of the Standard Specifications:

Pentagon pole sign structures structural materials shall be in conformance with the following:

Tapered steel post and base plate	ASTM Designation A 709, Grade 50
Hollow structural section	ASTM Designation A 500, Grade B
Materials not otherwise indicated	ASTM Designation A 709, Grade 36

One top nut, one leveling nut, and 2 washers shall be provided for the upper threaded portion of each anchor bolt.

Surfaces of base plates which are to come in contact with concrete, grout, or washers and leveling nuts shall be flat to within 3 mm tolerance in 305 mm, and to within 5 mm tolerance overall. Faying surfaces of plates in high-strength bolted connections including flange surfaces of field splices, chord joints, and frame junctures, and contact surfaces of plates used for breakaway slip base assemblies shall be flat to within 2 mm tolerance in 305 mm, and within 3 mm tolerance overall.

Thermally cut holes made in tubular members of sign supports, other than holes in base and flange plates, shall initially be made a minimum of 2 mm undersized, and then be mechanically enlarged by reaming or grinding to the final required size and shape. All edges shall have a surface roughness of not greater than 6.35 μm. Round holes may be drilled to the exact final diameter. No holes shall be made in members unless the holes are shown on the plans or are approved in writing by the Engineer.

Steel members used for overhead sign structures shall receive nondestructive testing (NDT) in conformance with AWS D1.1 and the following:

A.

Weld Location	Weld Type	Minimum Required NDT
Welds for butt joint welds in tubular sections, nontubular sections, and posts	CJP groove weld with backing ring	100% UT or RT
Longitudinal seam welds*	PJP groove weld	25% MT
	CJP groove weld	100% UT or RT
Welds for base plate, flange plate, or end cap to post or mast arm	CJP groove weld	25% UT or RT
	Fillet weld	25% MT
* Longitudinal seam welds shall have 60% minimum penetration, except that within 150 mm of any circumferential weld, longitudinal seam welds shall be CJP groove welds.		

B. A written procedure approved by the engineer shall be used when performing UT on material less than 8 mm thick. Contoured shoes shall be used when performing UT on round tubular sections under 1270 mm in diameter.

C. When less than 100 percent of a weld is specified for NDT, and if defects are found during this inspection, additional NDT shall be performed. This additional NDT shall be performed on 25 percent of the total weld for all similar welds, as determined by the Engineer, produced for sign structures in the project. If any portion of the additional weld inspected is found defective, 100 percent of all similar welds produced for sign structures in the project, as determined by the Engineer, shall be tested.

Circumferential welds and base plate to post welds may be repaired only one time without written permission from the Engineer.

Sheet metal for enclosing the pentagon pole sign mounting structure shall be flat, hot-rolled sheets, that are in conformance with ASTM Designation A 1011, Grade 33, galvanized after fabrication.

All ferrous metal parts of tubular sign structures shall be galvanized and shall be painted.

Full compensation for furnishing anchor bolt templates and for testing of welds shall be considered as included in the contract price paid per kilogram for furnish sign structure and no additional compensation will be allowed therefor.

10-1.66 CLEAN AND PAINT SIGN STRUCTURES

Sign structures shall be cleaned and painted in conformance with the provisions in Section 56-1.05, "Surface Finish," Section 59-2.05 "Steam Cleaning", Section 59-3, "Painting Galvanized Surfaces", and Section 91, "Paint," of the Standard Specifications and these special provisions.

Whenever the Standard Specifications refer to "Steel Structures Painting Council," the reference shall be replaced with "SSPC: The Society for Protective Coatings."

The Contractor shall provide suitable enclosures to permit cleaning and painting during inclement weather. Provisions shall be made to control atmospheric conditions inside the enclosures with limits suitable for cleaning throughout the cleaning operation, painting throughout the painting operation, and for the drying period in accordance with ASTM designation: D 1640. Full compensation for providing and maintaining such enclosures shall be considered as included in the prices paid for the various contract items of work requiring paint and no additional compensation will be allowed therefor.

No extension of contract time will be granted and no additional compensation will be allowed as a result of temperature or humidity which exceeds the limits for cleaning or painting designated herein.

APPLICATION

Fresh water shall be used for water rinsing operations. Water from water rinsing operations shall not be permitted to fall into the bay, or on public traffic, to flow across shoulders or lanes occupied by public traffic, or to flow into gutter or other drainage facilities.

Attention is directed to Section 59-2.01, "General," of the Standard Specifications.

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

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

The term "Exposed" shall not include the insides of steel boxes, pipes, and the like, when this specification is used for painting such items.

Prior to performing any painting or paint removal, the Contractor shall submit to the Engineer, in conformance with the provisions in "Working Drawings," of these special provisions, 3 copies of a separate Painting Quality Work Plan (PQWP) for each item of work for which painting or paint removal is to be performed. At a minimum, each PQWP shall include the following:

A. The name of each Contractor or subcontractor to be used.
B. One copy each of all current "SSPC: The Society for Protective Coatings" specifications or qualification procedures which are applicable to the painting or paint removal to be performed. These documents shall become the permanent property of the Department.
C. Proposed methods and equipment to be used for any paint application.
D. Proof of each of any required certifications, SSPC-QP 1 or SSPC-QP 3.

    1. In lieu of certification in conformance with the requirements in SSPC-QP 1 for this project, the Contractor may submit written documentation showing conformance with the requirements in Section 3, "General Qualification Requirements," of SSPC-QP 1.

2. In lieu of certification in conformance with the requirements in SSPC-QP 3 for this project, the Contractor may submit written documentation showing conformance with the requirements in Section 3, "General Qualification Requirements," of SSPC-QP 3.

The Engineer shall have 30 days to review the PQWP submittal after a complete plan has been received. No painting or paint removal shall be performed until the PQWP for that work is reviewed by the Engineer.

PAINT GALVANIZED SURFACES

Exposed areas of galvanized surfaces shall receive a minimum of 2 finish coats of an exterior grade latex paint.
The finish coat paint shall be formulated for application to inorganic zinc coating and shall conform to the following:

A.

Property	Value	ASTM Designation
Pigment content, percent	24 max.	D 3723
Nonvolatile content, mass percent	49 min.	D 2369
Consistency, KU	75 min. to 90 max.	D 562
Fineness of dispersion, Hegman	6 min.	D 1210
Drying time at 25°C, 50% RH, 100-µm wet film: Set to touch, minutes Dry through, hours	 30 max. 1 max.	D 1640
Adhesion	4A	D 3359, Procedure A

B. No visible color change in the finish coats shall occur when tested in conformance with the requirements of ASTM Designation: G 53 using FS 40 UV-B bulbs for a minimum of 38 cycles. The cycle shall be 4 hours of ultraviolet (UV) exposure at 60°C and 4 hours of condensate exposure at 40°C.
C. The vehicle shall be an acrylic or modified acrylic copolymer with a minimum of necessary additives.

The first finish coat shall be applied in 2 applications. The first application shall consist of a spray applied mist application. The second application shall be applied after the mist application has dried to a set to touch condition as determined by the procedure described in Section 7 of ASTM Designation: D1640. The first finish coat color shall match Federal Standard 595B No. 36628. The total dry film thickness of both applications of the first finish coat shall be not less than 50 µm.

Except as approved by the Engineer, a minimum drying time of 12 hours shall be allowed between finish coats.

The second finish coat color shall match Federal Standard 595B, No. 26408. The total dry film thickness of the applications of the second finish coat shall be not less than 50 µm.

The 2 finish coats shall be applied in 3 or more applications to a total dry film thickness of not less than 100 µm nor more than 200 µm.

PAYMENT

Attention is directed to Section 59-3.04, "Payment," of the Standard Specifications.

Full compensation for water rinsing shall be considered as included in the contract price paid per kilogram for furnish sign structure of the type involved and no additional compensation will be allowed therefor.

Full compensation for conforming to the requirements in SSPC-QP 1, SSPC-QP 2, and SSPC-QP 3 of the "SSPC: The Society for Protective Coatings" shall be considered as included in the contract lump sum price paid per kilogram for furnish sign structure of the type involved, and no additional compensation will be allowed therefor.

10-1.67 METAL BARRIER MOUNTED SIGNS

Metal barrier mounted signs shall conform to the provisions in Section 56-2, "Roadside Signs," of the Standard Specifications and these special provisions.

Metal barrier mounted signs shall be installed at the locations shown on the plans or where designated by the Engineer and in conformance with these special provisions.

Metal (barrier mounted sign) will be measured and paid for in the same manner specified for miscellaneous metal in Section 75, "Miscellaneous Metal," of the Standard Specifications.

10-1.68 PLASTIC LUMBER

This work shall consist of furnishing and installing plastic lumber in conformance with the details shown on the plans and these special provisions.

WORKING DRAWINGS

The Contractor shall submit working drawings for plastic lumber to the Engineer for approval in conformance with the provisions in Working Drawings," of these special provisions.

Working drawings shall show details for component layout and connections, the sequence of shop and field assembly, and installation procedures. Working drawings shall be supplemented with the manufacturer's material test reports, manufacturer's performance data, material safety data sheets, and two copies of the printed literature for the product.

The Engineer will require 20 days to review the working drawings after a complete set has been received, as determined by the Engineer. Fabrication of plastic lumber shall not commence until the working drawings are approved. The Engineer will notify the Contractor in writing of approval of the working drawings. In the event the Engineer fails to complete the review within the time allowed, and if, in the opinion of the Engineer, completion of the work is delayed or interfered with by reason of the Engineer's delay in completing the review, the Contractor will be compensated for any resulting loss, and an extension of time will be granted, in the same manner as provided for in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

MATERIALS

General

Plastic lumber shall be produced continuously and homogeneously without joints, shall be straight and true, free of twist, curvature, bulging, or other deformations, and shall have a smooth outer layer with no visible voids.

The cross-sectional dimensions of plastic lumber shall not vary by more than 12 mm nor shall the length vary by more than 25 mm from the dimensions shown on the plans.

Plastic lumber shall have total resistance to marine borers and dry rot, and shall not swell, shrink, crack, warp, bend or twist.

Plastic lumber shall conform to the physical property requirements listed in the following table:

Property	Test	Requirement
Density, min.	ASTM D 792, Test Method A	Skin: 880 kg/m^3 Core: 680 kg/m^3
Water Absorption, max.	ASTM D 570 (maximum weight increase)	1.0% at 2 hrs. 3.0% at 24 hrs.
Brittleness	ASTM D 746	Skin: No break at -40˚C
Hardness	ASTM D 2240 Shore D	Skin: 45-75
Ultraviolet Deterioration	ASTM D 4329 (See Note 1) ASTM D 2240 Shore D	Skin: After 500 hrs. of exposure, hardness shall not have changed by more than 10%
Abrasion	ASTM D 4060 Cycles: 10,000 Wheel: CS17 Load : 1 kg	Skin: Mass Loss: < 0.5 g Wear Index: 2.5-3.0
Chemical Resistance	ASTM D 543 Practice A, Procedure 1	Sea water < 1.5% mass increase Gasoline < 7.5% mass increase No. 2 Diesel < 6.0% mass increase
Coefficient of Thermal Expansion, max.	ASTM D 696	0.00009 mm/mm/°C
Ignition Temperature	ASTM D 1929	> 343°C

Note 1: ASTM D 4329 using UVB 340 bulbs operating at a UV intensity of 0.77 W/m^2/nm measured at 340 nm. The exposure cycle shall be 4 hours of ultraviolet (UV) exposure at 60°C and 4 hours of condensate (CON) exposure at 40°C.

Each piece of plastic lumber shall be permanently marked with the manufacturer's name.

Plastic lumber shall be shipped and stored in a manner that will minimize scratching or damage to the outer surfaces.

A Certificate of Compliance for each shipment of plastic lumber used on the project shall be furnished to the Engineer in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications. The certificate shall be accompanied by a laboratory test report certifying that the material conforms to the requirements specified herein.

Reinforced Recycled (RR) Plastic Lumber

RR plastic lumber shall consist of recycled plastic reinforced with fiberglass reinforcing bar elements, fiberglass filaments, or a combination of fiberglass reinforcing bar elements and fiberglass filaments.

RR plastic lumber shall conform to the requirements of a recycled product. A recycled product is defined as a material, good, or supply, of which no less than 50 percent of its total mass consists of secondary waste, and no less than 10 percent of its total mass consists of post-consumer waste. Post-consumer waste is defined as a finished material, which would have been disposed of as a solid waste, having completed its life cycle as a consumer item, and does not include manufacturing waste. Secondary waste is defined as either fragments of finished products or finished products of a manufacturing process, and includes post-consumer waste. Secondary waste does not include excess virgin resources of the manufacturing process.

RR plastic lumber shall be fabricated from a mixture of one or more of the following thermoplastics: high-density polyethylene, medium-density polyethylene, low-density polyethylene, or high-density polypropylene. RR plastic lumber shall consist of a dense outer skin, not less than 4.8 mm thick, surrounding a less dense core. The plastic for the outer skin shall be mixed with the appropriate colorants to produce a black or dark brown color, and shall contain an ultraviolet inhibitor and antioxidants.

Fiberglass reinforcing bar elements for RR plastic lumber shall conform to the following requirements:

Property	ASTM Designation	Requirement
Flexural Strength, min.	D 790	483 MPa
Compression Modulus, min.	D 695	276 MPa
Tensile Strength, min.	D 638	483 MPa

Fiberglass filaments for RR plastic lumber shall conform to the following requirements:

Property	ASTM Designation	Requirement
Density	D 693	2.57-2.60 gm/cm^3
Mechanical-Single Filament Tensile Strength	D 2101	3450-3790 MPa
Tensile Modulus of Elasticity	D 2101	69-72 MPa

RR plastic lumber reinforced with different types of reinforcing elements shall not be mixed on one contract, unless otherwise shown on the plans.

Composite Plastic (CP) Lumber

At the Contractor's option, CP lumber may be substituted for RR plastic lumber. CP lumber shall conform to the requirements specified herein.

The shell for CP lumber shall be produced from polyester or epoxy resin reinforced with E-Glass and shall be mixed with colorants, ultraviolet inhibitors, and antioxidants.

The core material for CP lumber shall be lightweight aggregate polymer concrete.

CP lumber shall conform to the physical property requirements for RR plastic lumber and the following:

Property	Test	Requirement
Density of concrete core, min.	ASTM D 792	1760 kg/m^3
28-day compressive strength of concrete core, min.	ASTM D 579	34.5 MPa
Structural Strength of shell		Less than 10% loss after UV deterioration test specified for plastic lumber
Tensile strength, tensile modulus	ASTM D 638	
Flexural strength, flexural modulus	ASTM D 790	

Cut ends of CP lumber shall be sealed with a cap securely held in place with an adhesive recommended by the manufacturer. The adhesive shall show no more than a 10 percent decrease in strength when tested in conformance with the requirements in ASTM Designation: D 3164 following two cycles of exposure in conformance with the requirements in

ASTM Designation: D 1183, Procedure D. The procedure shall be modified so that the low temperature phase of the procedure shall be at -20°C +3°C, and the high temperature phase shall be at 60°C +3°C.

CP lumber shall be coated with a black (Federal Standard 595B No. 37030) or dark brown (Federal Standard 595B No. 30097) coating to a minimum dry film thickness of 380 µm. No visible color change in the coating shall occur when tested in conformance with the requirements in ASTM Designation: D 4329 using UVB 340 bulbs operating at an ultraviolet (UV) intensity of 0.77 W/m^2 measured at 340 nm for 800 hours of exposure. The exposure cycle shall be 4 hours of UV exposure at 60°C and 4 hours of condensate (CON) exposure at 40°C. The coating shall have a minimum initial adhesion value of 1.03 MPa when tested in conformance with the requirements in ASTM Designation: D 4541. The coating shall show no more than a 10 percent decrease in its initial adhesion strength following two exposure cycles in conformance with the requirements in ASTM Designation: D 1183, Procedure D as modified above.

Unreinforced Recycled (URR) Plastic Lumber

At the Contractor's option, URR plastic lumber may be substituted for RR plastic lumber for chocks and filler blocks, and other nonstructural members shown on the plans or approved by the Engineer. URR plastic lumber shall conform to the requirements specified herein for RR plastic lumber except fiberglass reinforcement will not be required, and stiffness tests shall not apply.

Hardware

Hardware shall consist of bolts and rods with necessary nuts and washers, lag screws, fiberglass reinforcing bars, and other metal fasteners shown on the plans.

All hardware shall be stainless steel anchor devices as shown on the plans. All coupling, bolts and lag bolts, shall be ASTM A 276, Type 316 stainless steel.

TESTING

Stiffness Test Requirements

Prior to shipment to the jobsite, stiffness tests shall be performed for plastic lumber, in the presence of the Engineer, at an independent testing laboratory, and at the Contractor's expense, unless otherwise directed in writing. The Contractor shall notify the Engineer in writing prior to conducting the stiffness tests.

Two samples from each production lot will be randomly selected by the Engineer for stiffness tests.

A production lot of plastic lumber is defined as a quantity of 100 cubic meters, or fraction thereof, of plastic lumber, which is ready for shipment to the jobsite, of the same type, manufactured by the same method, and made of the same material. A new production lot shall be started if any production parameter changes before the maximum production lot size is reached.

The Engineer will be at the independent testing laboratory within a maximum of 10 days after receiving writing notification. In the event the Engineer fails to be present at the testing site within the time allowed, and if, in the opinion of the Engineer, completion of the work is delayed or interfered with by reason of the Engineer's failure to be present, the Contractor will be compensated for any resulting loss, and an extension of time will be granted, in the same manner as provided for in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

Stiffness tests shall conform to the requirements in ASTM Designation: D 790, except that the samples shall have a minimum length of 4 meters and the tests shall be performed on a 3.66-meter span length at a crosshead motion of 7 mm/min. The stiffness shall be calculated using the secant modulus at the flexural strain of 0.010 mm/mm and shall meet the minimum values specified in the following table:

Cross Section Size (mm)	Stiffness EI ($kN\text{-}m^2$)	Yield Stress in Bending (MPa)
203x254	385	32
203x305	364	26
254x254	729	27
254x305	756	25
305x305	1195	21

These values are for the weak axis of rectangular sections.

If one sample fails to conform to the requirements specified herein, a retest shall be performed on an additional 2 samples selected by the Engineer. If either sample in the retest fails to conform to the specified requirements, the entire production lot of plastic lumber represented by the samples will be rejected in conformance with the provisions in Section 6-1.04, "Defective Materials," of the Standard Specifications.

Void Test Requirements

Prior to use in the work, 2 samples of each size from each lot of plastic lumber delivered to the jobsite, or a quantity of 100 cubic meters, or fraction thereof, of said plastic lumber, whichever is smaller, will be selected by the Engineer for void tests.

The samples will be examined by the Engineer for exterior voids first. The exterior voids shall conform to the following requirements:

1. The maximum dimension of any void at each exposed end shall not exceed 25 mm.
2. The total number of voids with a maximum dimension greater than 6 mm at each exposed end shall not exceed 4.

If a sample examined for exterior voids fails to conform to either requirement above, a retest shall be performed on an additional 2 samples selected by the Engineer. If either sample in the retest fails to conform to either requirement, the entire lot of plastic lumber represented by the samples will be rejected in conformance with the provisions in Section 6-1.04, "Defective Materials," of the Standard Specifications.

After passing the requirements above, the samples are to be cut into 305-mm long segments by the Contractor and examined for interior voids by the Engineer. The cut sections of each segment shall conform to the following requirements:

1. The maximum dimension of any void in a cut section shall not exceed 12 mm.
2. The total area of voids in a cut section shall not exceed 5 percent of the total cross-sectional area.

If a cut section examined for interior voids fails to conform to either requirement above, a retest shall be performed on an additional 2 samples selected by the Engineer. If a cut section in the retest fails to conform to either requirement, the entire lot of plastic lumber represented by the samples will be rejected in conformance with the provisions in Section 6-1.04, "Defective Materials," of the Standard Specifications.

Test results will be reported in writing to the Contractor within 10 days after receipt of the samples by the Engineer. In the event the Engineer fails to provide the test results within the time allowed, and if, in the opinion of the Engineer, completion of the work is delayed or interfered with by reason of the Engineer's delay in providing the results, the Contractor will be compensated for any resulting loss, and an extension of time will be granted, in the same manner as provided for in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

All samples for stiffness and void tests shall be furnished by the Contractor at the Contractor's expense.

CONSTRUCTION

Plastic lumber shall be installed in conformance with the manufacturer's recommendations and these special provisions.

Plastic lumber shall be stacked on dunnage above ground so that it may be readily inspected and shall be stored and handled in a manner that will avoid damage, breakage, or other deformations. The lumber shall be protected from the sun to prevent warping.

Plastic lumber shall be cut, beveled, drilled, counterbored, and otherwise fabricated in conformance with the manufacturer's recommendations, and as shown on the plans. Fabrication shall be done in the manufacturer's facilities to the greatest extent possible.

Unless otherwise shown on the plans, holes for bolts in the plastic lumber shall be bored 3 mm larger in diameter than the bolt to be placed. Holes for lag screws shall be bored to a diameter in conformance with the manufacturer's recommendations. Bolts and lag screw heads shall be recessed 12 mm from the surface of the face of the plastic lumber fender or as shown on the plans.

Holes drilled through CP lumber members shall be coated with a concrete sealant conforming to the manufacturer's recommendations.

Plastic lumber elements that are split, broken, warped, or otherwise damaged will be rejected and replaced at the Contractor's expense.

MEASUREMENT AND PAYMENT

Plastic lumber will be measured by the cubic meter. The quantity to be paid for shall be determined from nominal widths and thicknesses and the actual lengths of the pieces in the finished assembly as shown on the plans.

The contract price paid per cubic meter for plastic lumber shall include full compensation for furnishing all labor, materials (including hardware), tools, equipment, and incidentals, and for doing all the work involved in furnishing and installing plastic lumber, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.69 CLEAN AND PAINT STRUCTURAL STEEL

Exposed new metal surfaces shall be cleaned and painted in conformance with the provisions in Section 59-2, "Painting Structural Steel," and Section 91, "Paint," of the Standard Specifications and these special provisions. Exposed surfaces include all surfaces exposed to the atmosphere.

High-strength fasteners consisting of ASTM Designation: A490M bolts shall be coated in conformance with the requirements of this section.

Attention is directed to Section 59-2.01, "General," of the Standard Specifications.

Unless otherwise specified, painting Contractors or subcontractors shall be required to have the following certifications from the "SSPC: The Society for Protective Coatings" (formerly the Steel Structures Painting Council), prior to performing the work:

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

Whenever the Standard Specifications refer to "Steel Structures Painting Council," the reference shall be replaced with "SSPC: The Society for Protective Coatings."

Attention is directed to "Metallizing" of these special provisions for surface coating the inside of saddle troughs.

The Contractor shall provide suitable enclosures to permit cleaning and painting during inclement weather. Provisions shall be made to control atmospheric conditions inside the enclosures within limits suitable for cleaning throughout the cleaning operation, painting throughout the painting operation, drying throughout the drying period to solvent insolubility, and throughout the curing period per the manufacturers' recommendations and these special provisions. Full compensation for providing and maintaining such enclosures shall be considered as included in the prices paid for the various contract items of work requiring paint and no additional compensation will be allowed therefor.

No extension of contract time will be granted and no additional compensation will be allowed as a result of temperature or humidity which exceeds the limits for cleaning or painting designated herein, except as approved by the Engineer.

The Contractor shall ensure that all cleaning and painting operations are done in conformance with the coating manufacturer's requirements. A manufacturer's representative shall be present to provide technical assistance during all cleaning and painting operations. The manufacturer shall provide written instructions that include recommendations for cleaning, painting, drying, curing, handling, shipping, and storage of coated steel. These instructions shall be available for review at the pre-painting meeting. The manufacturer's representative shall provide monthly written certification as to the Contractor's conformance with the manufacturer's requirements. If there is a conflict between the manufacturer's requirements and those specified herein, the conflicts shall be resolved at the pre-painting meeting and the Engineer shall be the final judge as to which requirements shall prevail.

Full compensation for services of the manufacturer's technical representative shall be considered as included in the contract price paid for the various items of work involved and no separate payment will be allowed therefor.

APPLICATION

Application of coatings shall be done in conformance with the requirements of SSPC-PA 1.

Fresh, potable water with a maximum chloride content of 75 mg/L and a maximum sulfate content of 200 mg/L shall be used for water rinsing or pressure washing operations. Water shall be single use. No continuous recycling of rinse water will be permitted. If rinse water is collected into a tank and subsequent testing determines that the collected water conforms to specified requirements, reuse may be permitted at the discretion of the Engineer, as long as no collected water is added to the tank after sample collection for determination of conformance to specified requirements. Water from water rinsing operations shall not be permitted to enter the bay, fall on public traffic, flow across shoulders or lanes occupied by public traffic, or to flow into gutter or other drainage facilities. Water rinsing is defined as a pressurized water rinse with a minimum nozzle pressure of 35 MPa and a minimum flow rate of 15 liters per minute.

Prior to submitting the Painting Quality Work Plan (PQWP) required herein, a pre-painting meeting between the Engineer, the Contractor's QCM, a representative from each entity performing painting for this project, and a representative from the manufacturer to provide the paint, shall be held to discuss the requirements for the Painting Quality Work Plan.

Prior to performing any painting or paint removal, the Contractor shall submit to the Engineer, in conformance with the provisions in "Working Drawings," of these special provisions, 3 copies of a separate Painting Quality Work Plan (PQWP)

for each item of work for which painting or paint removal is to be performed. As a minimum, each PQWP shall include the following:

A. The name of each entity performing painting or paint removal.
B. One copy each of all current "SSPC: The Society for Protective Coatings" specifications or qualification procedures, and one copy of all ASTM Standards which are applicable to the painting or paint removal to be performed. These documents shall become the permanent property of the Department.
C. A copy of the manufacturer's guidelines and recommendations for cleaning, painting, drying, curing, handling, shipping, and storage of the product.
D. Proposed methods and equipment to be used for any paint application.
E. Proof of each of any required certifications, SSPC-QP 1, SSPC-QP 2, SSPC-QP 3, AISC SPE.
F. Proposed methods to control environmental conditions in accordance with the manufacturer's recommendations and these special provisions.
G. Proposed method to protect the product during curing, shipping, handling, and storage.
H. Proposed rinse water collection plan.
I. For all coatings, the PQWP shall contain the manufacturer's written recommendations on chloride testing methods, maximum allowable chloride levels, and surface preparation.
J. A detailed paint repair plan for the repair of damaged areas both in the field and the shop.
K. A procedure for containing blast media and water during application of finish coats and/or repair of coating of erected steel.

The Engineer shall have 14 days to review the PQWP submittal after a complete plan has been received. No painting or paint removal shall be performed until the PQWP for that work is approved by the Engineer.

It is expressly understood that the Engineer's approval of the Contractor's PQWP shall not relieve the Contractor of any responsibility under the contract for the successful completion of the work in conformity with the requirements of the plans and specifications. The Engineer's review shall not constitute a waiver of any of the requirements of the plans and specifications nor relieve the Contractor of any obligation thereunder, and defective work, materials, and equipment may be rejected notwithstanding review of the PQWP.

CLEANING

Exposed new metal surfaces, except where galvanized or metallized, shall be dry blast cleaned in conformance with the requirements in Surface Preparation Specification No. 10, "Near White Blast Cleaning," of "SSPC: The Society for Protective Coatings." Blast cleaning shall leave surfaces with a dense, uniform, sharp angular anchor pattern of not less than 40 µm nor more than 86 µm as measured in conformance with the requirements in ASTM Designation: D 4417.

Mineral and slag abrasives used for blast cleaning steel shall conform to the requirements in Abrasive Specification No. 1, "Mineral and Slag Abrasives," of "SSPC: The Society for Protective Coatings" and shall not contain hazardous material. Mineral and slag abrasives shall comply with the requirements for Class A, Grade 2 to 3 as defined therein.

Steel abrasives used for blast cleaning steel surfaces shall comply with the requirements of SSPC-AB 3, "Newly Manufactured or Re-Manufactured Steel Abrasives" of "SSPC: The Society for Protective Coatings". If steel abrasive is recycled through shop or field abrasive blast cleaning units, the recycled abrasive shall conform to the requirements of SSPC-AB 2 "Specification for Cleanliness of Recycled Ferrous Metallic Abrasives" of "SSPC: The Society for Protective Coatings". The abrasive size and type shall be selected and maintained so as to achieve the required surface profile.

A Certificate of Compliance conforming to the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications and a Material Safety Data Sheet shall be furnished prior to use for each shipment of blast cleaning material for steel.

The inside surfaces of bolt holes shall be cleaned in conformance with the requirements in Surface Preparation Specification No. 1, "Solvent Cleaning," of the "SSPC: The Society for Protective Coatings," and visible rust shall be removed.

Abrasive blast cleaned surfaces shall be tested by the Contractor for soluble salts in conformance with the requirements in SSPC: The Society for Protective Coatings Technical Update No. 4, "Field Methods for Retrieval and Analysis of Soluble Salts on Substrates" and cleaned, if necessary, so that the maximum level of chlorides does not exceed the lesser of the coating manufacturer's written recommendations or 10 micrograms per square centimeter. Areas of abrasive blast cleaned steel shall be tested for chlorides at the rate of one test per 200 square meters or part thereof at locations chosen by the Engineer. If chloride levels exceed the maximum allowed by these special provisions, the entire 200 square meter area represented by the testing will be rejected. The Contractor shall perform additional cleaning and testing of rejected areas until chloride levels conform to these requirements.

Chloride testing of abrasive blast cleaned steel may be waived by the Engineer if the steel has not been manufactured, transported or stored in a marine or salt-containing environment. A salt-containing environment includes roads or highways where deicing salts have been used.

MATERIAL ANOMALIES

Corners shall be chamfered to remove sharp edges.

Chamfering is defined as a process by which a sharp corner is flattened by passing a grinder or other suitable device along the corner, normally in a single pass.

Preparation of Thermal Cut Edges – Thermal cut edges (TCEs) to be painted shall be conditioned before blast cleaning,

Edge conditioning is defined as very shallow grinding or other pre-blast cleaning preparation of thermal cut edges (TCEs) to remove a thin, hardened layer left by resolidification.

Base Metal Surface Irregularities –All visually evident surface defects shall be removed in accordance with ASTM A 6 or AASHTO M 160 prior to blast cleaning steel. When material defects exposed by blast cleaning are removed, the blast profile must be restored by either blast cleaning or by using mechanical tools in accordance with SSPC-SP 11.

PAINTING

Blast cleaned surfaces shall receive a single undercoat of inorganic zinc primer and, unless otherwise specified, a single finish coat of an inorganic thermosetting hybrid coating based upon a polysiloxane resin co-reacted or blended with an epoxy, acrylic, or urethane resin or combination thereof supplied by the manufacturer of the inorganic zinc coating.

The single undercoat shall consist of an inorganic zinc coating conforming to the requirements in AASHTO Designation M 300, Type 1- or Type II, except that: 1) the first 3 sentences of Section 5.6, "Primer Field Performance Requirements," shall not apply for Type II coatings and the entire Section 5.6.1 shall not apply for either type of inorganic zinc coating.

If the Contractor proposes a Type 1 coating, the Contractor shall furnish to the Engineer for approval documentation as required in Section 5.6 of AASHTO Designation M300. The Contractor shall allow the Engineer 30 days to review the proposal.

If the Contractor proposes to use a Type II coating, the coating shall be selected from the qualified products list, which may be obtained from the Transportation Laboratory.

The inside surfaces of bolt holes shall be maintained free from visible corrosion until final assembly or recleaned prior to assembly so as to remove all visible corrosion. The inside surface of bolt holes that are not sealed by bolts or washers shall be painted with two applications of a zinc rich primer (organic vehicle type) after completion of all applications of the undercoat of inorganic zinc on adjacent steel. If rust staining on coated surfaces occurs, all stains shall be completely removed by abrasive blast cleaning and reapplication of primer to specified requirements prior to application of finish coats. Finish coats are not required for the inside surfaces of bolt holes.

Inorganic zinc coating shall be used within 12 hours of initial mixing.

Application of inorganic zinc coating shall conform to the provisions for applying zinc-rich coating in Section 59-2.13, "Application of Zinc-Rich Primer," of the Standard Specifications.

Inorganic zinc coating shall not be applied when the atmospheric or surface temperature, or relative humidity does not conform with the manufacturer's published application requirements. The single undercoat of inorganic zinc coating shall be applied to the required dry film thickness in 2 or more applications within 8 hours of the beginning of blast cleaning. Abrasive blast cleaned steel shall not be exposed to relative humidity exceeding 85% prior to application of inorganic zinc coating. No significant time needs to elapse between the two paint applications. A commonly used procedure to satisfy this requirement is to apply horizontal passes with 50% overlap, followed by vertical passes with 50% overlap.

The total dry film thickness of all applications of the inorganic zinc undercoat, including the surfaces of outside existing members within the grip under bolt heads, nuts and washers, shall be not less than 90 µm nor more than 150 µm, except that the total dry film thickness on each faying (contact) surface of high strength bolted connections shall be between 25 µm and the maximum allowable dry film thickness as determined by certified testing in conformance with Appendix A of the "Specification for Structural Joints Using ASTM A325 or A490 Bolts" of the Research Council on Structural Connections (RCSC Specification). Unless otherwise specified, all coatings used on faying surfaces shall meet the slip coefficient requirements for a Class B coating on blast-cleaned steel, as specified in the RCSC Specification. The Contractor shall provide results of certified testing showing the maximum allowable dry film thickness for the Class B coating from the qualifying tests for the coating he has selected, and shall maintain the coating thickness on actual faying surfaces of the structure at or below this maximum allowable coating thickness.

Areas where mudcracking occurs in the inorganic zinc coating shall be blast cleaned and repainted with inorganic zinc coating to the specified thickness.

Dry spray, or overspray, as defined in the Steel Structures Painting Manual, Volume 1, "Good Painting Practice," of the "SSPC: The Society for Protective Coatings," shall be removed prior to application of subsequent coats or final acceptance. Removal of dry spray shall be by screening or other methods that minimize polishing of the inorganic zinc surface. The dry

film thickness of the coating after removal of dry spray shall be in conformance with the provisions for applying the single undercoat, as specified herein.

The inorganic zinc coating shall be tested for adhesion, hardness and chlorides. All tests shall be done in the presence of the Engineer or his designated representative unless otherwise directed by the Engineer in writing. Additional testing as defined in this section shall also be required for water borne inorganic zinc and solvent borne inorganic zinc coatings. The Engineer will determine the locations of the tests. The Contractor shall determine the sequence of the rinsing and testing operations. At the Contractor's expense, satisfactory access shall be provided to allow the Engineer to determine the location of the tests.

The following tests shall be performed on both water borne inorganic zinc primers and solvent borne inorganic zinc primers:

1. Adhesion

   The inorganic zinc coating shall have a minimum adhesion to steel of 4 MPa. Testing shall be performed at a minimum frequency of 1 test per 100 square meters of painted area using a self-aligning adhesion tester in conformance with the requirements in ASTM Designation: D 4541. The Contractor, at the Contractor's expense, shall: (1) verify compliance with the adhesion requirements, (2) furnish test results to the Engineer, and (3) repair the coating after testing.
2. Chlorides and Water Rinsing

   Except as approved by the Engineer, a minimum time of 72 hours shall be allowed between application of inorganic zinc coating and water rinsing.

   All areas of inorganic zinc coating, where finish coats are specified, shall be water rinsed in conformance with the requirements in Section 59-1.03 "Application," of the Standard Specifications and these special provisions. Areas of the coating that are removed by the water rinsing shall be reapplied in conformance with the provisions for applying zinc-rich coating in Section 59-2.13, "Application of Zinc-Rich Primer," of the Standard Specifications and these special provisions.

   All areas of inorganic zinc coating where finish coats are to be applied shall be tested by the Contractor for soluble salts in conformance with the requirements in SSPC: The Society for Protective Coatings Technical Update No. 4, "Field Methods for Retrieval and Analysis of Soluble Salts on Substrates" and cleaned, if necessary, so that the maximum level of chlorides does not exceed the lesser of the manufacturer's written recommendations or 10 micrograms per square centimeter. Areas of inorganic zinc coating shall be tested for chlorides at the rate of one test per 200 square meters or part thereof at locations chosen by the Engineer. If chloride levels exceed the maximum allowed by these special provisions, the entire 200 square meter area represented by the testing will be rejected. The Contractor shall perform additional cleaning and testing of rejected areas until chloride levels conform to these requirements.

   Finish coat shall be applied to areas passing the chloride tests within 48 hours.
3. Hardness

   Prior to application of finish paint, the inorganic zinc coating shall exhibit a solid, hard, and polished metal surface when firmly scraped with the knurled edge of a quarter. Inorganic zinc coating that is powdery, soft, or does not exhibit a polished metal surface, as determined by the Engineer, shall be repaired by the Contractor, at the Contractor's expense, by blast cleaning and repainting with inorganic zinc coating to the specified thickness.

Additional Requirements for Water Borne Inorganic Zinc Primers

1. Steel painted with water borne inorganic zinc primer shall be protected at all times from water immersion conditions during curing, shipping, and storage until the surface pH, measured as described herein, is less than or equal to 7, and until the coating passes the solvent insolubility test described below. Water immersion conditions are defined as standing water or continuous contact with wet materials for periods in excess of 30 minutes. The Contractor, at the Contractor's expense, shall repair damage caused due to immersion conditions by blast cleaning and repainting with inorganic zinc coating to the specified thickness.

2. The surface pH of the inorganic zinc primer shall be tested by wetting the surface with de-ionized water for a minimum of 15 minutes and no longer than 30 minutes and applying pH paper with a capability of measuring in increments of 0.5 pH units. At least two surface pH readings shall be taken for each 50 square meters or portion thereof. If less than 50 square meters of steel is coated in a single shift or day, at least two surface pH readings shall be taken for primer applied during that period. Application of finish coats will not be permitted until the surface pH is less than or equal to 7.

3. Dry to solvent insolubility for water borne inorganic zinc primers shall be determined in conformance with the requirements in ASTM Designation: D4752, "Standard Test Method for Measuring MEK Resistance of Ethyl Silicate (Inorganic) Zinc-Rich Primers by Solvent Rub" except that water shall be the solvent. The resistance rating shall not be less than 4. Areas of inorganic zinc coating shall be tested for solvent insolubility at the rate of one test per 50 square meters or portion thereof. Inorganic zinc coating that does not meet the solvent insolubility requirement shall be repaired by the Contractor, at the Contractor's expense, by blast cleaning and repainting with inorganic zinc coating to the specified thickness.

   The Contractor shall maintain suitable enclosures to protect the inorganic zinc coating from damage caused by the environment until the coating passes these tests and is fully cured per the manufacturer's written recommendations.

Additional Requirements for Solvent Borne Inorganic Zinc Primers

1. Dry to solvent insolubility for solvent borne inorganic zinc primers shall be determined in conformance with the requirements in ASTM Designation: D4752, "Standard Test Method for Measuring MEK Resistance of Ethyl Silicate (Inorganic) Zinc-Rich Primers by Solvent Rub." The resistance rating shall not be less than 4. Areas of inorganic zinc coating shall be tested for solvent insolubility at the rate of one test per 50 square meters or portion thereof. Inorganic zinc coating that fails to meet the solvent insolubility requirement shall be repaired by the Contractor, at the Contractor's expense, by blast cleaning and repainting with inorganic zinc coating to the specified thickness.
2. Surface hardness of solvent borne inorganic zinc shall be a minimum 2H when measured in conformance with the requirements in ASTM Designation D3363, "Standard Test Method for Film Hardness by Pencil Test." Areas of inorganic zinc coating shall be tested at the rate of one test per 50 square meters or portion thereof. Areas failing to meet the 2H pencil hardness require additional time to cure. Inorganic zinc coating that fails to meet the surface hardness requirement shall be repaired by the Contractor, at the Contractor's expense, by blast cleaning and repainting with inorganic zinc coating to the specified thickness.

The Contractor shall maintain suitable enclosures to protect the inorganic zinc coating from damage caused by the environment until the coating passes these tests and is fully cured per the manufacturer's written recommendations.

Finish Paint

Except as noted, exterior surfaces of undercoated areas and bolts shall receive a single finish coat of an inorganic thermosetting hybrid coating based upon a polysiloxane resin co-reacted or blended with an epoxy, acrylic, or urethane resin or combination thereof supplied by the manufacturer of the inorganic zinc coating. The coating shall not contain any isocyanate or polyisocyanate components. Exterior surfaces are defined as steel surfaces undercoated with inorganic zinc which are visible in the finished work from the outside of the bridge.

The surface of the undercoat that is to be covered shall be free from moisture, visible dust, visible grease, or other deleterious materials immediately prior to application of finish paint.

Galvanized or metallized surfaces designated to receive finish paint shall be cleaned in accordance with the requirements of SSPC-SP 1 and then primed with a galvanized surface primer recommended by the manufacturer of the polysiloxane finish paint. The complete finish paint system on galvanized fasteners shall have a minimum adhesion rating of 4 when measured in accordance with ASTM D 3359.

Finish coats will not be required on exterior surfaces receiving an overlay.

Finish coats are not required on interior surfaces. Interior surfaces are defined as steel surfaces undercoated with inorganic zinc not visible from the outside of the bridge and include, but are not limited to, the inside surfaces of the box girder, crossbeams and tower shafts.

At the Contractor's option, the finish coat shall be applied in accordance with one of the following two methods:

1. Field applied after meeting the requirements of these special provisions.
2. Shop coated after meeting the manufacturer's recommendations regarding curing of the inorganic zinc primer, meeting the finish coat manufacturer's recommendations for application over primed surfaces, and meeting the requirements of these special provisions.

The finish coat shall be applied within 48 hours following water rinsing and passing the chloride testing as specified previously in this section. Chloride testing prior to shop application of finish coats may be waived by the Engineer if the steel has not been transported or stored in a marine or salt-containing environment. A salt-containing environment includes, but is not limited to, roads or highways where deicing salts have been used.

The finish coat paint shall be formulated for application to inorganic zinc coating and shall conform to the following:

Exposure Test	Exposure Time	Measurement Test/ Minimum Criteria	
		Color Retention per ASTM D 2244 (Color change in ΔE*)	**Maximum Gloss Reduction from Original Reading per ASTM D 523**
Accelerated Weathering[c] (ASTM D 4587, Cycle 2)	4,000 hours	<2.0	10%

TEST METHOD		CRITERIA
Solvent resistance (ASTM D 5402)	100 double rubs with MEK	No visible topcoat on cloth, No softening (ASTM D 3363)
Adhesion to primed steel (ASTM D 4541, Type III, IV or V)		Minimum 5 Mpa. Adhesion greater than 4 Mpa satisfies this requirement if failure is in primer.
Adhesion to galvanized steel (ASTM D 3359, Procedure A, surface cleaned per SSPC-SP 1 and primed with manufacturer's recommended galvanized surface primer)		Minimum 4 A
Dry-Through (or Dry-To-Handle) Time (ASTM D 1640)		8 hours maximum
Abrasion Resistance (ASTM D 4060), 1000 cycles, CS17 wheel , 1 Kg load		< 0.125 g loss
Mandrel Bend (ASTM D 522, Method B), 125µm dry film applied to abraded steel plate		No cracking on 12.7 mm mandrel
Water Resistance (ASTM D 870), 125µm dry film on primed steel, cured 7-days.		No change in color or gloss after 7-days. Adhesion greater than 4 Mpa after 48-hours recovery

The finish coat shall be applied in 2 applications. The first application shall consist of a spray applied mist application. The second application shall be applied after the mist application has dried to a set to touch condition as determined by the procedure described in Section 7 of ASTM Designation: D1640. The total dry film thickness of both applications of the finish coat shall be not less than 125 µm.

The finish paint color shall be a semi-gloss, off-white conforming to the following requirements.

Color System: CIELAB
Illuminant/Observer: D65/10
Instrument Geometry: 45/0
Instrument used: BYK Color-Guide
Color coordinates:

$L^* = 94.48$
$a^* = -1.70$
$b^* = 4.06$

The color of the applied paint shall be within the following tolerances:

$\Delta E^* < 1.0$
where;
$\Delta E^* = \text{square root } [(\Delta L^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2]$

The 60 Gloss of the applied paint shall be between 60 and 70 (ASTM Designation D 523).

Referee samples are available for inspection by contacting the Toll Bridge Duty Senior at the District 4 Office, 111 Grand Avenue, Oakland California, 94612, email Duty_Senior@dot.ca.gov, telephone (510)-286-5209.

The total dry film thickness of all applications of inorganic zinc coating and finish coat paint shall be not less than 200 µm nor more than 325 µm.

Handling, Storage, and Erection

Due care shall be exercised in handling the steel in the shop, during shipping, during erection, and during subsequent construction of the bridge. The steel shall be insulated from the binding chains by softeners approved by the Engineer. Hooks and slings used to hoist steel shall be padded. Diaphragms and similar pieces shall be spaced in such a way that no rubbing that may damage the coatings will occur during shipment. The steel shall be stored on pallets at the job site or by other means approved by the Engineer, so that it does not rest on the dirt, so that water pockets are not formed, and so that components do not fall or rest on each other. All shipping and job site storage details shall be submitted for approval in the PQWP.

Field Repair of Damaged Areas

Field repair painting shall comply with all provisions specified in the special provisions, and the following:

Damaged areas of paint and areas which do not comply with the requirements of this specification shall have the paint removed and all defects corrected. The steel shall then be blast cleaned to a near white condition to produce a profile of between 1.0 to 3.5 mils [25 to 90 µm]. This profile shall be measured immediately prior to the application of the undercoat to ensure that the profile is not destroyed during the feathering procedure. All abrasive blasting and painting shall be done as specified herein.

The existing paint must be feathered to expose a minimum of 13 mm of each coat. During the re- application of the paint, care must be used to ensure that each coat of paint is only applied within the following areas. The undercoat shall only be applied to the surface of the bare steel and the existing undercoat, which has been exposed by feathering. The finish coat shall not extend beyond the areas which have been feathered or lightly sanded. All repairs shall be made in a manner to blend the patched area with the adjacent coating. The finished surface of the patched area shall have a smooth even profile with the adjacent surface. The first repair area shall be used as a test section and no more repairs made until the methods are approved by the Engineer. Finish coat repairs shall be applied by either brush or spray. Damaged paint which will be inaccessible for coating after erection shall be repaired and recoated prior to erection.

COATING A490M BOLTS

Bolts conforming to ASTM Designation: A490M shall receive a corrosion protection coating, in accordance with requirements of this section.

The corrosion protection coating applied to A490M bolts shall consist of Dacromet 320 P or equal. Dacromet 320 P is manufactured by the following supplier:

VENDOR ADDRESS AND PHONE NUMBER
METAL COATINGS INTERNATIONAL, INC. 275 Industrial Parkway Chardon, OH 44024-1083 Phone: (440) 285-2231 Fax: (440) 279-1483

The corrosion protection coating shall conform to the manufacturer's recommendations and shall be applied by an applicator licensed by the manufacturer. Licensed applicators may be found at the Internet website http://www.metal-coatings.com.

PAYMENT

Payment for clean and paint structural steel shall conform to the provisions in Section 59-2.16, "Payment," of the Standard Specifications and these special provisions.

Cleaning and painting structural steel, of the types listed in the Engineer's Estimate, will be paid for on the basis of lump sum price.

Full compensation for water rinsing and conforming to the requirements for testing outlined in these special provisions, including providing access for testing and repairing painted surfaces, and for services of the manufacturer's technical

representative shall be considered as included in the contract lump sum price paid for clean and paint structural steel of the types listed in the Engineer's Estimate and no additional compensation will be allowed therefor.

Full compensation for furnishing and applying the corrosion protection coating to ASTM Designation: A490M bolts shall be considered as included in the contract lump sum price paid for clean and paint structural steel of the types listed in the Engineer's Estimate and no additional compensation will be made therefor.

10-1.70 CLEAN AND PAINT STRUCTURAL STEEL (MODULAR JOINT SEAL ASSEMBLY, SPHERICAL BUSHING BEARING, AND SHEAR KEY)

Clean and paint structural steel (Modular Joint Seal Assembly, Spherical Bushing Bearing, and Shear Key) shall consist of cleaning and painting the following structural steel components:

A. Seismic Joint
B. Spherical Bushing Bearing at Pier E2
C. Shear Key at Pier E2
D. Spherical bushing ring bearing at Hinge K

Exposed new metal surfaces, except where galvanized, shall be cleaned and painted in conformance with the provisions in Section 59-2, "Painting Structural Steel," and Section 91, "Paint," of the Standard Specifications and these special provisions.

Prior to submitting the Painting Quality Work Plan (PQWP) required herein, a pre-painting meeting between the Engineer, the Contractor's QCM, a representative from each entity performing painting for this project, and a representative from the manufacturer to provide the paint, shall be held to discuss the requirements for the Painting Quality Work Plan.

Prior to performing any painting or paint removal, the Contractor shall submit to the Engineer, in conformance with the provisions in Section "Working Drawings," elsewhere in these special provisions, 3 copies of a separate Painting Quality Work Plan (PQWP) for each item of work for which painting or paint removal is to be performed. As a minimum, each PQWP shall include the following:

A. The name of each Contractor or subcontractor to be used.
B. One copy each of all current "SSPC: The Society for Protective Coatings" specifications or qualification procedures, and one copy of all ASTM Standards which are applicable to the painting or paint removal to be performed. These documents shall become the permanent property of the Department.
C. A copy of the manufacturer's guidelines and recommendations for cleaning, painting, drying, curing, handling, shipping, and storage of the product.
D. Proposed methods and equipment to be used for any paint application.
E. Proof of each of any required certifications, SSPC-QP 1, SSPC-QP 2, SSPC-QP 3.
F. Proposed methods to control environmental conditions in accordance with the manufacturer's recommendations and these special provisions.
G. Proposed method to protect the product during curing, shipping, handling, and storage.
H. A paint repair plan for the repair of damaged areas.

The Engineer shall have 10 days to approve the PQWP submittal after a complete plan has been received. No painting or paint removal shall be performed until the PQWP for that work is approved by the Engineer. Should the Engineer fail to complete the review within this time allowance and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in reviewing the PQWP, the delay will be considered a right of way delay in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

Conformance with the requirements in SSPC-QP 1, SSPC-QP 2, and SSPC-QP 3 of the "SSPC: The Society for Protective Coatings" will not be required for seismic joint.

CLEANING

Exposed new metal surfaces shall be dry blast cleaned in conformance with the requirements in Surface Preparation Specification No. 10, "Near White Blast Cleaning," of the "SSPC: The Society for Protective Coatings." Blast cleaning shall leave surfaces with a dense, uniform, sharp, angular anchor pattern of not less than 40 µm nor more than 86 µm as measured in conformance with the requirements in ASTM Designation: D 4417.

Mineral and slag abrasives used for blast cleaning steel shall conform to the requirements in Abrasive Specification No. 1, "Mineral and Slag Abrasives," of the "SSPC: The Society for Protective Coatings" and shall not contain hazardous material. Mineral and slag abrasives shall comply with the requirements for Class A, Grade 2 to 3 as defined therein.

Steel abrasives used for blast cleaning steel surfaces shall comply with the requirements of SSPC-AB 3, "Newly Manufactured or Re-Manufactured Steel Abrasives" of "SSPC: The Society for Protective Coatings". If steel abrasive is

recycled through shop or field abrasive blast cleaning units, the recycled abrasive shall conform to the requirements of SSPC-AB 2 "Specification for Cleanliness of Recycled Ferrous Metallic Abrasives" of "SSPC: The Society for Protective Coatings". The abrasive size and type shall be selected and maintained so as to achieve the required surface profile.

A Certificate of Compliance conforming to the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications and a Material Safety Data Sheet shall be furnished prior to use for each shipment of blast cleaning material for steel.

MATERIAL ANOMALIES

Corners shall be rounded to a minimum radius of 2 mm.

Preparation of Thermal Cut Edges – Thermal cut edges (TCEs) to be painted shall be conditioned before blast cleaning, if necessary, to achieve proper profile.

Edge conditioning is defined as very shallow grinding or other pre-blast cleaning preparation of thermal cut edges (TCEs) to remove a thin, hardened layer left by resolidification

Base Metal Surface Irregularities – All visually evident surface defects shall be removed in accordance with ASTM A 6 or AASHTO M 160 prior to blast cleaning steel. When material defects exposed by blast cleaning are removed, the blast profile must be restored by either blast cleaning or by using mechanical tools in accordance with SSPC-SP 11.

PAINTING

Blast cleaned surfaces shall receive a single undercoat, and a final coat where specified of an inorganic zinc coating conforming to the requirements in AASHTO Designation M 300, Type 1- or Type II, except that: 1) the first 3 sentences of Section 5.6, "Primer Field Performance Requirements," shall not apply for Type II coatings and the entire Section 5.6.1 shall not apply for either type of inorganic zinc coating.

If the Contractor proposes a Type 1 coating, the Contractor shall furnish to the Engineer for approval documentation as required in Section 5.6 of AASHTO Designation M300. The Contractor shall allow the Engineer 30 days to review the proposal.

If the Contractor proposes to use a Type II coating, the coating shall be chosen from the qualified products list, which may be obtained from the Transportation Laboratory.

The inside surfaces of bolt holes shall be painted with one application of a zinc rich primer (organic vehicle type) after the application of the undercoat of inorganic zinc on adjacent steel. Finish coats are not required for the inside surfaces of bolt holes.

Inorganic zinc coating shall be used within 12 hours of initial mixing.

Application of inorganic zinc coating shall conform to the provisions for applying zinc-rich coating in Section 59-2.13, "Application of Zinc-Rich Primer," of the Standard Specifications.

Inorganic zinc coating shall not be applied when the atmospheric or surface temperature is less than 7°C nor more than 29°C, nor when the relative humidity exceeds 85 percent.

The single undercoat of inorganic zinc coating shall be applied to the required dry film thickness in 2 or more applications within 4 hours after blast cleaning.

The total dry film thickness of all applications of the inorganic zinc undercoat, including the surfaces of outside existing members within the grip under bolt heads, nuts and washers, shall be not less than 90 µm nor more than 150 µm, except that the total dry film thickness on each faying (contact) surface of high strength bolted connections shall be between 25 µm and the maximum allowable dry film thickness for Class B coatings as determined by certified testing in conformance with Appendix A of the "Specification for Structural Joints Using ASTM A325 or A490 Bolts" of the Research Council on Structural Connections (RCSC Specification). Unless otherwise stated, all inorganic zinc coatings used on faying surfaces shall meet the slip coefficient requirements for a Class B coating on blast-cleaned steel, as specified in the RCSC Specification. The Contractor shall provide results of certified testing showing the maximum allowable dry film thickness for the Class B coating from the qualifying tests for the coating he has chosen, and shall maintain the coating thickness on actual faying surfaces of the structure at or below this maximum allowable coating thickness.

Areas where mudcracking occurs in the inorganic zinc coating shall be blast cleaned and repainted with inorganic zinc coating to the specified thickness.

Dry spray, or overspray, as defined in the Steel Structures Painting Manual, Volume 1, "Good Painting Practice," of the "SSPC: The Society for Protective Coatings," shall be removed prior to application of subsequent coats or final acceptance. Removal of dry spray shall be by screening or other methods that minimize polishing of the inorganic zinc surface. The dry film thickness of the coating after removal of dry spray shall be in conformance with the provisions for applying the single undercoat, as specified herein.

The inorganic zinc coating shall be tested for adhesion. Additional testing as defined in this section shall also be required for water borne inorganic zinc and solvent borne inorganic zinc primers. The locations of the tests will be determined by the Engineer. The sequence of the rinsing and testing operations shall be determined by the Contractor. The testing for adhesion

will be performed no sooner than 72 hours after application of the single undercoat of inorganic zinc coating. At the Contractor's expense, satisfactory access shall be provided to allow the Engineer to determine the location of the tests.

The following test shall be performed on both water borne inorganic zinc primers and solvent borne inorganic zinc primers:

Adhesion

The inorganic zinc coating shall have a minimum adhesion to steel of 4 MPa. Testing shall be performed at a minimum frequency of 1 test per 100 square meters of painted area using a self-aligning adhesion tester in conformance with the requirements in ASTM Designation: D 4541. The Contractor, at the Contractor's expense, shall: (1) verify compliance with the adhesion requirements, (2) furnish test results to the Engineer, and (3) repair the coating after testing.

Additional Requirements for Water Borne Inorganic Zinc Primers

1. Steel painted with water borne inorganic zinc primer shall be protected at all times from water immersion conditions during curing, shipping, and storage until the surface pH, measured as described herein, is less than 8, and until the coating passes the solvent insolubility test described below. Water immersion conditions are defined as standing water or continuous contact with wet materials for periods in excess of 30 minutes. The Contractor, at the Contractor's expense, shall repair damage caused due to immersion conditions by blast cleaning and repainting with inorganic zinc coating to the specified thickness.

2. The surface pH of the inorganic zinc primer shall be tested by wetting the surface with de-ionized water for a minimum of 15 minutes and no longer than 30 minutes and applying pH paper with a capability of measuring in increments of 0.5 pH units. At least two surface pH readings shall be taken for each 50 square meters or portion thereof. If less than 50 square meters of steel is coated in a single shift or day, at least two surface pH readings shall be taken for primer applied during that period. Application of finish coats will not be permitted until the surface pH is less than 8.

3. Dry to solvent insolubility for water borne inorganic zinc primers shall be determined in conformance with the requirements in ASTM Designation: D4752, "Standard Test Method for Measuring MEK Resistance of Ethyl Silicate (Inorganic) Zinc-Rich Primers by Solvent Rub" except that water shall be the solvent. The resistance rating shall not be less than 4. Areas of inorganic zinc coating shall be tested for solvent insolubility at the rate of one test per 50 square meters or portion thereof. Inorganic zinc coating that does not meet the solvent insolubility requirement shall be repaired by the Contractor, at the Contractor's expense, by blast cleaning and repainting with inorganic zinc coating to the specified thickness.

Additional Requirements for Solvent Borne Inorganic Zinc Primers

1. Dry to solvent insolubility for solvent borne inorganic zinc primers shall be determined in conformance with the requirements in ASTM Designation: D4752, "Standard Test Method for Measuring MEK Resistance of Ethyl Silicate (Inorganic) Zinc-Rich Primers by Solvent Rub." The resistance rating shall not be less than 4, "Burnished appearance in rubbed area; slight amount of zinc on cloth after 50 double rubs." The Contractor shall maintain suitable enclosures to protect the inorganic zinc coating from damage caused by the environment until the coating passes this test and is fully cured per the manufacturer’s written recommendations.

The color of the final application of inorganic zinc coating shall match Federal Standard 595B No. 36373.

The final coat of inorganic zinc coating shall be applied after testing for adhesion, testing for solvent insolubility, and completion of all operations that may damage or discolor the steel surface, including correction of runs, sags, thin and excessively thick areas in the paint film, skips and holidays, dry spray, or areas of non-uniform appearance.

The area to receive the final coat of inorganic zinc coating shall be lightly roughened by abrasive blasting using an abrasive no larger than 600 µm. Abrasive blasting shall remove no more than 15 µm of inorganic zinc. The surface to be lightly roughened shall be free from moisture, dust, grease or deleterious material. The undercoated areas of the under surfaces of bottom flanges shall be protected from abrasive blast cleaning operations.

The final coat of inorganic zinc coating shall be applied to the required dry film thickness in one uniform application within 24 hours after light roughening. The dry film thickness of the final coat shall be not less than 25 µm nor more than 75 µm.

Except at bolted connections, the total dry film thickness of all applications of the single undercoat and final coat of inorganic zinc coating shall be not less than 115 µm nor more than 225 µm.

Finish coats will not be required.

PAYMENT

Full compensation for clean and paint structural steel for seismic joint shall be considered as included in the contract lump sum price paid for seismic joint of the types and locations listed in the Engineer's Estimate and no separate payment will be made therefor.

Full compensation for clean and paint structural steel for spherical bushing bearing at Pier E2 shall be considered as included in the contract unit price paid for furnish and install spherical bushing bearing (Pier E2) and no separate payment will be made therefor.

Full compensation for clean and paint structural steel for shear key at Pier E2 shall be considered as included in the contract unit price paid for furnish and install shear key (Pier E2) and no separate payment will be made therefor.

Full compensation for clean and paint structural steel for spherical bushing ring bearing at Hinge K shall be considered as included in the contract unit price paid for furnish spherical bushing ring bearing (Hinge K) and no separate payment will be made therefor.

10-1.71 CLEAN AND PAINT CABLE SYSTEM

This work shall consist of surface preparation and painting of the cable system as shown on the plans, in accordance with the provisions in Section 59, "Painting," of the Standard Specifications and these special provisions.

The cable paint system shall be applied to the wire wrapped main cable, cable strand sockets, cable strand anchor rods, shims and nuts, cable bands, cable band bolts, cable band caulking, saddles, cable shrouds, suspender ropes, suspender rope sockets, suspender rope separators, suspender rope anchor rods and nuts, split colors, elastomeric collars, keeper angles, keeper bolts, shims, suspender clamps, handropes, handrope stanchions, handrope supports, handrope gates, handrope anchors, and appurtenances in accordance with the manufacturer's recommendations and these special provisions.

A qualified representative of the manufacturer shall be present for the test demonstration, and for at least 3 days at the beginning of the application and at completion of the application. The manufacturer's representative shall certify to the Engineer in writing that the proper installation procedures are being followed, including, but not limited to the following:

A. Surface preparation.
B. Type of equipment used.
C. Mixing of the material components.
D. Method of application, and finish.

Handling, mixing and addition of thinners or any other material shall be performed in accordance with the manufacturer's recommendations and with prior approval of the Engineer.

The cable paint system shall not be applied when weather or surface conditions, as determined by the Engineer, are such that the material cannot be properly handled, applied, and cured within the specified time.

The Contractor shall perform a test demonstration, in the presence of the Engineer and the manufacturer's representative, of all cable paint system application procedures to be used. The test demonstration shall consist of surface application and painting of two adjacent cable bands and the main cable between them. The Contractor shall notify the Engineer at least 20 days prior to the test demonstration.

MATERIALS

The cable paint system shall consist of a primer, a two intermediate coat Noxyde Plus paint system, or equal, and a finish coat. The Noxyde Plus cable paint system shall be manufactured by the following supplier:

VENDOR ADDRESS AND PHONE NUMBER
MARTIN MATHYS S.A. KOLENBERG 23 3545 ZELEM/HALEN BELGIUM

The primer shall be a waterborne, single component acrylic coating with highly elastic polymers that cure to a highly elastic, seamless rubber coating. The primer shall be Pegalink or equal.

The two intermediate coats shall be 100 percent Noxyde Plus.

The finish coat shall be a water-borne, single component semi-gloss acrylic paint. The finish coat shall be Pegacryl or equal.

The primer, intermediate coats, and finish coat shall be three different colors. The finish coat color shall match Federal Standard 595B, No. 26408. Color samples shall be submitted to the Engineer for approval 60 days prior to the start of painting.

Each shipment of cable paint system materials shall be accompanied by a Certificate of Compliance as provided in Section 6-l.07, "Certificates of Compliance," of the Standard Specifications. The certificate shall state that the materials and fabrication involved comply in all respects to the specifications and data submitted in obtaining approval, and shall include the type of paint products used and the application rates of all components of the cable paint system. The first shipment shall include a copy of the manufacturer's quality assurance program listing all in-house testing criteria.

Copies of Material Safety Data Sheets (MSDS) for all materials shall be kept on site for review by the Engineer.

The Contractor shall be responsible for the workmanship and performance of the installed cable paint system. The cable paint system shall be applied by a manufacturer certified applicator.

The primer for the cable paint system shall conform to the following physical requirements:

Property	Test	Requirement
Weight of Solids	ASTM Designation: D2369	48% ± 2%
Specific Gravity		1.2± 0.03
Volume of Solids	ASTM Designation: D2697	45.4% ± 2%
Elasticity		200% Elongation
Water Resistance		100%
Alkali Resistance		Fair
Salt Spray Resistance		100%
Water Vapor Transmission	ASTM Designation: E96	15g H2O/m2 in 24 hours
Chemical Resistance	10% Acid solution	Fair

The intermediate coats of the cable paint system shall conform to the following physical requirements:

Property	Test	Requirement
Weight of Solids	ASTM Designation: D2369	67% ± 2%
Specific Gravity		1.26± 0.02
Volume of Solids	ASTM Designation: D2697	57% ± 2%
Elasticity	CSTB No. 15.381	200% Elongation
Water Resistance		12 mo. Immersion, no change
Alkali Resistance		No damage from Na(OH) at pH = 14
Salt Spray Resistance	CSTB No. 15.381	100%
Water Vapor Transmission	ASTM Designation: E96	5.5g H_2O/m2 in 24 hours
Chemical Resistance	25% mineral acid solution	Excellent
UV Ray Resistance		100% against outdoor exposure
Shore A Hardness		70
Aging and Adhesion		Unaffected after 8 hours, 60°C to -20°C with rain, frost, UV light and humidity
Sulfur Dioxide Resistance		100% resistance
Ozone Resistance		No cracking or embrittlement when subjected to 1 PPM ozone for 30 days
Hot water immersion		No effect after 1000 hours in 38°C water
Impact Resistance	DIN 51155	90 N
Tensile Adhesion	CSTB (France)	47.5 An/cm2
Sand Blasting Resistance	DIN 51155	Unaffected at 20,000 shots

A minimum of four ounces of polyolefin beads conforming to the properties in the following table shall be added to each gallon of finish coat applied to horizontal or walking surfaces. The beads shall be added to the finish coat prior to application and be thoroughly dispersed into the coating during normal mixing procedures. The cured finish coat, following addition of polyolefin beads, shall have a minimum average slip-resistance of 0.50 when wet as determined in accordance with ASTM Designation: F 1679. Additional beads shall be added if the average slip-resistance fails to meet this requirement as

determined by the Contractor's independent laboratory upon testing of a sample of the finish coat. A copy of the slip-resistance testing results shall be furnished to the Engineer prior to application of finish coat.

Property	Requirements
Composition	Polyethylene or Polypropylene or a combination thereof
Appearance	White free-flowing powder
Size	210 to 300 µm
Specific Gravity	0.90
Initial Melt/Softening point	-6°C
Final Melt Point	166°C
Flash Point	greater than 275°C

The Contractor shall verify by testing that all properties are met. The physical properties shall be verified by an independent laboratory approved by the Engineer.

All material components of the cable paint system shall be supplied to the job site in the manufacturer's unopened packaging. Material for the cable paint system in opened or damaged containers shall not be used and shall be removed from the job site at the Contractor's expense.

All material components of the cable paint system shall be stored in cool, dry conditions, between 5°C and 20°C, out of direct sunlight and in accordance with the manufacturer's recommendations and Health and Safety regulations.

CLEANING

The main cables, suspender ropes, and handropes shall be cleaned in accordance with the provisions of Surface Preparation Specification No. 1, "Solvent Cleaning," of the SSPC: The Society for Protective Coatings. All traces of the zinc waterproofing paste applied to the main cable wires which has bled through the exterior wire wrapping shall be removed. Solvent cleaning shall be supplemented by hand tool cleaning in accordance with the provisions of Surface Preparation Specification No. 2, "Wire Brushing, and Hand Washing, and Rinsing," of the SSPC: The Society for Protective Coatings to remove any non-adherent shop applied coating, or detrimental foreign matter unable to be removed by solvent cleaning. Brass wire brushes shall be used for this surface preparation. Steel wire brushes will not be permitted.

Handrope stanchions, cable shrouds, and the surfaces of cable bands, saddles, and other items which are not in contact with the main cable or are metallized, shall be dry blast cleaned in the shop in accordance with the provisions of Surface Preparation Specification No. 10, "Near White Blast Cleaning," of the SSPC: The Society for Protective Coatings. Blast cleaning shall leave all surfaces with a dense, uniform, angular, anchor pattern of no less than 40 µm as measured in accordance with the requirements of ASTM Designation: D 4417.

All steel surfaces to be coated with the Noxyde Plus cable paint system shall be cleaned to remove all oil, dirt, rubber, dust, and other material which would prevent proper bonding to and curing of the primer.

Within 72 hours of wire wrapping of the main cable, and prior to application of the primer, the main cable shall be securely wrapped with a waterproof film to protect from salt air. The waterproof film shall not be removed sooner than 72 hours prior to application of the primer. Solvent and hand cleaning, as described in this section, will not be permitted as a substitute for placement of waterproof film.

Immediately prior to the application of any component of the Noxyde Plus system, the receiving surface shall be dry and all remaining dust or loose particles shall be removed by blowing with clean, dry, oil free air.

PAINTING

Primer shall be applied within 4 hours of the completion of surface preparation. All locations showing evidence of contamination, as determined by the Engineer, shall be recleaned at the Contractor's expense. The Engineer shall be the sole judge of the need for recleaning.

Primer shall be applied in accordance with the manufacturer's recommendations. The primer shall be spray applied in a fine even spray so as to produce a uniform coating. The dry film thickness of the primer shall be between 35 µm and 50 µm.

Primer shall be applied in the shop to the handrope stanchions, cable shrouds, and the surfaces of cable bands, saddles, and other items which are not in contact with the main cable or are metallized.

Surfaces painted with primer shall be protected from damage. Should damage to the primer occur, as determined by the Engineer, the surface shall be repaired at the Contractor's expense prior to application of the intermediate coats.

The primer shall cure before application of the intermediate coats. The Engineer with the assistance of the manufacturer's representative at the job site shall determine when the cure is adequate to continue.

The intermediate coats shall be applied within 24 hours of the application of primer, weather permitting, except for the handrope stanchions, cable shrouds, and the surfaces of cable bands and saddles. All undercoat surfaces showing evidence of

contamination, as determined by the Engineer, shall be cleaned. The Engineer shall be the sole judge of the need for recleaning.

The two intermediate coats shall be applied in accordance with the manufacturer's recommendations. The two intermediate coats shall be spray applied in a fine even spray so as to produce a uniform coating. The total dry film thickness of the two intermediate coats shall be between 200 µm and 350 µm.

The two intermediate coats shall cure before application of the finish coat. The Engineer with the assistance of the manufacturer's representative at the job site shall determine when the cure is adequate to continue.

The finish coat shall be applied within 24 hours of the application of intermediate coats, weather permitting. All locations showing evidence of contamination, as determined by the Engineer, shall be cleaned in accordance with the manufacturer's recommendations.

The application of the intermediate coats and the finish coat shall not be made if rain is forecast within 6 hours of application, or as determined by the Engineer. The finish coat shall be applied only when the atmospheric and steel temperatures are above 10°C and the relative humidity is below 85 percent, and these conditions are forecast to be maintained for a minimum of 6 hours. The temperature of the main cable shall be at least 3˚C above the dew point.

The finish coat shall be applied in accordance with the manufacturer's recommendations. The finish coat shall be applied to produce a uniform coating. The dry film thickness of the finish coat shall be between 35 µm and 50 µm.

The total dry film thickness of all coats shall be between 270 µm and 450 µm. The color of each coat shall be uniform throughout the entire member.

The Contractor shall check wet film thickness at least once every 10 square meters using a gauge pin or standard comb type thickness gauge.

The painted surface shall be checked for visible pinholes and other surface defects. The paint system shall provide a smooth, pinhole free continuous film on all coated surfaces.

In the event that any materials are damaged during this work due to the Contractor's operations, the Contractor shall repair or replace the damaged materials at the Contractor's expense, and as approved by the Engineer.

PAYMENT

The contract lump sum price paid for clean and paint cable system shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, including the services of the manufacturer's representative as specified herein, and for doing all the work involved in clean and paint cable system, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.72 METALLIZED STEEL SURFACES

DESCRIPTION

Metallized steel surfaces where shown on the plans shall have thermal sprayed coatings applied in accordance with the requirements in AWS C2.18-93, "Guide for the Protection of Steel with Thermal Sprayed Coatings of Aluminum and Zinc and their Alloys and Composites," and these special provisions.

Wire or powder feedstock for metallized surfaces shall be an alloy of 85 percent zinc and 15 percent aluminum and shall meet the requirements of ASTM Designation: B833-01a.

PREPARATION, APPLICATION, AND PROTECTION

Metallized steel surfaces shall be prepared in accordance with the requirements of the SSPC: The Society for Protective Coatings SSPC-SP10: Near-White-Metal Blast Cleaning. The blast profile shall be angular and shall have a roughness of 50 to 100 µm. The metallized surfaces shall have thermal sprayed coating deposited to a thickness between 375 to 425 µm with an average thickness of 400 µm, applied in at least two passes at right angles to each other with the application device held 125 to 230 mm from the surface, and applied by an operator qualified in accordance with the requirements of AWS C2.18-93.

When preparing metallized steel surfaces for thermal sprayed coatings by blast cleaning, adjacent painted surfaces shall be masked to avoid damage to the painted surfaces. If the steel surfaces adjacent to the completed thermal sprayed coatings are to be blast cleaned for painting, the thermal sprayed coatings shall be masked to avoid damage to the completed thermal sprayed coating surfaces during the blast cleaning operation.

Metallized steel surfaces shall be protected for shipping, handling, and erecting to avoid damage to the metallized steel surfacing during these operations. Any damage that does occur shall be repaired in the field by thermal spraying using the specified thermal sprayed coating application by a qualified operator and using the same feedstock and equipment settings and the same application pattern as used in the original specified thermal sprayed coating work.

TESTING

Metallized surfaces shall be tested and meet the requirements for Class B slip coefficient and creep resistance of Appendix A of the "Specification for Structural Joints Using ASTM A325 or A490 Bolts" of the Research Council on Structural Connections. Metallized surfaces shall have a minimum adhesive strength of 7.0 MPa by testing in accordance with the requirements of ASTM Designation: D4541, "Standard Test Method for Pull-Off Strength of Coatings."

Two test plates shall be prepared, each 300-mm by 300-mm of any convenient thickness. Each test plate shall receive the specified surface preparations and specified thermal sprayed coating application by a qualified operator and using the same feedstock and equipment settings and the same application pattern as proposed to be used in the actual specified thermal sprayed coating work. The two test plates shall be tested for the specified slip coefficient, for the specified adhesion strength, and for the specified coating thickness. The test plate results shall be approved by the Engineer before beginning the metallizing application work. Two additional plates shall be prepared during the progress of the metallizing application as directed by the Engineer.

Full compensation for performing all the work for metallized steel surfaces, complete in place, shall be considered as included in the contract prices paid for various items of work involved and no additional compensation will be allowed therefor.

10-1.73 MISCELLANEOUS METAL (BRIDGE)

Miscellaneous metal (bridge) shall conform to the provisions for miscellaneous bridge metal in Section 75, "Miscellaneous Metal," of the Standard Specifications and these special provisions.

Attention is directed to "Welding" of these special provisions.

Attention is directed to "Nonskid Surface" of these special provisions.

Miscellaneous metal (bridge) shall consist of the miscellaneous bridge metal items listed in Section 75-1.03, "Miscellaneous Bridge Metal," of the Standard Specifications, and the following:

A. Pullbox frames and covers
B. Stairs
C. Ladders
D. Fender boarding ladders
E. Railings, posts, and safety chains in tower and box girders
F. Hinged safety railings in tower and box girders (railing S11 modified)
G. Handrails in tower and box girders
H. Hinged and bolted access opening covers in tower and box girders
I. Platforms
J. Associated hardware

Cast-in-place inserts shall be the ferrule loop type.

Metal parts of concrete anchorage devices shall be fabricated from stainless steel conforming to the requirements of ASTM Designation: A 276, Type 316.

10-1.74 NONSKID SURFACE

Where shown on the plans, steel plates and ladders shall receive a nonskid surface consisting of epoxy mixed with grit. Epoxy shall conform to the provisions in Section 95, "Epoxy," of the Standard Specifications.

Epoxy shall consist of epoxy conforming to the provisions in either Section 95-2.01, "Binder (Adhesive), Epoxy Resin Base (State Specification 8040-01F-03)," or Section 95-2.09, "Epoxy Sealant for Inductive Loops (State Specification 8040-31D-06)," of the Standard Specifications.

Grit shall consist of commercial quality aluminum oxide, silicon carbide, or almandite garnet grit particles, screen size 1.7 m to 600 µm or 1.4 m to 500 µm, applied uniformly at the rate of at least 1.5-kg per square meter of surface area.

The finish color of the nonskid surface shall be light gray.

Prior to applying epoxy and grit to galvanized surfaces, the surface to be coated shall be prepared in conformance with the provisions in Section 59-3.02, "Surface Preparation," of the Standard Specifications.

The Contractor shall submit to the Engineer for approval a method of application stating the spread rate of epoxy and grit and the number of coats. The Contractor shall demonstrate the method of application to the Engineer, prior to placing any nonskid material, by preparing a 0.1 square meter sample placed on 6 mm minimum thickness hardboard. The nonskid surface shall have a total thickness of between 3 mm and 5 mm.

At the option of the Contractor, a commercial quality nonskid surface, comprised of a 2-component ultra violet resistant epoxy and grit of quality equal to the above requirements, may be submitted to the Engineer for approval.

Full compensation for furnishing and placing nonskid surface shall be considered as included in the contract price paid per kilogram for the various types of furnish structural steel (bridge) listed in the Engineer' Estimate, and no separate payment will be made therefor.

10-1.75 MISCELLANEOUS METAL (SERVICE PLATFORMS)

Miscellaneous metal (service platforms) shall conform to the provisions for miscellaneous bridge metal in Section 75, "Miscellaneous Metal," of the Standard Specifications and these special provisions.

Attention is directed to "Welding" of these special provisions.

Miscellaneous metal (service platforms) shall consist of the following:

A. Gratings
B. Checkered Plates
C. Guardrails
D. Railings
E. Handrails
F. Ladders and stairs
G. Hatchcovers
H. Hinged covers
I. Steel rope railing and posts
J. Framing at pier table
K. All anchors, fastenings, hardware, accessories and other supplementary parts necessary to complete the work.

GENERAL

Product Data

Submit manufacturer's specifications, anchor details and installation instructions for products used in miscellaneous metal fabrications.

Shop assembly

Preassemble items in shop to the greatest extent possible to minimize field welding and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly match mark all units for reassembly and installation.

Checkered floor plates shall be commercial quality steel with standard raised pattern.

Pipe shall be ASTM Designation: A 53, grade B.

Grating shall conform to Section 56-1.02F, "Steel Walkway Gratings," of the Standard Specifications. Grating shall be hot-dip galvanized and not painted.

Steel rope and accessories shall conform to Section 83-1.02E, "Cable Railing," of the Standard Specifications.

Galvanizing

Steel be hot-dip galvanized after fabrication in accordance with Section 75-1.05, "Galvanizing," of the Standard Specifications, unless otherwise noted. The weight of galvanized coating shall be at least 460 grams per square meter of surface area, except grates shall have at least 610 grams per square meter of surface area.

Steel Pipe Railings and Hand Railings

Pipe handrailing and guardrails shall consist of handrailing elements supported by metal brackets (wall type) or handrailing elements supported by tubular steel posts (post type).

Ends of railing pipe shall be closed, except for a 3 mm diameter weep hole at the low point.

All corners on railings shall be rounded. Simple and compound curves shall be formed by bending pipe in jigs to produce uniform curvature; maintain cylindrical cross-section of pipe throughout the bend without buckling, twisting or otherwise deforming exposed surfaces of the pipe.

Wall brackets, end closures, flanges, miscellaneous fitting and anchors shall be provided for interconnections of pipe and attachment of railings and handrails to other work. Inserts and other anchorage devices shall be furnished for connecting railings and handrails to concrete or masonry.

Steel railing shall be galvanized after fabrication. After galvanizing, all elements of the railing shall be free of fins, abrasions, rough or sharp edges, and other surface defects and shall not be kinked, twisted or bent.

Attention is directed to "Service Platforms" of these special provisions.

Full compensation for miscellaneous metal (service platforms) shall be considered as included in the contract price paid for service platforms, and no additional compensation will be allowed therefor.

10-1.76 CHAIN LINK RAILING

Chain link railing shall conform to the provisions in Section 83-l, "Railings," of the Standard Specifications and these special provisions.

The chain link fabric shall be 9-gage (3.76 mm), Type IV, Class B, bonded vinyl coated fabric, conforming to the requirements in AASHTO Designation: M 181. The color of the vinyl coating shall be black.

The strength of the bond between the coating material and steel of the bonded vinyl coated chain link fabric shall be equal to or greater than the cohesive strength of the polyvinyl chloride (PVC) coating material.

10-1.77 CABLE RAILING

Cable railing shall conform to the provisions in Section 83-1, "Railings," of the Standard Specifications.

10-1.78 BIKEPATH RAILING

Bikepath railing shall conform to the provisions in Section 83-1.02G(2), "Metal Railing (Tubular)," of the Standard Specifications and these special provisions.

Posts shall conform to the requirements in ASTM designation: A500, Grade C.

Stainless steel plates shall conform to the requirements in designation: ASTM A167, Type 316.

Stainless steel bolts shall conform to the requirements in designation: ASTM F593, Group 2, Type 316 or 316L.

Railing grill shall conform to the provisions in Section 56-1.02F, "Steel Walkway Gratings," of the Standard Specifications.

Welding of structural steel shall conform to the requirements of AWS D1.1. Welding of structural steel to stainless steel shall conform to the requirements of AWS D1.6.

When a weld overlay is used for stainless steel surfacing, the overlay shall be placed by submerged arc welding using Type 309L electrodes. The finished overlay shall have a 2.38 mm minimum thickness after welding, grinding and polishing. Prior to welding, the manufacturer must submit a complete weld procedure to the Engineer for approval.

The Contractor shall submit shop drawings in conformance to the provisions in "Working Drawings," of these special provisions.

Bikepath railing will be measured and paid for by the meter in the same manner specified for railing in Sections 83-1.03, "Measurement," and 83-1.04, "Payment," of the Standard Specifications.

10-1.79 CONCRETE BARRIER (TYPE 732 MODIFIED)

Concrete barriers shall conform to the provisions in Section 83-2, "Barriers," of the Standard Specifications and these special provisions.

Bar reinforcing steel for use in concrete barriers shall conform to the provisions in "Epoxy-Coated Prefabricated Reinforcement," of these special provisions.

Full compensation for epoxy-coated bar reinforcement and sealing concrete barrier surfaces shall be considered as included in the contract price paid per meter for concrete barrier of the type or types listed in the Engineer's Estimate and no separate payment will be made therefor.

10-1.80 STEEL BARRIER

Steel barrier shall conform to the details shown on the plans and to the section "Steel Structures," of these special provisions.

Steel barriers shall be cleaned and painted in accordance with "Clean and Paint Structural Steel," of these special provisions.

The contract price paid per meter for steel barrier (type 732 modified) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in furnishing and erecting the steel barrier, complete in place, including cleaning and painting, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.81 ULTRA HIGH MOLECULAR WEIGHT POLYETHYLENE PANEL

Ultra High Molecular Weight (UHMW) polyethylene panel shall consist of furnishing and installing UHMW panels and shall conform to the details shown on the plans and these special provisions.

MATERIALS

The UHMW panels shall be manufactured with a maximum 50 percent regenerated or recycled material; and with a molecular weight of 3,000,000 to 6,000,000 in accordance with ASTM Designation: D 4020, compression molded, stress relieved, and including an ultraviolet stabilizer. The color of the panels shall be black. The UHMW shall be approved by the Engineer. Physical characteristics shall conform to the following requirements:

A. Static coefficient of friction to steel (dry) shall be less than 0.25.
B. Specific gravity shall be greater than 0.92 (ASTM Designation: D 792)
C. No water absorption shall be shown under long term immersion (ASTM Designation: D 510)
D. The minimum tensile stress capacity shall be 25 MPa and the minimum impact shear capacity shall be 10 MPa.

The UHMW panels shall be anchored to the in-place, plastic lumber fender walers using stainless steel anchor devices as shown on the plans. All couplings, bolts, and lag bolts shall be ASTM Designation: A 276, Type 316 stainless steel.

CONSTRUCTION

The UHMW panels shall be delivered to the site and stored in a manner that will prevent damage to the panels. A Certificate of Compliance conforming to the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications, shall be furnished for each shipment of UHMW panels certifying that the material and workmanship conforms to the requirements in ASTM Designation: D 4020 and these special provisions. Two copies of the certifications from the manufacturer shall be furnished to the Engineer. Materials without manufacturer's certification will be rejected.

Immediately prior to installation, the Contractor shall inspect the panels for damage and the results of the inspection shall be reported to the Engineer. Materials which, in the Engineer's opinion, are defective or damaged, shall be repaired or replaced in kind by the Contractor at the Contractor's expense.

All lag screw heads shall be countersunk flush with the surface of the UHMW panels. All lag screw locations shall be pre-drilled into the receiving plastic lumber walers with bits having the same diameter as the bolt shank.

The minimum clear distance from the heads of all lag screws to the end or edge of the plastic lumber walers shall be 50 mm. The minimum edge distance from the centerline of lag screws to the edge of a UHMW panel shall be 50 mm.

UHMW panels shall be installed abutting each other with a 6.5 mm gap between two panels and all joints between panels shall be flush.

UHMW panels at all corners shall be constructed of a single unit formed by heat bending in accordance with the manufacturer's recommendations. Butt joints at corner locations will not be permitted.

MEASUREMENT AND PAYMENT

UHMW polyethylene panels will be measured by the square meter.

The contract price paid per square meter for UHMW polyethylene panel (50 mm) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in constructing UHMW polyethylene panel, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.82 THERMOPLASTIC TRAFFIC STRIPE AND PAVEMENT MARKING

Thermoplastic traffic stripes (traffic lines) and pavement markings shall be applied in conformance with the provisions in Section 84, "Traffic Stripes and Pavement Markings," of the Standard Specifications and these special provisions.

Thermoplastic material shall be free of lead and chromium, and shall conform to the requirements in State Specification PTH-02ALKYD.

Retroreflectivity of the thermoplastic traffic stripes and pavement markings shall conform to the requirements in ASTM Designation: D 6359-99. White thermoplastic traffic stripes and pavement markings shall have a minimum initial retroreflectivity of 250 $mcd \cdot m^{-2} \cdot lx^{-1}$. Yellow thermoplastic traffic stripes and pavement markings shall have a minimum initial retroreflectivity of 150 $mcd \cdot m^{-2} \cdot lx^{-1}$.

Where striping joins existing striping, as shown on the plans, the Contractor shall begin and end the transition from the existing striping pattern into or from the new striping pattern a sufficient distance to ensure continuity of the striping pattern.

Thermoplastic traffic stripes shall be applied at the minimum thickness and application rate as specified below. The minimum application rate is based on a solid stripe of 100 mm in width.

Minimum StripeThickness (mm)	Minimum Application Rate (kg/m)
2.0	0.4

Thermoplastic traffic stripes and pavement markings shall be free of runs, bubbles, craters, drag marks, stretch marks, and debris.

At the option of the Contractor, permanent traffic striping and pavement marking tape conforming to the provisions in "Prequalified and Tested Signing and Delineation Materials" of these special provisions may be placed instead of the

thermoplastic traffic stripes and pavement markings specified herein. Permanent tape, if used, shall be installed in conformance with the manufacturer's specifications.

If permanent tape is placed instead of thermoplastic traffic stripes and pavement markings, the tape will be measured and paid for by the meter as thermoplastic traffic stripe and by the square meter as thermoplastic pavement marking.

10-1.83 PAINT TRAFFIC STRIPE AND PAVEMENT MARKING

Painted traffic stripes (traffic lines) and pavement markings shall be applied in conformance with the provisions in Section 84, "Traffic Stripes and Pavement Markings," of the Standard Specifications and these special provisions.

Traffic stripe and pavement marking paint shall conform to the requirements in State Specification No. PTWB-01.

The color of the painted traffic stripes and pavement markings shall conform to the requirements in ASTM Designation: D 6628-01.

Retroreflectivity of the paint traffic stripes and pavement markings shall conform to the requirements in ASTM Designation: D 6359-99. White painted traffic stripes and pavement markings shall have a minimum initial retroreflectivity of 250 $mcd \cdot m^{-2} \cdot lx^{-1}$. Yellow painted traffic stripes and pavement markings shall have a minimum initial retroreflectivity of 150 $mcd \cdot m^{-2} \cdot lx^{-1}$.

At the option of the Contractor, permanent traffic striping and pavement marking tape conforming to the provisions in "Prequalified and Tested Signing and Delineation Materials" of these special provisions may be placed instead of painted traffic stripes and pavement markings. Permanent tape, if used, shall be placed in conformance with the manufacturer's specifications.

If permanent tape is placed instead of painted traffic stripes and pavement markings, the tape will be measured and paid for by the meter as paint traffic stripe and by the square meter as paint pavement marking of the number of coats designated in the Engineer's Estimate.

10-1.84 PAVEMENT MARKERS

Pavement markers shall be placed in conformance with the provisions in Section 85, "Pavement Markers," of the Standard Specifications and these special provisions.

Attention is directed to "Traffic Control System For Lane Closure" of these special provisions regarding the use of moving lane closures during placement of pavement markers with bituminous adhesive.

The Contractor shall furnish the Engineer certificates of compliance for the pavement markers in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

Retroreflective pavement markers shall be marked as abrasion resistant on the body of the markers.

10-1.85 WIND VORTEX GENERATOR PLATES

This work shall consist of furnishing, packaging and delivering wind vortex generator plates manufactured from transparent Acrylic Plexiglas G plates as shown on the plans, as specified in these special provisions, and as directed by the Engineer. Installation of the wind vortex generator plates will not be required.

Wind vortex generator plates shall be manufactured from transparent Acrylic Plexiglas G or equal conforming to Federal Standard LP-391, Type 1, Grade C. The Contractor shall furnish to the Engineer a Certificate of Compliance, in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications, for wind vortex generator plates. The certificate shall state that the wind vortex generator plates meet the requirements of Federal Standard LP-391, Type 1, Grade C. Certificates shall be submitted at least two months prior to delivery of the wind vortex generator plates.

Surfaces cut during manufacture shall be machined. Edges and corners shall be machined to a radius of 2 mm. Holes shall be drilled and drilled-hole edges machined to a radius of 2 mm. Drilled holes and all machined surfaces shall be finished to ANSI 2000.

The Contractor shall deliver the manufactured wind vortex generator plates to the Engineer at a location to be determined by the Engineer. Said location will be within 25 km of the San Francisco-Oakland Bay Bridge Toll Plaza. Wind vortex generator plates shall be delivered to the Engineer within six months prior to completion of the work. The Contractor shall notify the Engineer in writing at least two months prior to delivery of wind vortex generator plates.

Wind vortex generator plates shall be packaged in boxes for protection against physical damage and exposure during shipping and storage. Each wind vortex generator plate within a package shall be protected to prevent damage from adjacent wind vortex generator plates. Wind vortex generator plates shall be packaged to prevent shifting during shipping. The shipping package shall be clearly marked with a statement that the package contains wind vortex generator plates for the San Francisco-Oakland Bay Bridge, the number of wind vortex generator plates contained in the package, the weight of the package, and the date packaged.

MEASUREMENT AND PAYMENT

Wind vortex generator plates will be measured by the unit.

The contract unit price paid for wind vortex generator plates shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in manufacturing, furnishing, and delivering wind vortex generator plates to the location specified by the Engineer, including packaging and protecting from damage, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

SECTION 10-2. (BLANK)

SECTION 10-3. ELECTRICAL SYSTEMS

10-3.01 DESCRIPTION

The following work shall conform to the provisions in Section 86, "Signals, Lighting and Electrical Systems," of the Standard Specifications and these special provisions:

A. Underground (see E-11 to E-23) shall include, but not be limited to the following:

1. Install manholes, sumps, and duct banks as shown on the plans.
2. Install all conduit and cable tray including anchors, inserts, fittings, and supports as shown on the plans.
3. Install and terminate bare copper grounding conductors, grounding rods, and copper ground bars.

B. SAS Superstructure Roadway Westbound (see E-46 to E-89) shall include, but not be limited to the following:

1. Install roadway safety and aesthetic lighting fixtures and receptacles.
2. Install utility and lighting panels on the service platforms for both westbound and eastbound.
3. Install all conduit, conduit between panels and wireways, pull/junction boxes, wireways, bare copper bonding, anchors, fittings and supports.
4. Install and terminate cable itemized under "Cost Break-down" elsewhere in these special provisions.
5. Install and terminate cables as shown on the plans and cable schedule.
6. Conduct functional test on all lighting and receptacle circuits.
7. Install components and fabricate mounting racks on the service platforms.

C. SAS Superstructure Girder Westbound (see E-96 to E-132) shall include, but not be limited to the following:

1. Install girder access and crossbeam light fixtures, light switches, and receptacles.
2. Install all conduit, cable trays, pull/junction boxes, anchors, fittings and supports.
3. Install and terminate cable itemized under "Cost Break down" elsewhere in these special provisions.
4. Install and terminate cables as shown on the plans and cable schedule.
5. Install and terminate equipment grounding system as shown on the plans.
6. Conduct functional test on all power, lighting and receptacle circuits.

D. SAS Superstructure Roadway Eastbound (see E-135 to E-173) shall include, but not be limited to the following:

1. Install roadway safety and aesthetic lighting fixtures and receptacles.
2. Install all conduit, pull/junction boxes, anchors, fittings and supports.
3. Install and terminate cable itemized under "Cost Break-down" elsewhere in these special provisions.
4. Install and terminate cables as shown on the plans and cable schedule.
5. Conduct functional test on all lighting and receptacle circuits.
6. Install bike path conduit and lighting fixtures as shown on the plans.

E. SAS Superstructure Girder Eastbound (see E-181 to E-221) shall include, but not be limited to the following:

1. Install girder access light fixtures, light switches, and receptacles.
2. Install all conduit, cable trays, pull/junction boxes, anchors, fittings and supports.
3. Install and terminate cable itemized under "Cost Break-down" elsewhere in these special provisions.
4. Install and terminate cables as shown on the plans and cable schedule.
5. Install grounding system as shown on the plans.
6. Conduct functional test on all power, lighting and receptacle circuits.

F. Tower and Suspension Cable (see E-226 to E-287) shall include, but not be limited to the following:

1. Install safety and aesthetic lighting fixtures for the main suspension cable, roadway and pylon.
2. Install light switches, receptacles, utility panels and lighting fixtures inside the tower diaphragms and platforms.
3. Install all conduit, pul/junction boxes, anchors, fittings and supports.
4. Install and terminate cable itemized under "Cost Break-down" elsewhere in these special provisions.
5. Install and terminate cables as shown on the plans and cable schedule.
6. Conduct functional test on all power, lighting and receptacle circuits.

G. Navigation and Aviation Warning Systems (see E-291 to E-305) shall include, but not be limited to the following:

1. Install aviation lighting system, navigation lights, fog detection warning system and navigation relay panels.
2. Install all conduit, pull/junction boxes, anchors, fittings and supports.
3. Install and terminate cable itemized under "Cost Break-down" elsewhere in these special provisions.
4. Install and terminate cables as shown on the plans and cable schedule.
5. Conduct functional test on all power, control, lighting and receptacle circuits.
6. Remove temporary navigation lighting system. All temporary navigation light fixtures shall be turn over to the State after the permanent fixtures are installed and operational.

H. SCADA Remote Terminal Unit System (see E-311 to E-337) shall include, but not be limited to the following:

1. Install all SCADA panels, communication and telephone terminal boxes, and associated components.
2. Install and terminate cables as shown on the plans and cable schedule.
3. Conduct functional test on all RTU's and communication circuits.
4. Subcontract fabrication and configuration of SCADA cabinets.

I. Traffic Operation System (see E-341 to E-357) shall include, but not be limited to the following:

1. Install and test all camera stations including all associated cables.
2. Install and test microwave vehicle detection sensor systems including associated cable and junction boxes.
3. Install and test all fiber optic splice cabinet, fiber optic cables, splice closures, and fiber optic data modems.
4. Install and test all State-furnished controller cabinet assemblies.

J. Strong Motion Detection System (see E-361 to E-384) shall include, but not be limited to the following:

1. Install State-furnished sensors and State-furnished recorders with enclosures as shown on the plans.
2. Install all conduit, pull/junction boxes, anchors, fittings and supports.
3. Install and terminate cable itemized under "Cost Break-down" elsewhere in these special provisions and pull cable through the system conduit and cable trays.
4. Install and terminate cables as shown on the plans and cable schedule.
5. Install State-furnished seismic sensor mounting plates.
6. Conduct continuity test on all control circuits.

K. Call Box System (see E-396 to E-400) shall include, but not be limited to the following:

1. Install State-furnished call boxes.
2. Install and terminate cables as shown on the plans and cable schedule.
3. Conduct functional test on all circuits.

L. Electrical Utilities Removal (see E-10) shall include, but not be limited to the following:

1. Overhead cables.
2. Utility poles including foundations.
3. Pole-mounted transformers.
4. Filling of the holes with soil and grading the site.

M. SAS Superstructure and Skyway Structure Girder Interface Westbound (see E-101A) shall include, but not be limited to the following:

1. Install girder access light fixtures and light switches.

2. Install all conduit, cable trays, pull/junction boxes, fittings and supports.
3. Install and terminate cable itemized under "Cost Break-down" in these special provisions.
4. Install and terminate cables as shown on the plans and cable schedule.
5. Install and terminate equipment grounding system as shown on the plans.
6. Conduct functional test on all power, lighting and receptacle circuits.

Full compensation for SAS Superstructure and Skyway Structure Girder Interface Westbound shall be considered as included in the contract lump sum price paid for SAS Superstructure Girder Westbound and no separate payment will be made therefor.

N. SAS Superstructure and Skyway Structure Girder Interface Eastbound (see E-186A) shall include, but not be limited to, the following:

1. Install girder access light fixtures and light switches.
2. Install all conduit, cable trays, pull/junction boxes, fittings and supports.
3. Install and terminate cable itemized under "Cost Break-down" in these special provisions.
4. Install and terminate cables as shown on the plans and cable schedule.
5. Install grounding system as shown on the plans.
6. Conduct functional test on all power, lighting and receptacle circuits.

Full compensation for SAS Superstructure and Skyway Structure Girder Interface Eastbound shall be considered as included in the contract lump sum price paid for SAS Superstructure Girder Eastbound and no separate payment will be made therefor.

The YBI Substation plans included in this contract are for reference and information only.

10-3.02 ABBREVIATIONS

The following abbreviations are added to those listed in Section 1-1.02, "Abbreviations," of the Standard Specifications:

BNC	Bayonet Nut Connector
CPU	Central Processing Unit
CSA	Canadian Standards Association
C-UL	Canadian Underwriters Laboratories
DLCI	Data Link Control Identifier
DMA	Direct Memory Access
EEMAC	Electrical Equipment Manufactures Advisory Council
EEPROM	Electrically Erasable Programmable Read-Only Memory
EMI/RFI	Electromagnetic Interference/Radio Frequency Interference
EPR	Ethylene propelyne rubber
ESO	Electrical Safety Orders of the Division of Industrial Relations, State of California
FCC	Federal Communications Commission
GFCI	Ground Fault Current Interrupter
THD	Total Harmonic Distortion
IDC	Insulation Displacement Connector
ICEA	Insulated Cable Engineering Association
IEC	International Electrotechnical Commission
I/O	Input / Output
ISDN	Integrated Services Digital Network
ISO	International Organization for Standardization
IS/OS	Individual Shield/Overall Shield
JEDEC	Joint Electron Device Engineering Council
NEC	National Electrical Code
NETA	International Electrical Testing Association Inc.
NO	Normally Open
NC	Normally Closed
NFPA	National Fire Protection Association
NTSC	National Television Systems Committee
OSHA	Occupational Safety and Health Administration
OSI	Open Systems Interconnect
PVC	Polyvinyl Chloride
REA	Rural Electrification Administration
RTD	Resistance Temperature Detector
SAS	Self-Anchored Suspension
SCADA	Supervisory Control And Data Acquisition
SCSI	Small Computer Systems Interface
SDLC	Serial Data Link Control
TELCO	Telephone company
TIA	Telecommunications Industry Association
VME	Versa Module Eurocard
XLPE	Cross Linked Polyethelene
YBI	Yerba Buena Island

10-3.03 COST BREAK-DOWN

Cost break-downs shall conform to the provisions in Section 86-1.03, "Cost Break-Down," of the Standard Specifications and these special provisions.

The Engineer shall be furnished a cost break-down for each contract lump sum item of work described in this Section 10-3.

The cost break-down shall be submitted to the Engineer for approval within 30 days after the contract has been approved. The cost break-down shall be approved, in writing, by the Engineer before any partial payment for the items of electrical work will be made.

The cost break-down shall be divided into the following categories. Within each category, each item of work shall be broken down, as a minimum, to include the following listed items in addition to those listed in the Standard Specifications:

A. Underground electrical installation is shown on the plans (see E-11 to E-23) and shall include, but not be limited to the following additional items of the cost break-down:

1. Conduits, conduit anchors, fittings and supports – list each size and type.
2. Equipment rental - list each over $500.00 – list size and type.
3. Electrical hardware – list size and type.
4. Equipment grounding system – list each size and type.
5. Manholes – list each size and type.
6. Duct banks – list each size and type.
7. Cable trays - list size and type and installation method.

B. SAS Superstructure Roadway Westbound electrical installation is shown on the plans (see E-46 to E-89) and shall include, but not be limited to the following additional items of the cost break-down:

1. Cable – list each size and type.
2. Termination and splice - list each size and type.
3. Conduits, conduit anchors, fittings and supports – list each size and type.
4. Wireways on service platforms – list size and type.
5. Pull/junction boxes – list each size and type.
6. Lifting devices – list size and type.
7. Receptacles – list size and type.
8. Utility and lighting panels – list size and type.
9. Utility and lighting transformers list size and type.
10. Equipment required for functional testing – list size and type.
11. Equipment rental - list each over $500.00 – list size and type.
12. Electrical hardware – list size and type.
13. Mounting rack – list components and fabrication method.
14. Light poles - list size and type.
15. Light fixtures - – list each size and type.
16. Grounding system – list size and type.

C. SAS Superstructure Girder Westbound electrical installation is shown on the plans (see E-96 to E-132) and shall include, but not be limited to the following additional items of the cost break-down:

1. Cable – list each size and type.
2. Termination and splice - list each size and type.
3. Conduits, conduit anchors, fittings and supports – list each size and type.
4. Cable trays – list size and type and installation method.
5. Cable tray anchors, fittings and supports – list each size and type.
6. Hinge connections – list each size, type and installation method.
7. Grounding system – list size and type.
8. Pull boxes and junction boxes – list each size and type.
8. Termination boxes – list each size and type.
9. Light switches and fixtures – list each size and type.
10. Equipment rental - list each over $500.00 – list size and type.
11. Electrical hardware – list size and type.
12. Embed strut channel – list size and type.

D. SAS Superstructure Roadway Eastbound electrical installation is shown on the plans (see E-135 to E-173) and shall include, but not be limited to the following additional items of the cost break-down:

1. Cable – list each size and type.
2. Termination and splice - list each size and type.
3. Conduits, conduit anchors, fittings and supports – list each size and type.
4. Pull boxes and junction boxes – list each size and type.
5. Lifting devices – list size and type.
6. Receptacles – list size and type.
7. Lighting and utility transformers – list size and type.
8. Utility and lighting panels – list size and type.

9. Equipment required for functional testing – list size and type.
10. Equipment rental - list each over $500.00 – list size and type.
11. Electrical hardware – list size and type.
12. Light poles - list size and type.
13. Light fixtures - list size and type.

E. SAS Superstructure Girder Eastbound electrical installation is shown on the plans (see E-181 to E-221) and shall include, but not be limited to the following additional items of the cost break-down:

1. Cable – list each size and type.
2. Termination and splice - list each size and type.
3. Conduits, conduit anchors, fittings and supports – list each size and type.
4. Cable trays – list size and type and installation method.
6. Cable tray anchors, fittings and supports – list each size and type.
7. Hinge connections – list each size, type and installation method.
8. Grounding system – list size and type.
9. Pull boxes and junction boxes – list each size and type.
10. Termination boxes – list each size and type.
11. Light switches and fixtures – list size and type.
12. Equipment rental - list each over $500.00 – list size and type.
13. Electrical hardware – list size and type.
14. Receptacles – list size and type.
15. Equipment required for functional testing – list size and type.
16. Embed strut channel – list size and type.

F. Tower and Suspension Cable is shown on the plans (see E-226 to E-287) and shall include, but not be limited to the following additional items of the cost break-down:

1. Cable – list each size and type.
2. Termination and splice - list each size and type.
3. Conduits, conduit anchors, fittings and supports – list each size and type.
4. Pull boxes and junction boxes – list each size and type.
5. Light switches and fixtures – list size and type.
6. Receptacles – list size and type.
7. Utility and lighting panels – list size and type.
8. Lifting devices – list size and type.
9. Equipment required for functional testing – list size and type.
10. Equipment rental - list each over $500.00 – list size and type.
11. Electrical hardware – list size and type.
12. Transformer – list size and type
13. Power Disconnect Switches – list size and type

G. Navigation and Aviation Warning Systems are shown on the plans (see E-291 to E-305) and shall include, but not be limited to the following additional items of the cost break-down:

1. Cable – list each size and type.
2. Termination and splice - list each size and type.
3. Conduits, conduit anchors, fittings and supports – list each size and type.
4. Pull boxes and junction boxes – list each size and type.
5. Aviation lights – list make, model and type.
6. Navigation lights and relay panels – list make, model and type.
7. Fog detection system - list make, model and type.
8. Equipment required for functional testing – list size and type.
9. Equipment rental - list each over $500.00 – list size and type.

H. SCADA Remote Terminal Unit System installation is shown on the plans (see E-311 to E-337) and shall include, but not be limited to the following additional items of the cost break-down:

1. Remote Terminal Units– list size and type.

2. Telephone terminal boxes – list size and type.
3. SCADA communication terminal boxes – list size and type.
4. Telephone and SCADA cables – list each size and type.
5. Equipment required for functional testing – list size and type.
6. Equipment rental - list each over $500.00 – list size and type.
7. Termination and splice - list each size and type.

I. Traffic Operations System is shown on the plans (see E-341 to E-357) and shall include, but not be limited to the following additional items of the cost break-down:

1. Cable (except fiber optic cable) – list each size and type.
2. Mounting brackets – list size and type.
3. Equipment required for functional testing – list size and type.
4. Equipment rental - list each over $500.00 – list size and type.
5. Fiber distribution units – list size and type.
6. Fiber splice cabinet – list size and type.
7. Camera junction boxes – list size and type.

J. Strong Motion Detection System is shown on the plans (see E-361 to E-384) and shall include, but not be limited to the following additional items of the cost break-down:

1. Seismic cable – list size and type.
2. Interconnect cable – list size and type.
3. Telephone cable – list size and type.
4. Conduits, conduit anchors, fittings and supports – list each size and type.
5. Junction boxes and pull boxes – list each size and type.
6. Recorder cabinets – list size and type.
7. Termination and splice - list each size and type.

K. Call Box System installation details are shown on the plans (see E-396 to E-400) and shall include, but not be limited to the following additional items of the cost break-down:

1. Cable – list each size and type.
2. Termination and splice - list each size and type.
3. Equipment required for functional testing – list size and type.
4. Equipment rental – list each over $500.00 – list size and type.

L. Electrical Utilities Removal details are shown on the plans (see E-10) and shall include, but not be limited to the following additional items of the cost break-down:

1. Overhead cables – list each size and type.
2. Utility poles including foundations.
3. Pole-mounted transformers.
4. Filling of the holes with soil and grading the site.

M. SAS Superstructure and Skyway Structure Girder Interface Westbound electrical installation is shown on the plans (see E-101A) and shall include, but not be limited to the following additional items of the cost break-down:

1. Cable- list each size and type.
2. Termination and splice- list each size and type.
3. Conduits, fittings and supports- list each size and type.
4. Cable trays- list size and type and installation method.
5. Cable tray, fittings and supports-list each size and type.
6. Hinge AW connections- list each size, type and installation method.
7. Grounding system- list size and type.
8. Pull boxes and junction boxes- list each size and type.
9. Termination boxes- list each size and type.
10. Light switches and fixtures- list each size and type.
11. Equipment rental- list each over $500.00- list size and type.

12. Electrical hardware- list size and type.
13. Embed strut channel- list size and type.

N. SAS Superstructure and Skyway Structure Girder Interface Eastbound electrical installation is shown on the plans (see E-186A) and shall include, but not be limited to, the following additional items of the cost break-down:

1. Cable- list each size and type.
2. Termination and splice- list each size and type.
3. Conduits, fittings and supports- list each size and type.
4. Cable trays- list size and type and installation method.
5. Cable tray, fittings and supports-list each size and type.
6. Hinge AE connections- list each size, type and installation method.
7. Grounding system- list size and type.
8. Pull boxes and junction boxes- list each size and type.
9. Termination boxes- list each size and type.
10. Light switches and fixtures- list each size and type.
11. Equipment rental- list each over $500.00- list size and type.
12. Electrical hardware- list size and type.
13. Receptacles list size and type.
14. Equipment required for functional testing- list size and type.
15. Embed strut channel- list size and type.

10-3.04 NUMBERING ELECTRICAL EQUIPMENT

The placement of numbers on electrical equipment will be done by others, unless otherwise stated in these special provisions.

10-3.05 CONSTRUCTION CONTRACT INTERFACE RESPONSIBILITY

The Contractor shall install all materials between W2 manholes and Hinge A, which are the split points as shown on the plans. All mating of conduits, trays and grounding conductors at Hinge A, including splicing of 15 kV cables, communications, signal, fiber-optic and control cables shall be performed by the SAS superstructure Contractor. The SAS superstructure Contractor shall perform complete functional test of all installed equipment by the use of temporary power. The SAS superstructure Contractor shall provide sufficient lengths of “pigtails” as indicated on the interface block diagrams. The SAS superstructure Contractor shall provide the splice kits and terminate all connections.

The construction of the YBI structures will not be complete by the time the SAS superstructure Contractor is ready to perform functional test of the electrical equipment therefore, the SAS superstructure Contractor shall provide a temporary power source to perform complete functional test. The SAS superstructure Contractor shall provide 3-phase, 480 V, 60 Hz power for the duration of the equipment testing. The three phase power shall be of sufficient size to run all the loads to be tested including the dehumidifier motors.

The YBI structures Contractor will perform the final acceptance tests of each termination and splice in accordance with latest applicable ICEA, International Electrical Testing Association Inc. (NETA) and IEEE standards. The tests will include but not be limited to continuity, backscattering, attenuation and loss measurements of fiber-optic cables, including DC high potential tests, continuity and megger tests, as applicable, for each splice performed.

The SAS superstructure Contractor shall be responsible for connecting all mechanical equipment via the appropriate pipes, fittings and valves to the adjacent Skyway mechanical system.

10-3.06 CONDUIT

All conduit installed on the bridge shall be Type 2 unless otherwise specified. Conduit within the box girders and detector termination conduit shall be Type 1. All conduit installed in the barrier strip that are embedded into concrete shall be Type 1 or Type 2. Any conduit in the barrier strip that is not fully embedded in concrete shall be Type 2.

When a standard coupling cannot be used for joining Type 1 conduit, a UL listed threaded union coupling conforming to the provisions in Section 86-2.05C, "Installation," of the Standard Specifications, or a concrete-tight split coupling, or concrete-tight set screw coupling shall be used.

Pull ropes for use when installing cables in conduit shall consist of flat, woven, lubricated, soft-fiber polyester tape with a minimum tensile strength of 8000 N and shall have printed sequential measurement markings at least every meter.

After conductors have been installed, the ends of conduits terminating in pull boxes, enclosures, and cabinets shall be sealed with an approved type of sealing compound.

RIGID GALVANIZED STEEL CONDUIT, THREADED COUPLINGS AND ELBOWS

The rigid galvanized steel (RGS) conduit, threaded couplings, and elbows shall conform to Section 86-2.05, "Conduit," of the Standard Specifications for Type 1 where shown on the plans.

POLYVINYL CHLORIDE COATED RIGID GALVANIZED STEEL CONDUIT, THREADED COUPLINGS, AND ELBOWS

The polyvinyl chloride (PVC) coated rigid galvanized steel (RGS) conduit, threaded couplings, and elbows shall conform to "Rigid galvanized steel Conduit, Threaded Couplings, and Elbows" as specified elsewhere in these special provisions shall conform to Section 86-2.05, "Conduit," of the Standard Specifications for Type 2 where shown on the plans.

POLYVINYL CHLORIDE COATED RIGID GALVANIZED STEEL CONDUIT BODIES

The polyvinyl chloride (PVC) coated rigid galvanized steel (RGS) conduit bodies shall conform to the following requirements before the PVC coating is applied:

A. The PVC-coated RGS conduit bodies shall conform to Federal Specification W-C-586D, and UL Standard No. 514B. The PVC-coated RGS conduit bodies zinc surfaces shall remain intact and undistributed on both the inside and outside throughout the preparation and application processing.
B. The PVC-coated RGS conduit bodies shall be "Hot-Dipped" galvanized inside and out after fabrication with "Hot-Dipped" galvanized threads. The zinc coating for PVC-coated RGS conduit bodies will be tested in accordance with ASTM Designation: A239.
C. The "Hot-Dipped" galvanized threads, the exterior, and the interior for the PVC-coated RGS conduit bodies shall have a urethane coated of a nominal thickness of 50 microns.
D. The PVC-coated RGS conduit bodies shall conform to the following requirements when the PVC coating is applied:

    1. All PVC-coated RGS conduit bodies shall conform to NEMA Standard No. RN-1.
    2. The bond between the coatings and the metal shall be greater than the tensile strength of the coatings.
    3. All PVC-coated RGS conduit bodies shall have an exterior PVC coating of a minimum thickness of 1 mm applied by dipping in liquid plastisol.
    4. All Hubs on PVC-coated RGS conduit bodies shall have a PVC sleeve extending one pipe diameter or 53 mm whichever is less. The inside diameter (I.D.) of the sleeve to be equal to the outside diameter (O.D.) of the uncoated pipe.
    5. Stainless steel encapsulated screws shall be supplied with all form 7 and form 8 PVC-coated RGS conduit bodies.
    6. The PVC coating on all form 8 PVC-coated RGS conduit bodies shall form a gasket-like flange of at least 8 mm wide and 1 mm thick covering the top of the conduit body around the opening.
    7. The PVC coating on all form 8 conduit body covers shall form a gasket-like flange of at least 8 mm wide and 1 mm thick covering at the bottom of the cover and mating with the flange of the conduit body.
    8. All PVC-coated RGS conduit bodies for conduits less than 103 mm shall be form 7 conduit bodies.

LIQUIDTIGHT FLEXIBLE METAL CONDUIT

The liquid tight flexible metallic conduit shall conform to the following requirements:

A. The flexible metal shall be constructed of continuously interlocked strip and shall be coated with sunlight resistant PVC jacket.
B. The metal core shall be hot-dipped galvanized steel core with a heavy coating of zinc.
C. The jacket shall be resistant to weather, temperature, oil and chemical breakdown.
D. Conform to the provisions of NEC Article 351 under "Liquid-tight Flexible Metal Conduit.
E. UL listed for Safety 360.

10-3.07 UNDERGROUND RACEWAYS

DUCTBANKS

Underground conduits shall be Type 1 encased in concrete. Concrete for conduit encasement shall be 907 kg test with aggregate of 20 mm or smaller.

The concrete shall be colored red by the addition of 6 kg of red oxide powder to each cubic meter of mix. The coloring shall be thoroughly mixed into the concrete before pouring. Adequate spacers, tie-downs and bracing shall be provided to maintain conduits in place during the pouring of the concrete. Ducts shall be installed so as to drain to manholes.

All conduits entering and leaving the manholes shall be bonded together with copper bonding cable looped through the manhole. All conduit connections shall be treaded. All connections shall be made with suitable conductive thread compound. After installation all conduits shall be checked for continuity and cleaned properly. Cleaning of conduit shall be done by the use of compressed air for sizes 41 mm and smaller, and by the use of mandrel and cleaning brushes pulled through each conduit for sizes larger than 41 mm. Prior to backfilling of the underground duct system, the Contractor shall provide a yellow (with black lettering) warning tape, 340 mm from the finished grade, stating "CAUTION-BURRIED ELECTRICAL LINE".

MANHOLES

All manholes shall be installed by the Contractor as shown and specified on the plans.

10-3.08 SUPPORT HARDWARE FOR CONDUITS, CABLE TRAYS AND WIREWAYS

STAINLESS STEEL POWER-STUD ANCHOR-THREADED VERSION

Stainless steel power-stud, anchor-threaded version shall have a one-piece anchor body with the length identification code. The anchor bodies shall be manufactured from Type 316 stainless steel and shall have an expansion mechanism, which consists of a pair interlocking independent wedges.

Anchors that have less than a 40 mm hole depth can be installed anywhere in the box. If the anchor will require a hole depth of greater than 40 mm, the Engineer will consult with the Structural Engineer of Record prior to approving the location and depth of the anchor. The f"c for the superstructure is 55 Mpa. The average strength of the concrete will therefor be almost 62 MPa. As a consequence it will be difficult to drill.

Anchor Component	Component Material
Anchor Body	Type 316L Stainless Steel
Nut	Type 316L Stainless Steel
Washer	Type 316L Stainless Steel
Expansion Wedge	Type 316L Stainless Steel

EMBED STRUT CHANNEL

Embed strut channels, as shown on the plans, shall conform to the provisions in Section 75-1.03, "Miscellaneous Bridge Metal," of the Standard Specifications and these special provisions.

Embed strut channels cast in preformed the concrete shall be installed at the time of casting and not after. Embed struts shall be manufactured from 12-gage hot-dip galvanized rolled steel. Load ratings shall have a safety factor of 3. An electro-galvanizing and dichromate finishing process shall be applied after fabrication to achieve a 13 µm electro-galvanizing plating. The channels shall be of a standard size to accommodate standard channel fittings and nuts.

MOUNTING RACKS

Mounting racks shall be constructed from 12-gage steel channel. The steel shall be fabricated by a formed hot-dip galvanized rolled steel method and have a 13 µm electro-galvanizing plating applied after fabrication. All fittings and hardware used for construction of the mounting racks shall be of steel with the same electro-galvanizing plating.

THREADED BOLT SLEEVES AND BOLTS

Threaded bolt sleeves required for the navigation light mounting plate shall conform to the requirements in ASTM Designation: A 36 and installed by the concrete fabricator. The bolts shall conform to the requirements in ASTM Designation: A 37.

ELECTRICAL HARDWARE

All electrical hardware, including but not limited to, bolts, nuts, washers, lock washers, fastening screws, expansion anchors, U-bolts and hold-down clamps shall be Type 316L stainless steel unless otherwise noted.

CONDUIT AND TRAY SUPPORTS

Conduit and tray support brackets, as shown on the plans, shall conform to the provisions in Section 75-1.03, "Miscellaneous Bridge Metal," of the Standard Specifications and these special provisions.

The anchoring and supports of trays shown on the plans are designed to Seismic Zone 4 requirements. The Contractor shall determine the construction methods for Seismic Zone 4 conduit supports at each support location, including location and length of support channel. Once determined, the Contractor shall submit to the Engineer for review and approval at least 30 days prior to ordering or fabrication of conduit supports.

The Engineer will consult with the Structural Engineer of Record prior to approving concrete anchors requiring a depth of greater than 40 mm. Therefore it is recommended that support channels be embedded in the pre-fabricated concrete girder sections, during manufacture, for all trays and all major conduit runs. The following tray and conduit weight tables shall be used by the Contractor for determining the spacing of supports. The tables show the maximum probable mass of insulated copper conductors assuming maximum tray and conduit fill.

Conduit size in mm:	41	53	63	78	103
Mass in kg/m:	6.15	9	12.9	18.75	28.5

Tray size in mm:	305	610	762
Mass in kg/m:	37.5	75	93.75

Maximum tray support span shall be 4.74 meters.
Maximum conduit support span shall be 3.0 meters.

CABLE TRAY LADDER TYPE

Cable tray systems are defined to include, but are not limited to straight sections of ladder type cable trays, bends, tees, elbows, dropouts, supports and accessories.

Quality Assurance

The Contractor shall furnish to the Engineer a Certificate of Compliance from the manufacturer in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for each cable tray ladder type. The certificate shall be signed by the manufacturer's quality control representative and shall state that all materials and workmanship comply with the specifications and approved shop plans. The manufacturer shall be a firm regularly engaged in manufacture of cable trays and fittings of types and capacities required, whose products have been in satisfactory use in similar services. The cable tray ladder types shall comply with the following standards NEMA VE1, NEC Article 318, Underwriters Laboratory and NFPA 70B.

Cable Tray Sections and Components

Straight section and fitting side rails and rungs shall be made of ASTM Designation: A 570 and A 611 steel. The cable tray system shall be hot-dip galvanized after fabrication in conformance with the requirements in ASTM Designation: A 123. The cable tray side rails shall be stamped with the manufacturer's name, part number and material type. Transverse members (rungs) or corrugated bottoms shall be welded to the side rails with steel welding wire.

Ladder type trays shall consist of two longitudinal members (side rails) with transverse members (rungs) welded to the side rails. Rungs shall be spaced 229 mm on center. Rung spacing in fittings shall be 229 mm and measured at the center of the tray's width. Rungs shall have a minimum cable-bearing surface radius edge of 25 mm. Each rung must be capable of supporting 91 kg concentrated load above the cable load at the center of the cable tray with a safety factor of 1.5. Tray sizes shall have 127-mm minimum usable load depth or as noted on the plans.

Straight tray sections shall have side rails fabricated as I-beams. Tray widths shall be as shown on plans. Tray fittings shall include all reducers, and vertical and horizontal bends. All fittings must have a minimum radius of 610 mm. Splice plates shall be the bolted type made as indicated below for each tray type. The resistance of fixed splice connections between an adjacent section of tray shall not exceed 330 $\mu\Omega$. Splice plate construction shall be such that a splice may be located anywhere within the support span without diminishing rated loading capacity of the cable tray. (The splice plate shall be able to support the full load of the tray). Splice plates shall be manufactured of high strength steel. All hardware shall be stainless steel. Cable tray shall be supported at intervals of not more than 4.74 m. All conduit terminating at trays shall provide a continuous cable route by using bushings specifically suited for attaching conduit to the tray rail and for providing ground continuity.

Cable trays shall meet NEMA Class Designations 16B. The cable trays shall be manufactured by B-Line Systems, Chalfant, or other approved manufacturer.

Cable Tray Solid Trough Type

The solid trough type tray shall be the same as ladder type cable tray specified elsewhere in these special provisions except for the following. It shall be a solid bottom trough type tray with two longitudinal members (side rails) with a corrugated bottom welded to the side rails. The peaks of the corrugated bottom shall have a minimum flat cable-bearing surface of 70 mm and shall be spaced on 152-mm centers. The cable trays may be manufactured by B-Line Systems, Chalfant, or other approved manufacturer. Solid bottom trays with covers shall be used for communications and signal wire trays. Tray fittings shall include all reducers, and vertical and horizontal bends. Cable tray shall be supported at intervals of

not more than 4.74 m. All conduit terminating at trays shall provide a continuous cable route by using bushings specifically suited for attaching conduit to the tray rail and for providing ground continuity.

NEMA TYPE 4X WIREWAY

The wireway shall be NEMA Type 4x Continuous Hinge Feed-Through Wireway. It shall be 14-gage Type 304 stainless steel. The seams shall be continuously welded and ground smooth, no holes or knockouts. It shall have 10-gage stainless steel flanges with smooth, rounded edges on all sections and fittings preventing damage to the insulation of the wire. The stainless steel heavy butt hinges and door clamp assembly shall assure a complete seal between covers and bodies. The gasket and adhesive shall be oil-resistant. The solid oil-resistant gasket shall be positioned between flanges when sections and fittings are bolted together. The wireway shall meet the latest edition of the following industry standards NEMA Type 4X Enclosure, UL 870 and have a 2B finish. The physical size and dimensions shall be as shown on the plans. The wireway shall be manufactured by B-Line Systems, Chalfant, Hoffman or other approved manufacturer.

CABLE INSTALLATION IN CABLE TRAY

All cable installed in cable trays shall be dressed neatly, arranged in bundles by function and strapped to the cable tray at intervals no less than 600 mm using plastic ties.

10-3.09 PULL BOXES, SPLICE BOXES AND JUNCTION BOXES

BARRIER PULL BOXES

Type 9 and 9A barrier pull boxes shall be as shown on the plans and detailed on Standard Plans ES-9C, except the pull box shall have captive stainless steel cover screws.

Type PB-1A barrier pull boxes shall be used for weatherproof receptacles to be installed in the barriers. The pull box size shall be two gang tandem, sufficient for one outdoor barrier receptacle, and made of steel. The pull boxes shall be constructed of minimum 2-mm thick steel. All corner joints to be continuous seam welded. The physical size and dimensions shall be as shown on the plans. The barrier pull boxes (Type PB-1A) shall be extra deep.

OUTDOOR BARRIER RECEPTACLES, OUTDOORS

The receptacles to be installed in the barriers outdoors shall be rated 15 A, 120 V, weatherproof and with threaded caps which effectively seal the housing when not in use.

NEMA TYPE 4X STAINLESS STEEL PULL BOXES

The body and the cover plate of the NEMA Type 4X enclosure shall be made of 14-gage Type 304 or Type 316 stainless steel. The seams shall be continuously welded and ground smooth, no holes or knockouts. It shall have a seamless foam-in-place gasket that assures watertight and dust-tight seal. The gasket and adhesive shall be oil-resistant. All exterior hardware shall be Type 304 or Type 316 stainless steel.

The enclosure shall meet the latest edition of the following industry standards NEMA Type 4X Enclosure, UL870.

The box engraving, physical size and dimensions shall be as shown on the plans. The enclosure shall be manufactured by B-Line Systems, Chalfant, Hoffman or other approved manufacturer.

NEMA TYPE 12 PULL BOXES SINGLE DOOR

The NEMA Type 12 single door pull box shall conform to the following:

Construction

A. Enclosure bodies are either 14-gage or 16-gage steel. All doors are 14-gage steel.
B. Seams shall be continuously welded and ground smooth, no holes or knockouts.
C. Continuous hinge.
D. External screw door clamps are quick and easy to operate.
E. Door shall be removed by pulling heavy gage continuous hinge pin.
F. Oil-resistant gasket attached with oil-resistant adhesive and held in place with steel retaining strips shall be provided.
G. The box engraving, physical size and dimensions shall be as shown on the plans drawings.
H. Finish shall be white inside with ANSI 61 gray outside finish over phosphatized surfaces. Optional panels shall be white.

Industry Standards

A. UL 508 Type 12.
B. NEMA/EEMAC Type 12.

C. JIC standard EGP-1-1967 (14-gage only).
D. CSA Type 12.
E. IEC 529, IP-65.

NEMA TYPE 4X ENCLOSURES STAINLESS STEEL

The body and the door of the NEMA Type 4X enclosure shall be made of 14-gage Type 304 or Type 316 stainless steel. The seams shall be continuously welded and ground smooth, no holes or knockouts. It shall have a seamless foam-in-place gasket that assures watertight and dust-tight seal. It shall have a body stiffener in the larger size enclosures. The gasket and adhesive shall be oil-resistant. Enclosure shall have rolled lip around three sides of the door and all sides of the enclosure to assure a proper seal. All exterior hardware shall be Type 304 or Type 316 stainless steel. Enclosure shall have a hasp and staple for padlocking.

The door shall be removed by pulling stainless steel continuous hinge pin. The enclosure shall meet the latest edition of the following industry standards NEMA Type 4X Enclosure, UL508, and have a 2B finish.

The enclosure engraving, physical size and dimensions shall be as shown on the plans. The enclosure shall be manufactured by B-Line Systems, Chalfant, Hoffman or other approved manufacturer.

Proper air circulation in the cabinets to protect PLC equipment from suffocation. Isolated ground bus to connect instrumentation shields, and a ground lug for equipment ground.

Navigation Warning Relay Cabinet Enclosure

The cabinet enclosure shall include selector switches, general-purpose relays (10 A switching capacity), current-sensing relays, indicating lights, terminal blocks, fuses and nameplates as shown on the plans. A photo electric control external from the cabinet enclosure shall be included as part of the system and shall be as described on the plans. All components to be installed on the panel shall be corrosion resistant and watertight.

SCADA and Telephone Termination Enclosure

The cabinets shall include terminations for 50 twisted pair communications leads. Noise suppression resistors with a 1-percent tolerance shall be provided for each pair.

NEMA TYPE 12 ENCLOSURES STEEL

The NEMA Type 12 steel enclosures shall be single door have the following specification:

Construction

A. Enclosure bodies are either 14-gage or 16-gage steel. All doors are 14-gage steel.
B. Seams continuously welded and ground smooth, no holes or knockouts.
C. External mounting feet or wall mounted.
D. Door and body stiffeners in larger enclosure.
E. Rolled lip around three sides of door and all sides of enclosure opening excludes liquids and contaminants.
F. Door clamps are quick and easy to operate.
G. Door removed by pulling heavy gage continuous hinge pin.
H. Hasp and staple for padlocking.
I. Data pocket is high-impact thermoplastic.
J. Oil-resistant gasket attached with oil-resistant adhesive and held in place with steel retaining strips.
K. Collar studs provided for mounting panels.
L. The box engraving, physical size and dimensions shall be as shown on the plans.
M. Proper air circulation in the cabinets
N. Isolated ground bus to connect instrumentation shields, and a ground lug for equipment ground.

Finish

White inside with ANSI 61 gray outside finish over phosphatized surfaces. Optional panels are white.

Industry Standards

A. UL 508 Type 12.
B. NEMA/EEMAC Type 12.
C. JIC standard EGP-1-1967 (14-gage only).
D. CSA Type 12.
E. IEC 529, IP-65.

NEMA TYPE 4X FIBERGLASS ENCLOSURE

Lighting and Utility Transformer panelboards, to be located outside on the platforms, shall be installed inside a NEMA Type 4X Fiberglass Enclosure. Fiberglass enclosures shall be molded polyester with seamless foam-in-place gasket to assure watertight and dust tight seal. The enclosure shall meet the requirements of UL508 for Type 4X enclosures. The enclosures are to have corrosion resistant polyester latches with corrosion resistant morel hinge pin and bail. The enclosure shall be manufactured by B-Line Systems, Hoffman, Mac Products or equal. The size of the enclosures is to be determined by the Contractor.

The Contractor may use a NEMA Type 4X Stainless Steel enclosure in lieu of a fiberglass enclosure.

15 kV SPLICE BOX

The high voltage splice box shall be NEMA Type 12 as shown on the plans. The box shall conform to all applicable requirements in NEC, Article 370(D). Each cover shall be secured with at least ten stainless steel bolts. Cover makings for high voltage splice box shall read "High Voltage" and be permanently marked and readily visible. Enclosures and covers shall be 14-gage steel minimum with seams continuously welded and ground smooth. High voltage splice box shall be installed at each high voltage cable splice location.

FIBER OPTIC SPLICE CLOSURE

The fiber optic splice closure shall consist of an outer closure, an inner closure and splice trays, as specified in these special provisions.

The fiber optic splice closure shall be designed for a temperature range from -30°C to +70°C.

The size of the closure shall allow for all the fibers of the largest fiber optic trunk cable to be spliced to a second cable of the same size, plus 12 additional pigtails. The closures shall not be more than 864 mm in length and not more than 203 mm in diameter. The closures shall be designed for fusion splicing.

All materials in the closures shall be non-reactive and shall not be subject to galvanic cell action. The outer-closure shall be compatible with the other closure components, the inner closure, splice trays, and cables.

The end plate shall consist of two sections and shall have capacity for two fiber optics communication cables and 12 fiber optics pigtails, or two additional fiber optic communication cables.

The outer-closure shall protect the splices from mechanical damage, shall provide strain relief for the cable, and shall be resistant to salt corrosion.

The outer-closure shall be waterproof, and re-enterable. The outer-closure shall be flash-tested at 103 kPa.

The inner-closure shall be compatible with the outer closure and the splice trays and shall allow access to and removal of individual splice trays.

The splice trays shall be compatible with the inner-closure and shall be constructed of rigid plastic or metal.

Adequate splice trays shall be provided to splice all fibers of the communication cable with the greatest fiber count entering the closure, plus 12 pigtails.

The Contractor shall install the fiber optic splice closure on the cable trays where splicing is required. Splices to the distribution cable shall be mid-span access splices, allowing access to individual fibers at selected points without cutting the remaining fibers. The fiber optic splice closures shall be securely fastened to the cable tray using standard hardware found in communications manholes.

The Contractor shall provide all mounting hardware required to securely mount the closures to the cable tray.

The fiber optic splice closure shall be mounted in a manner as shown on the plans that allows the cables to enter at the end of the closure without exceeding any minimum bending radius specification.

Upon completion of the splices, the splice trays shall be secured to the inner closure.

The closure shall be sealed using a procedure recommended by the manufacturer that will provide a waterproof environment for the splices.

The Contractor is responsible to ensure that the cable entry points have a tight salt resistant and waterproof seal which will not leak upon aging. It is acceptable to have multiple pigtails enter the fiber optic splice closure through one hole as long as all spaces between the cables are completely sealed.

10-3.10 CONDUCTORS, CABLES AND WIRING

Splices shall be insulated by heat-shrink tubing of the appropriate size after thoroughly painting the spliced conductors with electrical insulating coating.

The minimum insulation thickness, at any point, for Type USE, RHH or RHW wire shall be 1.0 mm for conductor sizes No. 14 to No. 10, inclusive, and 1.3 mm for No. 8 to No. 2, inclusive. The minimum insulation thickness, at any point, for Type THW and TW wires shall be 0.69 mm for conductor sizes No. 14 to No. 10, inclusive, 1.02 mm for No. 8, and 1.37 mm for No. 6 to No. 2, inclusive.

600 VOLT SINGLE CONDUCTOR CABLE

All 600-volt single conductor cable shall be the following unless otherwise noted on the plans. The cables shall be insulated with a EPR insulation rated for 600 volts. The cables shall be UL listed as Type RHH, RHW-2, or USE-2, VW-1 600 V. All cables No. 1/0 and larger shall be UL Type TC rated.

The conductor shall be soft annealed uncoated copper Class B stranded per ASTM B-8. The EPR insulation shall meet the requirements of ICEA S-68-516, NEMA WC-8, and UL Standards 44 and 854. The composite insulation thickness shall be as follows:

Conductor Size	EPR Thickness
No. 14 - No. 10	1.14 mm
No. 8	1.52 mm
No. 6 - No. 2	1.91 mm
No. 1 - No. 4/0	2.54 mm
250 kcmil – 500 kcmil	3.30 mm

The cable surface shall be printed in a contrasting color with the following information:

A. Manufacturers' name.
B. Plant number.
C. Conductor size.
D. Cable type.
E. Voltage rating.

The cable shall be manufactured by The Okonite Company, BICC Cables, Pirelli, or equal. Manufacturer shall furnish a notarized certificate of compliance to demonstrate cable furnished is in compliance with ICEA S-68-516 and UL 44.

600 VOLT MULTI-CONDUCTOR CABLE

All 600 volt rated multi-conductor cables shall be the following unless otherwise noted on the plans drawings. The cables shall be insulated with ethylene propylene rubber, assembled as a multi-conductor cable with flame resistant fillers and binder tape with an overall PVC jacket. The cables shall be capable of operating continuously in both wet and dry locations at conductor temperature of 90°C for normal operation, 130°C for emergency overload rating, and 250°C short circuit rating.

The conductors shall be soft annealed uncoated copper Class B stranded in conformance to the requirements in ASTM Designations: B 8. The single conductors shall be ethylene propylene rubber insulated meeting the requirements of UL 1581 and ICEA S-68-516. Color coding for sizes No. 10, 12, 14 and 16 AWG shall conform to the requirements in ICEA Method I Table K-2. Sizes No. 8 and larger shall be numerically coded using ICEA Method 4. The insulation thickness shall be as follows:

Conductor Size	EPR Thickness
No. 16	0.64 mm
No. 14 - No. 10	0.76 mm
No. 8 - No. 2	1.14 mm
No. 1/0 - No. 4/0	1.39 mm

The insulated conductors (and grounding conductor if required) shall be cabled together with flame resistant fillers and binder tape. The jacket shall be extruded PVC meeting the physical and dimensional requirements of ICEA S-68-516. The cable shall pass the vertical tray flame test requirements of IEEE 383 and 1202 and UL 1277. The cable shall be UL listed as Type TC.

The cable surface shall be printed in a contrasting color with the following information:

A. Manufacturers' name.
B. Plant number.
C. Number of conductors.
D. Conductor size.
E. Cable type.
F. Voltage rating.

The cable shall be manufactured by The Okonite Company, BICC Cables, Pirelli, or equal. The manufacturer shall furnish a notarized certificate of compliance to demonstrate cable furnished is in compliance with ICEA S-68-516 and UL 1277.

600 VOLT ARMORED MULTI-CONDUCTOR CABLE

The 600-volt armored cable shall be used for call box power supply and bike path lighting as shown on the roadway eastbound plan sheet.

The individual conductor of the armored cable shall conform to the 600-volt cable requirements as specified above in the special provisions.

The armor sheath shall exceed the grounding conductor requirements of Table 250-95 of the National Electrical Code and UL 1569. The armor sheath shall be impervious, continuous, welded, corrugated aluminum that will provide complete protection against moisture, liquid, and gases, and has excellent mechanical strength. The armor sheath shall be covered with low temperature black polyvinyl chloride to protect the cable against chemical attack.

The cable shall have stranded copper grounding conductor, located in the outer interstices. The cable shall be UL Listed as type MC cable per Article 334 of the NEC.

SHIELDED TWISTED PAIR CABLE

All shielded twisted pair No. 18 (0.832 mm^2) multi-conductor communication cables (fifty pairs, six pairs and two pairs) shall be stranded annealed copper (per ASTM Designations: B 3 and ASTM B 8). The insulated single conductors shall be twisted into pairs. The insulation shall be flame-retardant cross-linked polyethylene with color code in conformance with the requirements in ICEA Method 1. The insulation shall be 0.76 mm nominal.

The cable components are cabled with non-hygroscopic fillers, as necessary, and an overall binder tape. The individual pairs shall be shielded with a 0.19 mm Aluminum/polymer tape with tinned copper drain wire applied helically over the pairs. The overall shield shall be a 0.19 mm Aluminum/polymer tape with tinned copper drain wire applied helically over the cable core.

The overall jacket shall be 2.8 mm Flame-retardant and sunlight resistant polyvinyl chloride (PVC). A nylon ripcord shall be applied longitudinally under the overall jacket to facilitate jacket removal.

The cable shall be suitable for Cable Tray use and have the following ratings and listings:

A. UL Type TC - 600 volt.
B. UL Class XL.
C. UL Subject 13 and 1277.
D. IEEE 383 and 1202.
E. ICEA S-66-524 - 600 volt.

The cable shall be manufactured by Belden Cable, The Okonite Company, BICC Cables, Pirelli, or equal. The manufacturer shall furnish a notarized certificate of compliance to demonstrate cable furnished is in compliance with ICEA S-68-516 and UL 44.

Communication Cable Splices

Splices shall be done only as approved by the Engineer. Splices for shielded No. 18 multi-conductor, twisted pair cables shall be as recommended by the cable manufacturer and suitable for the environment that the splice is located. The Contractor shall submit the cable manufacturer's recommended splicing method to the Engineer for approval prior to using the method. The Engineer shall approve splice locations. The splicing kits shall be manufactured by Raychem, 3M or other approved manufacturer.

600 Volt Shielded-Twisted Pair Armored Cable

The 600 V instrumentation armored cables shall be used for call box communication as shown on the roadway eastbound plan sheet.

The individual conductor of the armored cable shall conform to the shielded-twisted pair cable requirements as specified above in the special provisions.

The armor sheath shall be impervious, continuous, welded, corrugated aluminum that will provide complete protection against moisture, liquid, and gases, and shall have excellent mechanical strength and provide equipment grounding through the sheath. The armor sheath shall be covered with low temperature black polyvinyl chloride to protect cable against chemical attack.

The cable shall be UL Listed as ITC/PLTC in accordance with Article 727 and Article 725 of the NEC. Cables shall comply with UL 2250 and UL 13 for PLTC, CL2, and CL3.

15 kV CABLE

The 15 kV shielded single conductor power cable shall be 15 kV, 133 percent insulation rated power cable designed to operate at conductor temperatures of 90°C normal, 130°C emergency, and 250°C short circuit conditions as defined by ICEA S-93-639 (NEMA WC-78) and (UL) Standard 1072. The cable shall be suitable for installations above or below grade, indoors or outdoors, and in wet or dry locations. The qualifying cable shall be (UL) labeled as MV-90, Sunlight Resistant and for cable tray use in accordance with UL Standard 1072.

Conductors

The conductors shall be compressed, Class B stranded copper and shall be in accordance with the requirements of ICEA S-93-639. The copper conductors shall consist of all bare strands or tin-coated strands in the outer layer in conformance with the requirements in ASTM Designations: B 3, B 8 and B 33. Conductors shall be unbroken for the full length of the reels specified in the Purchase Order. Reels containing splices will be rejected.

Conductor Shield

The conductor shielding shall consist of an extruded, black-colored, nonmetallic semiconducting EPR thermosetting compound material in conformance with the provisions in Section 2.7 of ICEA S-93-639. The minimum average thickness shall be 0.5 mm.

Insulation

The insulation shall be a discharge resistant, ethylene propylene (EP) based compound and be listed by Underwriters Laboratories. The minimum average thickness of the insulation shall be 5.59 mm. The manufacturer shall perform the Insulation Corona Discharge Resistance Test (3.9.3.3 of ICEA S-93-639) tested in conformance with the requirements in ASTM Designation: D 2275-89, "Standard Test Method for Voltage Endurance of Solid Electrical insulating materials Subjected to Partial Discharges (Corona) on the Surface," and submit the results to the Engineer before acceptance of the cable.

Insulation Shielding

The insulation shielding shall consist of a nonmetallic semiconducting EPR material extruded directly over the insulation and a 0.12-mm bare copper tape. The nonmetallic semi conducting layer shall be black-colored with properties and thickness conforming to the requirements of Table 4a of ICEA S-68-516-93-639 and Tables 14.2 and 14.3 of UL-1072. The layer shall be free stripping from the EP insulation. The 0.12-mm bare copper tape shall be helical applied with a 15 percent overlap, directly over the nonmetallic layer.

Metallic Shield

The metallic shield shall be coated copper tape, helically applied with a minimum overlap of 12.5 percent, directly over the nonmetallic layer.

Overall Jacket

The overall jacket shall be extruded black-colored Polyvinyl Chloride (PVC) material with physical properties and thickness in accordance with Section 4.4.5 and Table 4-6 of ICEA S93-639 and shall be surface printed as required by UL Standard 1072.

Production Testing

Production testing shall consist of the following:

A. Continuous DC Spark testing of the non-conducting stress control layer prior to extrusion of the EP insulation.
B. Mooney Viscosity, Scorch Viscosity, and Specific Gravity of each batch of the EP insulation prior to extrusion.
C. AC Voltage Withstand test for a 5-minute duration, of each finished cable at 35 kV.
D. Volume Resistivity of the nonmetallic shield.
E. DC Resistance of all insulated conductors and metallic shields.
F. Dimensional Verification of all extruded layers.
G. Absence of water in conductors and interfaces confirmed.

Cable Accessories

The manufacturer of the splices and terminations shall have a minimum of 15 years specialized in manufacturing of heat shrinkable cable accessories. The manufacturer of the splices and terminations shall be the Raychem Corporation or approved equal.

The cable splicer shall have a minimum of five years experience and be certified by the splice and cable termination manufacturer. The splicer shall provide a resume documenting his experience and qualifications to be approved on this project.

Cable Terminations

The Termination shall be IEEE 48, Class 1, heat-shrinkable cable terminations in kit form, capable of properly terminating cables specified in this section. Terminations for single-conductor cables shall consist of heat-shrinkable radiation crosslinked high dielectric constant linear stress relief material and heat-shrinkable radiation crosslinked non-tracking outer insulation. Terminations shall contain a high relative permittivity electric stress relief mastic for insulation shield cutback treatment and a heat-activated sealant for environmental sealing.

In addition to the components described above, three-conductor kits shall contain heat-shrinkable components to seal the cable jacket, phase conductors, ground wire and rejacket phase and ground conductors.

Cable Splices

Splices of high voltage cable shall be avoided if possible. Where necessary, because of constructibility reasons, splice locations shall be approved by the Engineer. In general, splices of high voltage cables shall be scheduled so that the length of cable between splices is approximately 400 meters. All 15 kV splices shall be enclosed on a 15 kV splice box (Type PB-3A). A splice shall be scheduled at the construction boundaries. Where possible, longer cable runs are encouraged. The Splices, where necessary, shall be IEEE 404, heat shrinkable cable splices in kit form, capable of properly splicing cables specified in this section. Splice kits shall contain all necessary components to reinstate primary cable insulation, metallic shielding and grounding systems and overall jacket to the equivalent of the cable itself. Splices shall be of a uniform cross-section and shall consist of heat-shrinkable radiation crosslinked insulation. The outer insulating layer shall be bonded to a conducting layer for shielding. The splice shall be rejacketed with a heavy-wall, heat-shrinkable sealant lined sleeve to provide a waterproof hot melt adhesive seal. Splices shall contain heat-shrinkable radiation cross-linked high dielectric constant linear stress relief material. Splices shall contain a high relative permittivity electric stress relief mastic for insulation shield cutback treatment and a heat-activated sealant for environmental sealing. Kits shall allow splicing cables with different types of insulation, conductor sizes, and shielding construction. Kits shall accommodate commercially available standard connectors.

Cable End Sealing Caps

The end seal caps shall be heat-shrinkable crosslinked polymeric end sealing caps capable of sealing cables specified in this section. End caps shall be precoated with a heat activated sealant.

DC High Potential Test

Perform DC high potential test of each conductor in accordance with NEMA WC 5.

CLOSED CIRCUIT TELEVISION CABLES

Television control (TVC) cable shall consist of 15 No. 18 copper conductors, unshielded and with an outer jacket. Each conductor shall have a minimum of 16 tinned copper strands with a minimum of 400-µm insulation. Individual conductor insulation shall be chrome PVC with a nominal thickness of 1 mm. The outside diameter of the jacket shall not exceed 14 mm.

Color code for TVC cable shall be:

A. Black.
B. White.
C. Red.
D. Green.
E. Orange.
F. Blue.
G. White/ Black.
H. Red/ Black.
I. Green/ Black.
J. Orange/ Black.

K. Blue/ Black.
L. Black/ White.
M. Red/ White.
N. Green/ White.
O. Blue/ White.

Television power (TVP) conductors shall consist of three No. 14 (120 VAC, 120 VAC neutral, equipment ground) individually insulated, stranded copper conductors in conformance with the provisions in Section 86-2.08, "Conductors," of the Standard Specifications. The conductors shall be color coded black, white, and green respectively.

Television control power (TVCP) cable shall consist of twelve No. 18 conductors, unshielded with an outer jacket. Each conductor shall have a minimum of 16 tinned copper strands with a minimum of 400 µm insulation. Individual conductor insulation shall be polyvinyl chloride (PVC), rated for 300 V (see color code below). The jacket shall be chrome PVC with a nominal thickness of 1 mm. The outside diameter of the jacket shall not exceed 12 mm.

Color code for TVCP cable shall be:

A. Black.
B. White.
C. Red.
D. Green.
E. Orange.
F. Blue.
G. White/ Black.
H. Red/ Black.
I. Green/ Black.
J. Orange/ Black.
K. Blue/ Black.
L. Black/ White.

Television video (TVL) cable shall consist of an RG-6/U coaxial cable. Each cable shall be provided with a solid No. 18 copper clad steel center conductor and shall conform to the following requirements:

Electrical	TVL
Capacitance (picofarads/m nominal)	54.1
Impedance (ohms-nominal)	75
Velocity of propagation (nominal)	84%
D.C. loop resistance (ohms/100 m)	11.7

Attenuation at 20˚C:

Frequency (MHz)	TVL (Nominal dB/ 100 m)
5.0	1.90
30	3.64
108	6.40

Physical Specifications	TVL Nominal O.D. (mm)
Copper-clad steel center conductor	1.00
Foam polyethylene dielectric	4.57
Sealed APA tape with 1.6 mm overlap	4.75
Woven aluminum braid	5.39
Sealed APA tape with 1.6 mm overlap	5.49
Woven aluminum braid	6.12
Flooding compound	
PVC outer jacket	7.55

(APA = Aluminum polyolefin and aluminum with adhesive)

TVL cable shall be terminated with BNC plug connector at both ends.

Coaxial Cable Connectors (TVL Coaxial Cables)

Coaxial cable connectors for attaching Type TVL coaxial cable shall meet the following requirements:

A. Electrical:

Impedance	75 Ω nominal
Return loss	30 dB minimum (5 MHz to 300 MHz)
Rated working voltage	500 V rms

B. Mechanical:

Type of construction	Integral sleeve BNC
Method of attachment	Crimp-crimp
Composition	Bodies – alloy Finish - chromate conversion, silver plating, or other corrosion resistant metal

C. Environmental:

Temperature	-10˚C to +50˚C
Moisture	Weather resistance design

The mating connector for TVL cable in junction box shall be provided. The center contact of this jack shall be beryllium copper.

Testing

Testing of TVL cables and connectors shall be performed in accordance with the provisions in Section 86-2.14B, "Field Testing," of the Standard Specifications and these special provisions.

Cable lengths found to have faults shall be replaced and re-tested. The Contractor shall dispose of the replaced cable.

Prior to the beginning of work, each length of coaxial cable shall be tested for attenuation and faults to ensure compliance with specifications contained herein using a time domain reflectometer (TDR). For the purpose of these special provisions, a fault in a long length of cable is defined by one or more of the following:

A. Return loss measurements indicating that attenuation exceeds 3 dB at 5 MHz to 30 MHz in a portion of cable less than 3 m long.
B. A return loss measurement indicating that there is a short in the cable.
C. A return loss measurement indicating a cut or open circuit in the cable.
D. A visual inspection which reveals exposure of or damage to the cable shielding.

FIBER OPTIC OUTSIDE PLANT CABLE

General

Each fiber optic outside plant cable (FOP) shall be all dielectric, gel filled, duct type, with loose buffer tubes and shall conform to these special provisions. The singlemode fiber optic (SMFO) cables shall interconnect the equipment at the SAS Superstructure with the equipment at each controller cabinet on service platforms 4, 6 and 7. SMFO fibers shall contain singlemode (SM) dual-window (1310 nm and 1550 nm) fibers.

Fiber optic cables shall be supplied by the Contractor in the configurations as shown on the plans and specified in these special provisions.

The optical fibers shall be contained within loose buffer tubes. The loose buffer tubes shall be stranded around an all dielectric central member. Aramid yarn or fiberglass shall be used as a primary strength member, and a medium or high density polyethylene outside jacket shall provide for overall protection.

All fiber optic (F/O) cable on this project shall be from the same manufacturer as the cable used for Contract No. 04-012024.

The cable shall be qualified as compliant with Chapter XVII, Title 7, Part 1755.900 of the Code of Federal Regulations, "REA specification for filled fiber optic cables."

The following is the fiber count for each fiber optic cable:

A. Type A fiber optic cable, designated in the plans as Fiber Optic Trunk Line Cable, shall contain 72 singlemode fibers.
B. Type B fiber optic cable, designated in the plans as Fiber Optic Drop Cable, shall contain 12 singlemode fibers.

Fiber Characteristics

Each optical fiber shall be glass and consist of a doped silica core surrounded by concentric silica cladding. All fibers in the buffer tube shall be usable fibers, and shall be free of surface imperfections and occlusions to meet the optical, mechanical, and environmental requirements of these specifications. The required fiber grade SM shall reflect the maximum individual fiber attenuation, to guarantee the required performance of each and every fiber in the cable.

The coating shall be a dual layered, ultraviolet (UV) cured acrylate. The coating shall be mechanically or chemically strippable without damaging the fiber.

The cable shall comply with the optical and mechanical requirements over an operating temperature range from -40°C to +70°C. The cable shall be tested in accordance with EIA-455-3A (FOTP-3), "Procedure to Measure Temperature Cycling Effects on Optical Fiber, Optical Cable, and Other Passive Fiber Optic Components." The change in attenuation at extreme operational temperatures (-40°C to +70°C) for the fiber shall not be greater than 0.20 dB/km, with 80 percent of the measured values no greater than 0.10 dB/km. The attenuation shall be measured at 1310 nm and 1550 nm.

Fibers within the finished cable shall meet the requirements in the following table:

Fiber Characteristics Table

Parameters	Value
Mode:	Single
Type:	Step Index
Core diameter:	8.3 µm (nominal)
Cladding diameter:	125 µm ±1.0 µm
Core to Cladding Offset:	≤1.0 µm
Coating Diameter:	250 µm ±15 µm
Cladding Non-circularity, Defined as: [1-(min. cladding dia ÷max. cladding dia.)]x100	≤2.0%
Proof/Tensile Test:	345 MPa, min.
Attenuation: @ 1,310 nm @ 1,550 nm	≤0.4 dB/km ≤0.4 dB/km
Attenuation at the Water Peak:	≤2.1 dB/km @ 1383 ±3nm
Chromatic Dispersion:	
Zero Dispersion Wavelength:	1301.5 to 1321.5 nm
Zero Dispersion Slope:	=0.092 ps/(nm^2*km)
Maximum Dispersion:	≤3.3 ps/(nm*km) for 1285 - 1330 nm <18 ps/(nm*km) for 1550 nm
Cut-Off Wavelength:	<1250 nm
Mode Field Diameter: (Petermann II)	9.3 ±0.5 µm at 1310 nm 10.5 ±1.0 µm at 1550 nm

Color Coding

Optical fibers shall be distinguishable from others in the same buffer tube by means of color coding according to the plans, sheet E-354, TOS Fiber Optic Cable Assignment and the following:

1. Blue (BL)
2. Orange (OR)
3. Green (GR)
4. Brown (BR)
5. Slate (SL)
6. White (WT)
7. Red (RD)
8. Black (BK)
9. Yellow (YL)
10. Violet (VL)
11. Rose (RS)
12. Aqua (AQ)

Each buffer tube shall be distinguishable from other buffer tubes in the cable by using the same color coding as specified above for fibers.

The colors shall be targeted in accordance with the Munsell color shades and shall meet EIA/TIA-598 "Color Coding of Fiber Optic Cables."

The color formulation shall be compatible with the fiber coating and the buffer tube filling compound, and be heat stable. It shall not fade or smear or be susceptible to migration and it shall not affect the transmission characteristics of the optical fibers and shall not cause fibers to stick together.

Cable Construction

The fiber optic cable shall consist of, but not be limited to, the following components:

A. Buffer tubes.
B. Central member.
C. Filler rods.
D. Stranding.
E. Core and cable flooding.
F. Tensile strength member.
G. Ripcord.
H. Outer jacket.
I. Buffer Tubes.

Loose buffer tubes shall provide clearance between the fibers and the inside of the tube to allow for expansion without constraining the fiber. The fibers shall be loose or suspended within the tubes and shall not adhere to the inside of the tube. Each buffer tube shall contain 12 fibers.

The loose buffer tubes shall be extruded from a material having a coefficient of friction sufficiently low to allow free movement of the fibers. The material shall be abrasion resistant to provide mechanical and environmental protection of the fibers, yet designed to permit safe intentional "scoring" and breakout, without damaging or degrading the internal fibers.

Buffer tube filling compound shall be a homogenous hydrocarbon-based gel with anti-oxidant additives. It shall be used to prevent water intrusion and migration. The filling compound shall be non-toxic and dermatologically safe to exposed skin. It shall be chemically and mechanically compatible with all cable components, non-nutritive to fungi, non-hygroscopic and electrically non-conductive. The filling compound shall be free from dirt and foreign matter and shall be readily removable with conventional nontoxic solvents.

Buffer tubes shall be stranded around a central member by a method, such as the reverse oscillation stranding process, that will prevent stress on the fibers when the cable jacket is placed under strain.

2. Central Member.

The central member, which functions as an anti-buckling element, shall be a glass reinforced plastic rod with similar expansion and contraction characteristics as the optical fibers and buffer tubes. To ensure the proper spacing between buffer tubes during stranding, a symmetrical, linear overcoat of polyethylene may be applied to the central member to achieve the optimum diameter.

3. Filler Rods.

Fillers may be included in the cable cross-section. Filler rods shall be either solid medium or high density polyethylene. The diameter of filler rods shall be the same as the outer diameter of the buffer tubes.

4. Stranding.

Completed buffer tubes shall be stranded around the overcoated central member using stranding methods, lay lengths and positioning such that the cable shall meet mechanical, environmental and performance specifications. A polyester binding shall be applied over the stranded buffer tubes to hold them in place. Binders shall be applied with sufficient tension to secure the buffer tubes to the central member without crushing the buffer tubes. The binders shall be non-hygroscopic, non-wicking (or rendered so by the flooding compound), and dielectric with low shrinkage.

5. Core and Cable Flooding.

The cable core interstices shall be filled with a polyolefin based compound to prevent water ingress and migration. The flooding compound shall be homogeneous, non-hygroscopic, electrically non-conductive, and non-nutritive to fungus. The compound shall also be nontoxic, dermatologically safe and compatible with all other cable components.

6. Tensile Strength Member.

Tensile strength shall be provided by high tensile strength aramid yarns and fiberglass which shall be helically stranded evenly around the cable core and shall not adhere to other cable components.

7. Ripcord.

The cable shall contain at least one ripcord under the jacket for easy sheath removal.

8. Outer Jacket.

The jacket shall be free of holes, splits, and blisters and shall be medium or high density polyethylene (PE) with minimum nominal jacket thickness of 0.94 mm. Jacketing material shall be applied directly over the tensile strength members and flooding compound and shall not adhere to the aramid strength material. The polyethylene shall contain carbon black to provide ultraviolet light protection and shall not promote the growth of fungus.

The jacket or sheath shall be marked with the manufacturer's name, the words "Optical Cable", the number of fibers, year of manufacture, and sequential measurement markings every meter. The actual length of the cable shall be within ±1 percent of the length marking. The marking shall be permanently marked in a contrasting color to the cable jacket. The height of the marking shall be approximately 2.5 mm.

General Cable Performance Specifications

The F/O cable shall withstand water penetration when tested with a one-meter static head or equivalent continuous pressure applied at one end of a one-meter length of filled cable for one hour. No water shall leak through the open cable end. Testing shall be done in conformance with the requirements in EIA-455-82 (FOTP-82), "Fluid Penetration Test for Fluid-Blocked Fiber Optic Cable."

A representative sample of cable shall be tested in conformance with the requirements in EIA-455-81A (FOTP-81), "Compound Flow (Drip) Test for Filled Fiber Optic Cable". No preconditioning period shall be conducted. The cable shall exhibit no flow (drip or leak) at 80°C as defined in the test method.

Crush resistance of the finished fiber optic cables shall be 220 N/cm applied uniformly over the length of the cable without showing evidence of cracking or splitting when tested in conformance with the requirements in EIA-455-41 (FOTP-41), "Compressive Loading Resistance of Fiber Optic Cables". The average increase in attenuation for the fibers shall be no greater than 0.10 dB at 1550 nm (singlemode) for a cable subjected to this load. The cable shall not exhibit any measurable increase in attenuation after removal of load. Testing shall be in conformance with the requirements in EIA-455-41 (FOTP-41), except that the load shall be applied at the rate of 3 mm to 20 mm per minute and maintained for 10 minutes.

The cable shall withstand 25 cycles of mechanical flexing at a rate of 30 ±1 cycles/minute. The average increase in attenuation for the fibers shall be no greater than 0.20 dB at 1550 nm (singlemode) at the completion of the test. Outer cable jacket cracking or splitting observed under 10x magnification shall constitute failure. The test shall be conducted in conformance with the requirements in EIA-455-104 (FOTP-104), "Fiber Optic Cable Cyclic Flexing Test," with the sheave diameter a maximum of 20 times the outside diameter of the cable. The cable shall be tested in accordance with Test Conditions I and II of (FOTP-104).

Impact testing shall be conducted in conformance with the requirements in EIA-455-25 (FOTP-25) "Impact Testing of Fiber Optic Cables and Cable Assemblies." The cable shall withstand 20 impact cycles. The average increase in attenuation for the fibers shall be no greater than 0.20 dB at 1550 nm (singlemode). The cable jacket shall not exhibit evidence of cracking or splitting.

The finished cable shall withstand a tensile load of 2700 N without exhibiting an average increase in attenuation of greater than 0.20 dB (singlemode). The test shall be conducted in conformance with the requirements in EIA-455-33 (FOTP-33), "Fiber Optic Cable Tensile Loading and Bending Test." The load shall be applied for one-half hour in Test Condition II of the EIA-455-33 (FOTP-33) procedure.

Packaging and Shipping Requirements

Documentation of manufacturer’s compliance to the required optical fiber specifications shall be provided to the Engineer prior to ordering the material. The cable manufacturer shall be ISO 9001 certified.

Attention is directed to "Fiber Optic Testing," elsewhere in these special provisions.

The completed cable shall be packaged for shipment on reels. The cable shall be wrapped in a weather and temperature resistant covering. Both ends of the cable shall be sealed to prevent the ingress of moisture.

Each end of the cable shall be securely fastened to the reel to prevent the cable from coming loose during transit. Three meters of cable length on each end of the cable shall be accessible for testing.

Each cable reel shall have a durable weatherproof label or tag showing the manufacturer's name, the cable type, the actual length of cable on the reel, the Contractor's name, the contract number, and the reel number. A shipping record shall also be included in a weatherproof envelope showing the above information and also include the date of manufacture, cable characteristics (size, attenuation and bandwidth), factory test results, cable identification number and any other pertinent information.

The minimum hub diameter of the reel shall be at least thirty times the diameter of the cable. The fiber optic cable shall be in one continuous length per reel with no factory splices in the fiber. Each reel shall be marked to indicate the direction the reel should be rolled to prevent loosening of the cable.

Installation procedures and technical support information shall be furnished at the time of delivery.

Fiber Optic Labeling

The following labeling scheme shall be used for all fiber optic components on the project. These components include Individual Fibers, Buffer Tubes, Type A Cable, Type B Cable, Fiber Optic Splice Closures, and Fiber Distribution Units. All labels shall consist of materials that are permanent and clearly legible. All identification numbers for the components are shown on the project plans.

A. Individual Fibers.

Individual fibers shall have identification based on the color assignment shown in the plans, on sheet E-354, TOS Fiber Optic Cable Assignment.

B. Buffer Tubes.

Buffer tubes shall have identification based on the color assignment shown in the plans, on sheet E-354, TOS Fiber Optic Cable Assignment.

C. Type A Cable.

A label shall be attached to the cable outside and within one meter of each fiber optic splice closure listing, in order, the cable identification number, the identification number of the fiber optic splice closure, followed by the identification number of the fiber optic splice closure at the other end of the cable.

D. Type B Cable.

A label shall be attached to the cable outside and within one meter of the fiber optic splice closure listing, in order, the cable identification number, the identification number of the fiber optic splice closure, followed by the identification number of the controller cabinet at the other end of the cable. Within each controller cabinet, a label shall be attached to the cable within one meter of the fiber distribution unit listing, in order, the cable identification number, the identification number of the controller cabinet, followed by the identification number of the fiber optic splice closure at the other end of the cable.

E. Fiber Optic Splice Closures.

Each fiber optic splice closure shall be clearly marked in a consistent location clearly visible at all installations with the fiber optic splice closure identification number.

F. Fiber Distribution Units.

Each fiber distribution unit shall be clearly marked in a consistent location clearly visible at all installations with the identification number of the enclosing controller cabinet.

Cable Installation

Prior to installation of the optical fiber cable, the Contractor shall test the cable on the shipping reel conforming to the provisions as described in "Arrival on Site," elsewhere in these special provisions. The Contractor shall submit the manufacturer's recommended procedures for pulling the fiber optic cable to the Engineer for review and approval at least 20 days prior to installing cables. Mechanical aids may be used to assist cable installation. A tension measuring device or breakaway swivel shall be placed between the end of the cable grip and pull rope, to ensure that the tension does not exceed 100 percent of recommended tension. The cable grips for installing fiber optic cable shall have a ball bearing swivel to prevent the cable from twisting during installation.

During cable installation, the bend radius shall be maintained at a minimum of twenty times the outside diameter of the cable. The cable shall not be stressed beyond the minimum bend radius at any time during installation.

F/O cable shall be installed using a cable pulling lubricant recommended by the F/O cable and the innerduct manufacturer and a non-abrasive pull tape conforming to the provisions described under "Conduit" elsewhere in these special provisions. The Contractor’s personnel shall be stationed at each splice vault and pull box through which the cable is to be pulled to lubricate and prevent kinking or other damage.

F/O cable shall be installed without splices except where specifically allowed on the plans or described in these special provisions. The mid-span access method shall be used to access the individual fibers trunkline cable for splicing to the distribution cable. The cables used for distribution shall be spliced only in fiber optic splice closures or fiber distribution units. The trunk cables shall be spliced only at splice closures. The slack shall be divided equally on each side of each splice closure.

The mid-span access method shall be used to access the individual fibers in the distribution cable for splicing to the accessory cable. Cable manufactures recommended procedures and approved tools shall be used when performing a mid-span access. All measures shall be taken to avoid damaging buffer tubes and individual fibers not being used in the mid-span access. The Contractor will be allowed to splice a total of 5 fibers to repair any damage done during mid-span access

splicing without penalty. For each additional splice the Contractor will be assessed $300.00. 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 F/O cable must be replaced at the Contractor's expense.

A minimum of 18 meters of slack shall be provided for each unspliced cable at each splice closure. A minimum of 9 meters of slack shall be provided for each cable at each fiber optic splice closure.

Following installation of the cable in duct, all duct entrances in cabinets, pull boxes and vaults shall be sealed with duct sealing compound to prevent the ingress of moisture, foreign materials and rodents.

Unless shown or provided otherwise, only one F/O cable shall be installed in each conduit.

Splicing

Optical fibers shall be spliced using the fusion type and shall not exceed 0.07 dB loss per splice.

Termination splices shall join the fibers in the F/O cable span to the fibers in the FDC. The termination splices shall be placed in a splice tray and the splice tray(s) shall then be placed in the splice closure. The individual fibers shall be looped one full turn within the splice tray to avoid macro bending. A 254-mm minimum bend radius shall be maintained during installation and after placing in the optical fiber splice tray. Each fiber shall be individually restrained in a splice tray. The optical fibers in buffer tubes and the placement of the optical fibers in the splice tray shall be such that there is no discernable tensile force on the optical fiber.

All splices shall be protected with a thermal shrink sleeve.

Passive Cable Assemblies and Components

The F/O cable assemblies and components shall be compatible components, designed for the purpose intended, and manufactured by a company regularly engaged in the production of material for the fiber optic industry. All components or assemblies shall be best quality, non-corroding, with a design life of at least 20 years. All components or assemblies of the same type shall be from the same manufacturer.

Fiber Optic Cable Terminations

A. General

Fiber optic cable terminations shall include pigtails and jumpers. Breakout cables shall comply with the specifications for pigtails. Fiber optic outside plant cable entering a building shall be routed through rigid steel conduit as required by the NEC. The cable shall continue within the conduit to the designated termination point for distribution "breakout".

All components shall be the size and type required for the specified fiber.

B. Distribution Breakout

Fiber optic drop cable shall be routed within a conduit from the splice closure to the controller cabinet. Termination within the splice closure shall be in the manner specified elsewhere in these special provisions. Termination within the controller cabinet shall be in a fiber distribution unit (FDU).

Fiber optic cables that arrives within a building, shall be routed within conduit to a wall or ceiling mounted cable storage cabinet, as shown on the plans, where a minimum of 6 meter of spare cable shall be coiled for future use. The cable shall be terminated in a fiber distribution unit (FDU).

The cable jacket, aramid yarn and filler rods shall be removed exposing the buffer tubes. The exposed length of the buffer tubes shall be at least the length recommended by the hardware manufacturer which allows the tubes to be secured to the splice tray. Buffer tubes shall be secured to the splice tray. The remainder of the tubes shall be removed to expose lengths of the individual fibers sufficient for routing on the splice tray, as described in "Splicing" elsewhere in these special provisions. Moisture blocking gel shall be removed from the exposed buffer tubes and fibers. The manufacturer's directions shall be followed to ensure that throughout the specified temperature range gel will not flow from the end of the buffer tube. The individual fibers shall be stripped and prepared for splicing.

Fiber Optic Cable Assemblies

Cable assemblies (jumpers and pigtails) shall be products of the same manufacturer. The cable used for cable assemblies shall be made of fiber meeting the performance requirements of these special provisions for the F/O cable being connected, except that the operating temperature shall be modified to be from -20°C to +70°C. All cable assemblies will be installed inside controller cabinets. The manufacturer's attenuation test results shall be provided for all cable assemblies.

A. Pigtails.

Pigtails shall be of simplex (one fiber) construction, in 900-µm tight buffer form, surrounded by aramid for strength, with a connector on one end. The outer jacket shall be PVC with a nominal diameter of 3 mm, marked with the manufacturer's identification information. All pigtails shall be at least one meter in length. Pigtails installed in conduit shall

follow the installation procedures outlined for fiber optic cables, except that the pulling tension shall not exceed 890 N. All pigtails shall be factory fabricated.

B. Patchcords.

Patchcords may be of simplex or duplex design. Duplex jumpers shall be of duplex round cable construction, and shall not have zipcord (siamese) construction. All patchcords shall be at least 2 meters in length, sufficient to avoid stress and allow orderly routing. Patchcords shall have connectors on both ends.

The outer jacket of duplex patchcords shall be yellow. The two inner simplex jackets shall be contrasting colors to provide easy visual identification for polarity. All patchcords shall be factory fabricated.

C. Connectors.

Connectors shall be of the ceramic ferrule ST type. Indoor ST connector body housings shall be either nickel-plated zinc or glass reinforced polymer construction. Outdoor ST connector body housing shall be glass reinforced polymer. No index-matching fluids, gels or anti-reflection coating shall be applied to the end of the fiber.

The ST connector operating temperature range shall be from -40°C to +70°C. Insertion loss shall not exceed 0.4 dB, and the return reflection loss shall be at least 35 dB. Connection durability shall be less than a 0.2 dB change per 500 mating cycles in conformance with the requirements in EIA-455-21A (FOTP-21). All terminations shall provide a minimum 222 N pull out strength. The installed ST connector loss shall be less than 0.9 dB. Factory test results shall be documented and submitted to the Engineer prior to installing any connectors. Connectors shall have a yellow color body or boot.

All connectors shall be factory-installed and tested. There shall be no installation of connectors in the field.

All unmated connectors shall be installed with protective caps.

D. ST Couplers.

The ST couplers shall be made of nickelplated zinc or a glass reinforced polymer that is consistent with the material forming the associated ST connector body. The design mechanism for mounting the coupler to the fiber distribution unit connector panel may be flanged or threaded but shall coincide with the FDU panel punch-outs.

All coupler sleeves shall be ceramic of the split clamshell or cloverleaf design.

The temperature operating range for couplers shall be the same as that specified for the ST connectors.

Fiber Distribution Unit

The fiber distribution unit shall consist of a EIA 482.6 mm rack, a compartment for termination and distribution cable tray and a compartment for a splice drawer. The termination and distribution cable trays shall accommodate 48 singlemode optical fibers. The termination and distribution cable trays shall have sufficient tray areas for excess optical fiber storage with provisions to assure that the optical fibers do not exceed a 51-mm bend radius. The termination and distribution cable trays shall include a designation strip for identification of the 48 singlemode optical fibers. Each splice drawer shall include two splice trays with each splice tray capable of accommodating 24 fusion type splices. Each splice drawer shall allow for storage of excess lengths of the optical fibers of fiber optic cables. Each fiber distribution unit shall be provided with cable clamps to secure fiber optic cables to the chassis.

The Contractor shall install sufficient quantity of fiber distribution units to terminate all fibers in the largest cable. The fiber distribution units shall be mounted in the equipment racks as shown on the plans. At each fiber distribution unit, the Contractor shall terminate the optical fibers of the two fiber optic cables. The optical fibers shall be spliced to the single mode optical fiber cables assemblies within the splice tray(s). The optical fibers shall be of appropriate lengths to allow for future splicing with the splice drawer and shall be appropriately identified (tagged). All splices shall be fusion type and shall be arranged within the splice trays of the fiber distribution unit in accordance with the organizational design of the splice trays. Appropriate protective coating shall be applied to all fusion splices.

Full compensation for fiber distribution unit shall be considered as included in the contract price paid for the item requiring fiber distribution unit and no separate payment will be made therefore.

Fiber Optic Testing

A. General.

Testing shall include the tests on elements of the passive fiber optic components: (1) at the factory, (2) after delivery to the project site but prior to installation, and (3) after installation but prior to connection to any other portion of the system. The Contractor shall provide all personnel, equipment, instrumentation and materials necessary to perform all testing. The Engineer shall be notified 2days prior to all field tests. The notification shall include the exact location or portion of the system to be tested.

Documentation of all test results shall be provided to the Engineer within 2 days after the test involved. The Contractor's attention is directed to "As-Builts" elsewhere in these special provisions, regarding the requirements for recording test results.

A minimum of 15 days prior to arrival of the cable at the site, the Contractor shall provide detailed test procedures for all field testing for the Engineer's review and approval. The procedures shall include the tests involved and how the tests are to be conducted. Included in the test procedures shall be the model, manufacturer, configuration, calibration and alignment procedures for all proposed test equipment.

B. Factory Testing.

Documentation of compliance with the fiber specifications as listed in the Fiber Characteristics Table shall be supplied by the original equipment manufacturer. Before shipment, but while on the shipping reel, 100 percent of all fibers shall be tested for attenuation. Copies of the results shall be (1) maintained on file by the manufacturer with a file identification number for a minimum of 7 years, (2) attached to the cable reel in a waterproof pouch, and (3) submitted to the Contractor and to the Engineer.

C. Arrival On Site.

The cable and reel shall be physically inspected on delivery and the attenuation shall be measured for 100 percent of the fibers. The failure of any single fiber in the cable to comply with these specifications, is cause for rejection of the entire reel. Test results shall be legibly recorded, dated, compared and filed with the copy accompanying the shipping reel in a weather proof envelope. Attenuation deviations from the shipping records of greater than 5 percent shall be brought to the attention of the Engineer. The cable shall not be installed until completion of this test sequence and the Engineer provides written approval. Copies of traces and test results shall be submitted to the Engineer. If the test results are unsatisfactory, the reel of F/O cable shall be considered unacceptable and all records corresponding to that reel of cable shall be marked accordingly. The unsatisfactory reels of cable shall be replaced with new reels of cable at the Contractor's expense. The new reels of cable shall then be tested to demonstrate acceptability. Copies of the test results shall be submitted to the Engineer.

D. Outdoor Splices.

The Contractor shall verify the insertion loss quality of each splice as provided elsewhere in these special provisions, prior to sealing the splice closure.

E. Optical Time Domain Reflectometer Testing.

Once the passive cabling system has been installed and is ready for activation, 100 percent of the fiber links shall be tested with the optical time domain reflectometer (OTDR) for attenuation at wavelengths of both 1310 nm and 1550 nm. Test results shall be recorded, dated, compared and filed with previous copies. A hard copy printout and an electronic copy of traces and test results shall be submitted to the Engineer in the format designated by the Engineer.

The OTDR shall be capable of recording and displaying anomalies of at least 0.02 dB.

F. Power Meter and Light Source.

At the conclusion of the OTDR testing, 100 percent of the fiber links shall be tested end to end with a power meter and light source, in accordance with EIA Optical Test Procedure 171 and in the same wavelengths specified for the OTDR tests. These tests shall be conducted in both directions and the differential in test results shall not exceed 0.5 dB. Test results shall be recorded, compared, and filed with the other recordings of the same links. Test results shall be submitted to the Engineer.

G. Cable Verification Worksheet.

The Cable Verification Worksheet shown in Appendix A shall be completed for 100 percent of all links in the fiber optic system, using the data gathered during cable verification. The completed worksheets shall be included as part of the system documentation in the As-Built Plans.

H. Test Failures.

If the link loss measured from the power meter and light source exceeds the calculated link loss, or the actual location of the fiber ends does not agree with the expected location of the fiber ends (as would occur with a broken fiber), the Fiber Optic Link will not be accepted. The unsatisfactory segments of cable, or splices shall be replaced with a new segment of cable or splice at the Contractor's expense. The OTDR Testing, Power Meter and Light Source Testing and Cable Verification Worksheet shall be completed for the repaired link to determine acceptability. Copies of the test results shall be submitted to the Engineer. The removal and replacement of a segment of cable shall be interpreted as the removal and replacement of a single contiguous length of cable connecting two splices, two connectors. The removal of only the small section containing the failure and therefore introducing new unplanned splices, will not be allowed.

APPENDIX A
Cable Verification Worksheet

Contract No. _____ Contractor: _____

Operator: _____ Date: _____

Link Number: _____ Cable-Tube-Fiber (CTF) Number *: _____
* Use Sheet E-354 for CTF Assignment.
Test Wavelength (Circle one): 1310 1550

Expected Location of fiber ends:
End 1: _____ End 2: _____

OTDR Test Results:			
Forward Loss:	_____	dB	1A
Reverse Loss: [(1A + 1B)/2]	_____	dB	1B
Average Loss:	_____	dB	1C
Power Meter and Light Source Test Results:			
Forward Loss:	_____	dB	2A
Reverse Loss:	_____	dB	2B
Average Loss [(2A + 2B)/2]:	_____	dB	2C
Calculated Fiber Loss			
Length of the link (from OTDR):	_____	km	3A
Allowed loss per km of fiber:	0.4 dB/km		3B
Total Allowed Loss due to the fiber (3A * 3B):	_____	dB	3C
Calculated Splice Loss			
Number of Splices in the Link:	_____		4A
Allowed Link Loss per Splice:	0.10 dB		4B
Total Allowed Loss due to Splices (4A * 4B):	_____	dB	4C
Calculated Link Loss			
Connector Loss:	0.9 dB		5A
Total Link Loss (5A + 3C + 4C):	_____	dB	5B
Cable Verification:			
Compare Power Meter Average Loss to Calculated Link Loss (2C - 5B):	_____	dB	6A

If the value of 6A is greater than zero, the link has failed the Test. See Test Failures elsewhere in these Special Provisions.

To Be Completed by Caltrans:

Resident Engineer's Signature: _____ Cable Link Accepted: _____

10-3.11 SEISMIC ANCHORING

All equipment including fixtures and raceways shall be mounted and braced to withstand, without damage, seismic acceleration forces in both horizontal and vertical directions of 0.33 G, for installation in Seismic Zone 4, in accordance with the Uniform Building Code (UBC), Section 2312. The anchoring methods are to be submitted for review by the Engineer. The installation shall meet requirements of the Essential Services Building Seismic Safety Act, Senate Bill 230, Title 24.

10-3.12 STRUCTURE GROUNDING

The 500 kcmil main grounding conductor, spanning the bridge, shall at each pier be connected to two pier girder ground stations as shown on the plans. All bridge electrical components shall be grounded to this system as shown on the plans.

Grounding conductors shall be stranded soft drawn bare copper meeting the requirements of the ASTM Specifications.

The regulatory requirements which govern the work of this Section include the following governing Codes and Standards:

A. American Society for Testing and Materials (ASTM):

1. ASTM Designation: B-3, Soft or Annealed Copper Wire.
2. ASTM Designation: B-8, Concentric-Lay Stranded Copper Conductors.
3. ASTM Designation: B-33, Tinned Soft or Annealed Copper Wire for Electrical Purposes.

B. Federal Specification QQ-W-343, latest revision, Wire, Electrical, Copper, Uninsulated.

10-3.13 TRAFFIC OPERATION SYSTEM

The traffic operation system shall include the installation of closed circuit television camera stations, microwave vehicle detection sensor system, Model 170 controller assemblies, fiber optic data modems and fiber optic system, as shown on the plans and in conformance with these special provisions.

Prior to shipping to the project, the Contractor shall contact the Engineer and arrange for delivery. The Contractor shall submit the following items to the State of California, Department of Transportation Laboratory, 5900 Folsom Blvd., Sacramento, CA 95819 for acceptance testing:

A. Camera units.
B. Pan and tilt units.
C. Camera control units.
D. Video transmitter duplex data units.
E. Microwave Vehicle Detection Sensor Units

Approximately 30 days will be required for the testing. The Contractor will be notified upon completion of the testing and shall arrange for delivery of the equipment to a storage location designated by the Contractor. The costs of such testing and the transportation to and from the laboratory shall be borne by the Contractor.

CLOSED CIRCUIT TELEVISION CAMERA STATION

The Contractor shall install the following closed circuit television (CCTV) equipment at each camera station as described in these special provisions and as shown on the plans:

A. One camera unit with housing.
B. One pan and tilt unit.
C. One camera junction box.
D. One camera control unit.
E. One video transmitter duplex data.
F. Cable, connectors and fittings (as required.)

Camera Unit With Housing

Each camera unit shall consist of a camera, lens, environmental housing and camera unit cable assembly. The camera, lens and environmental housing, combined, shall not weigh more than 6.8 kg. Each camera unit shall be interchangeable with the existing camera units already installed on various traffic operations system (TOS) projects without changes or adjustments to either the system or the camera unit.

Each camera unit shall be assembled, inspected, and tested in accordance with these special provisions prior to delivery to the job site. Installation, operations and maintenance manuals shall also be submitted at the time of delivery.

Applicable Documents - The following documents of the U.S. Military Specification (MIL-SPEC), Underwriters' Laboratory, Inc. (UL), Electronics Industries Association (EIA) Standards, and other Standards form parts of the specification to the extent specified in these standards. In the event of a conflict between the content of this section and the content of the specification, the standards defined in this section shall supersede.

Military Specification Documents	
MIL-I-45208A	Inspection System Requirements, Dec. 16, 1963
MIL-C-45662	Calibration System Requirements, June 10, 1980
MIL-STD-416A	Electromagnetic Interface Characteristics Requirements for Equipment, Subsystems & Systems, Aug. 1, 1968
MIL-E-5400T	Electronic Equipment, Airborne General Specification
MIL-STD-810	Environmental Test Methods, 19 July 1983
MIL-C-5541	Chemical Conversion Coatings on Aluminum Alloys, June 3, 1970

Underwriters' Laboratory, Inc. and other documents	
UL-796	Printed Circuit Boards
EIA-170A	Electrical Performance Standards Color Television Studio Facilities
EIA RS-330	Electrical Performance Standards for Closed Circuit Television (CCTV) Camera 525/60 Interlaced

A. Camera

Approved Camera - The cameras listed below have been approved by the Engineer. Further information such as the source of the cameras can be provided upon demand. Any camera submitted by the Contractor that is not one of the approved cameras listed below shall be stringently compared to the specifications set forth in these special provisions before it is approved by the Engineer. Approved cameras are Cohu 8240 and Sony SSC-C374.

1. General -

   a. Each camera shall be self-contained and designed for continuous unattended 24-hour operation.
   b. Camera performance shall meet or exceed EIA-170A standards.
   c. Each camera shall have automatic sensitivity and black level control so that it operates without further adjustment when illumination ranges from the minimum specified herein to that of full daylight.
   d. Each active electronic device within the camera shall be solid-state.
   e. Each camera shall have a switch selectable electronic shutter. The shutter speed shall range from 1/60 of a second (off) to 1/10,000 of a second in 8 steps. The control of the electronic shutter rate shall be accessible through a side panel opening. Remote on/off control of the shutter shall be accomplished via an output connector on the rear of the environmental housing.

2. Light sensitivity - At a scene with 50 percent light reflectivity and with light level on the scene measured to be 10 lux and greater, each camera with its 10:1 zoom lens shall generate a picture on the monitor specified in these special provisions which resolves all 10 shades of gray on the EIA Television Test Chart. Not every camera shall be required to resolve the same gray scale when the light level on the same scene is measured to be less than one lux.

3. Electrical Power - Each camera shall operate when the applied voltage is between 95 to 130 VAC, 60 Hz ±0.3 Hz, single phase. The power consumption of camera shall not exceed 10 W. All camera circuitry shall be powered by a regulated, over-voltage protected DC power supply contained in the camera.

4. Synchronization –

   a. Each camera shall generate synchronization signals by means of a single integrated circuit.
   b. Each camera shall operate with the internal EIA-170A crystal as the sync reference source with the field rate of 59.94 Hz.
   c. Each camera shall have the capability of synchronizing to an external input source.
   d. The synchronization signal at the video output shall conform to EIA-170A.

5. Scanning - Each camera's mode of scanning shall be two-to-one interlaced at 525 lines, 60 fields per second, as specified by EIA-170A.

6. Video Processing -

   a. The video output level shall be maintained to within 3 dB for changes in scene brightness of 0.17 to 109 600 cd/m^2 using a motorized iris lens having a transmission range of F/1.2 to F/1200.
   b. Each camera shall have a black-level control system.
   c. Each camera shall have an automatic white (color) balance control to maintain proper color rendition by automatically referencing to white areas of the scene. Manual control of the white balance shall be accessible through side panel or remotely controlled via the rear connector on the environmental enclosure.
   d. Automatic gain control (AGC). The switch selectable fixed gain response shall maintain the output video level to 90 percent video when the light level on the image sensor falls too low to maintain full video output. The video out will be maintained at 90 percent peak-average setting to optimize video output under varying lighting conditions. The controls for the on/off and peak average adjustments shall be accessible through the side panel of the camera.
   e. One 75 Ω (±1 percent) source-terminated, single-ended video output jack shall be provided.
   f. An adjustable white clipper shall be provided to limit highlight brightness.
   g. The video output level shall be 1.0 V peak-to-peak composite (0.7 V video, 0.3 V sync) signal, polarity black negative, across a 75 Ω load impedance.
   h. The minimum signal-to-noise ratio shall be 50 dB at 25°C.

7. Imager -

   a. Each camera shall be designed to use a 12.7 or 16.9 mm format solid-state, color, interline transfer charged-coupled device (CCD) imager.
   b. The imager shall have a minimum resolution of 768 horizontal by 493 vertical active picture elements.
   c. When provided with 6.89 lux of highlight illumination on the environmental housing window, the camera shall provide the following resolution with AGC off:

      i. Horizontal center resolution shall be 460 TV lines minimum.
      ii. Vertical resolution shall be 350 TV lines minimum in the center and all corners simultaneously.

8. Mechanical -

   a. All camera circuitry shall be on a printed circuit board which shall be removable and replaceable using no more than common hand tools.
   b. Test points and adjustment identifications shall be etched or silk-screened on the boards.
   c. Each camera shall be self-supporting and operable when removed from the environmental housing and shall have a lens adapter ring which accommodates a standard 16 mm C-mount. A back focal distance adjustment shall be provided.
   d. Each camera shall utilize the rigidity of the environmental housing for strength against shock and vibration.

9. Environmental Operation – Each camera within its environmental housing shall withstand the following requirements:

   a. Operate over an ambient temperature range on -10°C to +50°C with the use of heaters.
   b. Peak random vibration of 5 g from 60 to 1000 Hz, with camera in operation.
   c. Shock up to 15 g in all axes under non-operating conditions.
   d. Exposure to sand, dust, fungus, and salt atmosphere as per MIL-E-5400T paragraphs 3.2.24.7, 3.2.24.8, 3.2.24.9, and 3.2.24.10.
   e. Up to 100 percent relative humidity as per MIL-E-5400T, paragraph 3.2.24.2.

10. Picture Quality -

   a. The quality of the picture shall be such that most objects in low light levels can be distinguished without excess interference from undesirable picture attributes.
   b. Undesirable picture attributes include blooming, transfer smear, and vertical register shifting.

B. Lens

1. General -

a. Each lens shall be fully compatible with the camera provided.
b. Each lens shall have a maximum aperture of no less than F/1.2, and a minimum range of F/1.2 to F/1200.
c. Each lens shall be a 16-mm C-mount.
d. Each lens shall have a minimum zoom range of 10 to 1. The lens focal length for a 16.9-mm CCD camera shall be 10-100 mm, 10.5-105 mm or 11-110 mm. The lens focal length for a 12.7-mm CCD camera shall be shall be 8-80 mm. A 1.5-X extender shall be included with the lens.
e. Each lens shall be equipped with a motorized zoom and focus control.
f. Each lens shall have an automatic, motor-driven iris with manual override. The iris shall be controlled directly through the camera in automatic mode and from the camera control unit in the manual mode. The automatic iris shall provide continuous aperture adjustments of the lens as determined by the amount of light reaching the camera imager. The power supply and electronics for iris motor shall be contained within the environmental housing.
g. Each lens shall be fitted with an intra-spot neutral density filter.
h. Each lens must be able to respond to the following inputs from camera control unit (CCU) for lens control:

Focus near	+9.0VDC @ 100 mA
Focus far	-9.0VDC @ 100 mA
Zoom in	+9.0VDC @ 100 mA
Zoom out	-9.0VDC @ 100 mA
Iris closed	+9.0VDC @ 100 mA
Iris open	-9.0VDC @ 100 mA

i. The travel time for the upper limit stop to the lower limit stop for zoom and focus shall be from 5 seconds minimum to 10 seconds maximum.
j. Each lens shall have the capability of at least 10 pre-positioning positions.

2. Environmental Operation - Each lens within its pressurized environmental enclosure shall withstand the following requirements:

a. Operate over an ambient temperature range on -10°C to +50°C with the use of heaters.
b. Peak random vibration of 5 g from 60 to 1000 Hz, with lens in operation.
c. Shock up to 15 g in all axes under non-operating conditions.
d. Exposure to sand, dust, fungus, and salt atmosphere as per MIL-E-5400T paragraphs 3.2.24.7, 3.2.24.8, 3.2.24.9, and 3.2.24.10.
e. Up to 100 percent relative humidity as per MIL-E-5400T, paragraph 2.24.2.

C. Environmental Housing

1. General -

a. Each camera and lens shall be mounted in a sealed, cylindrical, environmental housing which shall not exceed 165 mm in diameter and 560 mm in length.
b. The housing shall be fabricated of seamless aluminum tubing Type 6061-T6 and shall be finished with heat reflecting, weather resisting enamel. The rear plate shall be fabricated of Type 6061-T6 aluminum.
c. The front of the housing shall be closed with a clear optically flat glass or Lexan window.
d. The housing shall include a sun shroud which shall be strapped to the housing bindings in such a manner as to minimize heat conduction by maintaining air space between shroud and housing. The shroud shall shield the entire top portion of the housing from the sun, and shall extend a minimum of 76 mm in front of the housing's glass plate.
e. The housing shall not interfere with the widest viewing angle of the lens.
f. The housing shall include a thermostatically controlled heating pad rated at 115 V(ac), 100 W maximum.
g. The backplate, which is an integral part of the housing, shall have a nameplate attached bearing the manufacturer's camera assembly model number and serial number.

h. Camera connector -

   i. The camera connector shall be designed to MIL-C-28462 Series 1 specifications with solder contacts. It shall be Type PT-07C-20-39 P, the male counterpart to Type PT-06A-20-39 S (SR).
   ii. The connector shall be made of the same shell material and pin arrangement as the Type PT-06A-20-39 S (SR) connector on the end of the wiring harness.
   iii. The pinout of the connector shall be as shown on the plans.
   iv. Each camera connector shall be mounted on the rear plate with an airtight connection and a watertight seal for each conductor on its connecting cable.

i. Each camera shall be designed for operating with the housing purged of air and filled with dry nitrogen to 35 kPa.
j. Valves -

   i. The housing shall have two valves, both on the rear end plate of the housing.
   ii. One valve shall be a standard Schrader valve. It shall have a tube running from the valve to the front end of the housing.
   iii. The other valve shall be an air escape/pressure relief valve preset to 140 kPa.
   iv. The two valves shall be arranged such that filling with dry nitrogen from the Schrader valve will force gas to flow from front end of the housing to the rear end and vent through the air escape valve.
   v. The leakage rate with both valves closed and the housing pressurized to 70 kPa, shall leak less than 7 kPa per year, and less than 0.7 kPa per month.

k. The enclosure shall be factory pressurized to 35 kPa with dry nitrogen.
l. The notation "CAUTION PRESSURIZED" shall be printed on the rear plate of the enclosure.
m. A safety pressure release bolt shall be incorporated such that the enclosure may not be opened without first releasing the internal pressure.
n. A low-pressure (LP) sensor with related circuitry shall be provided to send an LP alarm (dry contact closure) via the camera connector. The LP sensor threshold shall be preset to activate the LP alarm at 14 kPa.
o. Two units of desiccant shall be placed inside the housing but will not obstruct the camera view or operation.
p. A humidity level indicator strip with discrete indications for 10, 20 and 30 percent humidity, shall be installed inside the housing in a position that allows inspection, while facing directly, through the window without obstructing the view of the camera at the widest viewing angle of the lens.

2. Mounting Base -

   a. A mounting base shall surround the enclosure to provide a tamper-resistant attachment of the environmental housing to the pan and tilt unit and securely hold the housing in either an upright or inverted position. The combined height of camera housing and mounting base shall be less than 254 mm. The mounting base attachment shall be as shown on the plans.
   b. All fasteners and nuts used in attaching the mounting base to the environmental housing shall be of Type 18-8 stainless steel.
   c. Each camera unit shall be provided with three stainless steel hex head bolts to secure the camera unit to the pan and tilt unit.

D. Camera Unit Cable Assembly

1. General - Each camera unit cable assembly shall consist of box mounting socket connector and a wiring harness.

2. Box Mounting Socket Connector -

   a. Each box mounting socket connector shall be in conformance with Military Part Numbering System Designation: MS-3102E-28-21S-F80.
   b. One full set of crimp contacts shall be provided with each box mounting socket connector.
   c. The pinout of the connector shall be as shown on the plans.

3. Wiring Harness -

   a. The camera unit cable assembly wiring harness shall be 3 m long and shall be COHU AC27E or other cable approved by the Engineer. The coaxial cables' impedance shall be 75 Ω. One end of each wiring harness shall be Type PT06A-20-39S (SR) and shall mate with the camera connector. It shall have a 90-degree end bell, Bendix 10-25997-203 or equal, for strain relief. The end bell shall be positioned such that the opening is 180 degrees from the main key on the connector. The other end of each wiring harness shall be in conformance with Military Part Numbering System Designation: MS-3106E-28-21P, and shall mate with the box mounting socket connector.
   b. All connectors shall be potted with an appropriate potting compound for environmental sealing.
   c. All connectors' pinout shall be as shown on the plans.

Pan and Tilt Unit

A. General
1. Each pan and tilt unit, with camera unit attached, shall pan 355 degrees minimum in either direction, and tilt 60 degrees minimum from horizontal position to either up or down positions.
2. Each pan and tilt unit shall be capable of minimum ten preset positions for each pan and tilt operation.

B. Electrical
1. Each pan and tilt unit shall operate with input voltage of 115 VAC, 60 Hz ±0.3 Hz.
2. Each pan and tilt unit shall not exceed 200 W power consumption.
3. The motors shall be impedance overload protected, two phase induction type, rated for continuous duty and shall be instantaneous reversing.
4. The limit switches shall be rated 5 A, 10 million cycles and with external adjustments.
5. Each pan and tilt unit shall be provided with box-mounting type connector.
6. One mating connector with full set of crimp contacts and strain relief shall be provided with the box-mounting connector.

C. Mechanical
1. The maximum load shall be 45 kg at 127 mm from tilt table to center of gravity in both upright and inverted position.
2. Each pan and tilt unit shall have maximum dimensions of 400 mm high, 355 mm wide and 230 mm deep.
3. Each pan and tilt unit shall not exceed the maximum mass of 27 kg.
4. Each pan and tilt unit shall be constructed in aluminum casting and plate. All internal parts shall be corrosion protected.
5. Each pan and tilt shall have textured semi-gloss beige enamel finish.
6. All bearings shall be heavy duty ball or roller bearing.
7. All gears shall be hardened steel.
8. All gasket seals shall be designed for all weather protection.
9. Each pan and tilt unit shall have a mounting hole pattern as shown on the plans.
10. Each pan and tilt unit shall have a minimum pan torque rating of 34 N•m and an instantaneous minimum tilt torque of 68 N•m.
11. The pan speed at no load shall be 6 to 8 degrees per second, nominal.
12. The tilt speed at no load shall be 3 to 4 degrees per second, nominal.

D. Environmental
1. Ambient operating temperature shall be from -10°C to 50°C.
2. The pan and tilt unit shall be able to withstand vibration of 760 µm total excursion from 5 to 30 Hz and a peak random vibration of 5 g from 30 to 1000 Hz.
3. The pan and tilt unit shall be able to withstand shock up to 15 g in all axes under non-operating conditions, conforming to MIL-E-5400R, Para. 3.2.24.6.
4. The pan and tilt unit shall be able to operate in atmospheres up to 95 percent relative humidity, conforming to MIL-E-5400R, Para 3.2.24.4.
5. The pan and tilt unit shall be able to withstand exposure to sand, dust, fungus, and salt atmosphere, conforming to MIL-E-5400R, Para 3.2.24.7, 3.2.24.8 and 3.2.24.9.

E. Pan and Tilt Unit Mounting

The nuts and bolts securing the pan and tilt unit to the camera platform shall be hex head and made of stainless steel. Before each bolt is fastened, a locking type coating shall be applied to the threads. The coating shall lock the bolts and nuts in place making it impossible to turn bolt or nut without tools. This coating shall last and be effective through at least 10 insertions and withdrawals of the bolt or nut.

Camera Junction Box

The camera junction box (JCB) shall be constructed as shown on the plans and described in these special provisions. All seams shall be continuously welded. All JCB mounting Hex head stainless steel nuts and bolts shall be 6 mm ∅-20 x 25 mm. Lock washers shall be used with each bolt. Steel surfaces on which JCB is to be mounted shall be drilled and tapped 6 mm ∅-20 thread. Each JCB shall be fabricated from 14-gage sheet steel. Two 8-32 threaded studs for terminal strip mounting shall be welded on the bottom of the box as shown on the plans. After fabrication the JCB shall be hot-dip galvanized.

A twenty position terminal block with No. 8 lugs and cover shall be mounted on the bottom of the box. Permanent terminal position markings shall be used. A laminated wiring schematic shall be permanently attached to the inside of box cover showing wiring from the camera unit box mounting connector to the terminal block.

Camera Control Unit

Each part of the camera control unit (CCU) shall be electrically and physically interchangeable with the like part in any other CCU furnished under this contract. The CCU shall be installed inside State-furnished Model 334 cabinet as shown on the plans.

A. Mechanical

1. Each CCU shall mount in 133 mm of EIA-310 rack space with a maximum depth of 356 mm.
2. The front panel shall be white gloss color Number 17886 as per Federal Standard Color Chart 595B.
3. The front and rear panel lettering shall be black color Number 17986 of Federal Standard Color Chart 595B.
4. A high-impedance panel jack BNC (Bayonet Nut connector) connector shall be installed on the front panel as shown on the plans. This connector shall provide video input to a test monitor without affecting the remainder of the CCTV system. This connector shall be directly connected to the video input on the rear panel.
5. A glass type, size 6.35 mm x 31.75 mm (AG) slow blow fuse shall be installed on the front panel. The fuse shall be replaceable from the outside of the front panel.
6. Switches shall protrude no more than 25 mm from the front panel and shall be mounted as shown on the plans.
7. The rear panel connectors shall be mounted as shown on the plans and shall meet the following requirements:

   a. Connectors C1-C3 shall be of the following type or equivalent:

C1	AMP 206430-1
C2	AMP 206043-1
C3	AMP 206306-1

   b. The pin and socket contacts for connectors C1-C3 shall be constructed with brass contact body material and with stainless steel spring that are sub-plated with 1.27 µm nickel and plated with 0.762 µm gold. Pin diameter shall be 1.575 mm. Contact size shall be 16.
   c. Each C1, C2 and C3 connector shall use the AMP No. 601105-1 or No. 91002-1 contact insertion and the AMP No. 305183 contact extraction tool.
   d. One mating connector with a full set crimp contacts and strain relief shall be supplied with connectors C1, C2 and C3.
   e. The connectors C4 and C5 shall be a DB-25 socket connector.

8. Serial cable assemblies (SCA1 and SCA2) with length of 3 m shall be provided to mate with C4 and C5, respectively.
9. Pin and socket contacts for DB-25 connectors shall be copper alloy body; finished with 0.762 µm gold over 1.27 µm nickel.
10. The rear and front panel BNC connectors shall be of copper material with bright nickel (tarnish resistant) finish for the body and silver finish for the contact.
11. Each printed circuit board shall be vertically installed.
12. Each LED shall be equal to Hewlett Packard High Intensity Red Un-tinted, Non-diffused LED (Part Number HLMP-D105). Each LED shall be mounted as shown on the plans.

13. A front panel on/off switch shall turn the CCU on/off and shall also control AC power to the rear panel power output connector (C1). The indicator used for AC power shall be green when energized.
14. One coaxial cable labeled "AVO" (Analog Video Output) terminated with BNC plug connectors on each end shall be provided. This cable shall be RG-59/U with overall length of one meter.

B. Electrical

1. Each CCU shall have auto-iris override.
2. Each CCU shall have circuitry to detect the absence and presence of video sync on its video input. Each CCU shall also have circuitry to monitor the low-pressure alarm contact closure from the camera unit. A local/remote control switch shall be provided to override the lens and pan and tilt controls through C4 when the switch is in local mode. When in local mode, the local control alarm shall be active. Alarm status shall be constantly monitored and updated. Upon receipt of a "status query" message, the CCU shall send alarm status message with data as follows:

"0"	None of the alarms active.
"1"	Local Control (LC) alarm active.
"2"	Low Pressure (LP) alarm active.
"3"	LP/LC alarms active.
"4"	Video Sync Absence (VSA) alarm active.
"5"	VSA/LC alarms active.
"6"	VSA/LP alarms active.
"7"	VSA/LP/LC alarms active.

The front panel alarm light shall be lit if any the alarms are active.

3. Each CCU shall have circuitry for a source character generator. The source character generator shall display 16 alphanumeric characters superimposed on the video image. Each character shall be 28 TV lines high and shall be derived from a standard 5 x 7 dot matrix. The programmed characters shall be stored in a non-volatile memory. Upon receipt of "Set ID" message, the CCU shall position from the camera ID in the video image as follows:

"1"	Upper 15% limit of the left viewing area
"2"	Upper 15% limit of the right viewing area
"3"	Lower 15% limit of the left side viewing area
"4"	Lower 15% limit of the right side viewing area

The characters shall be superimposed on the video signal using non-additive mixing techniques.

4. Each CCU shall be designed to prevent simultaneous operation of pan right/left, tilt up/down, zoom in/out, focus near/far or iris open/close.
5. Each CCU shall have power supply(ies) for camera zoom, focus, motors, control and interface circuits. The voltage for zoom, focus and iris shall be selectable internally by one jumper for 12.0 VDC, 9.0 VDC or 5.0 VDC at 100 mA. The CCU shall be pre-configured with the voltage jumper select set to 9.0 VDC. The operation of zoom, focus and iris shall be as follows:

Zoom in	+VDC
Zoom out	-VDC
Focus near	+VDC
Focus far	-VDC
Iris close	+VDC
Iris open	-VDC

6. The maximum power consumption for the CCU shall not exceed 450 W. Power consumption of equipment attached to pin 1 of connector C1 shall not exceed 100 W. Power consumption of equipment attached to pin 12 of connector C2 shall not exceed 200 W.
7. Each CCU shall have eight independently operating 24 VDC relays (options 1 to 8). Each relay shall be single pole, double throw (SPDT), with contacts rated 1.25 A at 120 VAC.
8. Each CCU shall be capable of a minimum of ten presets and capable of controlling camera units and pan and tilt units equipped with pre-positioning feedback potentiometers. Each CCU shall have circuitry to filter out any electrical noise interference on each of the pre-positioning feedback voltage signal for the camera unit and pan and tilt unit.

9. A system reset switch shall be a momentary-pushbutton type and be mounted on the front panel to function as external reset input to the microprocessor. System reset shall not cause existing pan and tilt and lens positions to change. System reset shall be executed without requiring the operator to hold the momentary-pushbutton for more than one second.
10. The front panel of the camera control unit shall have LEDs and switches to provide the following control functions as shown on the plans.

Function	Hardware	Indicator
Zoom (In/Off/Out)	(ON)-OFF-(ON)	2 LED
Focus (Near/Off/Far)	(ON)-OFF-(ON)	2 LED
Pan (Left/Off/Right)	(ON)-OFF-(ON)	2 LED
Tilt (Up/Off/Down)	(ON)-OFF-(ON)	2 LED
Iris (Open/Off/Close)	(ON)-OFF-(ON)	2 LED
Iris override (Manual/Auto)	ON-OFF	1 LED
Option 1 (On/Off)	ON-OFF	1 LED
Option 2 (On/Off)	ON-OFF	1 LED
Option 3 (On/Off)	ON-OFF	1 LED
Option 4 (On/Off)	ON-OFF	1 LED
Option 5 (On/Off)	ON-OFF	1 LED
Option 6 (On/Off)	ON-OFF	1 LED
Option 7 (On/Off)	ON-OFF	1 LED
Option 8 (On/Off)	ON-OFF	1 LED
Alarm (On/Off)	ON-OFF	1 LED
Control (Local/Remote)	ON-OFF	
Reset	(ON)-OFF (momentary pushbutton)	

11.

CCU connector assignments	
C1	4 contact connector
C2	14 contact connector
C3	37 contact connector
C4, C5	DB-25 connectors

C1 -- AC Power	
Position	Function
1	AC +
2	AC -
3	Equipment Ground
4	NA

C2 -- Pan and Tilt			
Pos.	Function	Pos.	Function
1	Pan right	8	Pan feedback
2	Pan left	9	Tilt feedback
3	AC-	10	Preset –VDC
4	Tilt up	11	NA
5	Tilt down	12	AC+
6	AC-	13	AC-
7	Preset +VDC	14	Ground

C3 -- Camera			
Pos.	Function	Pos.	Function
1	Zoom	20	Option 3 N.O.
2	Z/F/I Common	21	Option 3 Common
3	Focus	22	Option 3 N.C.
4	Iris	23	Option 4 N.O.
5	Iris Override Common	24	Option 4 Common
6	Iris Override	25	Option 4 N.C.
7	Preset +VDC	26	Option 5 N.O.
8	Zoom Preset feedback	27	Option 5 Common
9	Focus Preset feedback	28	Option 5 N.C.
10	Preset -VDC	29	Option 6 N.O.
11	LP alarm	30	Option 6 Common
12	LP alarm	31	Option 6 N.C.
13	NA	32	Option 7 N.O.
14	Option 1 N.O.	33	Option 7 Common
15	Option 1 Common	34	Option 7 N.C.
16	Option 1 N.C.	35	Option 8 N.O.
17	Option 2 N.O.	36	Option 8 Common
18	Option 2 Common	37	Option 8 N.C.
19	Option 2 N.C.		

Note:
N.O. = Normally open
N.C. = Normally closed
NA = Not Available

C4, C5 -- Serial communication ports to and from external device.			
Pos.	Function	Pos.	Function
1	NA	14	NA
2	Transmit Data	15	NA
3	Receive Data	16	NA
4	NA	17	NA
5	NA	18	NA
6	NA	19	NA
7	Signal Ground	20	NA
8	NA	21	NA
9	NA	22	NA
10	NA	23	NA
11	NA	24	NA
12	NA	25	NA
13	NA		

Serial cables			
SCA1		SCA2	
DB-25 Pin	DB-25 Pin	DB-25 Pin	DB-25 Socket
2	2	2	2
3	3	3	3
7	7	7	7

C. Environmental

1. Each CCU shall operate in an ambient temperature environment range from -10°C to 50°C.

2. Each CCU shall conform to MIL-STD-810D-516.1 and MIL-STD-810D-514.1 shock and vibration test.

D. CCU Messages

1. Each CCU shall communicate through the C4 serial port with the following communication message codes:

DIRECTION	MESSAGE	CHARACTER		DATA
		1ST CODE	2ND CODE	
Transmit	Alarm status	A	space	"0"-"7"
Receive	Status query	Q	space	NONE
Receive	Pan stop	p	space	NONE
Receive	Tilt stop	t	space	NONE
Receive	Zoom stop	z	space	NONE
Receive	Focus stop	f	space	NONE
Receive	Iris stop	i	space	NONE
Receive	Pan left	L	space	NONE
Receive	Pan right	R	space	NONE
Receive	Tilt up	U	space	NONE
Receive	Tilt down	D	space	NONE
Receive	Zoom in	I	space	NONE
Receive	Zoom out	O	space	NONE
Receive	Focus near	N	space	NONE
Receive	Focus Far	F	space	NONE
Receive	Iris open	J	space	NONE
Receive	Iris close	K	space	NONE
Receive	Iris manual	M	space	NONE
Receive	Iris auto	m	space	NONE
Receive	Set ID word	C	"1"-"4"	16-ASCII char.
Receive	Home position 0-9	H	"0"-"9"	NONE
Receive	Home position program 0-9	P	"0"-"9"	NONE
Receive	Option on 1-8	S	"1"-"8"	NONE
Receive	Option off 1-8	s	"1"-"8"	NONE
Receive	Enter Echo mode	E	space	NONE
Receive	Exit Echo mode	^]C	This sequence is not in a communication packet	

2. After receiving the "enter echo" command the CCU shall pass all characters from C5 to C4 and C4 to C5. The CCU shall disable all camera movement.
3. When the "exit echo" mode sequence is received on C4, the CCU shall return to normal operation.

E. Serial Communications Protocol

1. The communication protocol shall consist of 8 data bits, 1 stop bit and no parity.
2. Communication handshaking shall use XON/XOFF.
3. The communication packet shall contain the following items: ADDRESS, CODE, DATA, CHECKSUM, CR. The packet is sent as a string of ASCII printable characters. The ADDRESS, which has its $80 bit set in order to signal the start of the packet. The CHECKSUM is generated by Exclusive-ORing the ADDRESS, CODE, and DATA. The communication byte count shall be as follows:

ADDRESS	1
CODE	2
DATA	≥0
CHECKSUM	2
CR	1

4. The receiver will compute the CHECKSUM. If the computed CHECKSUM is correct the receiver will send ACK, otherwise the receiver will send NAK.

Video Transmitter Duplex Data

The video transmitter duplex data (VTDD) shall be stand-alone type mounted securely on a shelf that fastened to EIA-310 standard equipment rack in each State-furnished Model 334 cabinet as shown on the plans. The size and mounting arrangements shall be consistent with the space allocated in the cabinet layout. The equipment shall be mounted in a manner which allows easy access to all connections and indicators. All mounting hardware and mounting shall be provided by the Contractor.

The VTDD unit shall accept any NTSC baseband video signal and an EIA-232 data signal to convert to a signal suitable for launching into one singlemode optical fiber.

The video interface to VTDD shall be a nickel plated, bulkhead female BNC-style connector with a gold plated contact. The video transmitter shall accept a composite video signal at a level of 1.0 V peak to peak between sync tip and reference white, as measured on an oscilloscope. The transmitter shall operate as specified when the peak-to-peak value of the signal varies between 0.71 V and 1.4 V. The nominal input impedance shall be 75 Ω and the return loss shall be at least 30 dB in compliance with EIA RS-250 for an unbalanced to ground connection. Differential gain shall be less than 3 percent typical, 5 percent maximum at 3.58 MHz. Differential phase shall be less than 3 degree typical, 5 degree maximum at 3.58 MHz. Bandwidth at –3 dB points shall be between 2 Hz to 15 MHz. Weighted signal to noise ratio (SNR) shall be 60 dB for greater than or equal to -21 dBm input to the receiver.

The video signal and the EIA-232 data shall be applied to the optical source to produce a pulse rate modulated optical signal using pulse frequency modulation (PFM) technique. The VTDD shall have a laser emitter with a wavelength at 1550 nm to transmit simplex video and EIA-232 signals. The VTDD shall receive EIA-232 data using 1310 nm wavelength. The transmission range shall be up to 60 km via a singlemode fiber optic (9/125-μm). The transmitter shall interface to fiber with an ST style compatible connector. The video transmitter launch power shall be defined as the power launched by the transmitter into at least one meter of step index optical fiber with a nominal core diameter of 8.3 μm, a nominal cladding diameter of 125 μm and a theoretical numerical aperture of 0.275. The video transmitter launch power shall be at least 18 dB greater than the video receiver sensitivity. The optical modulation bandwidth required by the video transmitter for specified video link performance shall be 60 MHz, maximum.

The video transmitter shall include a power supply, which may be external to the remainder of the video transmitter components. The transmitter shall be powered from existing 120 V(ac) ±15 percent, 60 Hz ±5 percent power receptacle. The power supply shall supply all voltages required by the video transmitter for operation. The video transmitter shall have a panel indicator visible from the front that shows power "ON".

The video receiver duplex data (VRDD) unit will be installed under separate contract.

Cables, Connectors and Fittings

The camera unit cable assembly box mounting connector shall be mounted on one side of the JCB and shall be pre-wired to the 20 position terminal block as shown on the plans. The video signal pins of the camera unit cable assembly box mounting connector shall be terminated to a Bayonet Nut Connector (BNC) jack connector via Type RG-59/U coaxial cable stub.

The television control cable (TVC) and television power conductors (TVP) shall be wired to the 20 position terminal block as shown on the plans. The television control power (TVCP) cable shall go through but does not terminate inside the JCB. A watertight strain-relief box connector shall be installed at the JCB hole for the TVCP cable.

Installation of Camera Station

The work to be done at each camera station, as shown on the plans, as a minimum, shall consist of the following:

A. Attach pan and tilt unit to the mounting plate.
B. Attach camera unit to the pan and tilt unit.
C. Install JCB.
D. Terminate TVC and TVP inside JCB.
E. Terminate television video cable (TVL) inside JCB with a BNC plug connector.
F. Install camera unit cable assembly wiring harness (Type JC).
G. Terminate TVCP with pan and tilt mating connector.
H. Connect TVCP to the pan and tilt unit.
I. Terminate TVL inside controller cabinet with BNC plug connector.
J. Terminate TVP, TVCP and TVC with CCU mating connectors C1, C2 and C3, respectively.
K. Adjust limit stops of the pan and tilt unit as directed by the Engineer.
L. Adjust camera unit to provide the optimum picture for the full range of daylight and night time conditions as directed by the Engineer.

Camera Unit Mounting

The camera unit shall be secured to the pan and tilt unit using the stainless steel bolts provided with the camera unit. Before each bolt is fastened, a locking type coating shall be applied to the threads. The coating shall lock the bolt and nut in place, making it impossible to turn the bolt or nut without tools. This coating shall last through and be effective through at least ten insertions and withdrawals of the bolt or nut.

The work to be done between the camera mount and the controller cabinet, as shown on the plans, as a minimum, shall consist of install and terminate TVL, TVC, TVCP, and TVP, in the appropriate conduit, as shown on the plans.

The work to be done at each CCTV controller cabinet, as shown on the plans, as a minimum, shall consist of the following:

A. Install CCU.
B. Connect TVC, TVCP, TVP and TVL to CCU via their respective connectors.
C. Install the VTDD unit.
D. Connect CCU to VTDD.

The Contractor shall furnish all materials necessary to provide a complete and functional camera station in accordance with these special provisions. Miscellaneous equipment, and materials not mentioned but necessary to provide a complete and fully operational camera station shall be furnished by the Contractor as incidental to the work for which no additional compensation will be allowed therefore.

All items furnished under this contract shall be new and shall be the latest version.

The Contractor shall be responsible for demonstrating proper operation of the camera station using test software and diagnostics which shall be provided to the Engineer as incidental items at no additional cost. Testing procedures are described elsewhere in these special provisions.

Camera Station Testing

Upon completion of work, each camera station shall be subjected to post-installation tests as outlined herein. All testing shall be performed by the District Electrical Systems Branch personnel, arranged by the Engineer and in the presence of the Contractor. The Contractor shall notify the Engineer in writing fifteen days prior to the scheduled testing. Upon receipt of the notification, the Engineer shall contact the Electrical Systems Branch at Telephone: (510) 286-4770. The Contractor shall provide all necessary equipment required to access the CCTV equipment for testing.

The testing shall consist of five consecutive days of continuous satisfactory operation of each camera station. If any material and equipment furnished and installed by the Contractor in this project is found defective or otherwise unsuitable, or the workmanship does not conform with the accepted standards, the Contractor shall replace such defective material and equipment at no cost to the State.

Rejected material or equipment may be offered again by the Contractor for consideration provided all non-compliance has been corrected and pre-tested by the Contractor. After all defects have been corrected, the camera station shall be re-tested until five consecutive days of continuous satisfactory operation is obtained.

The post-installation tests shall consist of, but not be limited to, inspection and functional testing in accordance with these special provisions.

Inspection shall consist of, but not be limited to, verification of correct wiring terminations, correct cable interconnections, good workmanship and compliance with these special provisions.

Functional testing shall include, but not be limited to, the following:

A. Verification of all local mode CCTV operations using the CCU front panel controls.
B. Verify video signal output from CCU with a National Television Systems Committee (NTSC) monitor.
C. Verify the correct operation of the auto/manual iris and power zoom.
D. Verify the correct operation of the pan and tilt unit. The pan and tilt unit shall be functionally tested over 355 degrees in the horizontal plane and ±60 degrees in the vertical plane. The pan and tilt unit limit stops shall then be adjusted to optimize the camera viewing coverage of the freeway as directed by the Engineer.
E. Verify the correct operation of the preset positions.

MICROWAVE VEHICLE DETECTION SENSOR SYSTEM

The Contractor shall install the following microwave vehicle detection sensor (MVDS) equipment at each location as described in these special provisions and as shown on the plans:

A. Microwave detector units, connectors, cables, conduit, pull box, mounting equipment, software, firmware, power supply units and all other support equipment.
B. One State-furnished Model 334 controller cabinet (described elsewhere in these special provisions).

C. One fiber optic data modem (described elsewhere in these special provisions).

Functional Requirements

The MVDS signal shall emulate the response of an inductive loop detector. The MVDS units shall be tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. Each MVDS unit shall operate independently and not interfere with other MVDS units.

The microwave sensor unit shall operate in the frequency band of 10.525 GHz ± 25 MHz. The transmitter power shall be a maximum of 10 mW.

The MVDS field of view shall be covered by a maximum detection range defined as follows:

Elevation beam-width	45 degrees
Azimuth beam-width	15 degrees
Range	3 to 60 meters

Each MVDS unit shall have the capability of providing a minimum of 8 detection zones within each beam footprint. The size of each zone shall be user definable with a maximum range resolution of 2 meters. The minimum footprint shall be greater than or equal to 1.8 meters.

The time of events shall be measured in a maximum of 10 ms resolution.

Measurement accuracy shall be better than 95 percent certainty for vehicle presence.

Each MVDS unit shall be supplied with a connectorized MVDS cable harness with appropriate cable length for each installation. The MVDS cable shall consist of 15 unshielded twisted pairs of No. 20 conductors with an overall shield. Each conductor shall have a minimum of 19 tinned copper strands with a minimum of 1.60 mm PVC insulation rated for 300 V at 105˚C. The outer jacket shall be chrome PVC with minimum thickness of 1.60 mm. The outside diameter of the cable shall not exceed 19.2 mm. A minimum of 4 meter slack of MVDS cable is required in each controller cabinet.

The connector shall be in conformance with Military Part Numbering System Designation: MS3476W18-32S or equivalent. This connector shall include contacts for powering the sensor unit, RS-232 serial data communications and contact pairs for each detection zone. The connector pinout is as follows:

No.	Pin No.	Designation	Signal	Remark
1	A	Contact Closure	Opto 1	
2	B	Contact Closure	Opto 1 Return	
3	C	Contact Closure	Opto 2	
4	D	Contact Closure	Opto 2 Return	
5	E	Contact Closure	Opto 3	
6	F	Contact Closure	Opto 3 Return	
7	G	Contact Closure	Opto 4	
8	H	Contact Closure	Opto 4 Return	
9	J	Contact Closure	Opto 5	
10	K	Contact Closure	Opto 5 Return	
11	L	Contact Closure	Opto 6	
12	M	Contact Closure	Opto 6 Return	
13	N	Contact Closure	Opto 7	
14	P	Contact Closure	Opto 7 Return	
15	R	Contact Closure	Opto 8	
16	S	Contact Closure	Opto 8 Return	
17	d	Contact Closure	Opto 9	
18	e	Contact Closure	Opto 9 Return	
19	f	DC Power	12-24 VDC +	
20	g	DC Power	12-24 VDC -	
21	h	AC Power	115 VAC +	Not Used
22	j	AC Power	115 VAC -	Not Used
23	V	RS-232 p2	Tx	
24	T	RS-232 p3	Rx	
25	U, W	RS-232 p5	Signal Ground	
26	b	Auxiliary	+5VDC Out	Not Used
27	c	Auxiliary	+5VDC Out Return	Not Used
28-32				Spares

The Contractor shall wire the MVDS cable harness and power conductors to the 10-position Type DIN rail mounted terminal blocks in the controller cabinet as directed by the Engineer. The RS-232 serial data communication output conductors shall be terminated at the service panel terminal block, TB-0. The contact pair output conductors shall be terminated at the input panel terminal block, TB-2. The ends of all unused and spare conductors shall be taped to prevent accidental contact to other circuits.

All software for testing and set-up procedures shall be supplied with the MVDS unit. The software shall test the MVDS unit performance and provide diagnostic information.

Operational Requirements

The Contractor shall provide a certification from the manufacturer that the MVDS unit will interface and operate with a Model 170 controller. In addition, the MVDS unit shall meet the following requirements:

A. Electrical

The unit shall operate with 12-24 VDC at 0.5 A power source. The unit shall have a feature of automatic recovery after a power failure.

B. Physical

The unit shall be encased in a weatherproof NEMA-3R enclosure. The unit shall not exceed 160 mm x 240 mm x 250 mm in size and shall not weigh more than 4.5 kg. The unit shall operate over a temperature range from -37˚C to +74˚C, up to 95 percent relative humidity.

C. Pull Box

A pull box shall be installed with conduit connections as shown on the plans.

D. Installation and Testing

Prior to installing any MVDS units, the Contractor shall perform functional tests to verify that all MVDS units comply with these specifications. The MVDS units shall be installed as shown on the plans and in accordance with the manufacturer's recommended installation procedures. The Contractor shall confirm equipment placement with the Engineer before installing any equipment. The Contractor shall test the MVDS units for the following functions:

1. Speed, volume and occupancy for all roadway monitoring locations.
2. Correct speed and count readings of roadway traffic with a portable detection equipment.

FIBER OPTIC DATA MODEM

The fiber optic data modem (FODM) shall be RS-232 compatible fiber optic modem with dual optics for drop and insert capability which can be configured as master or local (slave) in either daisy chain or fault tolerant dual redundant (counter rotating) ring network architecture. These four modes of operations shall be selectable via an external Mode DIP-switch. All signals received via an optical port and retransmitted via fiber or via an expansion port shall be retimed to 0.01 percent pulse width accuracy by a crystal controlled timebase, eliminating pulse width distortion and eliminating virtually unlimited repeating. The FODMs shall have anti-streaming circuitry for both the optical fiber and the electrical (RS-232) sides. On RS-232 side, when enabled, the anti-streaming shall limit the amount of time an external device is allowed to transmit data onto the network for each Request to Send (poll). On the fiber side, the anti-streaming shall disable an optical receiver in the event that the receiver output stays high longer than maximum allowable time thus preventing the who fiber network from being disabled by a continuous "on" failure by receiver or optical emitter. External (TIME-OUT) DIP-switch shall allow user to disable or select the timeouts for both the optical side anti-streaming feature and the RS-232 side anti-streaming feature as well as to enable or disable the "Fiber Activity CTS Disable" feature. LED indicators to display power "on", anti-streaming "Fault" time-out and RS-232 fiber optic activity (selectable via dual function switch).

The FODMs at the field element shall be stand-alone type and shall be securely fastened on a EIA-310 rack-mount shelf. At the hub location, the FODMs shall be react-mount type installed in card cage assembly. The card cage assembly shall be EIA-310 rack mount type with at least 14 slots and with two power supplies for redundancy.

The FODM shall meet the following requirements:

Electrical Signaling:	EIA RS-232 with full handshake control signals
Electrical Power:	115 VAC, 60 Hz
Operating Temperature	-40 to 70°C
Operating Mode:	1. Daisy chain Master mode 2. Daisy chain Local mode 3. Fault tolerant Master mode 4. Fault tolerant Local mode
Emitter type:	Laser
Wavelength	1310 nm
Minimum coupled transit power into: 9/125 μm at 25°C (75°C)	-11 (-9.5) dBm
Output Variation	-0.015 dB/°C
Minimum receiver input power for 10^{-9} BER	-40 dBm
Maximum receiver input	-11 dBm
Optical port type	ST
RS-232 connector type	DB25S
Data Rates (auto)	1200 baud to 57.6 kbaud
Bit Error Rate (BER):	10^{-9}
Link Budget (Range) via singlemode 1310 nm	31 dB for (56 km)

FODMs shall be tested as follows:

A. Each optic modem shall be functionally tested by looping back optical transmit connector to the optical receive connector using a variable optical attenuator with measured optical loss at 31 dB at 1310 nm. A test set shall be connected to the modem and set for RS-232 communication testing. Fifteen minutes bit error rate (BER) test burn-in test shall be error free.

B. After performing the 15 minutes BER test, at least two modems shall be tested for receiver dynamic range. The following procedure shall be followed: First, the optical attenuation shall be increased to the point at which the data test just begins to register bit errors. The optical receive power into the modem shall be measured and recorded. The optical attenuation shall be then decreased until data test once again register errors. At no time shall the optical power into the receiver exceed the manufacturer's specified saturation level. The optical receive levels shall once again be measured and recorded. These minimum and maximum receiver power levels define modem receiver's dynamic range and shall meet or exceed the manufacturer's specification.

C. One pair of modem shall be interconnected using optical patchcords and attenuators with a loss of 31 dB in each direction. The RS-232 interface shall be looped back onto one modem and a test set connected to the RS-232 interface of the other modem. A bit error rate of less than 10^{-9} shall be demonstrated.

STATE-FURNISHED CONTROLLER ASSEMBLIES

The Model 170 controller assemblies, including controller unit and completely wired controller cabinet will be State-furnished as provided under "Materials" of these special provisions.

The Contractor shall install the controller cabinet on each service platform, including furnishing and installing anchor bolts, and shall make field wiring connections to the terminal blocks in the controller cabinet.

A listing of field conductor terminations, in each State-furnished controller cabinet, will be furnished free of charge to the Contractor at the site of the work.

State forces will maintain controller assemblies. The Contractor's responsibility for controller assemblies shall be limited to conforming to the provisions in Section 6-1.02, "State-Furnished Materials," of the Standard Specifications.

Controller Assemblies Power Strip (Contractor-furnished)

The Contractor shall furnish and install one rack-mount surge power strip with a switch in each State-furnished Model 334 controller cabinet. The power strip shall be plugged into the non-GFCI duplex outlet normally labeled with "Controller Unit Recp." in the back of the power distribution assembly (PDA) unit. The power strip shall be mounted at the top 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 power strip shall not hinder the accessibility to the back of all existing electrical equipment. All power cords for permanently field installed electrical equipment shall be plugged into the power strip.

The power strip, at a minimum, shall meet the following requirements:

A. Maximum rating of 15 A, 120 V(ac), 60 Hz.
B. The power strip shall have 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.
C. The power strip shall be 46 mm (H) x 483 mm (W) x 70 mm (D) maximum and shall not weigh more than 2.0 kg.
D. The front plate of the power strip shall have four cut-off EIA mounting screw holes, two on each side.
E. The power strip shall have six rear outlets with 38 mm minimum apart center to center. The power cord shall enter from the rear with a length of 2 meters minimum. The clearance between the power cord entrance and the nearest outlet shall be 90-mm minimum.
F. It shall have a 15 A circuit breaker and an internally illuminated switch to cut off power to all outlets. Both the circuit breaker and the switch shall be front mounted.

SERVICE MANUAL REQUIREMENTS

The Contractor shall provide to the Engineer a minimum of ten copies of service manuals for the camera unit, pan and tilt unit, camera control unit, video transmitter duplex data unit elsewhere in these special provisions. Each manual shall contain the following sections and sub-sections:

A. General Information Section

1. A list of applicable subassemblies that comprise the specified equipment.
2. Overall description of the equipment design features (including all enhance features if applicable), performance, and applications.
3. Equipment specifications summary.
4. Equipment installation instructions.

B. Theory of Operations Section

1. Theory of operation of the standard equipment, with unique or unusual circuitry described in detail.
2. Theory of operation reflecting any modifications to the standard equipment.

C. Maintenance Section

1. Recommended test equipment and fixtures, or minimum operational and performance requirements for appropriate test equipment.
2. Trouble shooting information and charts.
3. Removal and installation procedures for replacing assemblies and subassemblies, if not obvious or if improper sequencing of steps may result in component damage.

D. Replacement Parts Section

1. Each manual shall contain an equipment replacement parts list including electrical parts, mechanical parts and assemblies.
2. All semiconductors shall be identified by the supplier's numbers and by JEDEC numbers if applicable.

E. Diagram Section

1. Schematic diagrams(s) identifying all circuit components and showing normal test voltages and levels.
2. An overall functional block diagram.
3. Detailed interconnecting diagram(s) showing wiring between modules, circuit boards and major components.
4. Pictorial circuit board layout diagram(s) showing both component placement and printed wiring detail.
5. Diagram(s) showing location of circuit boards and other subassemblies.
6. Exploded view diagram(s) of complex mechanical assemblies.

F. Physical Requirements

1. All pages, including latest revisions, shall be securely fastened together between protective covers (loose-leaf ring binding is acceptable).
2. No page shall be subject to fading from exposure to any normal source of ambient lighting (diazo reproduced pages are not acceptable).

10-3.14 LIGHTING

The roadway lighting assembly shall include the base plate, anchor bolts, pole, luminaries, and, for poles over 12 m in height, a luminaire lowering device system, all as shown on the plans and in conformance with these special provisions.

GENERAL

For roadway lighting poles that incorporate a luminaire lowering device, the installation of the lowering device on each pole shall be made under the supervision of a trained representative of the lowering device manufacturer. Prior to acceptance of the contract, a trained representative of the lowering device manufacturer shall demonstrate that each roadway lighting assembly operates properly. The demonstration shall consist of a minimum of 3 complete cycles of raising and lowering the luminaire carriage (complete with luminaires) the full length of the carriage travel, as designed, within one day, prior to acceptance of the project.

All portions of the roadway lighting assembly shall have a minimum design wind velocity rating of 130 km/h.

The lowering device system shall be submitted for inspection and testing. Inspection and testing shall be performed at a site in California approved by the Engineer. The lowering device system shall be demonstrated at the Contractor's expense. Notification shall be given to the Engineer at least 7 days prior to demonstration.

After the roadway lighting system is in operation, an instructional video tape (VHS), complete written instructions and a demonstration to State Maintenance personnel on the maintenance of the roadway lighting assembly, including the procedures for the safe raising and lowering of the luminaire carriage, shall be provided.

Spare parts, part lists and the operating, maintenance and service instructions, packaged with or accompanying the equipment installed on the project, shall be delivered to the Engineer prior to acceptance of the project.

SUBMITTALS

Submittals for the roadway lighting assembly shall conform to the provisions in Section 86–1.04, "Equipment List and Drawings," of the Standard Specifications and these special provisions. Submittals shall be delivered to the Engineer at least 45 days prior to erection of the roadway lighting assembly. The Engineer shall be allowed 45 days for the review of submittals. Review areas will include structural, welding, electrical and other areas as determined by the Engineer.

A. Descriptive data, design working drawings, erection working drawings (including aiming directions for each luminaire), isolux diagram for each type of luminaire, calculations, and a list of the material used for the roadway lighting assembly shall be submitted to the Engineer. The material list shall be complete with the name of manufacturer, catalog number, size, capacity, finish, pertinent ratings and identification symbols used on the plans or in the special provisions for each unit.
B. Each submittal shall consist of 6 copies.
C. Plans and detailed drawings shall be not larger than 559 mm x 864 mm.
D. Each separate item submitted shall bear a descriptive title and the State contract number.

Two copies of the submittals shall be forwarded to the Office of Structure Design. The Engineer shall be given a copy of the cover letter or other notification, and date, that the copies were sent to the Office of Structure Design.

INSPECTION

The roadway light poles will be inspected at the fabrication site. The Engineer shall be notified when materials have been delivered to the fabrication site. After delivery, the Engineer shall be given at least 10 days notice before fabrication of the light poles commences.

If all or a portion of the roadway poles are fabricated more than 480 air line kilometers from both Sacramento and Los Angeles, additional shop inspection expenses will be sustained by the State. Whereas it is and will be impracticable and extremely difficult to ascertain and determine the actual increase in such expenses, it is agreed that payment to the Contractor for furnishing said Roadway Light Poles will be reduced by $2500 for each fabrication site located more than 480 air line kilometers from both Sacramento and Los Angeles and an additional $2500 ($5000 total) for each fabrication site located more than 4800 air line kilometers from both Sacramento and Los Angeles.

CORROSION RESISTANCE

Corrosion resistance shall be provided. Methods shall include the following:

A. Avoidance of contact between stainless steel and carbon steel, between different types of stainless steel (including welding material), and between aluminum and ferrous materials.
B. Utilizing continuous welding to eliminate crevices which retain moisture.
C. Minimizing welding of stainless steel.
D. Use of adequate sections and suitable materials to limit stress related corrosion.

POLE

The pole shall be constructed, finished and installed in conformance with the provisions for pentagon poles in "Sign Structures" of these special provisions.

The pole shall include shaft, access hole, access hole cover, support plate, vibration inhibiting plates and anchor base.

The pole shall be hot-dip galvanized after fabrication in conformance with the provisions in Section 75-1.05, "Galvanizing," of the Standard Specifications, and painted in conformance with the provisions in Section 59, "Painting," of the Standard Specifications.

The pole shall have a reinforced access hole, for poles with lowering devices, this access hole shall allow adequate clearance for maintaining and servicing the lowering device Other hardware inside the pole shall accommodate the lowering device.

The access door shall be hinged to the pole, open horizontally 180 degrees, and when in the open position shall not interfere with access to the interior of the pole.

Neoprene lining and bonding to pole wall shall conform to the provisions in Section 51-1.145, "Strip Waterstops," of the Standard Specifications.

The pole shall be erected plumb. The vertical axis of the erected pole shall be within 75 mm of the theoretical vertical axis when measured without the action of sunlight or wind.

An embossed aluminum plate shall be attached with rivets to the outside of each pole approximately 50 mm above the access hole. The nameplate shall indicate the name of the pole manufacturer and the height of the pole.

A plastic laminated data sheet shall be secured on the inside of the access hole door. The data sheet shall include the names, addresses and telephone numbers of the manufacturers of the pole, luminaire lowering device and luminaires, and the

design parameters, including wind velocity, luminaires (number, wattage, model number, mass, projected area and coefficient of drag), and the mass, projected area and coefficient of drag for the pole top lowering mechanism.

VIBRATION INHIBITING PLATES

Vibration inhibiting plates, consisting of polytetrafluoro-ethylene (PTFE) and structural steel plates shall conform to the details shown on the plans and these special provisions.

The working drawings for vibration inhibiting plates shall include a description of the method of mechanical interlocking of the PTFE fabric to the metallic substrate.

The manufacturer shall furnish Certificates of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for all material used in the vibration inhibiting plates.

PTFE surfaces of vibration inhibiting plates shall be unfilled PTFE fabric made from virgin PTFE oriented multifilament and other fibers. The resin in the filaments shall be virgin PTFE material (not reprocessed) in conformance with the requirements of ASTM Designation: D 4441.

At the highest point of substrate and after compression, the PTFE fabric shall have a minimum thickness of 1.6 mm and a maximum thickness of 3.2 mm.

Steel plates, shall conform to the requirements of ASTM Designation: A 709/A 709, Grade 36 [250], 50 [345], or 50W [345W].

Welding of structural steel shall conform to the requirements of AWS D1.1.

The PTFE fabric shall be epoxy bonded and mechanically interlocked to the steel substrate. All bonding shall be done under controlled factory conditions. Any edges, other than the selvage shall be oversown or recessed so that no cut fabric edges are exposed.

After completion of the bonding operation the PTFE surface shall be smooth and free from bubbles.

The surface of the interfacing elements shall be controlled such that upon completion of the assembly the PTFE to steel interface shall be in full bearing.

Metal surfaces of vibration inhibiting plates exposed to the atmosphere and in contact with the structure of the completed work, shall be hot-dip galvanized after fabrication in conformance with the provisions in Sections 75-1.05, "Galvanizing," of the Standard Specifications.

During fabrication, the maximum temperature of bonded PTFE surfaces shall be 150°C.

Damaged plates and plates with scratched mating surfaces shall be returned to the factory for replacement or resurfacing.

LUMINAIRE LOWERING DEVICE

The lowering device, along with lighting fixtures and poles shall be manufactured and tested as an integrated system and be provided and warranted by one manufacturer. A prototype system shall be constructed by the manufacturer, for testing of the device with the fixture and track assembly shown on the plans. The manufacturer shall submit prototype test analysis and certified test data demonstrating proper performance of the system lowering device, track, fixture and pole assembly for acceptance, prior to fabrication of equipment to be supplied. The lowering device shall consist of three main subassemblies: headframe, lowering channel and track, and the clevis and winch assembly. The lowering device system shall be in conformance with the following requirements:

Headframe

The headframes shall be hot rolled steel conforming to the requirements in ASTM Designation: A36. The headframes shall be hot-dipped galvanized in conformance with the provisions, in Section 75-1.05, "Galvanizing," of the Standard Specifications. The headframes shall consist of a hoisting cable sheave, power cable roller assembly, latch barrel and protective support cover. The hoist cable sheave shall be corrosion resistant with hardened surface to prevent cable imprint under load and shall have sintered bronze bushings and a cable keeper. The sheave shall be machined to match the cable diameter. The sheave shall be zinc electroplated and yellow chromate dipped. The hoisting cable shall be stainless steel aircraft cord, manufactured in conformance with the requirements in Military Specification MIL-8320B.

Power cable roller assemblies shall consist of multiple rollers providing a smooth even bending radius for the cable at each end. The design shall prevent the cables from riding up the

Latch barrel assemblies shall be cast of gall resistant aluminum. The latch shall support the entire weight of the fixture channel and fixtures on its own. It will support the fixture/channel assembly and unload the cables, clevis and winch when the lowering device is not in operation.

Luminaire lowering channel assembly shall consist of a latch pin, system status flag, fixture mounting plate, wiring junction box with power cord connection fitting and a stainless steel track system.

Latch pins shall be fabricated of stainless steel. Latching shall be accomplished by the alternate raising and lowering of the luminaire carriage by the winch and hoisting assembly. When the luminaire carriage is raised to the top of the pole, the carriage shall automatically latch and be secure in a locked position. During the unlatching sequence it shall transfer the load to the winch cable while the operator is away from the base of the pole. The latching and unlatching sequence shall be

indicated by reflecting flags visible from the ground. During latching no more than one G of force shall be imparted to the lamps in any direction.

Winch and Clevis

Clevis assemblies shall attach the winch cable to the hoisting cable and the main electrical power cord. The clevis shall not allow either the winch cable or the hoist cables to independently rotate and shall have an ultimate breaking strength of at least 4082.3 kg.

The winch shall have an ultimate strength of five times the lifted load. The winch shall have a 30 to 1 worm gear reduction and shall include an integral drag brake on the worm shaft to prevent free spooling of the winch drum. The drum shall be supported on both ends and shall include a Type 316 stainless steel cable keeper. The winch shall be factory pre-wound with Type 316 stainless steel aircraft cable manufactured in conformance with Military Specification MIL-8320B.

Drive Motor

Portable drive motors shall weigh less than 20.4 kg. Motors shall be 0.75 kW, heavy duty, reversing type with a stalled torque at least twice that required to operate the device. The motors shall drive the winch through a torque limiter coupling to limit the driving force on the cable. The torque limiter shall be factory pre-set. There shall be a back-up shear pin designed to shear at a torque level between 50 percent and 100 percent over the torque limiter setting. Motors shall be equipped a remote control unit with a 6 m operating cord.

Terminal Block

A prewired 600-V(ac) terminal block in a NEMA Type 3R enclosure and a weatherproof power receptacle shall be mounted on the luminaire ring raceway. When the luminaire carriage is in the lowered position, the receptacle shall enable the luminaires to be energized and tested.

Power Cables

An electrical cable of sufficient length to power the luminaire carriage, and with appropriate electrical connections, shall be provided to test the luminaires while in the lowered position. A circuit breaker of the rating shown on the plans and an outlet box shall be provided in the pole base.

Electrical cords shall be attached to a weathertight wiring chamber through weathertight cable connections. The main power cord shall support its full weight when installed. A positive connection between cord segments shall be provided across cord joints to prevent stress on the joints.

Power cable shall be Type SO, rated for 600 V(ac) with the number and size of conductors as required. Luminaire ring distribution cord shall be Type ST with insulation suitable for 105°C. Twist-lock receptacles (male and female) shall be provided and shall be rated at a minimum of 30-A, 480-V(ac).

Clevis assemblies shall attach the winch cable to the hoisting cable and the main electrical power cord. The clevis shall not allow either the winch cable or the hoist cables to independently rotate and shall have an ultimate breaking strength of at least 408 kg.

The winch shall have an ultimate strength of five times the lifted load. The winch shall have a 30 to 1 worm gear reduction and shall include an integral drag brake on the worm shaft to prevent free spooling of the winch drum. The drum shall be supported on both ends and shall include a Type 316 stainless steel cable keeper. The winch shall be factory pre-wound with Type 316 stainless steel aircraft cable manufactured in conformance with Military Specification MIL-8320B.

Portable drive motors shall weigh less than 20 kg. Motors shall be one horsepower heavy duty, reversing type with a stalled torque at least twice that required to operate the device. The motors shall drive the winch through a torque limiter coupling to limit the driving force on the cable. The torque limiter shall be factory pre-set. There shall be a back-up shear pin designed to shear at a torque level between 50 percent and 100 percent over the torque limiter setting. Motors shall be equipped a remote control unit and with a 6 m operating cord.

ROADWAY LUMINAIRES TYPE MSR

Pole mounted roadway luminaires shall be metal halide floodlight with a mounting suitable for the location shown on the plans. Fixtures shall be fully assembled, with die-cast aluminum socket housing, reflector housing, lens retainer and hood. Fixtures shall be furnished with metal halide lamp, tempered glass lens, Type 316 stainless steel fixture yoke, Type 316 stainless steel adjustable pivot bracket and mounting plate, with an attached die cast aluminum ballast box with ballast, and shall be in conformance with the following requirements:

Housings shall be die-cast aluminum. The socket housing shall be removable for lamp replacement, without altering the fixture mounting or aiming assembly. The socket housing shall be held captive by three Type 316 stainless steel latches and a Type 316 stainless steel safety cable attached to the pivot bracket. All exterior hardware shall be Type 316 stainless steel.

The reflector housing shall be equipped with a die cast aluminum lens retainer, sealed with a sponge silicone "O" ring lens gasket.

Reflector shall be 1.6 mm thick spun aluminum, Type 3002-0 with a polished brite dipped and clear anodized finish. NEMA beam spread shall be shown on the plans.

Fixtures shall be equipped with a fully adjustable Type 316 stainless steel mounting yoke and Type 316 stainless steel adjustable pivot bracket aiming system. Fixture and ballast shall be suitable for pole mounting. Mounting hardware shall be Type 316 stainless steel.

Lens shall be 4.8-mm thick clear tempered glass.

Lamp sockets shall be mogul base, 4 kV pulse rated, vibration resistant porcelain.

Lamps shall be metal halide of the wattage shown on the plans.

Ballasts shall be high power factor, constant wattage auto-transformer type of the voltage shown on the plans. The ballast shall be supplied with the lighting fixture, internally mounted in a corrosion resistant, cast aluminum, finned box with a weather-resistant sponge silicone "O" ring gasket.

Fixtures shall be UL listed for use in wet locations.

POLE MOUNTED MARKER LIGHTS TYPE MAM

Pole mounted marker light fixtures shall be a 200-mm diameter decorative lantern for use with twelve high flux LED lighting strips, each containing twelve 12 high flux led LED lamps. These fixtures shall be shipped fully assembled, furnished with lamps, power converter, transformer, single piece acrylic lens and gasketed base and fixture cap, and shall comply with the following requirements:

Housings shall consist of a gasketed bronze baseplate with an acrylic cylinder lens and a removable gasketed bronze cap secured to the fixture with a threaded cap anchor.

Lens shall be a 200-mm diameter, single piece injection molded acrylic cylinder, held in place by a gasketed fixture base plate and cap assembly.

Lamps shall have a 100,000 hour ± minimum rating, white high flux LED with 120 degree beam spread, installed within 25 mm x 25 mm x 280 mm LED mounting strips. Each strip shall contain LED lamps.

Power converter shall be integral with the fixture and shall convert 480 V, 1 phase, AC power to the required DC voltage for the LED lamps.

Housings shall have weatherproof "O" ring gaskets.

Fixtures shall be equipped with a cast mounting base, suitable for surface mounting to the Roadway Lighting Pole top. Mounting hardware shall be Type 316 stainless steel.

Fixtures shall be UL listed for use in wet locations.

BIKE PATH LIGHTS TYPE MSB

Bike path way lighting fixtures shall be a railing mounted, tubular shaped, compact fluorescent pathway fixture, with a mounting suitable for the locations shown on the plans. Fixtures shall be furnished complete with lamp, ballast, ballast enclosure and fixture support bracket, high impact lens, internal wiring, and shall be in conformance with the following requirements:

Housings shall be a complete assembly in conformance with the requirements in ASTM Designation: A 36. Housing shall be furnished to the railing fabricator to be incorporated into the railing structure. The housing shall consist of 89-mm diameter (Schedule 40) steel pipe with welded end plates and a welded attached ballast compartment and support bracket. The painted finish shall be applied by the railing fabricator, after the fixture is welded into place.

Reflectors shall be 0.81 mm thick specular aluminum sheet.

Lens shall be extruded high-impact acrylic with prisms on the internal surface and shall be retained by two or more Type 316 stainless steel tamper-proof screws.

Lamps shall be twin-tube compact fluorescent type of the wattage shown on the plans.

Ballasts shall be high power factor type of the voltage shown on the plans. The ballast shall be integral with the lighting fixture and internally mounted in the fixture support bracket. The fixture support bracket shall be equipped with a removable gasketed cover for ballast access.

Fixtures shall be UL listed for use in wet locations.

LIGHT PIPES TYPE MAL

Future light pipe fixtures will be surface mounted, linear lighting system, with two hollow prismatic light guides and a central luminaire housing for use with a 400 watt metal halide lamp. Fixtures will be fully assembled, furnished with lamp, mounting brackets, light guides and remote ballast and will be provided in a separate project.

Cast-in-place light pipe mounting fixtures shall be as shown on the plans. Mounting fixtures shall be installed as a part of this project.

BELVEDERE LIGHTS TYPE MSV

Belvedere light fixtures shall be suitable for pole mounting, compact, floodlight fixtures for use with compact metal halide PAR 20 lamps. Fixtures shall be fully assembled, furnished with lamp and ballast and shall be in conformance with the following requirements:

Housings shall be machined corrosion-resistant silicone aluminum alloy. Finish shall be a chromate conversion undercoating with a thermoplastic polyester powder coat, color will be selected by the architect. Housing shall be equipped with a lens bezel and glare shield.

Lens shall be tempered glass, housed within the fixture lens bezel, secured in place with a high temperature adhesive.

Lamps shall be PAR 20 compact metal halide of the wattage shown on the plans.

Lamp sockets shall be ceramic with attached high temperature teflon coated lead wires.

Ballasts shall be high power factor, core and coil, voltage shown on the plans. Ballast shall be integral with the lighting fixture, internally mounted in corrosion resistant silicone aluminum alloy box.

Housing and lens bezel shall be gasketed with high temperature "O" ring gaskets.

Fixtures shall be equipped with a fully adjustable mounting stem with locking clutch mechanism for control of vertical adjustment. Fixture and ballast shall be suitable for surface and pole mounted applications. Mounting hardware shall be Type 316 stainless steel.

Poles for mounting Belvedere lights shall be in conformance with the provisions in Section 86-2.04, "Standards Steel Pedestals and Posts," of the Standard Specifications and as shown on the plans. Poles shall be galvanized and painted.

Fixtures shall be UL listed for use in wet locations. Fixtures shall be C-UL certified.

SUSPENDER UPLIGHTS TYPE MAU

Suspender mounted uplight luminaires shall be bracket mounted, metal halide uplight assemblies with mounting brackets suitable for locations shown on the plans. Fixtures shall be fully assembled, with die-cast aluminum socket housing, reflector housing, lens retainer and hood. Fixture shall be furnished with metal halide lamp, tempered glass lens, Type 316 stainless steel fixture yoke, Type 316 stainless steel adjustable pivot bracket and mounting plate, with an attached die cast aluminum ballast box with ballast, and shall be in conformance with the following requirements:

Housings shall be die-cast aluminum. The socket housing shall be removable for lamp replacement, without altering the fixture mounting or aiming assembly. The socket housing shall be held captive by three Type 316 stainless steel latches and a Type 316 stainless steel safety cable attached to the pivot bracket. All exterior hardware shall be Type 316 stainless steel. The reflector housing shall be equipped with a die cast aluminum lens retainer, sealed with a sponge silicone "O" ring lens gasket.

Reflector shall be 1.6 mm thick spun 3002-0 with a polished brite dipped and clear anodized finish. NEMA beam spread shall be as indicated on the plans.

Lens shall be 4.8mm thick clear tempered glass.

Lamps shall be metal halide, and shall be of the wattage as shown on the plans.

Lamp sockets shall be mogul base, 4 kV pulse rated, vibration resistant porcelain.

Ballasts shall be high power factor, constant wattage auto-transformer type of the voltage shown on the plans. The ballast shall be supplied with the lighting fixture, internally mounted in a corrosion resistant cast aluminum finned box with a weather-resistant sponge silicone "O" ring gasket.

Fixtures shall be equipped with a fully adjustable Type 316 stainless steel mounting yoke and Type 316 stainless steel adjustable pivot bracket aiming system. Fixture and ballast shall be suitable for bracket mounting. Mounting hardware shall be Type 316 stainless steel.

Fixtures shall be UL listed, for use in wet locations.

CABLE MOUNTED LUMINAIRES TYPE MAD-C AND MSR-C

Cable mounted luminaires shall be bracket mounted, metal halide downlight assembly with mounting brackets suitable for locations shown on the plans. Fixtures shall be fully assembled, with die-cast aluminum socket housing, reflector housing, lens retainer and hood. Fixtures shall be furnished with metal halide lamp, tempered glass lens, Type 316 stainless steel fixture yoke, Type 316 stainless steel adjustable pivot bracket and mounting plate, with an attached die-cast aluminum ballast box with ballast, and shall be in conformance with the following requirements:

Housings shall be die-cast aluminum. The socket housing shall be removable for lamp replacement, without altering the fixture mounting or aiming assembly. The socket housing shall be held captive by three Type 316 stainless steel latches and a Type 316 stainless steel safety cable attached to the pivot bracket. All exterior hardware shall be Type 316 stainless steel.

The reflector housing shall be equipped with a die cast aluminum lens retainer, sealed with a sponge silicone "O" ring lens gasket.

Reflector shall be 1.6 mm thick spun 3002-0 with a polished brite dipped and clear anodized finish. NEMA beam spread shall be as indicated on the plans.

Lens shall be 4.8 mm thick clear tempered glass.

Lamps shall be metal halide, and shall be of the wattage shown on the plans.

Lamp sockets shall be mogul base, 4 kV pulse rated, vibration resistant porcelain.

Ballasts shall be high power factor, constant wattage auto-transformer type of the voltage shown on the plans. The ballast shall be supplied with the lighting fixture, internally mounted in a corrosion resistant cast aluminum finned box with a weather-resistant sponge silicone "O" ring gasket.

Fixtures shall be equipped with a fully adjustable Type 316 stainless steel mounting yoke and Type 316 stainless steel adjustable pivot bracket aiming system. Fixture and ballast shall be suitable for bracket mounting. Mounting hardware shall be Type 316 stainless steel.

Fixtures shall be UL listed, for use in wet locations.

MAIN TOWER FLOODLIGHTS TYPE MAR (UP TO 400 WATTS)

Main tower floodlight fixtures shall be surface, wall or tenon mounted, rectangular shaped, metal halide floodlight fixtures with mounting brackets, mounting suitable for locations shown on the plans. Fixtures shall be fully assembled, one piece cast aluminum, suitable for marine use, furnished with metal halide lamp, ballast, lens, power supply cord, and shall be in conformance with the following requirements:

Housings shall be one-piece cast aluminum with integrally cast heat dissipating fins. The housings shall be suitable for use in a marine environment and shall be cast of special alloy containing less than 0.2 percent copper alloy for resistance to corrosion. Housings shall be equipped with a rectangular shaped cast aluminum door frame, sealed with an E.P.D.M. (Ethylene-Propylene-Diene-Monomere) gasket. Fixture shall be finished with an electrostatically applied powder coat, the color shall be as selected by the architect.

Reflector shall be a high purity anodized specular aluminum segmented lighting sheet type.

Lens shall be clear thermal and impact tempered glass.

Lamps shall be pulse-start metal halide, and shall be of the wattage shown on the plans.

Lamp sockets shall be vibration resistant, mogul base, porcelain, equipped with an arc stream aligner for focusing lamp arc stream for maximum performance and beam precision.

Ballasts shall be high power factor, constant wattage auto transformer type, of the voltage shown on the plans. The ballast shall be integral with the lighting fixture, internally mounted in a corrosion resistant cast aluminum finned box with a weather-resistant E.D.P.M. gasket.

Fixtures shall be equipped with a fully adjustable aluminum mounting yoke. Fixture and ballasts shall be suitable for surface, wall and tenon mounting. Mounting hardware shall be Type 316 stainless steel.

Fixtures shall be UL listed, for use in wet locations, and Marine Listed, Outside Type – Salt Water.

MAIN TOWER FLOODLIGHTS TYPE MAT (1000 WATTS AND ABOVE)

Main tower floodlight fixture shall be a surface, wall or tenon mounted, octagonally shaped, metal halide floodlight fixture, with mounting brackets for locations shown on the plans. Fixtures shall be fully assembled, one-piece cast aluminum, suitable for marine use, furnished with metal halide lamp, ballast, lens, power supply cord, and shall be in conformance with the following requirements:

Housings shall be one-piece cast aluminum with integrally cast heat dissipating fins. The housings shall be suitable for use in a marine environment and shall be cast of special alloy containing less than 0.2 percent copper alloy for resistance to corrosion. Housings shall be equipped with an octagonal shaped cast aluminum door frame, sealed with an E.P.D.M. (Ethylene-Propylene-Diene-Monomere) gasket. Fixtures shall be finished with an electrostatically applied powder coat, color as selected by the architect.

Reflector shall be a specular aluminum segmented lighting sheet type.

Lens shall be clear thermal and impact tempered glass.

Lamps shall be pulse-start metal halide, and shall be of the wattage shown on the plans.

Lamp sockets shall be vibration resistant, mogul base, porcelain, equipped with an arc stream aligner for focusing lamp arc stream for maximum performance and beam precision.

Ballasts shall be high power factor, constant wattage autotransformer type, of the voltage shown on the plans. The ballast shall be integral with the lighting fixture, internally mounted in a corrosion resistant cast aluminum finned box with a weather-resistant E.D.P.M. gasket.

Fixtures shall be equipped with a fully adjustable formed steel bar mounting yoke. Fixtures and ballasts shall be suitable for surface, wall and tenon mounting. Mounting hardware shall be Type 316 stainless steel.

Fixture shall be UL listed, for use in wet locations.

MAIN TOWER MARKER LIGHTS TYPE MAP

Main tower marker light fixtures shall be a 300 mm marine signal lanterns for use with 4 quartz halogen lamps, automatic lamp changer, and solid state flasher. Fixtures shall be fully assembled, furnished with lamps, lamp changer, flasher and sun switch, single piece acrylic lens, and shall comply with the following requirements:

Housings shall be corrosion resistant, compression molded, UV stabilized fiberglass and polyester base. Housings shall be equipped with a lens ring attached to the base by eight polyester hold-down tabs, and sealed with weatherproof "O" ring gaskets. All metal exterior hardware shall be of marine grade Type 316 stainless steel.

Lens shall be 300 mm, single-piece injection molded acrylic fresnel, attached to the housing with polyester hold-down tabs and gasketed lens ring. Lens shall be equipped with a molded in place bird spike.

Lamps shall be double contact quartz halogen, and shall be of the wattage shown on the plans.

Lamp sockets shall be double contact, bayonet type with 4 lamp solid state flasher/lampchanger and integral sun switch.

Housing and lens ring shall be gasketed with weatherproof "O" ring gaskets.

Fixture housings shall be equipped with a compression molded mounting flange, suitable for surface and pedestal mounting. Mounting hardware shall be Type 316 stainless steel.

Fixtures shall be UL listed, standard wet location.

NAVIGATION WARNING SYSTEM

The bridge navigation lights shall be marine signal lanterns conforming to the requirements of Coast Guard Standards 33CFR 118.60, 33CFR84.13 and 33CFR 84.15. The lanterns shall be constructed of painted, anodized, cast aluminum, polycarbonate or fiberglass base, components with a precision-molded, color impregnated, glass, 200 mm Fresnel lens. The lantern shall be hinged for easy access to the lamps and internal assembly. The lantern shall have a bird spike incorporated into the lantern to reduce fouling where post mounted. Lanterns mounted upside down on the bridge structure shall be provided without a bird spike. Closure of the lantern shall be by captive toggle bolts and a watertight gasket. The lantern shall be capable of meeting IP-55 standards. The lantern top shall remain physically connected to the lantern base when opened for servicing. The lantern shall accommodate a 4-place lampchanger with four each S-11 marine signal lamps. Internal shock and vibration isolators are required to extend filament life.

The lantern shall have lens tie rods (astragal) constructed of stainless steel. The tie rods shall be placed at an angle of approximately 27 degrees to allow the light beam to be uniform within 25 percent at all viewing angles. Vertical lens tie rods will not be allowed due to shadowing of the lens, which significantly reduces lantern output. The lantern base shall incorporate a bottom cable entry and four attachment studs on a 120.65 mm bolt circle. Closure bolts and attachment hardware shall be constructed of stainless steel.

In order to operate the lampchanger and marine signal lamps, a transformer shall be fitted within the lantern to accept the supply voltage of 120 VAC and provide 10.0 V to 10.5 V to the lampchanger. Four 3.05 A, 12 V, marine signal lamps shall mount in the automatic lampchanger, which holds the operating lamps at the lens focal point and replaces the operating lamp upon failure. Only the operating lamp shall extend through the focal plane of the optic. Total lamp life for the optic shall exceed 25,000 hours.

AVIATION WARNING SYSTEM

The aircraft warning aviation light shall be a medium intensity, omnidirectional, red obstruction light that complies with AC 70/7460-1K, FAA L-864 and ICAO Annex 14 Chapter 6 for a flash rate of 20 flashes per minute. The light shall consist of an aviation red, FA-250 lantern containing 6 each, 24 volt, 150 watt, prefocussed, high pressure halogen marine signal lamps mounted on a 6 place microprocessor controlled lamp changer. The lens shall be a 250 mm acrylic Fresnal lens with a red lens cover. The housing shall be corrosion resistant cast aluminum with stainless steel fittings and a double silicone-rubber lens gasket. A bird spike shall be provided at the top optic. Lanters shall be hinged at midpoint for relamping. When the operating lamp fails, the lampchanger shall automatically rotate the next lamp into precise focal position. When all lamps fail, the lampchanger shall automatically post a failure alarm. The lampchanger shall use a pulse with modulated regulator to operate the lamp at 24 volts giving 2000 hours of life per lamp. Input voltage shall be 480 volts, single phase. In order to operate the lampchanger and the aviation light, a transformer shall be fitted with in the lantern to accept the supply voltage of 480 volts.

The red steady aircraft warning aviation light shall be a low intensity, omnidirectional, red obstruction light that complies with the requirements of AC 70/7460-1K, ICAO Annex 14 6.3.11 and FAA-L-810. The light shall consist of a single 155 mm red acrylic lenses mounted on a FA-249 (WA) lantern. The lantern shall contains four each, 12 volt, prefocussed, marine signal lamps mounted on a four lampchanger. The housing shall be corrosion resistant cast aluminum

with stainless steel fittings and a double silicone-rubber lens gasket. A bird spike shall be provided at the top optic. Lanters shall be hinged at midpoint for relamping. When the operating lamp fails, the lampchanger automatically rotates the next lamp into precise focal point position. A transformer shall be provided inside the optic which reduces the 480 volt input to 10.5 VAC at the lamp giving 5300 hours per lamp and greater than 21,000 hours for the optic. The aviation warning system shall be operational as soon as the tower is in place.

FOG DETECTION SYSTEM

Marine Infrared Fog Detection

The fog detector shall consist of a single station, backscatter device using modulated infrared light to monitor visibility and trigger operation of a fog signal. The detector shall be capable of remote monitoring of fault and visibility levels with contacts for remote On/Off function. All components shall be designed and constructed so as to provide service under exposed conditions commonly found along the seacoast. The equipment shall be suitable for single pole mounting. Workmanship shall be of the highest grade throughout.

The detector sampling light shall have a wavelength of 0.94 pm with modulated pulse frequency of 16 kHz. The detector shall be capable of triggering operation of a fog signal at three adjustable visibility thresholds over a range of 0.5 to 4 nautical miles. The detector shall have sampling zones of approximately 2 to 12 meters with adjustable sampling times not to exceed 12 seconds every two minutes and a threshold accuracy to with 10 percent of the threshold values. The detector shall automatically adjust for the accumulation of dirt on the lens panel with no effect on the performance. Threshold relays and remote alarm output shall use no volt contacts.

The detector casing shall be sealed to IP67 requirements with a Hammerite finish. The detector shall be supplied with 120 volt, single phase input 12 volt output power supply mounted in NEMA 4X box, complete with clips to mount on the same pole as the detector. Current drain is not to exceed 50 mA at 12 volts DC.

Fog Signal

The fog signal shall consist of an emitter array, a power supply and interconnection cables that, when assembled, will produce a 300 cycle directional signal of not less than 132 db measured at 7.5 meters on the axis of the horns with a power input of 2000 watts maximum into the array. The interconnection cables shall not be part of the bid. All components shall be designed and constructed so as to provide extended satisfactory service under exposed conditions commonly found along seacoasts and industrial areas. The equipment shall be constructed to withstand the strains, jars, vibration and conditions incident to shipping, storage, installation and operation as an aid to navigation. Components shall be designed so the adjustments and repairs can be made easily and readily by relatively untrained personnel. Workmanship shall be of the highest grade throughout. All components shall be easily accessible and removable from the front of the power supply cabinets.

The emitter array and power supply shall be separate entities. The emitter shall be capable of mounting on a horizontal platform or on a vertical framework. In use, it will be exposed to the weather. The power supply shall be housed in NEMA 12X enclosure designed for wall mounting. The emitter array shall consist of two transmitters each with two steel diaphragms tuned to 150 cycles per second to produce a tone of 3000 cycles per second, with directional horns to couple the mechanical vibrations to the air. Each transmitter shall be driven by a single fixed electromagnet. The horns shall be resonant at 3000 cycles per second and shall be spaced vertically so as to produce the optimum signal. A steel spacer shall be provided with each transmitter.

The power supply shall consist of two solid state inverters, each in its own cabinet, designed to operate from 120 volts, 50 or 60 cycles, single phase alternating current. The input to each shall not be more than 1800 W, 18 A at 120 volts AC, and the output of each shall be not less than 1000 watts of 150 cycle, +0.2 percent, square wave alternating voltage into a single transmitter. A tuning fork for maintaining frequency shall be incorporated in each inverter with provisions for either turning fork to maintain the frequency of both inverters and to keep them in phase. A solid state coding timer shall be installed in each inverter with provisions for either timer to code both inverters. Provisions shall also be so that either inverter can operate one transmitter of the emitter array. Provisions shall also be made for coding from an external timer. The characteristic shall be specified for each order. The power supply shall be capable of at least a 30 percent duty cycle with any characteristic with a minimum OFF time of one second and maximum ON time of 6 seconds. The power supply and timer shall operate over an ambient temperature range from -29ºC to 49ºC. The components shall be housed in metal enclosures with gasketed doors. Cable entries shall be through stuffing tubes or similar sealing system. Cabinets shall be finished with one prime coat and one finish coat of enamel. Each power supply shall contain a meter panel clearly labeled which consists of a DC inverter voltage meter, an AC horn current meter, an input AC circuit breaker, a DC inverter circuit breaker, a DC inverter circuit breaker, an adjustable horn level control zero to 100 percent continuously variable, a manual keying switch, a master slave switch, all with suitable permanent nameplates.

Submittal package shall consist of six copies. Submittals shall be delivered to the Engineer at least 180 days prior to the start of the installation. The Engineer will be allowed 90 days for review of the submittals.

The manufacturer shall provide 6 instruction manuals with each signal. The instruction manual shall include, but not necessary be limited to, the following:

A. General description of the equipment, including weights of the major components.
B. Installation instruction, scaled and dimensioned elevation and plan drawings, point to point wiring diagram and schematic wiring diagram. Drawings and installation shall be sufficiently detailed and complete to ensure proper installation and adjustment by others.
C. Operating and maintenance instructions. These shall be complete and detailed enough to permit proper maintenance by persons not specifically trained on the equipment.
D. List of all parts with description numbers and photographs or drawings sufficiently complete and clear to permit ready identification for ordering replacements for work or damaged parts in the future.

TESTING

Prior to start of functional testing of the navigation and aviation warning systems, the Contractor shall perform the following tests on all circuits, in the presence of the Engineer, and shall be furnished in a tabulated form to the Engineer.

A. Continuity Test.
B. Ground Test.
C. Insulation Resistance Test.

The above test shall conform to Section 86-2.14B(1), 86-2.14B(2) and 86-2.14B(3) of the Specification respectively. The function test shall consist of not less than 7 days of continuous satisfactory operation. If unsatisfactory performance of the system develops, the conditions shall be corrected and test shall be repeated until the 7 days of continuous, satisfactory operation is obtained.

10-3.15 FIXTURES

TYPE F3

The fixture shall be UL listed for wet location. The fixture shall be stanchion mounted and shall meet the following standards:

A. UL Standard 844 for Hazardous Location - Class I, Division 2 (with heat-treated glass globe and guard).
B. UL Standard 595 for Marine Outside Type (Saltwater).
C. UL Standard 1570/1571 for Wet Location.
D. United States Coast Guard (U.S.C.G.) approved.

The housing shall be a gray glass reinforced thermoplastic. The fixture shall have brass screws and inserts. The fixture shall have long life silicone vapor tight seal gaskets. The fixture shall have an integral metal grounding frame. The globe must be clear heat-treated glass. The fixture shall have an integral high power factor ballast.

Manufacturer:	Phoenix VP 00-2-8-1-1-0 or approved equal with the same photometrics
Lamp:	CFM32W/GX24q/835
Ballast:	High Power Factor

TYPE F4

Same as type F3, except wall mounted.

TYPE H3

The fixture shall be UL listed for wet location. The fixture shall be wall mounted and shall meet the following standards:

A. UL Standard 844 for Hazardous Location - Class I, Division 2 (with heat-treated glass globe and guard).
B. UL Standard 595 for Marine Outside Type (Saltwater).
C. UL Standard 1570/1571 for Wet Location.
D. United States Coast Guard (U.S.C.G.) approved.

The fixture housing, mounting hoods and guards shall be die cast copper free aluminum with baked epoxy finish. The fixture shall have brass screws and inserts. The fixture shall have long life silicone vapor tight seal gaskets. The fixture shall

have an integral metal grounding frame. The globe must be clear heat-treated glass with 30º angle reflectors made of fiberglass reinforced white polyester. The fixture shall have an integral high power, meeting the following requirements:

Manufacturer:	Appleton, Mercmaster III
Lamp:	100 W, HID metal halide
Ballast:	High Power Factor

TYPE H4

Same as type H3, except ceiling mounted with standard dome reflector.

10-3.16 SUPERVISORY CONTROL AND DATA ACQUISTION REMOTE TERMINAL UNIT SYSTEM

GENERAL

Attention is directed to "Order of Work" of these special provisions for the timely identification of the supplier of the remote terminal units and products to be used by the Contractor.

The State will arrange for the procurement and installation of a new Supervisory Control and Data Acquisition (SCADA) Master Programmable Logic Controller (PLC) including workstations. The equipment will be installed in the Administration Building. The communications protocol between field devices and the RTUs will be MODBUS. Communications between the RTUs and the SCADA Master Controller (HMI) shall be through the use of frequency shift key (FSK) modem

The Contractor shall arrange for the procurement and installation of the SCADA remote terminal units (RTUs) with the Engineer prior to procurement and shall provide identical equipment as used in Contract No. 04-012024, constructing San Francisco-Oakland Bay Bridge structures, to assure compatibility between the SCADA RTUs and the new SCADA Master PLC.

The Contractor shall arrange for the RTU supplier to generate complete wiring diagrams, based on shop drawings, of each RTU, showing all incoming cable and wire terminations to be terminated by the Contractors. The wire, cable and circuit numbers shall match and be coordinated with the RTU requirement plans (elementary and wiring diagrams), furnished for the SCADA RTU system. This information shall be available for the Engineer to review upon request prior to installing any of the RTUs.

SUBMITTALS

Each submittal package shall consist of six copies. Submittals shall be delivered to the Engineer at least 180 days prior to the start of the installation. The Engineer will be allowed 90 days for review of the submittals.

Submittals (For Review and Approval)

The following information shall be submitted to the Engineer:

A. Master drawing index
B. Front view elevation
C. Floor plan
D. Top view
E. Block diagram
F. Schematic diagram
G. Nameplate schedule
H. Component list
I. Conduit entry and exit locations
J. Assembly ratings including:

   1. Voltage
   2. Continuous current

K. Cable terminal sizes

Key interlock schematic plans and sequence of operations shall be submitted to the Engineer:

Submittals (For Information)

When requested by the Engineer the following product information shall be submitted:

A. Descriptive bulletins

B. Product data sheets.

Submittals (For Final Acceptance)

The following information shall be submitted for record purposes prior to final payment:

A. Final as-built plans drawings and information for remote terminal units.
B. Wiring diagrams
C. Certified production test reports
D. Installation information
E. Seismic certification and equipment anchorage details.

Operation and Maintenance Manuals

Ten copies of the equipment operation and maintenance manuals shall be provided prior to shipment of the equipment. Operation and maintenance manuals shall include the following information:

A. Instruction books or leaflets
B. Recommended renewal parts list

PROGRAMMABLE CONTROLLER

Scope

This section covers the technical requirement for a programmable controller which can receive discrete and analog inputs. Through the use of relay ladder logic and other languages, including "C", State Logic and Sequential Function Chart (SFC), it can control discrete and analog output functions, perform data handling operations and communicate with external devices.

Manufacturer's Standards

The manufacturer shall have shown high commitment to product, manufacturing and design process quality. It shall have attained ISO9001 registration.

Design and Manufacturer

The SCADA RTUs furnished by the contractor, will be part of the overall new San Francisco – Oakland Bay Bridge SCADA system, to be furnished and installed by multiple contractors. The Contractor shall ensure compatibility with the overall SCADA system by providing identical equipment as used in Contract 04-012024. The new RTUs for the San Francisco – Oakland Bay Bridge shall be furnished with GE 90-30 PLCs or equal. The RTU cabinets, including all internal subcomponents, shall, where applicable, be identical to the subcomponents furnished with the RTUs as used in Contract 04-012024.

The SCADA RTU system shall be obtained from the following supplier:

VENDOR ADDRESS AND PHONE NUMBER
INKELIS ASSOCIATES 6722 CORTE SANTA MARIA PLEASANTON, CA 94566 TEL: 925-485-0497 FAX: 925-485-0794 CONTACT: KAREN INKELIS

The unit prices quoted by the supplier for the SCADA RTU system are as follows:

	QTY	NTP 2004	NTP 2005	NTP 2006	NTP 2007	NTP 2008
RTU-10W & 10E	2	$69,000	$72,588	$78,674	$84,008	$89,703
RTU-11W & 11E	2	$67,000	$70,484	$76,393	$81,573	$87,103
#COM-4 Terminal Cabinet	1	$ 3,850	$ 4,050	$ 4,390	$ 4,687	$ 5,005
#COM-5,6,7,8 Terminal Cabinets	4	$ 3,875	$ 4,077	$ 4,418	$ 4,718	$ 5,038
#TEL-4,5,6,7,8 Terminal Cabinets	5	$ 4,050	$ 4,261	$ 4,618	$ 4,931	$ 5,265
Testing and Checkout (hr)	64	$ 7,900	$ 8,311	$ 9,008	$ 9,618	$10,270
Training (hr)	12	$ 3,000	$ 3,156	$ 3,421	$ 3,653	$ 3,900
Software Programmer (hr)	24	$ 4,200	$ 4,418	$ 4,789	$ 5,114	$ 5,460
Relay	24	$ 720	$ 757	$ 821	$ 877	$ 936

The prices quoted are effective for each NTP (Notice to Proceed) yearly period from January 19 to January 18 of the following year. The FOB location is Everett, Washington. The above prices include freight and insurance, but do not include sales tax. All products are tested and ETL Labeled before shipment.

The programmable controller and all of the corresponding components within the family of controller products shall be offered by a company who regularly manufactures and services this type of equipment**.**

All products shall be designed, manufactured, and tested in accordance with recognized UL, CSA, IEC and CE mark industrial standards. The system shall be operational during and after testing. The standards requirements are as follows:

The programmable controller and all of the corresponding components within the family of controller products shall be offered by a company who regularly manufactures and services this type of equipment**.**

All products shall be designed, manufactured, and tested in accordance with recognized UL, CSA, IEC and CE mark industrial standards. The system shall be operational during and after testing. The standards requirements are as follows:

AGENCY APPROVALS OVERVIEW		***Comments***
Quality Assurance in Design/ Development, Production, Installation & Servicing	**ISO9001**	Certification by Underwriters Laboratories and BSI Quality Assurance
Safety for Industrial Control Equipment	**UL508** **C-UL or CSA 22.2, 142-M1987**	Certification by Underwriters Laboratories Certification by Underwriters Laboratories [C-UL] or Canadian Standards Association for selected modules
Safety for Hazardous Locations Class I, Div II, A, B, C, D	**UL1604 with C-UL** **FM3611** **CSA22.2, 213-M1987**	Certification by Underwriters Laboratory for selected modules Certification by Factory Mutual for selected modules Certification by Canadian Standards Association for selected modules
European EMC and Low Voltage Directives	**CE Mark**	Certification by Competent Body for EMC Directive for selected modules

STANDARDS OVERVIEW		*Conditions*
ENVIRONMENTAL		
Vibration	**IEC68-2-6, JISC0911**	IG@40-150Hz, 0.012in p-p@10-40Hz
Shock	**IEC68-2-27, JISC0912**	15G.11ms
Operating Temperature		0°C to 60°C:[inlet] 0°C to 55°C:[ambient]
Storage Temperature		-40°C to +85°C
Humidity		5% to 95%, non-condensing
Enclosure Protection	**IEC529**	Steel cabinet per IP54: protection from dust & splashing water
EMC EMISSIONS		
Radiated Conducted	**CISPR11, EN55011 FCC**	Class A [applies to CE Marked modules] part 15, subpart J, Class A
EMC IMMUNITY		**[applies to CE Market modules]**
Electrostatic Discharge	**IEC 1000-4-2**	8KVAir, 4KV Contact
RF Susceptibility	**IEC 1000-4-3**	$10V_{rms}$/m80Mhz to 1000Mhz, 80% AM
Fast Transient Burst	**IEC 1000-4-4**	2KV:power supplies,1KV:I/O,communications
Surge Withstand	**ANSI/IEEE C37.90a IEC255-4**	Ring Wave, 2.5KV: Power supplies, I/O [12,240V] Ring Wave, Class II: Power supplies, I/O[12,240V]
Conducted RF	**IEC 1000-4-6**	$10V_{rms}$, 150khz to 80Mhz, 80%AM: communication modules with cables>30m
ISOLATION		
Dielectric Withstand	**UL508, UL840, IEC664**	1.5KV for modules rated from 51v to 250v
POWER SUPPLY		
Input Dips, Variations	**IEC 1000-4-11**	During Operation: Dips to 30% and 100%, Variation for AC +/- 10%, Variation for DC +/- 20%

The manufacturer shall have a fully operational quality assurance and quality control program in place and shall comply with ISO9001 standards for "Quality Systems- Model for Quality Assurance in Design/Development, Production, Installation, and Servicing."

Complete documentation describing installation, operation, programming and simple field maintenance shall be available in paper format and on CD-ROM.

Support

The manufacturer or its authorized representative shall provide complete technical support for all of the products. This shall include headquarters or local training, regional application centers, and local or headquarters technical assistance. A toll-free (800) number hot-line shall be available for emergency support.

Product shall have a warranty period of at least 1 year from the date of purchase. The contractor shall maintain the warranties of the product to the completion of the project.

Hardware

The system shall consist of rugged components designed specifically for industrial environments. A complete system shall consist of one or more racks containing I/O modules, interconnected by signal cables.

Packaging

All components shall be housed in structurally secure enclosures.

The controller CPU shall be modular. The modular type shall be fully enclosed within a durable plastic shroud. When mounted on the system base, the modular CPU shall not occupy more than one available slot.

The I/O system shall be modular. Each module shall be fully enclosed within a durable plastic shroud. When mounted on the system base, each I/O module shall not occupy more than one available slot.

There shall be at least two sizes of I/O bases available. One shall hold up to 10 I/O modules and the other shall hold up to 5 I/O modules.

I/O modules shall be retained in their slot by a hinge on the upper rear edge and snap on the lower rear edge of the baseplate. Removing the module shall require no tools.

I/O modules shall be installed in any available slot in the CPU or expansion baseplates, and shall require no tools for insertion and extraction.

I/O modules shall connect electrically to the baseplate via a pin and socket connector.

I/O modules shall be fully enclosed in a plastic covering protecting the electronic circuitry from exposure.

Durability

All components within the controller family shall be manufactured with a high degree of durability.

All switches and other operator-controlled devices shall be of the size and durability for the intended use as is normally offered for industrial applications.

All signal cables furnished by the manufacturer shall be constructed so as to withstand, without damage, all normal use and handling.

Parts Interchange

In order to minimize spare parts stocking requirements, the controller family shall have a high degree of interchange capability. The power supply and the battery should all operate equally well regardless of the CPU being used.

The system shall incorporate a modular design using plug-in assemblies with pin and socket connectors.

Wherever possible, all assemblies and sub-assemblies performing similar functions shall be interchangeable.

The system design shall accommodate the replacement of assemblies without having to disconnect field wiring. Wherever possible, removable connectors shall be used to connect field wiring to the individual circuit board assemblies.

All major assemblies and sub-assemblies, circuit boards, and devices shall be identified using permanent labels or markings each of which indicates the manufacturer's catalog number, product manufacturing date code, UL and CSA certifications.

Environmental Conditions

All components of the controller system, except CRT terminals and programming workstations, shall meet the following environmental specifications:

Storage Conditions (Temperature): from -40°C to 85°C.
Operating Conditions (Temperature): from 0°C to 60°C.
Humidity: from 5 to 95 percent relative humidity, non-condensing.

Power Supply Module

The power supply shall be a wide range supply operating from a voltage source in the range from120 to 264 V AC and from 90 to 125 VDC, providing 30 W of power. Available power shall be 30 W at a +5VDC output, 15 W at a 24VDC relay power output, and 20 W at an isolated 24 VDC output.

Specifications

The power supply shall contain an isolated, internal 24VDC power source for I/O modules requiring 24 VDC power

The power supply shall contain a built-in serial communication port which can be used to:

A. Connect the programmer for PC compatible programming software.
B. Connect to one of the wide variety of third-party operator interfaces utilizing an open architecture software protocol.

This serial port shall provide RS-422 signals with RS-485 compatibility. The characteristics of this port shall be software configurable and shall be modem compatible.

The power supply shall contain dual battery connectors in a battery compartment such that a battery may be installed to protect programming CMOS RAM memory. Dual connectors are required to provide bumpless battery power transfer.

The backup battery for RAM memory shall be a Lithium, long-life battery with a typical life of 6 months under load, and 8 to 10 years under no load. This battery shall be replaceable while power is applied to the PLC.

The power supply shall be modular in design, separate from the CPU and baseplate for easy replacement in the unlikely event of failure.

The power supply shall be universal in design, compatible with main CPU racks, as well as with expansion racks.

There shall also be a super capacitor that provides a minimum of 1 hour batteryless backup power for CPU RAM memory.

Central Processing Unit (CPU)

The central processing unit (CPU) shall be a modular CPU with up to 5 different configurations. The CPU shall possess the capability to solve application logic, store the application program, store numerical values related to the application processes and logic, and interface to the I/O systems. The CPU shall need no additional modules to provide at least the following advanced programming features: PID, Modulo, Math, Double Precision math, Logical functions, Subroutines, Data Array Move and Indirect Addressing.

Modular CPU

The modular CPU shall contain a minimum of an Intel 80386EX microprocessor operating at speeds no less than 25 MHz as the main processing element, memory mounted on the board, and a dedicated VLSI Instruction Sequencer Coprocessor (ISCP - Boolean Coprocessor) for performing Boolean operations, and interfaces to a serial port and the system bus.

The modular CPU shall contain a real-time calendar and clock that can be accessed by the user program. This Time of Day clock and calendar shall be battery-backed and maintain seven time functions: Year (2 digits), Month, Day of Month, Hour, Minute, Second, and Day of week.

The modular CPU shall execute Boolean functions at a rate of .22 microseconds per instruction or lower.

The modular CPU shall be capable of controlling up to 79 I/O slots.

The modular CPU shall be able to provide special functions such as High Speed Counter function, Axis Positioning function, and Local Area Networking function.

The modular CPU shall be have 2 additional serial ports, 1 a phone jack RS232 and 1 a 15 pin RS485 for communications. The modular CPU shall also be configured as a Modbus RTU Slave ports, allowing them to communicate with other devices in a communication scheme that allows the PLC to be interrogated by those devices for data. The serial ports shall be supported by an additional Hitachi H8 microprocessor.

Visual Diagnostics

Status of low or dead battery shall be indicated by a red Battery LED on the power supply module.

The diagnostic status of the fuses, for those discrete I/O modules containing fuses, shall be indicated by a red LED mounted on the top of the module. The red LED shall illuminate when a blown fuse condition is present.

Alarm Processor

The modular CPU's shall contain an alarm processor that has special PLC feature designed to receive and process faults. The diagnostics shall provide information on the configuration and CPU, memory, communications and I/O status.

The alarm processor function shall log I/O and system faults in two fault tables that shall be accessible for display on the PC compatible programming software screen or uploaded to a host computer or other coprocessor.

The alarm processor shall maintain the states of up to 128 discrete system diagnostic bits to be read by a host or incorporated as contacts into the ladder program for customized diagnostic routines.

Each fault table shall have a total capacity of 32 faults. The last 16 entries shall maintain the latest 16 faults. The first 16 shall be kept unchanged.

Faults may be cleared by the user by way of a programmer. Provision shall be made by way of passwords to protect these faults from unauthorized clearing.

Alarm Features

The alarm processor shall report three types of fault action; fatal, diagnostic, or informational, and the CPU shall respond as follows:

Fault Action	Fatal	Diagnostic	Informative
CPU Enters STOP Mode	YES	NO	NO
Set Diagnostic Bit	YES	YES	NO
Logged In Fault Table	YES	YES	YES

When an I/O fault occurs, the alarm processor shall report the rack and slot location of the fault, the condition, the address and the circuit number if appropriate.

The modular CPU alarm processor function shall have the capability to time-stamp system faults for future references.

PLC Memory Protection

The PLC shall have 4 levels of security or password privilege levels to prevent unauthorized changes to the contents of the PLC. These built-in privilege levels shall be set in the programming software or with the Hand-Held Programmer and shall impose the following constraints:

Level	Constraint
1.	Read PLC data only (except passwords)
2.	Write to any data memory
3.	#2 and write to all configuration or logic in STOP mode
4.	#3 and write to logic in STOP or RUN mode (on-line change) and password level access.

There shall be one password, one to four ASCII characters in length, for each privilege level in the PLC, and the same password can be used for more than one level.

Any attempts to access or modify information in the PLC without the proper password privilege level shall be denied.

Subroutine Password

The PLC shall have a software OEM key that allows users to control access to each subroutine in the relay ladder program.

OEM Program Protection

The PLC shall have a software OEM key that allows users to protect the resident program from unauthorized reads and writes.

CPU Memory

The PLCs modular CPU shall contains at least the following:

A. 120K 16-bit words for application programming and register, analog input and analog output memory.
B. Up to 16384 (16K) 16-bit registers for data usage.
C. 1280 global references
D. 4096 (4K) internal relay coils
E. 2048 (2K) bits for discrete inputs
F. 2048 (2K) bits for discrete outputs
G. Up to 16384 (16K) 16-bit registers for analog inputs
H. Up to 16384 (16K) 16-bit registers for analog outputs

All application memory shall be available to the user program. Executive level operations performed by the CPU shall not consume application memory.

Memory Storage

The register values and the application program shall be stored in battery backed, CMOS static RAM memory. The application program and system configuration shall also be stored in FLASH memory.

There shall be a long-life Lithium battery used to maintain the contents of the CMOS RAM memory in the CPU.

There shall be an easily accessible battery compartment in the power supply with dual battery connectors. The battery shall be replaceable with power applied to the PLC and without removing the CPU.

An LED shall provide visual indication of the battery condition. Additionally, a low battery condition shall be alarmed with a system diagnostic bit.

The modular CPU shall allow the resident user program to be maintained in the CPU without power applied. Two levels of maintainability shall be provided, short duration and long duration.

For short duration, the program shall be maintained by a hi-capacity capacitor for a period of no less than 1 hour. This allows adequate time for replacing the battery in the power supply module, should the external supply to the CPU be interrupted.

For long duration, the CPU module shall maintain its contents by using the battery. This allows the CPU module to be shipped via surface mail where power supply to the module is not available. This method may be achieved by providing internally mounted battery.

The CPU shall calculate the application program checksum at the end of every sweep. A complete checksum calculation for a program may take several sweeps. A fixed number of program memory checksum shall be calculated each sweep. This

number is configurable by the user. If the calculated checksum does not equal the reference checksum, a fault shall be recorded, and the CPU mode will change to STOP.

Programming Devices

A Software programming package, for development of application programs, shall be furnished. The software programming package shall be capable of running on a PC compatible laptop or desktop computer.

On-line and off-line, CPU and I/O configuration and application program development shall be achieved with a PC compatible computer and programming and documentation software. The PC compatible computer shall be connectable to the PLC via a built-in serial communication port on the power supply or serial ports on the CPU. The serial communication port shall provide RS-422 signals with RS-485 compatibility.

In addition to the serial communications, the PC compatible computer shall be connectable to the PLC via Ethernet TCPIP supporting the SRTP application protocol. A separate module providing Ethernet communications through an AAUI connection shall plug into any system.

The programming devices shall have access to the application program, the CPU and I/O system configurations, all registers, CPU and I/O status, system diagnostic relays, and I/O over-ride capabilities.

MS-DOS®/Windows® Compatible Software

The MS-DOS/WINDOWS compatible software shall provide the capability of reading, writing, and verifying the configuration and program with a diskette backup.

The software shall execute on DOS operating system or in a DOS Window in a WINDOWS operating system.

The software shall provide on-screen help information throughout its execution paths.

It shall have the capability of programming the relay ladder program, store the program to the PLC, monitor program and reference address status while the PLC is in Run or Stop mode.

The software must be capable of generating a printout of the program for documentation purposes. The user shall be able to select any of the program documentation below:

Types of Documentation Description

Print Program	This printout shall print the program logic with or without the equivalent Boolean instructions for each rung, the reference list, reference descriptions and users rung comments.
Cross reference tables	This printout shall show the use of references in the program.
Reference tables	This printout shall show the values of each reference in each selected table.
Configuration Printout	This printout shall allow the user to generate a rack hardware and its assigned reference addresses listing, and the CPU configuration listing.

The software shall provide the capability for programming using user-defined variables (nicknames).

The software shall have built-in modem connection capabilities.

WINDOWS® Compatible Software

The WINDOWS compatible software shall provide the capability of reading, writing, and verifying the configuration and program with a diskette backup.

The software shall execute on a Windows® 95 or Windows NT® platform.

The software shall provide on-screen help information throughout its execution paths.

It shall have the capability of programming the relay ladder program, store the program to the PLC, monitor program and reference address status while the PLC is in Run or Stop mode.

The programming software shall support bumpless run mode storage of the program to the CPU.

The software must be capable of generating a printout of the relay ladder program for documentation purposes. The user shall be able to select any of the program documentation below:

Types of Documentation	Description
Print Program	This printout shall print the program logic with or without the equivalent Boolean instructions for each rung, the reference list, reference descriptions and users rung comments.
Cross reference tables	This printout shall show the use of references in the program.
Reference tables	This printout shall show the values of each reference in each selected table.

Configuration Printout	This printout shall allow the user to generate a rack hardware and its assigned reference addresses listing, and the CPU configuration listing.

The software shall provide the capability for programming using user-defined variables (nicknames).
The software shall have built-in modem connection capabilities.
The software shall be IEC 1131 compliant.
The software shall have provisions for importing and exporting tag names, comments and descriptions in an .xls format.

Operator Interface

The programming port and its protocol shall be open in architecture. The protocols of this communication port shall be published such that a user may develop their own operator interface device, software or hardware, to access Register, I/O status, I/O override and system diagnostic memory data.

Through an open nature of this communications protocol, a wide variety of operator interface shall be made available. These may be manufacturer's own brand or they may be manufactured by 3rd party vendors.

Programming Language

The CPU shall be capable of solving an application program whose source format shall be relay ladder diagram. The language shall support relay, timers and counters, arithmetic, relational, bit operation, data move, conversion, and control functions.

The CPU shall be capable of solving an application program whose main program format is in Sequential Function Chart (SFC) with underlying code in relay ladder diagram.

Relay Functions

Relay ladder operations shall consist of the following contacts and coils:

Normally Open Contact
Normally Closed Contact
Coil
Negated Coil
Retentive Coil
Negated Retentive Coil
Positive Transition Coil
Negative Transition Coil
Set Coil (Latch)
Reset Coil (Unlatch)
Retentive Set Coil
Retentive Reset Coil

Positive transition coils and negative transition coils shall function as leading and trailing edge one-shot coils respectively.

Contacts may be referenced any number of times within the application program.
A single rung may contain more than one coil.
There shall be a service that allows user programs to be checked for multiple coil use. This flag may be set to:

Disallow more than one coil in a single rung
Allow multiple coil use but generate warning messages
Allow multiple coil use without warnings

Timers And Counters

Timer and counter operations shall consist of the following types:

Retentive On-Delay Timer (ONDTR)
Simple Off- Delay Timer (OFDT)
Simple On-Delay Timer (TMR)
Up Counter (UPCTR)
Down Counter (DNCTR)

The retentive on-delay timer shall behave as a stop-watch that increments time when enabled and holds the current timed value until receiving power flow to the reset input.

The simple on-delay timer shall increment while it receives power flow and reset to zero when power flow stops.

The simple off-delay timer shall increment while it power flow stops and reset to zero when power flow is present.

There shall be at least 682 programmed timers or counters available for use in application programs.

Each timer or counter requires the use of three 16-bit registers within %R memory for storage of the preset, the current value and a control word. These three registers shall be accessible to the user via a register reference.

The timers and counters shall not require an output reference. The output of a timer or counter can be used to energize a coil, or enable another function, such as a math function, or another timer or counter.

The time/count limit shall be either a programmed constant or shall be programmable via a register reference value.

The time shall be counted in tenths of seconds or hundredths of seconds, and the range for the timers and counters is 0 to 32,767 time units.

Arithmetic

The arithmetic operations shall support two data types, Signed Integer (INT), and Double Precision Integer (DINT). On the modular CPU, the Floating Point data type shall also be supported via floating point emulation. Arithmetic functions shall consist of the following types:

Addition
Subtraction
Multiplication
Division (quotient)
Modulo (remainder)

Square Root

Signed Integers (INT) data shall be stored in 16 contiguous bits of memory, in 2's complement notation. The range for Signed Integer Data shall be -32,768 to +32,767.

Double Precision Integer (DINT) data shall be stored in 32 contiguous bits of memory, double precision data is always signed. The range for Double Precision Integer Data shall be -2,147,483,648 to 2,147,483,647.

The arithmetic function blocks shall consist of 3 inputs and 2 outputs. The enable input shall begin the execution. When the function is enabled, the two data inputs are operated upon and the result is output. There shall also be an OK output that is always true when the function is enabled, unless an overflow or other error exists.

All of the Arithmetic functions shall be such that they can be cascaded together in a single rung.

Relational Functions

Relation Functions which are used to compare two numbers, shall operate on Signed Integer and Double Precision Integer data types, and shall consist of the following types:

Equal To	Not Equal To
Greater Than	Greater Than or Equal to
Less Than	Less Than or Equal to

Bit Operation Functions

Bit Operation Functions shall perform comparison and movement operations on word data that is specified as a continuous string of data in 16-bit increments, with the first bit of the first word being the least significant bit, and the last bit of the last word being the most significant bit.

Bit Operation Functions that are used to perform Boolean operations on corresponding bits of two bit strings of the same length shall consist of the following types:

Logical AND
Logical OR
Logical Exclusive OR

Bit Operation Functions used to create an output string that is a copy of an input bit string, but with its bits inverted, shifted, or rotated shall consist of the following types:

Logical Invert (NOT)

Shift Left
Shift Right
Rotate Left
Rotate Right

The shift functions shall allow for the user to specify the number of places that the array is to be shifted as an input, and provide the state of the last bit shifted out, and a copy of the shift register as outputs.

Data Move Functions

Basic data movement capabilities shall be provided by the following list of functions:

Move
Block Move
Block Clear
Shift Register
Bit Sequencer
Range
Communications Request

The movement of data (16 bit integer or word), as individual bits, from one location to another shall be accomplished by the Move function. The user shall be able to specify the length of the move.

The Block Move function shall provide the functionality to move a block of 7 constants (integer or word) to a specified location.

The ability to fill a specified block of data (word) with zeros shall be accomplished by the Block Clear function. The user shall be able to specify the length of the block.

The Shift Register function shall provide the functionality to shift one or more data words from a reference location into a specified memory location. All of the data within the Shift Register shall be accessible throughout the program from logic addressed memory.

A method of shifting a bit sequence through an array of bits shall be provided by a Bit Sequencer function. The function shall provide the ability to reset the sequence, change the direction of the bit pattern, or access the step location within the array.

A method of checking for a value to be contained within a group of values shall be provided in a Range function.

Provisions to initiate communications with a specialized communication module shall be made through the use of a Communication Request function. This function shall allow the PLC to behave as a master on a serial communication link, thus providing the ability to communicate master/slave or peer to peer with any controller or computer using the same serial communication protocol.

Table

Table operations shall consist of moving data into or out of tables and searching for data of values equal to, not equal to, greater than, greater than or equal to, less than, and less than or equal to a specified value. Table functions shall consist of the following functions:

Array moves
Search Equal
Search Not Equal
Search Greater Than
Search Greater Than or Equal to
Search Less Than
Search Less Than or Equal to

The array move feature shall be capable of implementing indirect addressing applications.

Conversion Functions

Two conversion functions shall be provided to convert a data item from a 4 digit Binary Coded Decimal (BCD-4) data type to a 16 bit signed integer and vice versa.

Control Functions

Control functions shall be provided to limit program execution, alter the way the CPU executes the application program, or provide special PLC services. The following Control Functions shall be provided:

CALL
Immediate I/O update (DO I/O)
Comment rung (COMMNT)
Master Control Relay (MCR, END MCR)
Jump to a label (JUMP, LABEL)
Special Service Requests (SVCREQ)

An immediate I/O update function shall be provided for the update of all or a portion of the inputs or outputs for one scan while the program is running, or to update I/O during the program in addition to the normal I/O scan.

Additionally, the function shall provide a mean to read inputs into memory auxiliary to the true input table, and execute outputs from discrete memory alternate to the true output table.

A comment rung function shall be provided to enter a rung explanation in the program. The rung explanation shall have the capacity to hold 2048 characters of text. The memory required for the comment shall be independent of the program storage memory. The comment shall have the ability to be edited via the PC compatible programming software.

A master control relay function shall allow all rungs between the MCR and its subsequent END MCR function to be executed without power flow.

A method for structuring the ladder program shall be provided with the use of a JUMP Function. This will cause the program execution to jump to a specified location in the logic targeted by the location of the LABEL function.

Seven different special PLC service requests shall be accessible by the programmer by utilizing one of the Service Request Functions listed below:

Service Request Functions

The following Service Request Functions shall be provided:

Change/Read Checksum Task State and
Logical Number of Words to Checksum
Change/Read Time of Day Clock.
Shut Down the PLC.
Clear Fault Tables.
Read Last Fault Table Entry.
Read Elapsed time Clock.
Read I/O Override Status.

The Data written by these service request functions shall be in BCD or Packed ASCII format, and written into user definable register locations.

PID Function

A single PID function block instruction must be provided by the CPU without any additional module. Two versions of this closed loop control algorithm (Proportional/Integral/Derivative) shall be available:

The standard ISA PID algorithm, which applies the proportional gain to each of the proportional, derivative, and integral terms; and

The independent algorithm that applies the proportional gain only to the proportional gain term.

Subroutine Function

A single function block must be available to allow repetitive call of a function. A password to protect the integrity of the subroutine must also be available.

A Subroutine may be called from within another subroutine. The nesting must be at least 8 deep.

A Periodic Subroutine shall be available that is executed once a programmable interval. The interval shall be between 1 and 10 milliseconds. The accuracy of the subroutine execution shall be 50 nanoseconds. Discrete I/O shall be available to update during the execution of the subroutine.

Discrete I/O

Interface between the PLC and user supplied input and output field devices shall be provided by rack type I/O modules.

Configuration

There shall be an expandable I/O system that shall be supported by a single slot modular CPU, and shall accommodate up to 8 total racks or 79 I/O slots up to a total distance of 50 feet with the standard expansion racks and 700 feet with the remote expansion racks.

Expansion I/O racks shall be connected to the CPU rack via a high speed serial interface cable. The receiver shall be contained within the expansion baseplates eliminating the requirement for additional communication modules.

I/O Addressing

I/O reference addressing for each I/O module shall be assigned through the use of the PC compatible configuration and programming software or the hand held programmer. There shall be no jumpers or DIP switch settings required to address modules.

The circuit status of each I/O point on a module shall be indicated by a green LED mounted at the top of the module. These LED's must be visible through a clear plastic lens. Each LED shall illuminate a letter and number which corresponds to the energized I/O circuit.

Addressing of all references including I/O must be represented as a Decimal Based number.

Construction

Terminal blocks shall be easily removable, and common to all discrete and analog I/O to allow for convenient pre-wiring of field devices.

Each I/O module shall contain a hinged, clear plastic, terminal block cover (door) with a removable label.

The inside of the label shall have the module description, catalog number, and circuit wiring diagram for that module type, and the outside of the label shall have a user legend space to record circuit identification information.

The label shall have color coding for quick identification of the module as high voltage (red), low voltage (blue), or signal level (gray) type.

Electrical Specifications

I/O modules shall be designed for 1500 volt isolation between the field wiring and the system backplane.

Input Specifications

The 120 Volt AC input module shall accommodate an input voltage range from 0 to 132 volts.

The 240 Volt AC input module shall accommodate an input voltage range from 0 to 264 volts.

The 24 Volt DC positive and negative logic input modules shall accommodate an input voltage range of 0 to +30 volts DC.

The 125 Volt DC input module shall accommodate an input voltage range from 0 to 150 volts.

Availability Of Input Modules

As a minimum, the following discrete input modules shall be available:

Description	Points/Module
Input Simulator	8, 16
120 Vac Isolated Input	8
240 Vac Isolated Input	8
120 Vac Input	16
24 Vac/Vdc Negative Logic Input	16
24 Vdc, Positive/Negative Logic Input	8.16.32
24 Vdc Positive/Negative Logic Input, (1ms response)	16
125 Vdc Positive/Negative Logic Input	8
5/12 Vdc Positive/Negative Logic Input (TTL)	32

Output Specifications

Discrete AC output modules shall have separate and independent commons allowing each group to be used on different phases of AC supply.

Each discrete AC output shall be provided with an RC snubber to protect against transient electrical noise on the power line.

Discrete AC outputs shall be suitable for controlling a wide range of inductive and incandescent loads by providing a high degree of inrush current (10x the rated current).

Discrete DC output modules shall be available with positive and negative logic characteristics in compliance with the IEC industry standard.

Discrete DC output modules shall be provided with at least eight output points in a group with a common power input terminal per group.

Discrete DC output modules shall be compatible with a wide range of user-supplied load devices, such as: motor starters, solenoids, and indicators.

A 2 A relay output module shall be capable of supplying 2 A resistive maximum load per output and 4 A resistive maximum load per group of 4 outputs.

A 4 A relay output module shall have 8 isolated outputs per module and shall be capable of supplying 4 A resistive maximum load per output and 32 A resistive maximum load per module.

Availability Of Output Modules

As a minimum, the following discrete output modules shall be available:

Description	**Points/Module**	**Fuse** Rating	**# Fuses/** Module
120 VAC, 0.5A (2 groups)	12,16	3A	2
120/240 VAC, 1A (2 groups)	8	3A	2
120/240 VAC Isolated, 2A	5	3A	5
12/24 VDC Positive Logic, 2A	8	5A	2
12/24 VDC Positive Logic, 0.5A	8,16,32	N/A	0
12/24 VDC Negative Logic, 2A	8	5A	2
12/24 VDC Negative Logic, 0.5A	8,16	N/A	0
125 VDC Positive/Negative Logic, 1A	6	N/A	0
5/12/24 Vdc Negative Logic, 0.5A	32	N/A	0
Relay, Normally Open, 2A (4 groups)	16	N/A	0
Relay, Normally Open, 4A Isolated	8	N/A	0
Relay, Isolated, 4 Normally Closed, 4 Normally Open (Form B & C) 8A	8	N/A	0

Availability Of Mixed I/O Modules

As a minimum, the following discrete output modules shall be available:

Description	**Points/Module**
24 Vdc Input, Relay Output	8 in, 8 out
120 Vac Input, Relay Output	8 in, 8 out

Analog I/O

For the conversion of analog to digital and digital to analog conversion required by an application, the following shall be available:

Analog Voltage Input

The analog voltage input module shall be capable of converting 4 or 16 channels of inputs in the range of -10 to +10 volts.

Resolution of the converted analog voltage input signal shall be 12 bits binary or 1 part in 4096.

All of the channels of converted analog voltage input signals shall be updated each scan into a dedicated area of data registers in a 16-bit 2's complement format.

The conversion speed for all of the analog voltage input channels shall be no less than 2 milliseconds and no greater than 13 milliseconds..

The analog voltage input module shall be configurable to a 4 to 20 mA analog current input via an external resistor.

Analog Current Input

The analog current input module shall be capable of converting 4 or 16 channels of inputs in the range of 4 to 20 mA or 0 to 20 mA.

Resolution of the converted analog current input signal shall be 12 bits binary or 1 part in 4096.

All of the channels of converted analog current put signals shall be updated each scan into a dedicated area of data registers in a 16-bit 2's complement format.

The conversion speed for all analog current input channels shall be a minimum of 2 milliseconds and no greater the 13 milliseconds.

Analog Voltage Output

The analog voltage output module shall be capable of converting 2 or 8 channels of digital data to analog outputs in the range of -10 to +10 volts.

Resolution of the converted output signal shall be 13 bits or 16 bits.

All channels of analog output data shall be updated each scan from a dedicated area of data registers in a 16-bit 2's complement format.

The analog voltage outputs shall be configurable to default to 0 mA, 4 mA or hold-last-state in the event of a CPU failure.

Analog Current Output

The analog current output module shall be capable of converting 2 or 8 channels of digital data to analog outputs in the range of 0 to 20 mA. .

Resolution of the converted output signal shall be 12 bits or 16 bits.

All channels of analog output data shall be updated each scan from a dedicated area of data registers in a 16-bit 2's complement format.

The analog current outputs shall be configurable to default to 0 volts or hold-last-state in the event of a CPU failure.

Analog Combination

The analog combo module shall be capable of converting 4 channels of analog inputs to digital data and 2 channels of digital data to analog outputs.

All channels are configurable for 0-20ma, 4-20ma, 0-+10V, and -10-+10V. Resolution of the converted input signals shall be 12 bits and output signals shall be 16 bits.

All channels of analog data shall be updated each scan from a dedicated area of data registers in a 16-bit 2's complement format.

The analog outputs shall be configurable to default to 0 volts or hold-last-state in the event of a CPU failure.

Module Availability

As a minimum, the following analog modules shall be available:

Description	**Channels/Module**
Input	4, 16
Voltage Analog Input	4, 16
Current Analog Output	2, 8
Voltage Analog Output	2, 8
Combo Analog Inputs/Outputs	4/2

Temperature Control Module

A specialized temperature control module shall be available to accommodate applications where precise temperature control is needed.

The temperature control module shall support auto-tuning, closed looped PID control, and open looped manual control.

The temperature control module shall provide eight thermocouple inputs, 1 RTD input, and 8 PID-controlled output channels for controlling heaters.

The temperature control module shall provide alarms indications for each status zone, voltage failure, open or reversed thermocouple, compensation temperature error, high or low temperature, high or low temperature deviation, and open channel short circuit.

Motion Control

Specialized analog and digital motion control modules shall be available to perform 1 or 2 axes of closed or open loop servo control. These modules shall support encoder feedback with analog output for velocity command.

The positioning mode shall support linear and S curve acceleration and deceleration.

The modules shall provide user-defined control inputs and outputs for application such as torque follower and flying cut-off applications.

The modules must have user defined inputs and outputs, an English-language programming software, and automatic data transfer of data between PLC and axis positioning module with no user programming.

The positioning mode shall have a powerful instruction set, that includes absolute or incremental move, wait to move, dwell, conditional jump and subroutine functions.

The modules shall provide non-volatile program storage without the use of battery or super capacitor.

The follower mode shall provide either parallel or cascade operation from a single master.

The follower mode shall provide a selectable master source of encoder, analog, or internal time base.

The single axis module shall have a position loop update time of not more than 1 msec. The dual axis module shall have a position loop update time of not more than 2 msec. per axis.

High Speed Counter

A specialized high speed counter option module shall be available to accommodate applications where pulse input rates exceed the input capability of the PLC.

The high speed counter module shall provide direct processing of rapid pulse signals up to 80 KHz in frequency.

The high speed counter module shall be configurable as four independent counters counting either up or down, two independent bi-directional counters, or one counter that can calculate the difference between two changing count values.

Programmable Coprocessor Module

A specialized high-performance programmable microcomputer module having up to 640 KBytes of on-board CMOS battery-backed user memory shall be available to perform coprocessor functions.

The specialized coprocessor module shall be programmable with a powerful BASIC language interpreter or 'C' Language to perform data acquisition, data storage and retrieval, real time computing, and operator interface functions.

The specialized coprocessor module shall be capable of performing master/slave or peer-to-peer serial communication tasks in point to point or multidrop configurations utilizing a serial communication protocol.

The configurable module shall have two serial communication ports, one RS-232 and the other a selectable RS232 or RS-485. It shall have dual tasking capabilities, and shall be software configurable to behave as:

One serial communication port,

Two independent serial communication ports,

One serial communication port and one ASCII/BASIC application using one port, or

One ASCII/BASIC application using one or both ports.

Specialty I/O And Communications

Based on open architecture specifications of the vendor and explicit permission of the vendor, specialty module shall be available but not limited to PID, co-processor, and stepper.

Complete documentation, kits for building modules, and engineering resource shall be available for the 3rd party based on the type of development.

Peer/Peer Communications

A specialized option module shall be available that will allow the PLC to communicate on a token passing peer-to-peer, noise immune network providing high-speed transfer of control data.

The specialized communication module shall be configurable to broadcast data to and receive data from up to 31 other devices on a network automatically and repeatedly from a shared and dedicated database in RAM memory.

The communication medium for this specialized network shall be a high energy and noise immune single shielded twisted pair cable transmitting data at an adjustable rate of up to 153.6 Kbaud. The distance of the communication shall be up to 2286 m at a lower baud rate.

Master/Slave Communications

There shall be modules (such as a Modbus RTU protocol module as specified elsewhere in these special provisions) that allows the PLC to act as a master in a communication scheme that allows the PLC to interrogate other PLCs and devices for data.

PLC And CNC I/O Interface

The I/O Interface shall provide an interface between the PLC and a CNC, allowing a CNC to control 64 I/O points on the PLC.

Client/Server Interface

There shall be a module that provides CLIENT/SERVER with PEER to PEER communications over Ethernet TCPIP. The modular CPU system and special module shall support up to 16 simultaneous connections.

FSK Modem

The format of the FSK Modem shall be Standard RS233C with four-wire operation for long range up to 12.2 km. Mode of operation will be point-to-point of multi-drop. Data transmission speed shall be up to 9600 baud. Modulation shall be frequency shift key (FSK); carrier signal transformer and capacitively isolated. Interface shall be DTE/DCE jumper selectable; Female DB25 connector for RS232C; two position pluggable terminal block for carrier; 2.5 mm x 5.5mm barrel jack (center positive) for 24VDC. Power shall be from 21 to 28 VDC or 120VAC with wall mounted transformer. The FSK modem shall be designed for a temperature range from 0 to 60 °C and humidity of 0 to 95%, non-condensing. Enclosure shall be 16-gauge steel with mounting flanges.

Modbus RTU Master Modules

The RTU Master Modules shall support the Modbus protocol and shall be compatible with the CPU. The RTU Master Modules shall be flexible with both RS-232(direct) and RS-485 (multidrop) ports with the capability of simultaneous communications on up to two ports. The two Modbus/RTU channels provided shall be controlled by the CPU to access data from remote field devices. Each channel shall be individually programmed for dial in, dial out, radio, multi-drop (RS-485) and direct (RS-232) operation. Each channel shall be able to send or receive Analog or Discrete data using standard RTU commands (i.e. Read Coil). Multiple commands can be sent to each slave with each command requesting either single point or multiple continuous points up to 250 bytes. Data to be sent or stored shall be placed in the CPU reference data tables. The module shall function as a master and allow data to be read/written up to 32 slaves and support RTU mode (binary) and Modbus mode (ASCII). Port connections shall be made to a single 25-pin connector, with a pinout that provides RS-232 signals for port one, and RS-232 and RS-485 signals for port two. A "Y" cable that separates port one signals from port two shall be included. Three LEDs visible through the front of the module shall provide module status and port status. Report by exception shall be supported by the module provided.

INSTALLATION REQUIREMENTS

Four Remote Terminal Units (RTUs) shall be installed by Contractor. The RTU are to be installed and wired as shown on the plans.

The Contractor shall be responsible for making a complete, operational loop check of each circuit installed by the Contractor and connected to the input and output terminals of the RTU. Loop checks shall be performed by simulating a contact closure as necessary to prove the operation of each circuit. The complete functional check including the SCADA Master PLC and workstations shall be performed under different contracts.

10-3.17 ELECTRICAL EQUIPMENT

UTILITY AND LIGHTING PANELS

The utility and lighting panels shall conform to the following requirements and as shown on the plans:

A. The bus shall be copper.
B. Boxes shall be made from code gage galvanized steel.
C. The trim shall be made form code gage steel and painted ANSI 61 gray.
D. Doors 1200 mm or less shall have a single point lock. Doors over 1200 mm shall have a three point catch and lock.
E. The ground bar and neutral bar shall be standard, bolted in box.
F. The enclosure shall be NEMA Type 12. The top and bottom gutters shall be minimum 139 mm and the side gutters shall be 152 mm.

The Contractor shall install three-phase general purpose individually mounted panels, self-cooled, as specified herein and as shown on the plans. The panels and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of ANSI and NEMA.

Submittals

Submittal package shall consist of six copies. Submittals shall be delivered to the Engineer at least 180 days prior to the start of the installation. The Engineer shall be allowed 90 days for review of the submittals. The following information shall be submitted to the Engineer:

A. Dimension drawing and weight.
B. Technical certification sheet.
C. Transformer ratings.
D. Component ratings.

Qualifications

For the equipment specified herein, the manufacturer shall be ISO 9000, 9001 or 9002 certified. The manufacturer of this equipment shall have produced similar electrical equipment. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided.

Ratings

Voltage ratings shall be as shown on the plans. Units shall be designed for continuous operation at rated kVA, for 24 hours a day, 365 days a year operation, with normal life expectancy as defined in ANSI C57.96. Where applicable, transformer sound levels shall not exceed 45 dB for a 10 to 50 kVA rated self-cooled transformer as defined by ANSI and NEMA.

Construction

Each single-phase panel shall include a main primary breaker. Main primary and feeder breakers shall be enclosed with a padlock lockable hinged door.

Each three-phase to single-phase panel shall include a main breaker, step-down transformer breaker. Main primary, secondary and feeder breakers shall be enclosed with a padlock lockable hinged door.

Transformer

Transformers for the three-phase panels shall be insulated with a 185°C-insulation system. Required performance shall be obtained without exceeding the above-indicated temperature rise in a 40°C maximum ambient, with a 30°C average over 24 hours. All insulation materials shall be flame-retardant and shall not support combustion in conformance with the requirements in ASTM Designation D 635.

Transformer core shall be constructed with high-grade, non-aging, grain-oriented silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Maximum magnetic flux densities shall be substantially below the saturation point. The transformer core volume shall allow efficient transformer operation at 10 percent above the nominal tap voltage. The core laminations shall be tightly clamped and compressed. Coils shall be wound of electrical grade aluminum with continuous wound construction. The core and coil assembly shall be completely encapsulated in a proportioned mixture of resin and aggregate to provide a moisture-proof, shock-resistant seal. The core and coil encapsulation system shall minimize the sound level. The core of the transformer shall be grounded to the enclosure. The transformer shall include two 5 percent taps below nominal voltage.

Enclosure

The enclosure shall be made of heavy-gage steel and the maximum temperature of the enclosure shall not exceed 90°C. The enclosure shall be totally enclosed, non-ventilated, NEMA 3R, with lifting eyes. Panels shall be mounted in additional fiberglass enclosures as shown on the plans. Each panel to be mounted outside on the platforms shall be installed in a NEMA 4X fiberglass or stainless steel enclosure.

Circuit Breaker Type B

The circuit breaker Type B shall be a molded case circuit breaker providing complete circuit overcurrent protection by having inverse time and instantaneous tripping characteristics and shall be designed, manufactured, assembled and tested in accordance with UL 489 and NEMA AB-1 Standards. The frame rating and settings shall be as specified on the plans.

The molded case circuit breakers shall be operated by a toggle-type handle and shall have a quick-make, quick-break over-center switching mechanism that is mechanically trip free from the toggle handle so that the contacts cannot be held closed against short circuits and abnormal currents. All poles shall be so constructed that contacts open, close and trip simultaneously in the either ON or OFF position. All breaker covers shall have molded-in "ON" and "OFF" position.

The circuit breaker frames shall employ high strength, molded-polyester, glass-reinforced cases and covers. The breaker frame shall have legible, tamper-proof nameplates containing maximum frame ampere ratings, maximum voltage ratings and

interrupting ratings in accordance with UL standards. All breaker frames sizes shall have external means for manually tripping the breaker and exercising the mechanism and trip latch member.

The molded case circuit breakers shall have inverse time and instantaneous tripping characteristics. Automatic tripping of the breaker shall be clearly indicated by the handle position. Contacts shall be non-welding silver alloy and arc extinction shall be accomplished by means of arc chutes.

The circuit breaker rating shall be as specified on the plans and as required by the load and coordination studies.

Ground fault protection shall be provided where indicated. Shunt trips, bell alarms and auxiliary switches shall be provided.

DRY TYPE TRANSFORMER

The Contractor shall install three-phase general purpose individually mounted dry-type transformers of the two-winding type, self-cooled as specified herein, and as shown on the contract plans. The transformers and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of ANSI and NEMA.

Submittals

Submittal package shall consist of six copies. Submittals shall be delivered to the Engineer at least 180 days prior to the start of the installation. The Engineer shall be allowed 90 days for review of the submittals. The following information shall be submitted to the Engineer for review and approval:

A. Dimension drawing and weight.
B. Technical certification sheet.
C. Conduit entry and exit locations.

Qualifications

For the equipment specified herein, the manufacturer shall be ISO 9000, 9001 or 9002 certified. The manufacturer of this equipment shall have produced similar electrical equipment. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided. The transformers shall be suitable for and certified to meet all applicable seismic requirements of the California Building Code (CBC) for Zone 4 application.

Ratings

The transformer's kVA and voltage ratings shall be as shown on the plans.

Transformers shall be designed for continuous operation at rated kVA, for 24 hours a day, 365 days a year operation, with normal life expectancy as defined in ANSI C57.96. Transformer sound levels shall not exceed the following ANSI and NEMA levels for self-cooled ratings:

A. Up to 9 kVA less than 40 dB.
B. 10 to 50 kVA less than 45 dB.

Construction

Transformers shall be insulated as follows:

A. Rated 2 kVA and below: 150°C insulation system based upon 80°C rise.
B. Rated 3 to 15 kVA: 185°C insulation system based upon 115°C rise.
C. Rated 15 kVA and above: 220°C insulation system based upon 150°C rise. All insulation materials shall be flame-retardant and shall not support combustion in conformance with the requirements in ASTM Designation D 635. Transformer core shall be constructed with high-grade, non-aging, grain-oriented silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Maximum magnetic flux densities shall be substantially below the saturation point. The transformer core volume shall allow efficient transformer operation at 10 percent above the nominal tap voltage. The core laminations shall be tightly clamped and compressed. Coils shall be wound of electrical grade aluminum with continuous wound construction. On units rated 15 kVA and below the core and coil assembly shall be completely encapsulated in a proportioned mixture of resin and aggregate to provide a moisture-proof, shock-resistant seal. The core and coil encapsulation system shall minimize the sound level. The transformer shall include two 5 percent taps below nominal voltage.

Enclosure

The enclosure shall be made of heavy-gage steel. All transformers shall be equipped with a wiring compartment suitable for conduit entry and large enough to allow convenient wiring. The maximum temperature of the enclosure shall not exceed 90°C. The core of the transformer shall be grounded to the enclosure.

The transformer enclosures shall be general purpose ventilated type suitable for indoor service only. Enclosures shall be finished with ANSI 61 color.

SAFETY SWITCH

Submittal package shall consist of six copies. Submittals shall be delivered to the Engineer at least 180 days prior to the start of the installation. The Engineer shall be allowed 90 days for review of the submittals. The following information shall be submitted to the Engineer for review and approval:

A. Dimension drawing and weight.
B. Technical certification sheet.
C. Conduit entry and exit locations.

The safety switch shall be a heavy-duty low-voltage safety switch with the following requirements:

A. Rated for 600 VAC.
B. Terminals be copper-aluminum.
C. The enclosure shall be NEMA Type 4 enclosure.
D. A metal nameplate shall be mounted on the front cover that contains switch information (type, catalog number, electrical ratings V, A, and horsepower).
E. Handle whose position is easily recognizable and padlockable in the "Off" position.
F. Visible blades.
G. Reinforced fuse clips.
H. Nonteasible, positive, quick-make quick-break mechanisms.
I. Switch assembly plus operating handle as an integral part of the enclosure.
J. Switch shall be UL listed, horsepower rated, meet Federal Specification WS-885c, and NEMA Specifications KSI-1990.
K. Switch shall have defeatable door interlocks that prevent the door from opening when the operating handle is in the "ON" position.
L. Switch shall have line terminal shields.

10-3.18 STRONG MOTION DETECTION SYSTEM

The Contractor shall install the strong motion detection system in accordance with the details shown on the plans, and the provisions in "Concrete Structures," "Steel Structures," "Miscellaneous Metal" and "Clean and Paint Structural Steel" elsewhere in these special provisions.

GENERAL

Attention is directed to "Cooperation" and "Order of Work" of these special provisions.

Upon completion of installation at each seismic sensor enclosures and seismic recorder locations on the bridge and on pile caps, the California Division of Mines and Geology (CDMG) will install, test, and adjust the sensors and recorders of the seismic monitoring system.

System layouts shown on the plans are generally diagrammatic and location of equipment is approximate. Exact routing of conduits and other facilities and location of equipment is to be governed by structural conditions and other obstructions, and shall be coordinated with the work of other trades. Equipment requiring maintenance and inspection shall be located where it is readily accessible for the performance of such maintenance and inspection.

ORDER OF WORK

At each seismic sensor and recorder location, the sequence of work shall be as follows:

A. Construct the free field.
B. Mount the seismic sensor enclosures, seismic sensor cable junction boxes and the complete conduit system.
C. Pull all seismic cables (without any splices) from each seismic sensor enclosure to the respective seismic recorder location as shown on the plans.

D. Pull all interconnect cables (without any splices) from each seismic recorder location to the next seismic recorder locations as shown on the plans.
E. Ensure that electrical power and ISDN telephone service is present at each of the recorder locations.
F. Notify the Engineer 20 days in advance when California Division of Mines and Geology (CDMG) is to install and test their equipment as specified elsewhere in these special provisions.

COORDINATION WITH CALIFORNIA DIVISION OF MINES AND GEOLOGY

Access and Contractor Assistance

The Contractor shall provide CDMG personnel means and equipment to safely access and perform work at all recorder, sensor and antenna locations after all Contractor-installed equipment, conduit and cabling is completed. The Contractor's assistance shall include transportation of equipment on the job site, traffic control, and movement of stored materials or parked vehicles where necessary.

California Division of Mines Geology's Requirements

At recorder locations, CDMG will require the following:

A. Convenient access to the recorder housings prior to their installation for the purpose of preparing to mount the recorders into the housings.
B. Approximately three days access per recorder location to install and wire the recorders.
C. Access to each recorder location during the installation and testing of the sensors wired to that recorder.
D. Approximately three days access per recorder location during the final system testing and any necessary troubleshooting and repairs.

At normal sensor locations: CDMG will require approximately 30 minutes work time, excluding transit time, at each sensor location on a minimum of two occasions (installation and operational testing) to accomplish their work.

At pile-type downhole locations: CDMG will require approximately 1/2 day access for pile cap downhole package. In addition, access may be required to the pile cap downhole locations, during the two days required for wiring and testing the recorder.

MATERIAL

State-furnished Material

The following materials will be State-furnished (by CDMG to State) as provided under "Materials" of these special provisions:

A. Force Balance Accelerometer (FBA) pigtails.
B. Seismic sensor mounting plates.

State-furnished and Installed Material

The following materials will be furnished and installed by State (CDMG) forces:

A. Seismic sensors on bridge.
B. Seismic recorders.

Cables and Conductors

A. **Seismic Sensor Cable**: Seismic sensor cable, SSC, shall be four twisted pairs stranded tinned copper conductors, AWG No. 22 (7 x 30 strands), insulation 0.18 mm thick, individually shielded pairs with an aluminum polyester shield and AWG No. 22 stranded tinned copper drain wire for each pair, overall nominal outside diameter of 7.6 mm or less and outer jacket of 0.23 mm thick. Cable shall be instrument cable, NEC rated CLP2 plenum cable rated for 150°C. Cable shall be similar to Belden plenum cable, Catalog No. 87778 except with only four pairs and having a color code as specified below:

1st Pair	red, black
2nd Pair	white, brown
3rd Pair	blue, violet
4th Pair	yellow, orange

Seismic sensor cable shall be United Wire and Cable Co., Inc., Consolidated Wire and Cable, or equal. Cable spools shall be of sufficient length to allow cables to be installed without splices from the sensor enclosures to the recorder cabinets as shown on the plans.

B. **Telephone Cable**: Telephone cable shall be waterproof filled-sheath, ISDN rated cable with four twisted pairs, individually shielded stranded conductor, minimum AWG No. 22 tinned copper, polyethylene insulated, with a foil aluminum-polyester shield, and chrome PVC jacket rated for 300 V. Cable spools shall be of sufficient length to allow the cables to be installed without splices from telephone service point to the seismic recorders.

C. **Interconnect Cable**: Interconnect cable, IC, shall be EIA RS-485 applications cable, Plenum type, NEC rated CL2P for temperature of 150°C. Cable shall be similar to Belden cable No. 9844 but plenum rated. The cable shall have eight tinned-copper, insulated conductors (4 twisted pairs). Overall aluminum-polyester shield and 24 AWG stranded tinned copper drain wire. Overall tinned copper braid shield (90 percent coverage). Overall nominal O.D. of 8.9 mm or less, with outer jacket of 0.23 mm thick. Color code shall be as specified below:

1st Pair	White/Blue Stripe, Blue/White Stripe
2nd Pair	White/Orange Stripe, Orange/White Stripe
3rd Pair	White/Green Stripe, Green/White Stripe
4th Pair	White/Brown Stripe, Brown/White Stripe

Interconnect cable shall be United Wire and Cable Co., Inc., Consolidated Wire and Cable, or equal.

D. **Conductors**: Conductors shall conform to "Conductors and Wiring" specified elsewhere in these special provisions.

Electrical Boxes

A. **Seismic Sensor Enclosure and Cast Iron Box, Submersible (Enclosure Type No. 1)**: The enclosure and cover shall be cast iron, with the word "SEISMIC" cast into the cover. The enclosure shall withstand submersion in water to two-meter in depth for extended periods (6 hours) without any leakage. Cast mounting lugs shall be attached on two opposing sides, with a minimum of two lugs on each side. The enclosure shall have one each bossed, drilled and tapped (NPT) hole to accept a conduit connector centered between mounting lugs on one side only. The enclosure shall have one each mounting button drilled and tapped for 6.35 mm x 508 mm located in the center (±3.175 mm) of the inside bottom of the box. The enclosure finish shall be hot-dip galvanized.
The enclosure shall be equivalent to one of the following:

1. O-Z Gedney P/N YF-121206-SUB, with raised cast lettering "SEISMIC" in cover. One each mounting button P/N 1MBT installed in the center inside the bottom of the box. Mounting lugs P/N 4ML1816 attached. One each P/N BDT100 installed centered between mounting lugs on one side only.
2. Crouse Hinds P/N WCB121208-1-000G with mounting straps and raised cast lettering "SEISMIC" in cover. One each mounting pad, blind tapped for 6.35 mm x 508 mm installed in the center inside box. One each drilled and tapped (NPT) hole centered between mounting straps on one side only.

B. **Seismic Sensor Enclosure Stainless Steel Box with Hinged Cover (Enclosure Types 2-5)**: Enclosure to be NEMA Type 4X. Box to have padlock hasp installed of same material as enclosure. The backside of the enclosure must be a flush and smooth surface. Ground stud (6.35 mm x 508 mm) to be installed on inside lower right corner of door when viewed with door open and hinge on left side of box.
The enclosure shall be equivalent to the following: Circle AW P/N 14126-4XSCHC or Hoffman P/N A-1412CHNFSS6, without upper and lower mounting flanges, with #10-32 ground stud installed on inside lower right corner of the door (when viewed with door open and hinge on left side of box) and with padlock hasp similar to P/N A-PLKJIC in 316L stainless steel installed.
The watertight connectors shall be equivalent to Crouse Hinds P/N CGB397.

C. **Seismic Sensor Cable Junction Box**: Seismic sensor cable junction boxes shall be NEMA Type 4, 14-gage steel enclosure with lift-off cover of the size as shown on the plans. Finish shall be hot-dip galvanized. A nameplate with the inscription "Seismic Junction Box" shall be installed on the cover of each junction box.

No unused openings shall be left in any box. Two-piece knockout seals shall be installed as required to close openings.

Junction boxes shall be installed at the locations and elevations shown on the plans or specified herein. Adjustments to locations may be made as required by structural conditions and to suit coordination requirements of other trades.

TELEPHONE SERVICE

The permits, licenses and all charges required for the connection of the Integrated System Digital Network (ISDN) telephone service are included on the Skyway contract.

TESTING

After all the seismic sensors and recorders have been installed and connected by the CDMG, the seismic monitoring system shall be tested by the CDMG to insure that the system functions properly. The Contractor shall make necessary repairs and replacements at the Contractor's expense if the resource of the problem is determined to be part of the Contractor's scope of work.

After the seismic monitoring system installation work has been completed, the seismic monitoring system shall be tested in the presence of the Engineer to demonstrate that the seismic monitoring system functions properly. The Contractor shall make necessary repairs, replacements, adjustments and re-tests at the Contractor's expense.

SUBMITTALS

A list of materials and equipment to be installed, manufacturer's descriptive data, and such other data as may be requested by the Engineer shall be submitted for approval. The Engineer will require 3 weeks to review the submittal after a complete set has been received, as determined by the Engineer.

Manufacturer's descriptive data shall be submitted for the following:

A. Conduit – list by size and installation method.
B. Pull boxes – each type.
C. Seismic cable.
D. Interconnect cable.
E. Telephone cable.
F. Cable support.
G. Seismic sensor enclosures – each type.
H. Seismic sensor cable junction boxes – each type.
I. Downhole junction box.

Attention is directed to the provisions in Section 5-1.01, "Authority of the Engineer," of the Standard Specifications. The Engineer may request submittals for materials or products where submittals have not been specified in these special provisions, or may request that additional information be included in the specified submittals, as necessary to determine the quality or acceptability of such materials or products.

The submittals shall be delivered to the Office of Structure Design, Documents Unit, Fourth Floor, 1801 – 30th Street, Sacramento, California 94274-0001.

Each submission of drawings, materials lists, and descriptive data shall consist of at least five copies. Two copies will be returned to the Contractor either approved for use or returned for correction and re-submittal.

Each separate item submitted shall bear a descriptive title, the name of the project, district, county, and contract number. Plans and detailed drawings shall not be larger than 559 mm x 915 mm.

The material list shall be complete as to name of manufacturer, catalog number, size, capacity, finish, all pertinent ratings, and identification symbols used on the plans and in the special provisions for each unit.

Unapproved samples and samples not incorporated in the work shall be removed from State Right of Way, when directed by the Engineer.

10-3.19 ELECTRICAL UTILITIES REMOVAL

The electrical utilities removal work shall be performed in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Fifteen days in advance of any scheduled activity on electrical utilities removal, submit to the Engineer, a comprehensive work plan detailing description of each activity, sequence, duration, safety measures, resources allotted, and the like for approval by the Engineer.

EXECUTION

No work shall be performed on utilities removal until the work plan is approved by the Engineer.

The overhead power lines shall be de-energized by others. The Contractor shall notify the Engineer 48 hours in advance of requiring overhead power lines de-energized.

10-3.20 CLOSEOUT SUBMITTALS

Project record drawings shall be submitted in accordance with the requirements listed below.

One set of the project plans shall be kept on file by the Contractor for the sole purpose of recording as-built information and shall be so marked. Data to be recorded shall include, but not be limited to, all clarification and change orders, location of underground utilities, and changes in size, manufacture or location of features shown on the plans. In addition, the locations of significant items such as main filters, controls, isolating valves and similar items shall be highlighted on this set of as-built plans.

All corrections shall be made in red ink or red pencil. Superseded material shall be neatly lined out. Original figures shall not be eradicated nor written over. Each sheet shall be clearly marked as having "As-Built Changes" or "No As-Built Changes" as appropriate. The Contractor shall sign and date each sheet of the plans certifying that all information shown is correct.

Additional plans shall be submitted when as-built information cannot be clearly shown on existing plans. Supplemental plans for as-built information shall be not less than 279 mm x 432 mm in size and shall have the contract number on each plan.

Final location of all underground work shall be recorded by depth from finished grade and by offset distance from permanent surface structures, for example: buildings, curbs and walks. Equipment within the building and all concealed conduits shall be recorded by offset distances from building walls.

The Contractor shall periodically review the set of record drawings with the Engineer during the progress of the work to assure that all changes and other required information are being recorded.

Before completion of the work, the Contractor shall request a review of the as-built plans to determine completeness and adequacy. If the as-built plans are unacceptable, the Contractor shall inspect, measure and survey the project and record the required additional information.

The as-built plans shall be delivered to the Engineer prior to acceptance of the contract.

10-3.21 FIELD TESTING

Field testing shall be performed in the presence of the Engineer. The Contractor shall submit to Engineer at least 180 days prior to start of testing, methods and procedures thereby allowing the Engineer 90 days for a thorough review. The Contractor shall notify the Engineer five days prior to conducting tests. The Contractor shall furnish all materials, instruments, labor, and equipment necessary to conduct field tests. The Contractor shall perform all tests recommended by the manufacturer unless specifically waived by the Engineer. The Contractor shall perform acceptance tests of all installed electrical equipment in accordance with latest applicable ICEA, NETA and IEEE standards.

The tests shall include, but not be limited to, testing of equipment, field wiring, and circuit to circuit and system to system, to ensure the satisfactory operation of each system complete. Initiate moving parts and doors, including locks and latches. All units and components shall operate within the efficiency, repeatability, and accuracy limitations approved and shall in all respects conform to the plans, special provisions and approved submittals.

The Contractor shall maintain a written record of all tests performed which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results. All field test report shall be signed and dated by the Contractor.

The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in test vicinity. The Contractor shall replace any devices or equipment which are damaged due to improper procedures or handling.

10-3.22 PAYMENT

The contract lump sum prices paid for the following items shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in the listed items below, complete in place, including manuals, preparation and delivery of any and all proposals, plans, submittals, or other documents to the Engineer, warranty work or modifications, software or software changes, testing and training, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

A. Underground.
B. SAS Superstructure Roadway Westbound.
C. SAS Superstructure Girder Westbound.
D. SAS Superstructure Roadway Eastbound.
E. SAS Superstructure Girder Eastbound.
F. Tower and Suspension Cable.
G. Navigation and Aviation Warning Systems.
H. SCADA Remote Terminal Unit System.

I. Strong Motion Detection System.
J. Call Box System.
K. Electrical Utilities Removal.

The contract lump sum price paid for traffic operations system shall include full compensation for furnishing all labor, materials (except items covered by other bid items), tools, equipment, and incidentals, and for doing all the work involved in installing traffic operations system, complete in place, including all the manuals and testing, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract unit price paid for each of the following items shall include full compensation for furnishing all materials, tools, equipment, and incidentals, as shown on the plans, as specified in these special provisions, and as directed by the Engineer:

A. Camera with housing enclosure.
B. Pan and tilt unit.
C. Camera control unit.
D. Video transmitter duplex data.
E. Microwave vehicle detection sensor system.
F. Fiber optic data modems.
G. Fiber optic splice closure.

The contract price paid in meters for each of the following items shall include full compensation for furnishing the materials as shown on the plans, as specified in these special provisions, and as directed by the Engineer:

A. 72 singlemode fiber optic cable.
B. 12 singlemode fiber optic cable.

SECTION 10-4. MECHANICAL

10-4.01 MECHANICAL WORK

PART 1.- GENERAL

Scope

Mechanical work shall consist of performing mechanical work in accordance with the details shown on the plans and these special provisions. Mechanical work shall include all such work for the City and County of San Francisco (CCSF) water mains and sewage force main, domestic water piping and compressed air for Caltrans bridge maintenance.

Mechanical work shall include furnishing all labor, materials, equipment and services required for providing piping systems.

Earthwork, foundations, sheet metal, painting, electrical, and such other work incidental and necessary to the proper installation and operation of the mechanical work shall be in accordance with the requirements specified for similar type work elsewhere in these special provisions.

System layouts are generally diagrammatic and location of equipment is approximate. Exact routing of pipes, ducts, etc., and location of equipment is to be governed by structural conditions and obstructions. Equipment requiring maintenance and inspection is to be readily accessible.

SUBMITTALS

Product Data

A list of materials and equipment to be installed, manufacturer's descriptive data, and such other data as specified herein shall be submitted for approval.

Manufacturer's descriptive data shall include complete description, performance data and installation instructions for the materials and equipment specified herein. Control and wiring diagrams, rough-in dimensions for plumbing fixtures, and component layout shall be included where applicable.

Manufacturer's descriptive data shall be submitted for the following:

A. All piping materials, components, and associated appurtenances
B. Booster Pump Station

CLOSEOUT SUBMITTALS

Operation and Maintenance Manuals

Prior to the completion of the contract, 3 identified copies of the operation and maintenance instructions with parts lists for the equipment specified herein shall be delivered to the Engineer at the jobsite. The instructions and parts lists shall be indexed and bound in a manual form and shall be complete and adequate for the equipment installed. Inadequate or incomplete material shall be returned. The Contractor shall resubmit adequate and complete manuals at no expense to the State.

Operation and maintenance manuals shall be submitted for the following equipment:

A. Booster Pump Station
B. Vacuum Relief Valves
C. Moisture Traps

QUALITY ASSURANCE

Working Drawings

The Contractor shall submit complete working drawings.

Working drawings shall be submitted as described elsewhere in these specifications. The working drawings shall be supplemented by manufacturer's descriptive data, performance data, and installation instructions for the following:

A. Pipe
B. Valves
C. Air outlets
D. Hose and Fittings
E. Couplings
F. Supports
G. In-line Components

For initial review, 5 sets of drawings shall be submitted. After review, 6 sets shall be submitted to the said Office for final approval and use during construction.

Project Record Drawings

Project record drawings shall be submitted in accordance with the requirements of these special provisions.

As the work progresses, the Contractor shall maintain a record of all deviations in the work from that shown on the plans.

One set of the project plans shall be kept on file by the Contractor for the sole purpose of recording as-built information and shall be so marked. Data to be recorded shall include, but not limited to, all clarifications and change orders, location of underground utilities, and changes in size, manufacture or location of features shown on the plans. In addition, the locations of significant items shall be highlighted on this set of project record drawings.

All corrections shall be made in red ink or red pencil. Superceded material shall be neatly lined out. Original figures shall not be eradicated nor written over. Each sheet shall be clearly marked as having "As-Built Changes" or "No As-Built Changes", as appropriate. The Contractor shall sign and date each sheet of the plans certifying that all information shown is correct.

The Contractor shall periodically review the set of record drawings with the Engineer during the progress of the work to assure that all changes and other required information are being recorded.

Before completion of the work, the Contractor shall request a review of the record drawings to determine completeness and adequacy. If the record drawings are unacceptable, the Contractor shall inspect, measure and survey the project and record the required additional information.

The record set of plans shall be delivered to the Engineer prior to acceptance of the contract.

Codes and Standards

Mechanical work, including equipment, materials and installation, shall conform to the California Building Standards Code, Title 24, and to the California Code of Regulations, Title 8, Chapter 4, Division of Industrial Safety (DIS).

WARRANTY

Warranties and Guarantees

Manufacturer's warranties and guarantees for materials or equipment used in the work shall be delivered to the Engineer at the jobsite prior to acceptance of the contract.

SYSTEM IDENTIFICATION

Piping, Ducts, Valves and Equipment

Identification of piping, ducts, valves and equipment shall be as shown on the plans or these special provisions:

Above Ground Piping and Ducts

Markers shall be provided on lines which are either exposed or concealed in accessible spaces. For piping systems, except drain and vent lines, indicate the fluid conveyed or its abbreviation; either by preprinted markers or stenciled markings, and include arrows to show the direction of flow. To assure secure attachment of adhesive type pipe markers, circumferential taping shall be applied to strap the pipe marker to the pipe, insulation, etc. Colors of the strapping tape shall be the same as the pipe marker background color. Colors shall comply with ANSI/ASME Standard: A13.1. Locate markers at ends of lines, near major branches and other interruptions including equipment in the line, where lines pass through penetrations in floors, walls or ceilings or otherwise pass into inaccessible spaces, and at 20 meter maximum intervals along exposed portions of the lines. Marking of short branches and repetitive branches for equipment connections is not required.

Valves

Valve tags shall be provided on all valves of each piping system, excluding check valves, valves within equipment, faucets, stops and shut-off valves at fixtures and other repetitive terminal units. Provide brass or plastic laminate tags. Prepare and submit a tagged valve schedule, listing each valve by tag number, location and piping service. Valve schedule shall be mounted in a glazed frame at a location approved by the Engineer.

Equipment.--All equipment shall be identified with a plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (for example, AC-4). Provide 13 mm high lettering, white on black background. Nameplates shall be permanently secured to the unit.

PART 2.- PRODUCTS (Not Applicable)

PART 3.- EXECUTION (Not Applicable)

MEASUREMENT AND PAYEMENT

Measurement and payment provisions for Mechanical work are specified in each section of these special provisions.

10-4.02 PIPE, FITTINGS AND VALVES

PART 1.- GENERAL

SUMMARY

Scope

Pipe, fittings and valves shall consist of furnishing and installing pipes, fittings and valves in accordance with the details shown on the plans and these special provisions. Pipe, fittings and valves shall include such piping accessories and appurtenances, not mentioned, that are required for the proper installation and operation of the piping systems.

Pipe, fittings, and valves for the following system shall be routed as indicated on the plans and specified in these special provisions:

A. Domestic Water and Compressed Air for Bridge Maintenance

The pipe sizes shown on the plans are nominal pipe size (NPS). No change in the pipe size shown on the plans shall be permitted without written permission from the Engineer.

The pipe and fitting classes and material descriptions shall be as specified herein. No change in class or description shall be permitted without written permission from the Engineer.

QUALITY ASSURANCE

Codes and Standards

Pipe, fittings and valves shall be installed in accordance with the requirements in the latest edition of the Uniform Plumbing Code, ANSI/ASME B31.3, the manufacturer's recommendations and the requirements specified herein.

PART 2.- PRODUCTS

MATERIALS,

PIPE AND FITTINGS

Class Description

Black steel pipe conforming to ASTM Designation: A 53 grade B. NPS 2 and smaller shall be extra strong pipe with 20 700 kPa WOG socket welding fittings and couplings, ASTM Designation: A 105. NPS 2 ½ and larger shall be standard weight pipe with standard weight butt welding fittings and couplings, ASTM Designation: A234 Gr WPB.

For full size branches use Tee; for reducing branches use sockolets unless indicated otherwise.

Grooved Mechanical Couplings

Mechanical pipe couplings shall be self-centering and shall engage and lock in place the grooved pipe and pipe fittings in a positive, airtight couple. Couplings shall be capable of minimum 3 degree angular deflection from centerline.

Coupling housing clamps shall be fabricated in 2 or more parts of malleable iron castings conforming to the specifications in ASTM Designation: A47, Grade 32510. Housing clamps shall hold in place a molded synthetic rubber composition air sealing gasket designed so that internal pressure serves to increase the seal's air tightness. Couplings shall be coated with a rust inhibiting vinyl alkyd enamel coating.

The coupling assembly shall be securely held together by 2 or more trackhead, square or oval neck, steel bolts. Bolts and nuts shall be heat treated carbon steel and shall be in accordance with the specifications in ASTM Designation: A 183. Couplings shall be rated for a working pressure of 6890 kPa. Couplings shall be Gruvlok Fig. 7001 or approved equal.

Hinged Flex Joint

Joints shall be hinged type, allowing angular movement of plus or minus 20 degrees in a single plane and operate by angulation of bellows. Bellows shall consist of multiple convolutions of type 304 stainless steel, be rated for pressure of 1034 kPa and temperature of 93° C. Joints shall be flange by flange. Flanges and hinge mechanism shall be carbon steel. Hinged flex joints for compressed air service shall incorporate permanently attached internal linters of the same material as the bellows. Joints shall be U.S. Bellows, Metraflex, Flexatherm or approved equal.

Manufactured Expansion Loop for Compressed Air and Water

Provide flexible expansion loops of size noted on drawings. The loop shall consist of flexible sections series 300 SS hose and braid, and two steel end nipples with cut grooves for groove-couplings and gaskets. Loops shall be installed in a neutral condition unless noted otherwise.

Install loop within four pipe diameters, both upstream and downstream, from a pipe guide or anchor. Loop shall be Metaflex, Metraloop or equal.

Hose (for maintenance lines)

Hose shall be rated by manufacturer for severe service, minimum working pressure 2750 kPa and temperature range of -29°C to 82°C. Inside diameter to match piping.

Hose shall be constructed of a flame resistant Hypalon cover designed to withstand weather, abrasion and chemicals, two braids of wire reinforcement and a neoprene tube.

Ground Joint Hose Coupling

Coupling shall be malleable iron ground joint type suitable for compressed air service. The spud half of coupling shall feature a machined recess holding a beveled polymer insert and come complete with malleable iron wing nut cap and chain. Coupling shall be Dixon EZ Boss #GB28 or approved equal.

Twist Lock Hose Coupling

Coupling shall be brass, female NPT type with rubber washer and be rated to minimum pressure 758 kPa. Coupling shall be Dixon AB or approved equal.

Unions (for steel pipe)

Unions (for steel pipe) shall be 1730 kPa, threaded malleable iron, ground joint, brass to iron seat, galvanized or black to match piping.

Unions (for copper or brass pipe)

Unions (for copper or brass pipe) shall be 1040 kPa cast bronze, ground joint, bronze to bronze seat with silver brazing threadless ends or 860 kPa cast brass, ground joint, brass to brass seat with threaded ends.

Dielectric waterway

Dielectric waterway shall be a premanufactured unit that incorporates an insulated interior lining at least 75 mm in length between the 2 pipes being connected while maintaining metal to metal contact on the exterior surface. Dielectric water way shall be listed by IAPMO (International Association of Plumbing and Mechanical Officials).

Insulating union

Insulating union or flange as applicable shall be suitable for the service on which used. Connections shall be constructed such that the 2 pipes being connected are completely insulated from each other with no metal to metal contact. Insulating couplings shall not be used. Insulating union shall be F. H. Maloney; Central Plastics; EPCO; or equal.

VALVES

Gate Valve (NPS 2 ½ and Smaller)

Gate valve (NPS 2 ½ and smaller) shall be bronze body and trim, removable bonnet and non rising stem, Class 125 and same size as pipe in which installed. Valves downstream of booster pump shall be class 250. Gate valve shall be Crane, 438; Nibco Scott, T-113; Jenkins, 370; or equal.

Gate valve in nonferrous water piping systems may be solder joint type with bronze body and trim. Valve shall be Kitz, 59; Nibco Scott, S-113; Jenkins, 1240; or equal.

Gate Valve (NPS 3 and Larger, Above Ground)

Gate valve (NPS 3 and larger, above ground) shall be iron body with bronze trim, removable bonnet and non-rising stem, class 125 and same size as pipe in which installed. Gate valve shall be Crane, 461; Nibco Scott, F-619; Jenkins, 326; or equal.

Ball Valve

Ball valve for water and air service shall be two piece, minimum 2760 kPa WOG, bronze body with hard chrome plated brass ball and reinforced Teflon seat. Valve shall be Nibco Scott, T-580; Watts, B-6000; Kitz, 56; or equal.

Check Valve (NPS 1 ½ and Smaller)

Check valve shall be silent spring loaded type, threaded bronze body, nylon or teflon disc, beryllium or stainless steel helical spring and shaft, Class 125 and same size as pipe in which installed. Check valve shall be Nibco/Scott, T-480; CPV, 36; Kitz, 26; or equal.

Check Valve (NPS 2 and Larger)

Check valve shall be silent wafer type, full faced for installation between 860 kPa flanges, iron body with bronze trim, nylon or teflon disc, stainless steel helical spring and shaft, Class 125 and same size as pipe in which installed. Valves downstream of booster pump shall be class 250. Check valve shall be APCO, Series 300; CPV, 10D; Metraflex, Series 900; or equal.

Pressure Reducing Valve (PRV)

Pressure reducing valve (PRV) shall be direct acting, spring loaded diaphragm type control valve with balanced single seat, bronze body, bronze trim and screwed connection. PRV shall be completely self-contained and shall require no external sending pipes or outside control medium. The outlet pressure of the PRV shall be adjustable within a range of 170 kPa to 400 kPa. Valve shall be rated for inlet pressure of 1700 kPa.

Butterfly Valve (NPS 2 ½ & Larger)

Butterfly valve shall be lever operated, lug type, bi-directional, with bubble tight shutoff and be rated at 1200 kPa. Valve shall feature ductile iron body, 316 stainless steel disc, 17-4 PH stainless steel stem and EPDM seat.

MISCELLANEOUS ITEMS

Water Hammer Arrestor

Water hammer arrestor shall be stainless steel body with bellows or piston. Arrestor compression chambers shall be pneumatically charged. Water hammer arrestors shall be tested and certified in accordance with the Plumbing and Drainage Institute Standard: PDI-WH201 and sized as shown on the plans.

Access Door

Access door shall be 1.52 mm prime coated steel, face mounting square frame, minimum 300 mm x 300 mm door with concealed hinge and screwdriver latch.

Link Type Penetration Seal

The pipe to wall penetration closures shall be a modular mechanical type consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between pipe and wall opening. Once expanded, the seal shall provide a watertight seal between pipe and wall. Pressure end plates shall be manufactured of glass reinforced plastic with a tensile strength of 186 mPa.

Automatic Moisture Trap

Trap shall be inverted bucket type, screwed connection, ASTM-A 48 Class 30 Cast Iron body, suitable for working pressure to 1720 kPa. Drain valve Trap shall be Armstrong Model 811 or equal.

Air Release Valve

Valve shall be free floating lever type designed to provide automatic positive venting of accumulated air from water piping. Valve shall be sized for 54 L/s discharge and be rated for 34 bar at 38 degree Celsius. Valve body, cap, float, seat and all working parts shall be stainless steel.

Pressure Gages (for PRV)

Pressure gages (for PRV) shall have 0 to 700 kPa scale with 80 mm minimum diameter dial. Gages shall be installed within 150 mm of the inlet and outlet sides of the pressure reducing valve. Pressure gages shall be provided with a brass gage cock.

Wye Strainer

Wye strainer shall be wye pattern, cast iron body and Type 304 stainless steel or monel strainer screen. The strainer screen shall have an open area equal to at least 3 times the cross sectional area of the pipe in which it is installed and shall be woven wire fabric with 20 mesh or perforated sheet with 850 micron maximum diameter holes.

Pipe Hanger (for Piping Supported from Overhead)

Pipe hanger (for piping supported from overhead) shall be Grinnell, Model 269; Super Struct, C711; or equal.

Pipe Wrapping Tape and Primer

Pipe wrapping tape shall be pressure sensitive polyvinyl chloride or pressure sensitive polyethylene tape having nominal thickness of 0.50 mm. Wrapping tape shall be Polyken, 922; Manville, Trantex VID-20; Scotchrap, 51; or equal.

Pipe wrapping primer shall be compatible with the pipe wrapping tape used.

PART 3 – EXECUTION

INSTALLATION

INSTALLATION OF PIPES AND FITTINGS

Pipe and Fittings

Pipe and fittings shall be installed in accordance with the following designated uses:

Designated Use	Pipe and Fitting Class
Domestic water	B3
Compressed air	B3"

Installing Piping

Piping shall be installed generally level, free of traps and bends, and arranged to conform to the building requirements. Long radius elbows shall be used wherever possible.

Piping installed underground shall be tested before backfilling, as specified in these special provisions.

Piping shall be installed parallel to walls. All obstructions shall be cleared, headroom preserved and openings and passageways kept clear whether shown or not. Piping shall not interfere with other work.

Where pipes pass through exterior walls, a clear space around pipe shall be provided. Space shall be caulked water tight with silicone caulk.

Underground copper pipe shall have brazed joints. Underground plastic pipe shall be buried with No. 14 solid bare copper wire. Wire ends at pipe ends shall be brought up 200 mm and looped around pipe.

Compressed air piping shall be pitched to low point. Branches shall be taken off top of main, unless noted otherwise.

Welding Pipe

Welding for carbon steel pipe shall be in accordance with ANSI B31.3. Welding for structural steel pipe supports and accessories shall be in accordance with AWS D1.1. Quality control for all welding shall be in accordance with "Welding Quality Control" in these special provisions.

Pipe sleeves

The Contractor shall provide sleeves, inserts and openings necessary for the installation of pipe, fittings and valves. Damage to surrounding surfaces shall be patched to match existing.

PVC pipe sleeves shall be provided where each pipe passes through concrete floors, footings, walls or ceilings. Inside diameter of sleeves shall be at least 20 mm larger than outside diameter of pipe. Sleeves shall be installed to provide at least 10 mm space all around pipe the full depth of concrete. Space between pipes and pipe sleeves shall be caulked watertight.

Inspection

Inspection and NDE shall be in accordance with "Welding Quality Control" elsewhere in these special provisions. Welds shall be visually inspected by the Contractor.

Cutting pipe

All pipe shall be cut straight and true and the ends shall be reamed to the full inside diameter of the pipe after cutting.

Damaged pipe

Pipe that is cracked, bent or otherwise damaged shall be removed from the work.

Pipe joints and Connections

Joints in threaded steel pipe shall be made with teflon tape or a pipe joint compound that is nonhardening and noncorrosive, placed on the pipe and not in the fittings.

The use of thread cement or caulking on threaded joints will not be permitted. Threaded joints shall be made tight. Long screw or other packed joints will not be permitted. Any leaky joints shall be remade with new material.

Exposed polished or enameled connections to fixtures or equipment shall be made with special care, showing no tool marks or threads.

Cleaning and Closing Pipe

The interior of all pipe shall be cleaned before installation. All openings shall be capped or plugged as soon as the pipe is installed to prevent the entrance of any materials. The caps or plugs shall remain in place until their removal is necessary for completion of the installation.

Securing Pipe

Pipe in the buildings shall be held in place by iron hangers, supports, pipe rests, anchors, sway braces, guides or other special hangers. Material for hangers and supports shall be compatible with the piping or neoprene isolators shall be used. Allowances shall be made for expansion and contraction. Steel pipe shall have hangers or supports every 3 m. Copper pipe 25 mm or smaller shall have hangers or supports every 2 m and sizes larger than 25 mm shall have hangers or supports every 3 m. Plastic pipe shall have hangers or supports every 1 m. Cast iron soil pipe with neoprene gaskets shall be supported at each joint. Vertical pipes shall be supported with clamps or straps. Horizontal and vertical piping shall be securely supported and braced to prevent swaying, sagging or flexing of joints.

Flushing

Flush all water piping systems clean of dirt and foreign material following completion of the hydrostatic and leakage test. Flushing shall consist of running clean fresh water through the piping system at a velocity sufficient to keep the pipe filled and remove materials from the line.

Such flow shall continue until in the opinion of the Engineer the line is discharging only clean water.

Provide all equipment, and supplies for performing the work, and waste the water at locations or by procedures approved by the Engineer.

Air Blowing

Air blow all compressed air piping systems clean of dirt and foreign materials following completion of leakage tests. Air used shall be from a source approved by the Engineer.

Lines shall be blown using clean, dry, oil free air at a sufficient velocity to loosen all foreign materials until, in the opinion of the Engineer, the discharge is free from foreign materials.

Painting

All exposed surfaces of carbon steel piping, components, supports and appurtenances shall be painted in accordance with requirements for structural steel bridge members. Color to match bridge color.

Hangers and Supports

Locate pipe supports as indicated in the plans. Unless stated otherwise, use ASTM A36 for fabrication of pipe supports and ASTM A325 heavy hex head bolts with hardened washers and heavy hex nuts for bolted connections; use hot-dip galvanized nuts, bolts and washers for galvanized supports. Pipe supports shall be fabricated and installed according to MSS SP-58 and SP-69.

Dimensions and elevations for supports are the responsibility of the Contractor and should be confirmed in the field prior to fabrication and installation.

Hangers and supports for field routed piping shall be selected to withstand all conditions of loading to which the piping and associated equipment may be subjected and within the manufacturer's load ratings. Hangers and supports shall be spaced and distributed so as to avoid load concentrations and to minimize the loading effect on the building structure.

Hangers and supports shall be sized to fit the outside diameter of pipe or pipe insulation. Hangers shall be removable from around pipe and shall have provisions for vertical adjustment after erection. Turnbuckles may be used.

Materials for holding pipe in place shall be compatible with piping material.

Hanger rods shall be provided with locknuts at all threaded connections. Hanger rods shall be sized as follows:

Wrapping and Coating Steel Pipe

Steel pipe buried in the ground shall be wrapped or shall be plastic coated as specified herein:

1. Wrapped steel pipe shall be thoroughly cleaned and primed as recommended by the tape manufacturer.
2. Tapes shall be tightly applied with 1/2 uniform lap, free from wrinkles and voids with approved wrapping machines and experienced operators to provide not less than 1.00 mm thickness.
3. Plastic coating on steel pipe shall be factory applied. Coating imperfections and damage shall be repaired to the satisfaction of the Engineer.
4. Field joints, fittings and valves for wrapped and plastic coated steel pipe shall be covered to provide continuous protection by puttying and double wrapping with 0.50 mm thick tape. Wrapping at joints shall extend a minimum of 150 mm over the adjacent pipe covering. Width of tape for wrapping fittings shall not exceed 50 mm. Adequate tension shall be applied so tape will conform closely to contours of fittings. Putty tape insulation compounds approved by the Engineer shall be used to fill voids and provide a smooth even surface for the application of the tape wrap.

Wrapped or coated pipe, fittings, and filed joints shall be approved by the Engineer after assembly. Piping shall be placed on temporary blocks to allow for inspection. Deficiencies shall be repaired to the satisfaction of the Engineer before backfilling or closing in.

Plastic pipe underground shall be provided with thrust blocks and clamps at changes in direction of piping, connections or branches from mains NPS 2 and larger, and all capped connections.

Each coated and wrapped pipe section shall be electrically tested for flaws in the coating by means of a suitable holiday detector approved by the Engineer. The electrical inspection shall be in accordance with the requirements of NACE RP-02074, "High Voltage Electrical Inspection of Pipeline Coatings Prior to Installation." The detector shall impress a minimum of the approved dielectric strength voltage for the layer being tested. The electrical inspection shall take place on the first

layer of tape before any subsequent layers are applied. If a holiday is detected, it shall be repaired according to approved field application procedures.

Union

Unions shall be installed where shown and at each threaded or soldered connection to equipment and tanks. Unions shall be located so piping can be easily disconnected for removal of equipment or tanks. Unions shall be omitted at compression stops.

Dielectric waterway

Dielectric waterway shall be provided between metal pipes of different material, and between brass or bronze valves and steel piping.

Insulating Union and Insulating Connection

Insulating union and insulating connection shall be provided where shown and at the following locations:

1. In metallic water, and air service connections. Insulating connections shall be installed on the exterior of the building, above ground and after shut-off valve.
2. In water, and air service connections in ground at point where new metallic pipes connect to existing metallic pipes. Install valve box above insulating connection.
3. At points of connections of copper or steel water pipes to steel domestic water heaters and tanks.
4. At each end of buried ferrous pipe protected by cathodic protection.

Bonding at Insulating Connections

Interior water piping and other interior piping that may be electrically energized and are connected with insulating connections shall be bonded in accordance with the National Electrical Code. Bonding shall all be coordinated with electrical work.

INSTALLATION OF VALVES

Pressure Reducing Valve

A capped tee connection and strainer shall be installed ahead of the pressure reducing valve.

Exterior Valves

Exterior valves located underground shall be installed in a valve box marked "Water." Extensions shall be provided as required.

INSTALLATION OF MISCELLANEOUS ITEMS

Water Hammer Arrestor

Water hammer arrestor shall be installed so that they are vertical and accessible for replacement. Water hammer arrestor shall be installed with access door when in walls or there is no access to ceiling crawl spaces. Access door location shall be where shown on the plans or as approved by the Engineer.

Flushing Completed Systems

All completed systems shall be flushed and blown out.

Chlorination

All domestic water piping and facilities shall be flushed and chlorinated by disinfecting solutions.

Calcium hypochlorite granules or tablets, if used, shall not be applied in the dry form, but shall first be dissolved into a solution before application.

The Contractor shall take adequate precautions in handling chlorine so as not to endanger workmen or damage materials. All pipes and fittings shall be completely filled with water containing a minimum of 50 ppm available chlorine. Each outlet in the system shall be opened and water run to waste until a strong chlorine test is obtained. The line shall then be closed and the chlorine solution allowed to remain in the system for a minimum of 24 hours so that the line shall contain no less than 25 ppm chlorine throughout. After the retention period, the system shall be drained, flushed and refilled with fresh water.

FIELD QUALITY CONTROL

Testing

The Contractor shall test piping at completion of roughing in, before backfilling, and at other times as directed by the Engineer.

The system shall be tested as a single unit, or in sections as approved by the Engineer. The Contractor shall furnish necessary materials, test pumps, instruments and labor and notify the Engineer at least 3 days in advance of testing. After testing, the Contractor shall repair all leaks and retest to determine that leaks have been stopped. Surplus water shall be disposed of after testing as directed by the Engineer.

The Contractor shall take precautions to prevent joints from drawing while pipes and appurtenances are being tested. The Contractor shall repair damage to pipes and appurtenances or to other structures resulting from or caused by tests.

General Tests

All piping shall be tested after assembly and prior to backfill, pipe wrapping, connecting fixtures, wrapping joints and covering the pipe. Systems shall show no loss in pressure or visible leaks.

The Contractor shall test water piping systems according to the following test schedule and in accordance with Section 20-5.03H, "Pressure Testing," of the Standard Specifications:

Test Schedule		
Piping System	Test Pressure	Test Media
Water	1550 kPa	Water
Air	1035 kPa	Air

During testing of water systems, valves shall be closed and pipeline filled with water. Provisions shall be made for release of air.

The Contractor shall test compressed air piping according to the test schedule and according to the following procedure:

A. The section of piping to be tested shall be sealed and compressed air shall be slowly introduced into the system. Pressure shall be raised to preliminary test pressure not greater than 175 kPa to locate major leaks. After leaks detectable at this preliminary test pressure have been corrected, the pressure shall be slowly raised in steps, each not greater than 175 kPa until specified test pressure is attained. Pressure shall be held at each step for a minimum of 10 minutes to allow for detection of defects. After full specified pneumatic test pressure has been attained, each joint, valve packing, and other potential leak points shall be soap tested for air leaks, and such leaks shall be corrected.

MEASUREMENT AND PAYMENT

Domestic water pipe and compressed air pipe will be measured and paid for per meter in the same manner specified for galvanized steel pipe and plastic pipe in Section 20-5.04, "Measurement," and Section 20-5.05, "Payment," of the Standard Specifications.

Full compensation for furnishing and installing valves, drains, steel brackets, and other fittings, hose, hose couplings, dirt stops, pipe supports, testing and checking, pipe wrapping tape, epoxy adhesives, and seismic expansion assemblies, shall be considered as included in the contract prices paid per meter for the types of line involved and no additional compensation will be allowed therefor.

10-4.03 CCSF WATER MAINS AND SEWAGE FORCE MAIN

CCSF water main and sewage force main shall consist of furnishing and installing pipes, fittings, and valves in accordance with the details shown on the plans and these special provisions. Pipe, fittings, and valves shall include such piping accessories and appurtenances, not mentioned, that are required for the proper installation and operation of the piping systems.

Pipe, fittings and valves for the following systems shall be routed as indicated on the plans and specified in these special provisions:

CCSF Water Main
CCSF Sewer Force Main
CCSF Reclaim Water Main

MATERIALS

Pipe and Fittings for Line 4 NPS or Greater

Pipes and fittings for piping 4 NPS or greater shall be ductile iron.

Ductile iron pipe shall be restrained, push-on joint pipe conforming to ANSI/AWWA C151/A21.51.

Ductile iron pipe shall be furnished in either 5.5 or 6.1-meter lengths.

Restrained push-on joints for ductile iron pipe shall conform to ANSI/AWWA C111/A21.11. The joints shall be boltless, non-compression, non-threaded with synthetic rubber gasket seals and have a positive-locking device to keep the connection from separating. The pipe joints shall be designed for a working pressure of 2,413 Kpa and be capable of deflecting after assembly. Fittings and flanges for ductile iron pipe shall conform to ANSI/AWWA C110/A21.10, except for the manufacturer's proprietary design dimensions for restrained push-on joint pipe.

Ductile iron pipe and fittings shall have cement mortar lining and seal coating conforming to ANSI/AWWA C104/A21.4. Pipe shall have a bituminous outside coating conforming to ANSI/AWWA C151/A21.51, and fittings shall have a bituminous outside coating conforming to ANSI/AWWA C110/A21.10.

Sleeve-type Expansion Assembly for Piping 4 NPS or Greater

Sleeve-type expansion assembly for lines of 4 NPS or greater shall consist of a sleeve-type expansion joint and an integral ball joint at each end with insulated flange connections to piping. Expansion joint shall be manufactured of ductile iron and conform to the requirements of ANSI/AWWA C153/A21.53. Expansion joint for pipe sizes 24 NPS and smaller shall be pressure rated to a minimum of 2413 KPa, and expansion assembly for pipe sizes greater than 24 NPS shall be rated at a minimum of 1,723 KPa. Seismic expansion assembly shall be capable of deflecting and expanding simultaneously to an amount of not less than a 15 degree deflection at each end of the unit and a total of 200 mm axial movement.

Expansion joint shall be lined with a minimum of 15 mils of fusion-bonded epoxy conforming to the requirements of ANSI/AWWA C213, and shall be holiday tested with a 1,500-volt spark test conforming to the requirements of ANSI/AWWA C213.

Flexible Ball Joint

Flexible ball joints shall be installed in the locations indicated on the drawings and shall be manufactured of ductile iron conforming to the material properties of ANSI/AWWA C153/A21.53. Flexible joints shall consist of a ball and socket type joint capable of 20- degree minimum deflection. Each flexible ball joint shall be pressure tested against its own restraint to a minimum of 2,413 KPa. Joint shall be flange by flange.

All pressure-containing parts shall be lined with a minimum of 15 mils of fusion-bonded epoxy, conforming to the applicable requirements of ANSI/AWWA C213, and shall be tested with a 1,500-volt spark test conforming to said specification. All flexible ball joints shall be FLEX 900 as manufactured by EBAA IRON, Inc., or approved equal.

Manufactured Expansion Loop

Provide flexible expansion loops of size noted on drawings. Flexible loops shall be designed to impart no thrust loads on the anchors. The loop shall consist of two flexible sections of series 300 SS hose and braid, two 90 degree elbows, and a 180 degree return. Loops used for sewer service shall have an interlocked liner. Loops shall be installed in a neutral condition unless noted otherwise.

Loops installed hanging down shall have a drain plug. Loops installed straight up may be fitted with an automatic air release valve to purge air from the high point of the loop. Loops installed in any position other than hanging down must have the 180 degree return supported. Install loop within four pipe diameters, both upstream and downstream, from a pipe guide or anchor. Loop shall be Metaflex, Metraloop or equal.

Pipe Wrapping Tape

Wrapping tapes for pipe shall be a pressure-sensitive polyvinyl chloride or polyethylene tape having thickness of 50 mils, minimum.

Pipe Supports

All steel anchor bolts, nuts, pipe clamps, and other fittings shall be suitable for the type and size of the lines or casing, and shall conform to the provisions in Section 75-1.03, "Miscellaneous Bridge Metal," of the Standard Specifications.

Locate pipe supports as indicated on the plans. Unless stated otherwise, use ASTM A36 for fabrication of pipe supports and ASTM A325 heavy hex head bolts with hardened washers and heavy hex nuts for bolted connections. Pipe supports shall be fabricated and installed according to MSS SP-58 and SP-69.

Dimensions and elevations for supports are the responsibility of the contractor and should be confirmed in the field prior to fabrication and installation.

Mechanical Snubber

Snubber shall be a mechanical, velocity-limiting device designed to arrest shock forces and movements by becoming a load carrying member during seismic disturbances or other transient events. During normal operation the snubber shall telescope freely through its normal operating stroke allowing thermal expansion. Snubber shall be complete with front and rear bracket attachment assemblies. Snubber shall be Piping Technology and Products model MSA-35 or approved equal.

Wedge Action Mechanical Joint

Mechanical joint restraint shall be incorporated in the design of the follower gland and shall include a restraining mechanism which, when actuated, impart multiple wedging action against the pipe, increasing its resistance as the pressure increases while maintaining the flexibility of the joint. Glands shall be manufactured of ductile iron conforming to ASTM A536-80. Restraining devices shall be ductile iron heat treated to minimum hardness of 370 BHN. Twist of nuts shall be incorporated in the design of the wedge activation screws insuring proper torque. Joint shall be pressure rated to minimum 2413 KPa. And be EBAA Iron Inc; Megalug, Ford Meter Box Company; Uni-flange or approved equal.

INSTALLATION

Piping in bridge structures shall be supported as shown on the plans and in conformance with these special provisions.

If a block-out is provided in the bridge abutment wall for casing, the space between the casing and bridge abutment wall shall be filled with portland cement mortar conforming to the provisions in Section 51-1.135, "Mortar," of the Standard Specifications, unless stated otherwise.

When the bridge superstructure is to be prestressed, the space around lines through abutments shall not be filled until the prestressing has been completed.

Openings for lines through bridge superstructure concrete shall either be formed or shall consist of pipe sleeves.

Ductile iron pipe for lines 4 NPS in diameter or greater shall be connected and fully extended (pulled out) at the joint before the next connection is made.

Expansion joint for lines 4 NPS in diameter or greater, or the type specified, shall be factory adjusted and set at half the expansion capacity and approved by the Engineer in advance.

Cleaning and Closing of Pipe

The interior of all pipes shall be cleaned before installation. All openings shall be capped or plugged as soon as the pipe is installed to prevent the entrance of any materials. The caps or plugs shall remain in place until their removal is necessary for completion of the installation.

TESTING

Piping of 4 NPS in diameter or greater shall be tested in accordance with the provisions in Section 20-5.03H(1), "Method A," of the Standard Specifications, except that the testing pressure shall be 1,380 KPa of water pressure and the testing period shall be four hours minimum with no leakage or pressure drop. The air relief valve shall not be subjected to water pressure due to testing.

The Contractor shall furnish pipe anchorages to resist thrust forces occurring during testing. All leaks shall be repaired, and all defective materials shall be replaced at the Contractor's expense.

All pressure testing and necessary repairing of lines shall be completed prior to backfilling, placing deck slabs over lines in box girder cells, or otherwise covering the lines.

Each end of line shall be capped prior to and after the testing

The line shall be tested as one unit. The limits of the unit shall be 1.5 meter beyond the casing at each end of the bridge.

MEASUREMENT AND PAYMENT

CCSF water main, CCSF sewer force main, and CCSF reclaimed water pipe will be measured and paid for per meter in the same manner specified for welded steel pipe in Section 70-1.04, "Measurement," and Section 70-1.05, "Payment," of the Standard Specifications.

Full compensation for furnishing and installing air release valves, drains, steel brackets, and other fittings, dirt stops, pipe supports, testing and checking, pipe wrapping tape, epoxy adhesives, and seismic expansion assemblies, shall be considered as included in the contract prices paid per meter for the various sizes of pipes involved and no additional compensation will be allowed therefor.

10-4.04 BOOSTER PUMP STATION

PART 1 - GENERAL

SUMMARY

This Section specifies the requirements for a booster pump station including furnishing and installing all pumps, motors, expansion tank, controls, enclosures, piping, fittings, valves, gages, other accessories and incidentals required for a fully operating system, complete in accordance with the details shown on the plans and these special provisions.

Booster pump station shall be a completely skid-mounted horizontal centrifugal pump station built by a single manufacturer. All equipment, including but not limited to, pumps, tank, motors, valves, instrumentation, and controls shall be mounted on a common structural steel base, unless otherwise indicated, to form a complete operating pumping station.

REFERENCES

The regulatory requirements which govern the work of this Section include the following governing Codes and Standards:

A. American National Standards Institute (ANSI): ANSI B58.1 Turbine Pumps
B. American Society for Testing and Materials (ASTM):

   1. ASTM Designation: A48 Specification For Gray Iron Castings.
   2. ASTM Designation: A105/A105M Standard Specification for Carbon Steel Forgings for Piping Applications.
   3. ASTM Designation: A126 Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
   4. ASTM Designation: C126 Standard Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units

C. Steel Structures Painting Council (SSPC): SSPC 10 Near-White Blast Cleaning/Surface Preparation
D. Institute of Electrical and Electronic Engineers (IEEE): C62.41 Standard
E. National Electrical Manufacturers Association (NEMA): NEMA 4 Outdoor/Indoor Enclosures

SUBMITTALS

Refer to "Working Drawings," of these special provisions, for general submittal requirements and procedures.

A. A general arrangement drawing showing overall dimensions and all piping layouts.
B. Complete submittal data for all major equipment (pumps, motors, expansion tank, programmable controllers (PLC), valves, and motor starters).
C. An electrical schematic showing power wiring.

PART 2 - PRODUCTS

MATERIALS

Station Base

The pump station base shall be designed and fabricated to provide proper structural support for all attached equipment. The base shall supply sufficient rigidity to withstand the stresses of reasonable and competent transportation to site, off loading, installation, and operation. Main structural members shall be constructed from heavy-weight channel or I-beam steel. Provisions shall be made in the station base for off-loading and handling the station at the site of installation. Base shall include checkered deck plate and steel plate mounted under pump discharge heads. All deck plate and steel plate shall be 100% seal welded to main structural members. Skip welding is not acceptable. Maximum allowable deflection on skid assembly shall be 0.0085.

Piping

All piping shall be constructed from ASTM A105 Schedule 40 pipe or heavier, as required to maintain a 3-to-1 pressure safety factor (including 1.5 mm. corrosion allowance). All piping shall be hydrostatically tested to 150% of maximum shutoff pressure.

Paint

Structural steel, attached piping, and supports shall be grit blasted with #50 steel grit per SSPC-10 to a near white metal condition. The cleaned steel surface shall be immediately primed with an industrial grade epoxy primer. The finish coat shall be acrylic enamel applied through an electrostatic method to insure proper adhesion. Manufacturer shall provide a touch-up kit for owner's use.

Panel Paint

The control panel shall be dip cleaned, acid etched and neutralized, iron phosphate coated, and painted with a finish coat of polyurethane.

Bolts

All bolts used in the assembly of the pumping system shall be zinc plated to retard corrosion. Anti-corrosion washers shall be used on each side of fastener.

Pumps

Each pump shall be of the horizontal centrifugal type with flow and head, as shown on the plans. The horizontal pumps shall be manufactured according to the standards of the Hydraulic Institute and to ANSI Specification No. B58.1. The pump casing shall be ASTM A48, Class 30, cast iron capable of hydrostatic test at 150% of maximum discharge pressure and of having both suction and hub replaceable wear ring. All mating parts shall have a register fit to ensure alignment.

The impeller shall be an enclosed, single-piece bronze or cast-iron casting completely machined on all outside surfaces, and statically balanced at time of pump assembly. The impeller shall be keyed to the shaft and securely fastened with a vibration-resistant lock screw and washer.

The packing box shall contain a mechanical seal for the specific application.

The impeller shall not contact the suction or hub wear ring under any operating load condition.

The pump and motor shall be connected by an ASTM A48, Class 30, cast-iron bracket incorporating a full isolating shield with dual slinger rings to prevent moisture from entering the front motor bearing.

Expansion Tank

The expansion tank shall be a bladder-type hydropneumatic pressure tank, designed in accordance with the requirements of ASME Section VIII, Unfired Pressure Vessels. The bladder shall be made of butyl rubber and FDA approved for potable water applications. The tank shall be incorporated into the skid or shipped loose for field installation as indicated on the plans.

Pump Motors

Pump motor shall be close-coupled type, with rodent screens on all ventilating passages, and be open-drip proof, 1.15 service factor, and Class F insulation. Design pump brake horsepower shall not exceed 98% of motor horsepower exclusive of service factor. Maximum pump run-out horsepower shall not be greater than 8% higher than motor rating exclusive of service factor. The motor bearings shall be selected to withstand thrust loads and have a minimum life of five years' continuous operation. The motor shaft shall be high-strength steel protected by a bronze shaft sleeve secured to the shaft to prevent rotation. All motors shall be of the same manufacturer.

Motor Space Heater

The pump station manufacturer shall provide on each pump motor a 120-volt, single-phase space heater of ample size to prevent condensation from occurring within the motor during nonoperating periods. The space heater shall be de-energized when the motor is running.

Pump Check Valve

Pump check valves shall be bolted directly to the pump discharge heads and sized per the technical data sheet. They shall be of the silent operating type that begin to close as forward velocity diminishes and be fully closed at zero velocity preventing flow reversal. Valve bodies shall be cast from ASTM A126C cast iron or better, and shall be free from blow holes, sand holes, and other impurities. The valve design shall incorporate a center-guided, spring-loaded poppet, guided at opposite ends, and having a short linear stroke that generates a flow area equal to the pipe diameter. Internals shall be machined bronze disc, seat, and stem guide. Seat shall be Buna-N to provide resilient sealing. Dual disc style check valves are not acceptable. Valves shall be sized to permit full pump capacity to discharge through them without exceeding a pressure drop of 17 kPa.

Pump Isolation Valves

Pump isolation valves shall be installed on the inlet and outlet of the pump pipelines to completely isolate the individual pumps. Valve shall be of the lug style butterfly type as indicated in Pipe, Fittings and Valves of these special provisions.

Pressure Relief Valve

A pilot-operated modulating pressure relief valve shall be included. The valve shall be set between 70 to 100 kPa above operating pressure, and relieve when inlet pressure exceeds spring setting on pilot. Valve shall be quick opening and slow closing to minimize surging. Pressure relief valve or lug valve shall not be used as an integral part of normal pressure control. Discharge of relief valve shall be piped to drain. Valve body shall be ductile iron. A wye strainer shall be installed in the inlet side of the valve body to provide clean water to the CRL pilot. A wafer style butterfly valve shall be installed on the inlet of the relief valve. The pressure relief valve shall work hydraulically, and shall not be operated or opened from any electrical external source or control. The relief valve shall work solely as a safety for over-pressure relief, and shall not function as a normal part of the station controls.

Pressure Gauge

A pressure gauge shall be mounted on the discharge header with an isolation ball valve. All gauges shall be glycerin silicon filled to reduce wear due to vibration. Accuracy shall be within 2%. Gauge diameter shall be 80 mm. minimum. Range shall be at least 50% higher than the highest pressure attainable from the pumps at shutoff head conditions. Gage shall feature drawn stainless steel satin finish case with pressure relief in back, threaded polycarbonate ring and window, adjustable aluminum pointer with black finish, silver brazed phosphor bronze bourdon tube and NPT connection.

STATION CONTROLS

Scope

Provide complete instrumentation and controls to automatically, start, cycle and stop, pumps. Provide all alarms and safety features needed to protect the equipment and piping system. All electrical controls shall be U.L. Listed as an Industrial Control Device and shall be designed, assembled and tested by the pump station manufacturer.

Control Enclosure

Controls shall be housed in a NEMA 4 enclosure with integral latches. The control enclosure should be constructed of 12-gauge steel, and the back plate assembly shall be constructed of 12-gauge steel. Enclosure cut-outs are to be done for proper fit, sealing, and coating retention. All indicating lights, reset buttons, selector switches, and the operator interface device shall be mounted on enclosure door and also be rated NEMA 4. All internal components shall be mounted and secured to the removable back plate assembly. No water line connections shall be permitted inside of the control enclosure. Status and internal parameters must be viewable without the opening of the enclosure door. The control panel with controls shall be built in accordance with N.E.C., and U.L. standards. All equipment and wiring shall be mounted within the enclosure and labeled for proper identification. All adjustments and maintenance shall be able to be done from the front of the control enclosure. A complete wiring circuit and legend with all terminals, components, and wiring identification shall be provided. The main disconnect shall be interlocked with the door. Cabinet shall be lockable.

Lighting and Surge Arrester

All electrical equipment shall be protected by a U.L. approved Category C and Category B surge arrester to suppress voltage surges on incoming power. The device under IEEE C62.41 Category C shall withstand an impulse of 10 kV/10 kA and Category B shall withstand a ringwave of 6 kV/3 kA. Pass voltage for a 480 V device to the end equipment shall not exceed 1,500V-1,800V when subjected to an 8 ms * 20ms waveshape resulting in the following performance statistics: 3,720 joules minimum with a power dissipation of 82.5 MVA at 1,800V maximum pass voltage to the protected equipment. Response time shall be less than five nanoseconds.

Main Disconnect

A non-fusible main disconnect shall be provided to completely isolate all controls and motor-starting equipment from incoming power. The main disconnect shall have a through-the-door operator. Disconnect shall not be rated as a service disconnect.

Control Power

Power for the controls shall be provided by a control power transformer which will provide low-voltage, single-phase power for the pumping system control operation. Control power transformer shall not be used for any other external load. The control power transformer shall be protected on the primary side by current-limiting fuses of adequate size and voltage rating. All control components shall be protected by time-delay circuit breakers of adequate size.

Skid Conduit

All on-skid conduits shall be flexible conduit with water-tight connections at enclosure and termination device. All conduits shall be fastened to the skid every 600 mm.

Junction Boxes

All off-skid devices requiring control interface shall be terminated in a junction box. This junction box shall be located at the skid edge nearest the installation point of the off-skid device. Monitoring systems shall be terminated in a NEMA 4 junction box located on the top left side of the main controls enclosure to allow end user connection.

Motor-Starting Equipment

All motor starters for the pumping station shall be mounted on a single back panel in a single NEMA 4 enclosure. Motor starters shall meet I.E.C. standards, and shall be rated for a minimum of 1,250,000 operations. Motor overload relays shall be I.E.C. rated Class 10 ambient compensated. Fuses shall supply short circuit protection to each motor and shall be rated for a minimum 200,000-amp interrupting capacity. Motor overloads shall be manual reset only. Auto-reset of motor overloads shall not be permitted.

Pressure Transducer

A pressure transducer shall be utilized for providing all pressure signals for the control logic. The pressure transducer shall be a solid-state bonded strain-gage type with an accuracy of plus/minus 0.20% and constructed of 316L stainless steel. Transducer shall be rated for station discharge pressure, and shall provide gauge pressure output, rather than an absolute. Pressure transducer constructed of plastic is not acceptable. Threshold transducers are not acceptable.

Controls

All control logic shall be handled by a microprocessor-based controller having a 2-line, 16-character LCD (liquid crystal display) operator interface. The controller shall provide demand controlled sequential pump start, shutdown, and alarm features through its pressure-sensing and flow-sensing devices. The controller shall be provided with a built in EEPROM, which shall store all operating parameters of the pump station.

Controller Capabilities:

A. Controller shall be capable, if so programmed, of alternating equal-sized pumps based on accumulated run time for each pump.
B. Controller shall automatically reconfigure itself for fewer pumps if one or more pumps fails to start when required.
C. Operation type shall be selectable by means of the controller parameters.
D. Adjustable set point, with all other functions settable relative to set point.
E. Adjustable timing functions for delay on start, delay on stop, must run, and delay on activation of alarms.

Power input for the controller shall be 24 VDC provided through a separate external power supply. The controller shall have a minimum of 64K ROM and 32K RAM. The controller shall have eight 24-VDC transistor outputs and sixteen 24-VDC transistor inputs. It shall also include one high-speed counter input for flow and four dedicated analog I/O.

Alarms and Shut-Downs:

A. Low-discharge pressure alarm (manual reset)
B. High-discharge pressure alarm
C. Low inlet (pressure or water level) alarm
D. Phase-failure alarm (manual reset)
E. Pump-cycle-fault alarm
F. Individual pump fault alarm (phase failure or overload, manual reset).

Each active alarm shall be indicated on the LCD screen clearly indicating the current fault. A general alarm light may also be illuminated for visual indication of an existing alarm.

Individual motor-phase-failure and low-voltage-safety circuitry shall retire any pump that experiences low voltage, phase failure, or phase unbalance at the load side of each pump motor contactor (as sensed by the solid-state overload relay). Each pump motor shall have its individual protective device and time delay to allow for transient low voltage during motor starting to allow maximum motor protection.

Separate system power-phase failure and low-voltage-alarm circuits shall also be provided to retire the pumping system if it experiences low voltage, phase failure, or phase reversal as monitored at the load side of the control-enclosure-disconnect switch. Phase monitor shall have a time delay to allow for transient low voltage during motor starting to allow maximum

motor protection. The individual pumps or pumping system shall not operate until the voltage problem has been corrected and the alarm has been manually reset.

Interface Device:

The pump station shall include a user interface with 2-line, 16-character-per-line LCD display. Interface shall include a keypad, and the interface shall be mounted on the control panel door. This device will allow the operator to view and modify values in the controller. The unit shall store its messages in non-volatile memory. The device shall allow for display and modification of all adjustable parameters.

The interface device shall be capable of displaying the following:

A. Pressure, and System Status: The current pressure and a system status overview shall be displayed.
B. Current Alarm Condition: Any active alarm shall be shown, as listed above.
C. Current number of pumps running shall be displayed.
D. Pump Run Time: Run time for each pump shall be viewable by means of a set of commands. The interface shall include non-resetable and resetable totals for each pump.

Additional Support Components:

The panel shall include individual pump H-O-A switches, and a system Manual-Off-Auto push button switch on the interface device. The System Manual-Off-Auto push button switch in manual operation shall allow operator to start any pump manually by placing the pump switches in the Auto position. Operation of the pumps in this mode shall include the full alarm system being active and protecting the pumps and system. System switch in automatic operation shall allow controls to start pumps sequentially by placing the pump switches in Auto position. Operation of the pumps in this mode shall include the full alarm system being active and protecting the pumps and system. Pump switches in the Hand position shall bypass the controller completely, and force the pumps to run continuously. The only alarms remaining active shall be the inlet pressure fault and system phase failure.

A panel-mounted pressure transducer shall be supplied with a linear range from 4 mA to 20 mA output to the control panel equaling 0 kPa to 1725 kPa. An inlet water fault dry contact shall be supplied.

Interface relays may be utilized for input signals from a remote source or for motor starter and device outputs.

PART 3 - EXECUTION

Booster pump stations shall be installed in full compliance with the manufacturer's requirements. If the expansion tank is shipped loose, it shall be installed as shown on the plans.

Booster pump stations shall be unloaded and stored in full compliance with manufacturer's requirements. All motor and control heaters shall be connected to temporary power. Documentation of required storage and maintenance shall be provided.

Start-Up

When discharge piping, electrical connections, and electrical inspection have been completed, the pump station manufacturer shall be contacted for start-up. During start-up, the complete pumping system shall be given a running test of normal start and stop and fully loaded operating conditions. During this test, each pump shall demonstrate its ability to operate without undue vibration or overheating, and shall demonstrate its general fitness for service. All defects shall be corrected and adjustments made at the expense of the contractor. Test shall be repeated until satisfactory results are obtained.

After the station start-up has been completed, but before leaving the job site, a training session will be given. The training session will be given to the owner or the owner's representative to familiarize them with the pumping system operation, maintenance, and adjustments.

MEASUREMENT AND PAYMENT

The contract unit price paid for booster pump station shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in booster pump station, complete in place for a fully operational station, including all items of work, as shown on the plans, as specified in these special provisions, and as directed by the Engineer

10-4.05 ELEVATOR

This work shall consist of furnishing, installing and testing an electric rack and pinion elevator complete in place as shown on the plans, as specified in these special provisions and as directed by the Engineer.

GENERAL

The elevator system shall consist of a rack and pinion drive system mounted on the car, a vertically mounted machine steel rack incorporated with the tubular guide rails and an elevator car with controls, doors and safeties. The car shall be controlled by a single automatic push button (SAPB) operation from push buttons located in the car station and hall stations. For inspection, maintenance and operation outside of the car, a separate control station shall be furnished on top of the car. Access to this platform shall be through an electric interlocked hatch door in the car roof. A ladder shall be provided inside the car for roof access. The roof platform shall be provided with all required safety rails and equipment. In case of power failure, a brake release handle shall be furnished and located in the car for lowering the car by gravity. The drive gear shall be equipped with a centrifugal brake that shall automatically limit the descending speed of the car when the motor brake is released.

Related work not included in this section includes the following:

A. Construction of buffer support beam.
B. Providing supports as shown to carry structural reaction, impact and uplift loads imposed by elevator equipment, and for connection of structures which will be provided and installed by the elevator subcontractor.
C. Caulking behind entrance frames where tower walls occur.
D. Patching of floors, walls and surfaces constituting final finishes.
E. Attachments to tower structures for entrances, signals, fixtures, cables and conduit, as approved by the Engineer.
F. Installation and connection of three phase power through fused mainline switches or circuit breaker and extended to terminals of controller.
G. Single phase circuit through disconnect and extended to controller for car lights and fan.
H. Telephone circuit terminated at junction box of controller.
I. Lights, light switches and convenience outlets at buffer support beam and landings.
J. Installation of electrical conduit and pull boxes required for the complete installation shall be installed as a part of the work of this special provision. Wire and final connections by the Elevator Installer. The conduit requirements shall consist of one conduit and not less than 15 mm in size.

Temporary Electric Power

Electric power during construction for installation shall be furnished by the Contractor and shall include the following:

A. Provide 480V, 3 Phase, 60 Hz power available through lockable disconnect switch for installation.
B. Protection of open hoistway during construction as required by regulatory agencies.

QUALITY ASSURANCE

Quality assurance shall be in accordance with Section 6-1, "General," of the Standard Specifications, these special provisions and shall include the following:

Qualifications of Bidders

The entire elevator installation shall be manufactured, installed and maintained by the acceptable manufacturers listed or as qualified by addendum. No portion of the work shall be subcontracted unless qualified and accepted by addendum.

Acceptable Manufacturers

One of the following acceptable manufacturers or approved equal shall be used:

- USA Hoist Company, Inc.
- Champion Elevators, Inc.
- Alimak Elevator Company.

Those not listed must prequalify ten (10) days prior to bid date. Submit list of projects representing equivalent equipment that has been operational for at least two years. Include State's name, person to contact and telephone number.

Manufacturer's Qualifications

As a standard of quality, equipment manufactured by USA Hoist Company, Inc., Champion Elevators, Inc. and Alimak Elevator Company will be acceptable. The manufacturer shall be responsible for the following:

A. Preparation of all engineering and shop drawing submittals.
B. Performance of Branch Office or Agent installing equipment.
C. Material delivery and construction schedules.

D. Equipment installation is per manufacturer's requirements and contract documents.
E. Equipment and performance guarantees.

Installer and Maintenance Qualifications

Installer shall be a licensed Elevator Contractor in the State of California and include the following:

A. Show evidence of successful experience in complete installation and maintenance of proposed manufacturer's elevator equipment.
B. Employ sufficient competent personnel within 80 km of project to handle construction and maintenance duties.
C. Maintain local stock of parts adequate for replacement on permanent or emergency basis within 80 km of the project site.
D. Respond to trouble calls within one hour.
E. Offer the State an agreement for continuing maintenance after expiration of maintenance period under this contract.

ELEVATOR DESIGN CRITERIA

The elevator's performance shall be level within 9.5 mm over 1000 mm under any elevator loading condition and shall also be level with the floor at all times. The elevator shall not overrun floor and level back.

The elevator's operating qualities shall include the following:

A. The Engineer shall approve the riding quality of the car, make any necessary adjustments and enforce the following requirements:

    1. Acceleration and Deceleration: Starting and stopping shall be smooth and comfortable, without obvious steps of acceleration. Slowdown, stopping and leveling shall be without jars or bumps. Stopping upon operation of emergency stop switch shall be rapid but not violent.
    2. Vertical acceleration shall not exceed a maximum 1.2 meter per second squared nor a maximum jerk 2.4 meter per second squared.
    3. Full speed riding shall be free from vibration and sway.

B. Equipment shall be capable of operating at plus or minus ten percent of normal feeder voltage and plus or minus three percent of feeder frequency without damage or interruption of elevator service.
C. Control System shall be a closed loop feedback control incorporating positional and velocity selector system that is capable of operating continuously at contract speed and load for one hour without exceeding 50 °C from ambient. Design system to not adversely affect stability of voltage and frequency controls of emergency generator set or loads connected to emergency power bus during standby power operation.
D. Elevator and all equipment shall be designed for a service life of 50 years in a severe marine environment.

REQUIREMENTS OF REGULATORY AGENCIES

Codes shall be in accordance with the latest applicable edition requirements of the following and as specified:

- ASME: A17.1; Part XVI Safety Code for Elevators and Escalators.
- CCR: Titles 8 and 24; Group III California Code of Regulations.
- California Electrical Code
- California Building Code
- All State and local codes which govern.

The Contractor shall arrange and pay for inspections by governing authorities and obtain operating permits.

TECHNICAL DATA

Model:	USA Hoist Model 2000DR or approved equivalent
Capacity (Maximum):	906 kg
Car Size (Inside):	1676 mm wide x 965 mm deep x 2590 mm high
Speed:	0.762 m/s
Power Requirements:	480 V, 3 PH, 60 Hz, 100 amps

SUBMITTALS

All submittals shall be in accordance with "Plans and Working Drawings," of the Standard Specification, and as directed by the Engineer. The Engineer reserves the right to require any details of any portion of the equipment. The Contractor shall submit the following:

A. Shop Drawings.
B. Layouts of the plan and section of hoistway, including loads imposed on bridge structure.
C. Details of cab, fixtures and entrances.
D. Data depicted on layouts or separate data sheets; power requirements, conduit runs outside of hoistway car and roller guides.
E. Samples provided of materials and finishes exposed to public view and additional, if specifically requested, 152.4 mm by 152.4 mm panels, 304.8 mm lengths or full size if smaller, as applicable.
F. Operating instructions of manufacturer's literature describing system operations and special operations and maintenance as specified.
G. After completion and prior to final acceptance, submit three sets of complete and accurate maintenance data specific for the elevator. Final payment will not be made until received.

    1. Manuals describe proper use and maintenance of equipment, lubrication points, types of lubricants used and frequency of lubricant application.
    2. Parts catalog consists of a complete listing of all parts of equipment and components used in the installation.
    3. Wiring diagrams consist of one laminated set mounted inside the elevator control panel, one reproducible mylar set, and one blue line set delivered to State. Wiring diagrams shall be as built, specific for this installation, and reference identification on drawings shall match points identified on terminals of controller.

H. Provide maintenance tools, and supporting software documentation and manuals required for the complete maintenance of the entire system, including diagnostics and adjusting. Maintenance tools may be hand held or built into control system and shall be of the type not requiring recharging or reprogramming, nor of the automatic destruct type. The tool and supporting software may be programmed to operate only with this project's identification serial numbering.

Product Delivery, Storage and Handling

Protect equipment during transportation, erection and construction. Store under cover to prevent damage due to weather conditions. Replace damaged materials.

Schedule and be responsible for coordinating related work with other trades to avoid omissions and delays in job progress and conform to the provisions of "Order of Work" of these special provisions.

Warranty

Warranty shall be provided as a special project warranty, signed by the Contractor, Installer and Manufacturer, agreeing to replace, repair, and restore defective materials and workmanship of elevator work which may develop within one year from final date of completion and acceptance of the entire installation. "Defective" is hereby defined to include, but not by way of limitation, operation or control system failures, performances below required minimums, excessive wear, unusual deterioration or aging of materials or finishes, unsafe conditions, the need for excessive maintenance, abnormal noise or vibration and similar unusual, unexpected and unsatisfactory conditions.

Continuing Full Maintenance Contract

Quote cost and submit manufacturer's proposal for full maintenance contract for a period of five years after expiration of 12 month maintenance provided with this new installation.

Provide examinations, replacements and call-back service as specified for maintenance under these special provisions.

DESCRIPTION OF SYSTEM

Type:	Dual Geared Rack and Pinon
Capacity:	906 kg
Speed:	0.762 m/s
Stops:	5
Openings:	Pass-Through Elevator Openings: 4 Front; one rear
Travel:	As Shown
Control:	VF - AC Drive
Operation:	Single Automatic Push Button (SAPB) - NEMA 4X Control Cabinet
Machine Location:	Car Sled / Top of Car
Special Operations:	Independent Service
	Fire Emergency Service
	Standby Emergency Power
Car Enclosure Type:	Passenger - Galvanized Panels with Power Paint Finish.
Platform Size:	1800 mm Wide by 1100 mm Deep
Clear:	1676 mm Wide by 965 mm Deep by 2590 mm High
Flooring:	ASTM A 572 Tread Plate - Hot Dipped Galvanized
Car Door:	Vertical Bi Parting Galvanized - Manual
Guide Mast:	Tubular Galvanized Steel
Signals and Fixtures:	Design as Specified
Car Operating Panels:	1; Applied Type - NEMA 4X
Car Position Indicator:	Integral with Car Panel - NEMA 4X
Communication System:	Integral with Car Panel - NEMA 4X
Service Cabinet:	Integral with Car Panel - NEMA 4X
Hall Pushbuttons:	1 Riser - NEMA 4X
Passenger Entrance Type:	Swing Door / Gate or Accordion - Manual, Hot-Dipped Galvanize
Size:	1676 mm Wide by 2438 mm High Clear Opening
Frames:	
All Floors:	Hot-Dipped Galvanized
Doors:	
All Floors:	Hot-Dipped Galvanized
Sills:	
All Floors:	Hot-Dipped Galvanized Rust Proof
Miscellaneous Items:	Key Operated Hoistway Access
	Earthquake Requirements

MATERIALS

Guide rails

Two 76.2 mm galvanized tubular guide rails shall be supplied for the full travel plus height of car and over travel shall be fabricated in 3048 mm sections with two racks securely attached by three bolts per rack, per location (rack material shall conform to AISI 1045 min. with 180 min. Brinell). The sections shall have male and female ends and shall be bolted together with four ASTM A 325 galvanized bolts using tension indicator washers. A single rail system will not be acceptable.

Car

The car shall be made up of rigid steel profiles standard with the manufacturer, with walls constructed of 2.66 mm thickness galvanized steel panels. Car roof and floor shall be made up of skid resistant aluminum check-plate. The car shall be attached to a frame structure and form an integral unit with the drive machinery located on top of the car. The car shall be provided with two vertical bi-parting doors, electrically and mechanically interlocked which shall prevent the car from being operated when the car door is not fully closed or the door from being opened while the car is between landing floors. Steel keeper safety hooks shall be mounted on the car frame to ensure the car cannot disengage from the guide rail.

Drive Machinery

The complete drive shall consist of two 14.9 kw T.E.F.C. motors (or as required by the manufacturer), one reduction gear and two drive pinions engaging separate racks (one on each tower) on opposite sides of the car, connected by a common shaft. Each drive motor shall also include one electric disc brake provided with external manual brake release mounted on the rear of the motor.

Safety Device

A combined overspeed governor and safety device shall be mounted on a machinery plate separate from the drive system machinery plate and shall be in constant engagement with the rack via a safety pinion. In the event of overspeed, the governor shall instantly actuate the safety device which shall bring the car to a gradual stop. Actuation of the overspeed safety device shall cause power to be removed from the drive motor. Manual resetting of the safety device shall actuate the safety device electrical contact thereby returning power to the drive motor.

Centrifugal Brake

For safe control of the descending speed of the car by gravity, in case of power failure, the machinery shall be provided with a centrifugal brake device which shall be mounted on the gear reduction housing and connected directly to the input gear reduction shaft. When the motor brake is released, the centrifugal brake shall automatically keep the descending car at a preset speed below the governor/safety device tripping speed.

Landing Doors

For all landings (including the bottom landing), an electrically and mechanically interlocked horizontal safety gate shall be provided with associated equipment, mounting hardware and control accessories and protective screens on all sides of hoistway accessible from the platform. The gate shall be manufacturer's standard swing, accordion, or other suitable design and shall provide a minimum clear opening of 1676 mm wide by 2438 mm high. Landing door mechanical and electrical interlocks shall be of the type approved by state and local authorities. The interlock shall prevent the landing door from being opened when the elevator car is not at the landing. Mounting of landing doors shall be coordinated with the Contractor. Mounting details shall be submitted for Engineer's approval.

Surface Finishing

The finishing of the elevator shall be galvanized, suitable for service in a marine environment. All construction made by plate, beam and bar and tubular material shall be hot-dipped galvanized. Materials, such as wire mesh, which may be subject to deforming by hot dipping, shall be spray galvanized.

Power and Control Feed

Power and control feed to the car shall be by means of a power buss conductor strip(s) attached to the tower legs as noted on the plans. The strip(s) shall be suitable for outdoor marine installation.

Electrical Equipment

Incoming electric power shall be connected to an auxiliary panel at the ground level. The panel shall be equipped with a main contactor, which disconnects motive power to the car when any landing door is opened. All electric devices on the car shall be connected to the main control panel. The control circuits shall be fed from the main power supply by control transformers. Control voltage shall be 127 V, 1 PH, 60 Hz. The car shall be provided with limit switches for the door(s), trap door, safety devices and normal up and down terminal limits. The final limit switch, also mounted on the car, shall act directly on the power supply and disconnect power to the motor in the event of over travel. The car shall also be provided with a light, emergency light and 12 volt battery with charger, push button control station with emergency stop, and a constant pressure control on a separate circuit on top of car for inspection and maintenance purposes. A telephone shall be provided inside the car for connection with the bridge communications system. Elevator manufacturer shall furnish each motor with a variable frequency drive.

All electrical panels, enclosures and junction boxes shall be rated NEMA-4X.

Single Automatic Push Button Operation

Operate elevator from single button landing stations and operating buttons in car. Activating a landing or car button shall cause the car to start and proceed to that floor. When the car is in use and a hall call is registered, a bell will sound and the "in-use" indicator will light. All elevator operation and control functions shall also be provided on the roof operation platform. Provision shall be provided for manual starting and stopping between landings for inspection and maintenance

Signal Fixtures

Provide operating devices as required for SAPB operation specified. Provide a car operating station with a light up push button for each landing served. Include emergency devices and signals as required by code. Incorporate emergency communications and all required devices in a single applied car operation station. Provide NEMA-4X devices and boxes.

Provide applied hall stations at each landing with call buttons and in-use lights. Provide keyed hoistway access at terminal landings.

Options

The following items shall be available on special order:

- Special Surface Treatment.
- Marine environment paint for galvanized surfaces.
- Stainless Steel control cabinets and electrical boxes; NEMA-4X.
- Radio or communication system.
- Warning lights and siren.
- Extended warranty beyond 12 months.
- Lights for landing platforms.

CONSTRUCTION

Bidders shall examine architectural, structural, electrical and mechanical plans and specifications. Any discrepancies that affect the elevator work or conditions adverse to the bidder's equipment shall be brought to Engineer's attention at least seven days prior to the bid date. If no discrepancies are presented, changes required to accommodate bidders' equipment become the responsibility and cost of the Contractor.

Preparation

The Contractor shall verify field dimensions before proceeding with the workand coordinate related work by other trades. Verify the following to be acceptable for installation of elevator:

A. Hoistway has been correctly sized and otherwise properly prepared.
B. Equipment supports are satisfactory.
C. Electrical rough-ins are correct.
D. Do not begin installation until unsatisfactory conditions have been corrected.

INSTALLATION

Installation of the elevator shall be per manufacturer's requirements, those of regulatory agencies and as specified.

Welded Construction

Provide welded connections for installation of elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustments, inspection, maintenance and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.

Lubrication

Lubricate operating parts of systems as recommended by manufacturer.

Alignment

Coordinate installation of hoistway entrances with installation of elevator guide rails, for accurate alignment of entrances with car. Reduce clearances to minimum, safe workable dimensions at each landing.

Erect guide rails plumb and parallel with maximum deviation of 1.6 mm. Anchorage of guide rails shall not compromise waterproofing. Do not bottom rails on buffer support beam.

Temporary Acceptance And Use

When the elevator is near completion and declared ready for service, State agrees to accept elevator and place it into automatic service.

The elevator must be tested and inspected by regulatory agencies and a permit to operate issued.

A walk-through examination will be performed in the presence of the Engineer, General Contractor and Elevator subcontractor to determine present condition of elevator.

The State agrees to sign or cause the General Contractor to sign a temporary acceptance form that is mutually agreeable to all parties.

During this temporary acceptance period, the State agrees to pay or cause the General Contractor to pay an agreed amount per day per elevator for regular maintenance. The Elevator subcontractor shall state in his bid per diem cost for this maintenance per elevator.

The guarantee and full maintenance period will be effective upon final acceptance of the entire installation.

FIELD QUALITY CONTROL

Regulatory Agencies Inspection

Upon completion of elevator, the Contractor shall provide instruments, weights and personnel to conduct test required by regulatory agencies. The Contractor shall submit a complete report describing the results of all the tests.

Examination and Testing

When installation is ready for final acceptance, the Contractor shall notify and assist the State in making a walk-through inspection of entire installation to assure workmanship and equipment complies with contract documents. The Contractor shall provide equipment to perform the following tests:

A. One hour heat and run test with full load in car.

1. Stop car at each floor in each direction.
2. Provide well-shielded thermometers for motor and generator and verify that temperatures do not exceed 50 degrees Centigrade above ambient.
3. Performance and leveling tests shall be made before and after heat and run test.

B. Check and verify operation of all safety features and special operations.

1. Measure horizontal acceleration.
2. Measure acoustical output levels in machine room, lobbies and car.

C. Correction.

1. Make corrections to defects or discrepancies at no cost to State. Should discrepancies be such that re-examination and retesting is required, all costs including those of State's representative fees shall be paid for by the Elevator subcontractor.

Final Acceptance

Final acceptance of the installation will be made only after all corrections are complete, final submittals and certificates received and the State is satisfied and the installation is complete in all respects. Final payment will not be made until the above is completed.

Instructions

The Contractor shall instruct State's personnel in proper use of system.

Maintenance

The Contractor shall provide complete continuing maintenance on entire elevator equipment during regular working hours on regular working days for a period of 12 months after filing a "Notice of Completion".

Include systematic examination twice monthly, adjustment, and lubrication of elevator equipment whenever required and replacement of defective parts with parts of same manufacture as required for proper operation. The Contractor shall not be responsible for repairs to car enclosure, door panels, frames, sills or platform flooring resulting from normal usage or misuse, accidents and negligence for which the Contractor is not responsible.

Maintain the performance standard set forth in this special provision and maintain correct operation of the dispatching system.

Maintain smooth starting and stopping, smooth riding qualities and accurate leveling at all times.

In event of failures, provide 24 hour call-back service at no additional cost to State.

Should the elevator become inoperative, repair within 24 hours of notification of such failure. Breakdown of major components shall be completed and service restored within 72 hours.

If the Contractor fails to comply with above, the State may order the work done by others at the Contractor's expense. Devices repaired or replaced by others shall, nevertheless, become the sole responsibility of the Contractor for all maintenance and correct operation of such devices for lifetime of this contract.

During the maintenance period at six month intervals or less, testing of all safety devices and emergency operations shall be performed with written reports on each test provided as directed. Testing shall be performed at such time, as not to interfere with building operations.

Expendable Parts

The Elevator subcontractor shall provide a metal cabinet on project premises containing expendable parts required for prompt replacement. Parts used for routine maintenance shall be replenished and stored in the cabinet to ensure an adequate supply is available. Parts and cabinet shall become State's property and not removed upon expiration of maintenance period.

Final Service and Inspection

Two weeks before expiration of the year's maintenance, the equipment shall be lubricated, fully serviced, adjusted to the standards designated and emergency service operation devices shall be checked. A complete inspection will be made by a representative of the State.

MEASUREMENT AND PAYMENT

The contract lump sum price paid for elevator shall include full compensation for furnishing all labor, materials, including expendable parts, tools, equipment, and incidentals and for doing all the work involved in installing the elevator complete in place, including all required permits, agency inspections, testing and maintenance, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-4.06 DEHUMIDIFIER SYSTEM

The dehumidifier system shall be constructed as shown on the plans and as provided in the Standard Specifications and these special provisions.

This work shall consist of the furnishing and installing a dehumidification system with equipment, ductwork, controls, and accessories in each of the two cable chambers and in each of two main spans, complete in place.

GENERAL

The work shall include the following:

A. Furnishing and installing one (1) dehumidifier in the tower base and tower head (total of two units) at the locations shown on the plans.
B. Furnishing and installing dehumidifiers in each main span (total of three units 1 for the west span and 2 for the east span) at locations shown on the plans.
C. Furnishing and installing ductwork, duct insulation, supports for ductwork, equipment supports, condensation controller, supply air registers, and alternating control panel.
D. Test and correct malfunctions and errors and the balancing of each dehumidification and monitoring system.
E. Painting of support steel.
F. Spare parts.
G. Factory furnished demonstration and training in the repair and operation of the dehumidification equipment.

Standards

Comply with the Codes, Rules, and Regulation of the State of California and the following codes and standards latest editions:

A.	IARC	International Agency for Research on Cancer
B.	NEMA	National Electrical Manufacturers Association
C.	NEC	National Electrical Code
D.	CalOSHA/OSHA	Occupational Safety and Health Act
E.	ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers.
F.	ASTM Designation: 36	Structural Steel
G.	ASTM Designation: E 84, NFPA 255 and	Surface burning characteristics of building materials (Insulation).
H.	SMACNA	Sheet Metal and Air Conditioning Contractor's National Association. HVAC Duct Construction Standards Latest Edition
I.	AISC	American Institute of Steel Construction Manual
J.	AWS	American Welding Society
K.	ASTM Designation: B 209	Standard Specifications for Aluminum Alloy Sheet and Plate
L.	NFPA 90A	Installation of Air Conditioning and Ventilating Systems
M.	NFPA 90B	Installation of Warm Air Heating and Air Conditioning Systems
N.	UL	Underwriters Laboratory
O.	CSA	Canadian Standard Association
P.	SCM	Steel Construction Manual

Submittals

A. Submit product data, details, manufacturer's operating and maintenance instructions for all equipment and components specified. Include maintenance log forms.
B. Submit sheet metal fabrication and installation drawings to the Engineer for approval. Submit sheet metal fabrication shop standards including horizontal and vertical duct support fabrication details.
C. Submit products, equipment, and material data to the Engineer for approval.
D. Contractor shall determine dimension of dehumidifier framing, design, and detail connections. Shop drawings shall be submitted to the Engineer for approval.
E. Fabrication and installation may begin only when the Engineer has approved all shop drawings and equipment submittals.
F. Indicate quantity and type of spare parts as herein specified.

Guarantee and Service

A. The Contractor shall, during the period of the guarantee, perform warranty work at the Contractor's expense, as soon as notified by the Engineer. The Contractor shall also repair all damage to surrounding work caused by the failure, repair, or replacement of defective equipment, and no additional compensation will be allowed therefor.
B. Acceptance of the installations by the Engineer will only be made after the Contractor has adjusted the equipment, balanced the various systems, and demonstrated that it fulfills the requirement of the plans and specifications.

C. The Contractor shall be responsible for the repair, replacement of defective parts or equipment, routine maintenance, and service of all equipment systems installed until acceptance by the Engineer and for two years thereafter and no additional compensation will be allowed therefor. The Contractor shall take measures as necessary to insure adequate protection of all equipment and materials during delivery, storage, installation, and shutdown conditions. This responsibility shall include all provisions required to meet the conditions incidental to the delays pending final test of systems and equipment.

Instruction Manual

The Contractor shall submit to the Engineer, five copies of bound instruction manuals on acid free paper, easily reproducible, suitable for archival use on 3-ring (steel) hard binder, and five copies of floppy disks, containing the following information regarding the dehumidifying system:

A. Manufacturer's Equipment Parts list of all components of the systems listed on the equipment schedules, circuit and wiring diagrams. Dehumidifiers and Controls list shall give Manufacturer's Model No., Serial No., and Drawing No., if any.
B. Step by step operating instructions, including preparation for starting equipment, operation and shutdown.
C. Maintenance recommendations and instructions for each type of equipment.
D. Trouble shooting guide and repairs for each type of equipment.
E. List of local suppliers for all equipment.
F. Manufacturer's literature describing each item listed on the equipment, spare parts, schedules, as-built wiring diagrams and all test reports.
G. Overall system circuit diagrams and equipment interconnection wiring diagrams.

MATERIALS

All materials and apparatus required for the work shall be new, of high quality, and shall be furnished, delivered, erected, connected, tested and finished in every detail, and shall be so selected and arranged to fit properly into the assigned spaces.

The Contractor shall remove all materials delivered, or work erected, which does not comply with plans and specifications, and shall replace with proper materials, or correct such work as directed, at the Contractor's expense and no additional compensation will be allowed therefor.

No work of any kind shall be covered or hidden from view before it has been examined or approved by the Engineer and other agency having jurisdiction. All unacceptable or imperfect work or unauthorized or disapproved materials discovered shall be removed and corrected immediately after being rejected.

The Contractor shall protect the work and material of all trades from damage by the Contractor's work or workmen, and shall replace all damaged material with new.

Dehumidifiers

Dehumidifiers for the east and west cable anchorage and tower base shall be Cargocaire Model #HCD-600EA, or approved equivalent. For the tower head, the dehumidifier shall be Cargocaire Model #HC-300, or approved equivalent. Additional acceptable manufacturer's are Bry-Air, Inc. and Stulz Air Technology System, Inc.

Dehumidifier systems shall be adjusted as necessary to allow installation using the access openings shown on the plans.

Dehumidifier Unit Casing

The unit casing shall be fabricated of strain-hardened aluminum with a minimum thickness of 3.2 mm for torsional rigidity and corrosion resistance. The casing shall be formed, welded, and sealed as a single unified structure. Carbon steel construction will not be accepted. Screws or non-welded joints for casing construction will not be accepted. In addition, the unit casing shall include:

A. Insulation
To avoid either condensation, heat loss or loss of cooling capacity, the unit casing shall be insulated such that the heat transfer rate through casing walls is less than 1.53 W/m^2 if the wall separates air streams which differ in temperature by more than 13.9 °C.
B. Wiring
All wiring between dehumidifier components shall comply with the current National Electrical Code (NEC). Wiring unprotected by approved conduit shall not be acceptable.
C. Process and reactivation air flow gauges
To set and verify the specified air flow rates through the unit, the casing shall be equipped with differential pressure gauges which measure and display the pressure drop across the desiccant wheel. The dial of the pressure gauges

shall include a warning zone to indicate when the air flow is above the recommended operating range of the equipment.

D. Coating
All surfaces of access panels shall be degreased and cleaned, then primed with one coat of industrial wash primer and finished with one coat of catalyzed polyurethane enamel. All pieces shall be painted individually prior to assembly to assure complete protection.

E. Weathertight construction
The dehumidifier shall be capable of continuous outdoor operation and the air inlets shall be protected from flowing water and rain by weather hoods or connected duct work. All access panels shall be weather tight, as shall all joints between casing and electrical conduits and between the unit casing and any components mounted in separate enclosures.

F. Air flow dampers
Inlets shall be equipped with manual flow control dampers with locking hardware. For air inlets smaller than 381 mm in height or width, single-blade dampers will be acceptable. When any inlet dimension exceeds 381 mm, the manufacturer shall provide opposed-blade dampers with stainless steel end seals, elastomeric edge seals and oil-impregnated blade shaft bushings.

G. Maintenance access and inspection panels
The unit casing shall include access panels for inspection and for any maintenance required by the operating and maintenance manual. These panels shall be fastened by captive hardware permanently fixed to either the panel frame or the unit casing. The panels shall be airtight to the extent of not leaking more than 1 percent of the rated airflow when the interior of the casing is under 1.25 kPa positive air pressure, nor more than 0.5 percent of the rated flow when the casing is under 1.25 kPa of negative pressure. Panels without gaskets will not be accepted. Panels held in place by drill-screws will not be accepted. Equipment which requires disassembly of components rather than by access through removable panels for any maintenance required by the operating and maintenance manual will not be accepted.

H. Filters
The unit casing shall include removable filters at the inlet of both process and reactivation air streams. These filters shall be mounted on sliding racks and accessible through panels equipped with fast-acting, captive hardware. The filters shall have a 35 percent efficiency and a 90 percent resistance conforming to the ASHRAE Weight Resistance Test.

Electrical Control Cabinet

The electrical control cabinet shall be weather tight to NEMA 4 standards and shall include the following:

A. Wiring shall comply with the current National Electrical Code with further fuse and wiring sizing to meet or exceed UL 508A Industrial Control Panel.

B. Wires shall be color-coded or numbered at both ends and all terminal block connection points shall be numbered. These markings shall correspond with the electrical diagram provided in the operating and maintenance manual.

C. Components shall be UL or CSA approved where possible.

D. Programmable logic controller
The unit sequence of operations shall be controlled by a programmable logic controller which includes separate indication for the following:

1. Power on
2. Unit running
3. Desiccant wheel rotation fault
4. Reactivation air overheat after heaters
5. Reactivation air leaving below set point temperature
6. Motor overload
7. Relative Humidity

E. Operating and Maintenance (O&M) manual
The control cabinet shall include a copy of the O&M manual, mounted in a separate compartment or weatherproof, sealable pocket.

F. Run-hour meter
The cabinet shall have a run-hour meter mounted and visible from the exterior of the unit.

Reactivation Circuit

The reactivation circuit shall conform in all respects to the current National Electrical Code.

Electrical reactivation shall be sized for 460 Volts/60 Hz/3 phase utility and shall include solid-state proportional heater control for automatic modulation of energy in strict proportion to the changes in moisture load on the unit. Modulation shall be infinitely adjustable.

Desiccant Wheel

The desiccant wheel media shall be a monolithic, extended surface contact medium, fabricated entirely of inert, inorganic binders and glass fibers formed into narrow passages in the direction of airflow. The wheel shall be non-toxic. It shall also meet the following requirements:

A. Materials
The glass fibers which form the support matrix shall be made from uniform continuous strands larger than five microns in diameter which are nonrespirable and are not considered a possible health risk by the International Agency for Research on Cancer (IARC).

B. Flame spread and smoke generation
The wheel shall be tested according to ASTM Designation: E 84-90 (Standard Test Method for Surface Burning of Building Materials) and shall achieve the following results:

1. Flame spread index = 0
2. Smoke developed index = 10

C. Desiccant impregnation
The desiccant shall be evenly impregnated throughout the structure for predicable, consistent performance and for maximum wheel life. Coatings applied on top of the contact medium will not be accepted unless the manufacturer can provide independent life tests demonstrating less than a 5 percent decline in desiccant capacity over a five year period of normal operation.

D. Desiccant type
The desiccant impregnated into the contact medium shall be Titanium-reinforced silica gel. The Honeycombe desiccant wheel shall be a fabricated extended surface contact media with a multitude of small passages parallel to the airflow. The rotary structure shall be a monolithic composite consisting of inert silicates with microscopic pores designed to remove water in a vapor phase. The desiccant shall be hydrothermally stabilized silica gel reinforced with titanium for maximum strength and stability over time. The fabricated structure shall be smooth and continuous having a depth of 400 millimeters in the direction of airflow without interruptions or sandwich layers which restrict air flow or create a leakage path at jointing surfaces. Nominal face velocity shall not exceed 3.0 m/s. The Honeycombe wheel shall be manufactured in the United States. The manufacturer shall provide documentation to establish that:

1. The desiccant retains more than 90 percent of its original capacity after ten years of continuous operation in clean air, with inlet air conditions up to and including 100 percent relative humidity.
2. The wheel as impregnated with silica gel is capable of withstanding five complete water immersion cleaning cycles while retaining more than 95 percent of its original adsorption capacity.

E. Desiccant Wheel Support and Drive Assembly
The wheel shall be a single piece for fast removal and simple handling. The desiccant wheel shall be supported by four rollers at the base of the unit so the wheel can be easily removed for maintenance by lifting it over the rollers using the drive belt. Center-axle support or any arrangement which requires disassembly of the support structure for wheel removal will not be accepted. In addition, the wheel drive assembly shall provide:

1. Drive belt
The drive belt shall be the flat, toothed type, with aramid fiber reinforcement.
2. Drive motor
The drive motor shall be rated for continuous duty for a minimum period 20,000 hours under the load conditions imposed by the drive assembly.
3. Rotation detection
The drive assembly shall be equipped with a rotation detection circuit which shuts down the dehumidifier and signals the operator through an indicating light on the control cabinet if the wheel is not rotating.
4. Air Seals and Internal Air Leakage

The process and reactivation air streams shall be separated by air seals and internal partitions so that the humid reactivation air does not mix with the dry process air. The proposed equipment shall meet the following minimum requirements:

a. Wheel face seals
The dehumidifier shall have full-face seals on both the process air entering and the process air leaving sides of the wheel. These shall seal the entire perimeter of both air streams as they enter and leave the wheel. Partial seals shall not be acceptable. The seals shall be the silicone rubber bulb-type, with a protective strip of low-friction, abrasive-resistant tape to extend seal life and reduce the force needed to turn the desiccant wheel. Neither wiper-type seals nor brush-type nor any non-contact-type seal shall be acceptable. The seals shall be documented to have a minimum working life of 25,000 hours of normal operation.

b. Total casing air leakage
The unit shall not allow leakage to exceed the greater of the following values:

1. One percent of the process air flow
2. SMACNA (Sheet Metal and Air Conditioning Contractors National Association) Leakage Class 6

Process and Reactivation Air Fans

Process and reactivation air fans shall be the single-inlet, single-width, centrifugal-type.

A. Fan wheel type
Fans driven by motors of 2.24 kW and below shall be the direct-drive, forward-curve centrifugal type.

B. Balancing
Fans shall be balanced after assembly and after coating at the speed the unit is scheduled to operate. Fans shall be balanced such that the maximum displacement in any plane is less than 0.025 mm peak to peak.

C. Fan motors
Fan motors shall be the totally-enclosed, fan-cooled, high-efficiency type and shall be selected for a service factor of 1.15.

D. Belt Driven Fans
For belt driven fans, the belt guard shall meet CalOSHA/OSHA requirements.

Moisture Removal Capacity Control

The dehumidifier shall operate automatically, in response to the control system supplied by the manufacturer and interface with the Direct Digital Control (DDC) system:

A. On-off control
The dehumidifier shall turn on and off in response to the humidistat, which shall be provided by the manufacturer and mounted in the specified location and connected to the dehumidifier by the installing contractor.
B. The dehumidifier shall operate automatically, in response to the control system supplied by the manufacturer.
C. The dehumidifier shall turn on and off in response to the sensor specified, which shall be provided by the manufacturer and mounted in the specified location and connected to the dehumidifier by the installing contractor.

Spare Parts

Furnish the following spare parts in quantities suitable for two years normal operation:

A. Process Air Filters
B. Reactivation Air Filters
C. Timing Belts
D. Bottom Seals
E. Top Seals
F. Desiccant wheel (one per model) in appropriate storage covering

Warranty

Provide two years service (labor and materials) warranty.

DUCTWORK AND ACCESSORIES

Ductwork

A. Construction of stainless steel, Type 316 and galvanized steel ductwork and casings shall be in accordance with the appropriate standards of ASTM Designation: B 209 and Sheet Metal and Air Conditioning Contractors National Association (SMACNA), unless indicated otherwise.
B. Ductwork for conveying dehumidified air shall conform to SMACNA latest edition Duct Construction Standards. Minimum thickness of ducting shall be 0.91 mm.
C. Reactivation air ducting and outside process non-dehumidified air shall be stainless steel Type 316 ducting. Dehumidified process air interior ducting shall be galvanized steel ducting.
D. Provide adequate space around ducts to assure proper support and to allow the installation of the specified dielectric isolation.
E. Dielectric isolation shall be by asphalt impregnated paper, zinc chromate paint, or bituminous paint and installed between dissimilar metal ducting.
F. Make all connections between ductwork and equipment with gradually tapered transition fittings.
G. Install backdraft dampers where indicated on the plans.

Hangers and Supports

A. Provide supports and fastenings where shown on the plans and in accordance with SMACNA latest edition Duct Construction Standards.
B. Fasten hangers and supports to concrete by lead shield anchors, angle knee brackets, or to structural steel only. Do not hang from bridge structure except where shown on plans.
C. Do not hang or support one duct from another.
D. Use structural angle frames welded or bolted in accordance with the Steel Construction Manual (SCM) to support ductwork and associated equipment from floor, slabs, or walls.
E. Fabricate items of unit's supports in the shop. Use steel in compliance with ASTM Designation: A 36. Identify all sections for assembly in the field.
F. Welding shall comply with AWS D1.1 Code for procedures, appearance, and quality of welds.
G. Suspend ducts with hanger straps and support to decking steel with double sided beam clamps.
H. Assemble and weld the unit's supports in cable chamber to fit the unit's dimensions.
I. Provide finish surface of members free from markings, burrs, and other defects.
J. Use Corothane I zinc primer and mastic urethane second coat by Sherwin Williams or approved equivalent. Paint all ferrous structural steel, rods, fasteners, and similar items.

Intake Louver

A. Furnish and install intake louver of the size and at a location shown on the plans.
B. Intake louver shall be stainless steel Type 316, weather resistant type drainage, with bird screen.

Materials of Construction for Accessories

A. Unless otherwise specified, use stainless steel Type 316 ductwork accessories in contact with outside air or reactivation air.
B. Materials not otherwise defined are to conform to the following:

   1. Sheet Metal Material: Stainless steel, Type 316, 0.91 mm

C. Air inlet and outlet screens shall be stainless steel, Type 316.

Protection and Cleaning of Ductwork

A. During construction cover all open ends of ductwork with one layer of waterproof canvas.
B. Remove all foreign materials, and clean ducts inside and outside.
C. Clean ducts and install filters before operating fans. Do not operate fans unless filters are installed.

Duct Installation

A. Provide duct insulation on all reactivation discharge air ductwork. Conform to ASTM Designation: 547, ASTM Designation: E 84, and ASTM Designation: C 335.
B. Insulation shall be rigid glass fiber, 25.4 mm thick, 38 °C rigid pipe insulation. Chamber insulation shall be factory applied, integral wrapped, reinforced foil, double lapped jacketing. Outdoor insulation will not require factory applied foil jacketing.

C. Outdoor insulation shall have outdoor jacketing of asphalt impregnated and coated mineral fiber sheet. Duct outside the chamber shall have outdoor jacketing.
D. All joints shall be soldered.
E. Insulation shall be Owens Corning Fiberglass ASJ/SSL-11 and Fiberglas No Wrap Heavy Density One-Piece Pipe Insulation, or approved equivalent.

CONSTRUCTION

General

A. Install equipment and materials in accordance with manufacturer's recommendations.
B. All equipment supports shall be prime painted with Corothane I zinc primer and mastic urethane second coat by Sherwin Williams or approved equivalent. The Contractor shall be responsible for supplemental steel welding and installation of dehumidifier equipment supports. Supplemental steel supports shall be prime painted.
C. Upon completion of the construction work and prior to commencing the final testing, the Contractor shall thoroughly vacuum clean the ductwork, and provide (furnish and install) a complete change of filters for the dehumidifiers.

PERFORMANCE TESTS

A. Upon completion of the installation, test all equipment and systems under field operating conditions to demonstrate their compliance with specification requirements.
B. Performance test each dehumidifying system to meet the performance requirements indicated on the Technical Data Sheet furnished by the manufacturer. Performance testing shall be conducted by an independent certified testing company and control contractor. Tests shall be performed in presence of Engineer and a representative of the of dehumidifier manufacturer.
C. Test shall be performed in two consecutive days during an 8 hour period for each day. Two test periods shall be performed. The first test is to be performed upon completion of installation. The second is to be performed in approximately six months and during the summer dehumidification season.
D. Place the system in full automatic operation, with automatic controls set in accordance with design condition of 45 percent, plus or minus 5 percent, relative humidity between 7.2 °C and 24 °C , in accordance with the following:

1. Turn all dehumidifier switches to auto position.
2. Measure compartments relative humidity at every hour during the test with Probe HMP 35, with HMI 31 by Vaisala, or approved equivalent humidity instrument.
3. Record all data. Submitted data shall be typed. Submit all data to the Engineer.
4. Measure the temperature and relative humidity of the process air entering and leaving. Measurements shall be taken at the inlets and the outlets of process air duct.
5. Measure the temperature of reactivating air leaving the dehumidifier.
6. Measure the electrical input at the dehumidifier, when unit is in full operation.
7. Check the quantity of air entering the unit and leaving the unit at process air site and at reactivation air.
8. Check unit's control indicators.

E. Should any part of the system fail to meet the requirements specified under "Materials" and the performance tests in Item 4 above of this special provision, the Contractor shall adjust, repair, or replace all defective or inoperative parts; again, conduct the complete performance tests at no additional cost.
F. Submit typed test reports to the Engineer for review and approval.

MEASUREMENT AND PAYMENT

The contract lump price paid for dehumidifier system shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in dehumidifier installation, complete in place, including testing and training, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.