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Seismic Retrofit Project

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

NOTICE TO CONTRACTORS

AND

SPECIAL PROVISIONS

FOR CONSTRUCTION ON STATE HIGHWAY IN

THE CITY AND COUNTY OF SAN FRANCISCO
AT SAN FRANCISCO-OAKLAND BAY BRIDGE
FROM 0.2 MILE EAST OF SAN FRANCISCO
ANCHORAGE TO YERBA BUENA ANCHORAGE

DISTRICT 04, ROUTE 80

For use in Connection with Standard Specifications **DATED JULY, 1992**, Standard Plans **DATED JULY, 1992**, and Labor Surcharge And Equipment Rental Rates.

CONTRACT NO. 04-043554

INFORMAL BIDS CONTRACT

04-SF-80-5.8/7.6

Bids Open: July 13, 1999

Dated: April 26, 1999

OSD

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IMPORTANT SPECIAL NOTICES

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PRE-AWARD MEETING SPECIAL NOTICE

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The bidder's attention is directed to Section 2-1.07, "Bridge Seismic Retrofit Information/Questionnaire," and Section 3, "Pre-Award Meeting and Award and Execution of Contract," in the Special Provisions.

Responses to the **"Bridge Seismic Retrofit Information/Questionnaire"** included in the Proposal must be **submitted with the bid**

A pre-award **qualifications review meeting** will be conducted with the apparent low bidder on **July 15, 1999 at 10:00 a.m. in the third floor conference room, 1727 - 30th Street, Sacramento, CA 95816.** The purpose of the meeting will be to determine the bidder's qualifications and ability to complete the seismic retrofit work on this project. The second and third apparent low bidders may also be requested to participate in pre-award qualifications review meetings.

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

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DEPARTMENT OF TRANSPORTATION

NOTICE TO CONTRACTORS

THIS IS AN INFORMAL BIDS CONTRACT

CONTRACT NO. 04-043554

04-SF-80-5.8/7.6

Sealed proposals for the work shown on the plans entitled:

STATE OF CALIFORNIA; DEPARTMENT OF TRANSPORTATION; PROJECT PLANS FOR CONSTRUCTION ON STATE HIGHWAY IN THE CITY AND COUNTY OF SAN FRANCISCO AT SAN FRANCISCO-OAKLAND BAY BRIDGE FROM 0.2 MILE EAST OF SAN FRANCISCO ANCHORAGE TO YERBA BUENA ANCHORAGE

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 July 13, 1999, 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 THE CITY AND COUNTY OF SAN FRANCISCO AT SAN FRANCISCO-OAKLAND BAY BRIDGE FROM 0.2 MILE EAST OF SAN FRANCISCO ANCHORAGE TO YERBA BUENA ANCHORAGE

General work description: Seismic retrofitting of San Francisco Oakland Bay Bridge.

This project has a goal of 3 percent disabled veteran business enterprise (DVBE) participation.
No pre-bid meeting is scheduled for this project**.**
Bidder inquiries may be made as follows:

For structures work: Structures PS&E Duty Senior, Specifications and Estimating Branch, telephone number (916) 227-8770.

For all other inquiries: Toll Bridge Retrofit Program Duty Senior at District 04 Office, 111 Grand Avenue, Oakland, California 94612; Fax Number (510) 286-4563, email Duty Senior Tollbridge District04@dot.ca.gov.

Bidders will be requested to submit their inquiries in writing to the Oakland address, accompanied by an electronic copy where feasible, in order to avoid any misunderstandings. Written inquiries shall include the bidder's name, address and phone number. Written inquiries will be investigated and an addendum to the contract will be issued to the extent feasible and at the discretion of the Department. A copy of each addendum will also be posted on the Internet at "http://tresc.dot.ca.gov/sfobb/CONTRACTORINQUIRIES.html.

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 accordance 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.

Preference will be granted to bidders properly certified as a "Small Business" as determined by the Department of General Services, Office of Small Business Certification and Resources at the time of bid opening in accordance with the provisions in Section 2-1.04, "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 Certification and Resources, 1531 "I" Street, Second Floor, Sacramento, CA 95814, Telephone No. (916) 322-5060.

A reciprocal preference will be granted to "California company" bidders in accordance 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.

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

Cross sections for this project are not available.

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

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 Department of Industrial Relations are referenced but not printed in the general prevailing wage rates.

DEPARTMENT OF TRANSPORTATION

Deputy Director Transportation Engineering

Dated April 26, 1999

RRF/CCI

COPY OF ENGINEER'S ESTIMATE

(NOT TO BE USED FOR BIDDING PURPOSES)

04-043554

Item	Item Code	Item	Unit of Measure	Estimated Quantity	Unit Price	Item Total

1	015743	TIME RELATED OVERHEAD	WDAY	480		
2	070010	PROGRESS SCHEDULE (CRITICAL PATH)	LS	LUMP SUM	LUMP SUM	
3	071321	TEMPORARY FENCE (TYPE CL-6)	LF	1,780		
4	015744	TEMPORARY 10' CHAIN LINK GATE (TYPE CL-6)	EA	12		
5	074019	PREPARE STORM WATER POLLUTION PREVENTION PLAN	LS	LUMP SUM	LUMP SUM	
6	074020	WATER POLLUTION CONTROL	LS	LUMP SUM	LUMP SUM	
7 (S)	120090	CONSTRUCTION AREA SIGNS	LS	LUMP SUM	LUMP SUM	
8 (S)	120100	TRAFFIC CONTROL SYSTEM	LS	LUMP SUM	LUMP SUM	
9	120120	TYPE III BARRICADE	EA	4		
10	120149	TEMPORARY PAVEMENT MARKING (PAINT)	SQFT	35		
11	120159	TEMPORARY TRAFFIC STRIPE (PAINT)	LF	1,000		
12	015745	TEMPORARY PARKING METER POST	EA	7		
13	015746	TEMPORARY CURB RAMP	EA	3		
14	129000	TEMPORARY RAILING (TYPE K)	LF	1,080		
15	129100	TEMPORARY CRASH CUSHION MODULE	EA	31		
16	150608	REMOVE CHAIN LINK FENCE	LF	160		
17	150711	REMOVE PAINTED TRAFFIC STRIPE	LF	310		
18	150712	REMOVE PAINTED PAVEMENT MARKING	SQFT	120		
19	150826	REMOVE MANHOLE	EA	2		
20	151540	RECONSTRUCT CHAIN LINK FENCE	LF	420		

Item	Item Code	Item	Unit of Measure	Estimated Quantity	Unit Price	Item Total
21	015747	RESET PARKING METER POST	EA	27		
22	015748	RESET SEAT BOLLARD	EA	2		
23 (S)	153101	PLANE ASPHALT CONCRETE PAVEMENT	SQYD	2,900		
24	153210	REMOVE CONCRETE	CY	170		
25	157560	BRIDGE REMOVAL (PORTION)	LS	LUMP SUM	LUMP SUM	
26	047650	TEMPORARY SUPPORTS	LS	LUMP SUM	LUMP SUM	
27	047651	REMOVE RIVET	EA	15,650		
28	190101	ROADWAY EXCAVATION	CY	290		
29 (F)	192021	STRUCTURE EXCAVATION (TYPE DH)	CY	7,550		
30 (F)	193003	STRUCTURE BACKFILL (BRIDGE)	CY	6,580		
31 (S)	200001	HIGHWAY PLANTING	LS	LUMP SUM	LUMP SUM	
32	047652	MODIFY WATER AND AIR LINE (BRIDGE)	LS	LUMP SUM	LUMP SUM	
33 (S)	204099	PLANT ESTABLISHMENT WORK	LS	LUMP SUM	LUMP SUM	
34 (S)	208000	IRRIGATION SYSTEM	LS	LUMP SUM	LUMP SUM	
35	260301	CLASS 3 AGGREGATE BASE	CY	168		
36	390102	ASPHALT CONCRETE (TYPE A)	TON	510		
37	394040	PLACE ASPHALT CONCRETE DIKE (TYPE A)	LF	20		
38	405030	PORTLAND CEMENT CONCRETE BASE	CY	82		
39 (F)	510051	STRUCTURAL CONCRETE, BRIDGE FOOTING	CY	1,460		
40 (F)	510053	STRUCTURAL CONCRETE, BRIDGE	CY	3,400		

Item	Item Code	Item	Unit of Measure	Estimated Quantity	Unit Price	Item Total
41	510101	CLASS A CONCRETE (MINOR STRUCTURE)	EA	1		
42 (F)	510502	MINOR CONCRETE (MINOR STRUCTURE)	CY	3.2		
43	510522	MINOR CONCRETE (PIPE COVER)	CY	17		
44	511106	DRILL AND BOND DOWEL	LF	77,000		
45 (S)	515060	CORE CONCRETE (1")	LF	96		
46 (S)	047653	CORE CONCRETE (2") AND BOND	LF	2,040		
47 (S)	047654	CORE CONCRETE (3") AND PRESSURE GROUT	LF	96		
48 (S)	047655	CORE CONCRETE (3 1/2") AND PRESSURE GROUT	LF	2,210		
49 (S)	047656	FURNISH SEISMIC ISOLATION BEARING	EA	5		
50 (S)	047657	INSTALL SEISMIC ISOLATION BEARING	EA	4		
51 (S-F)	520102	BAR REINFORCING STEEL (BRIDGE)	LB	1,200,000		
52 (S-F)	520110	BAR REINFORCING STEEL (EPOXY COATED) (BRIDGE)	LB	500,000		
53 (S-F)	540101	ASPHALT MEMBRANE WATERPROOFING	SQFT	4,990		
54 (S-F)	047658	STEEL JACKET (CONCRETE)	LB	272,100		
55 (S-F)	550203	FURNISH STRUCTURAL STEEL (BRIDGE)	LB	868,000		
56 (S-F)	550204	ERECT STRUCTURAL STEEL (BRIDGE)	LB	868,000		
57 (S)	590115	CLEAN AND PAINT STRUCTURAL STEEL	LS	LUMP SUM	LUMP SUM	
58 (S-F)	590135	SPOT BLAST CLEAN AND PAINT UNDERCOAT	SQFT	13,600		
59 (S)	590301	WORK AREA MONITORING	LS	LUMP SUM	LUMP SUM	
60	714035	10" CLAY SEWER PIPE	LF	64		

Item	Item Code	Item	Unit of Measure	Estimated Quantity	Unit Price	Item Total
61	714036	12" CLAY SEWER PIPE	LF	26		
62	718005	10" CAST IRON SEWER PIPE	LF	38		
63	718006	12" CAST IRON SEWER PIPE	LF	16		
64	731502	MINOR CONCRETE (MISCELLANEOUS CONSTRUCTION)	CY	170		
65 (S-F)	750001	MISCELLANEOUS IRON AND STEEL	LB	1,243		
66 (S-F)	750501	MISCELLANEOUS METAL (BRIDGE)	LB	11,400		
67 (S)	840656	PAINT TRAFFIC STRIPE (2-COAT)	LF	680		
68 (S)	840666	PAINT PAVEMENT MARKING (2-COAT)	SQFT	480		
69 (S)	015749	ELECTRICAL FACILITIES (SEISMIC RETROFIT)	LS	LUMP SUM	LUMP SUM	
70	015900	ELECTRONIC MOBILE DAILY DIARY COMPUTER SYSTEM DATA DELIVERY	LS	LUMP SUM	LUMP SUM	
71 (S)	015901	HANDLING, HAULING, AND DISPOSAL OF HAZARDOUS NON-RCRA MATERIALS TO CLASS I	TON	1,650		
72 (S)	015902	SITE WORK (PUMP STATION)	LS	LUMP SUM	LUMP SUM	
73 (S)	015903	BUILDING WORK (PUMP STATION)	LS	LUMP SUM	LUMP SUM	
74 (S)	015904	MECHANICAL WORK (PUMP STATION)	LS	LUMP SUM	LUMP SUM	
75 (S)	015905	ELECTRICAL WORK (PUMP STATION)	LS	LUMP SUM	LUMP SUM	
76 (S)	015906	LAKE MERCED CONTROL WORK (PUMP STATION)	LS	LUMP SUM	LUMP SUM	
77 (S)	015907	YERBA BUENA ISLAND ELECTRICAL AND TELEMETRY WORK (PUMP STATION)	LS	LUMP SUM	LUMP SUM	
78 (S)	015908	PUMP STATION DEMOLITION WORK	LS	LUMP SUM	LUMP SUM	
79 (S)	015909	REPLACEMENT WATERLINE ON PIER W-1	LS	LUMP SUM	LUMP SUM	
80	015910	ELECTRICAL CONDUIT INSTALLATION ON PIER W-1	LS	LUMP SUM	LUMP SUM	

Item	Item Code	Item	Unit of Measure	Estimated Quantity	Unit Price	Item Total
81	999990	MOBILIZATION	LS	LUMP SUM	LUMP SUM	

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISIONS

Annexed to Contract No. 04-043554

SECTION 1. SPECIFICATIONS AND PLANS

The work embraced herein shall conform to the provisions in the Standard Specifications dated July, 1992, and the Standard Plans dated July, 1992, of the Department of Transportation insofar as the same may apply and these special provisions.

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 indented text following said 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.

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

As-built plans and as-built working drawings shall be considered as essential parts of the contract for the purposes set forth in Section 5-1.04, "Coordination and Interpretation of Plans, Standard Specifications and Special Provisions," of the Standard Specifications.

In case of conflicts between the as-built plans or as-built working drawings, and the project plans, the project plans shall take precedence over and be used in lieu of the conflicting portions.

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 accordance 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 done by each subcontractor listed. A sheet for listing the subcontractors is included in the Proposal.

If the Bidder submits cash or a cashier's check or a certified check as the form of bidder's security (See said Section 2-1.07 of the Standard Specifications), the Bidder shall also include with the bid submittal a signed and notarized affidavit from an admitted surety insurer that contract bonds, as required by Section 3-1.02, \"Contract Bonds,\" of the Standard Specifications, will be provided within the time specified elsewhere in these special provisions for executing and returning the contract for approval.

The form of Bidder's Bond 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.

In accordance 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.

If the bidder claims a mistake was made in his bid, the bidder shall give the Department written notice within 48 hours, not including Saturdays, Sundays and legal holidays, after the opening of bids of the alleged mistake, in lieu of the 5 days specified in Section 2-1.095, \"Relief of Bidders,\" in the Standard Specifications. The notice of alleged mistake shall specify in detail how the mistake occurred.

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 Veterans 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 Certification and Resources, 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:

a. signed agreements that all trucking will be performed by DVBE truckers if credit is toward the DVBE goal;

b. a "certified roster" showing that all trucks are owned by DVBEs; and

c. 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:

a. 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;

b. a "certified roster" showing that at least 20 percent of the number of trucks are owned by DVBE truckers; and

c. 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 3-1.01A, "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 Certification and Resources, 1531 "I" Street, Second Floor, Sacramento, CA 95814, 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), 3 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 Certification and Resources, Department of General Services, may be contacted at (916) 322-5060 or visit their internet web site at http://www.osmb.dgs.ca.gov/ for program information and certification status. The Department's Business Enterprise Program may also be contacted at (916) 227-9599 or the internet web site at http://www.dot.ca.gov/hq/bep/.

2-1.04 SUBMISSION OF DVBE INFORMATION

The required DVBE information shall be submitted **WITH THE BID** on the following \"CALTRANS BIDDER - DVBE - INFORMATION\" and \"TELEPHONE LOG AND LIST OF REJECTED DVBEs.\"

It is the bidder's responsibility to meet the goal for DVBE participation or to establish that, prior to bidding, the bidder made good faith efforts to do so based on the information in the \"CALTRANS BIDDER - DVBE - INFORMATION\" and \"TELEPHONE LOG AND LIST OF REJECTED DVBEs.\"

The information to show that the DVBE goal will be met on the \"CALTRANS BIDDER - DVBE - INFORMATION\" form shall include the names of DVBEs and DVBE joint venture partners to be used, with a complete description of work or supplies to be provided by each and the dollar value of each such DVBE transaction. 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 said work to be performed or furnished by that DVBE shall be included in the DVBE information, including the planned location of said work. DVBE prime contractors shall enter their Office of Small Business Certification and Resources (OSBCR) - DVBE reference number and/or DBA name, as listed with OSBCR, on the line provided. (Note: DVBE subcontractors to whom the bidder proposes to directly subcontract portions of the work are to be named in the bid. - See Section 2-1.054, \"Required Listing of Proposed Subcontractors,\" of the Standard Specifications and Section 2-1.01, \"General,\" of these special provisions, regarding listing of proposed subcontractors).

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 with the bid. 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 with the bid. The \"certified roster\" must indicate that at least 20 percent of the broker's trucks are owned by 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 at least 20 percent of the revenue paid by the broker will be paid to DVBEs listed on the \"certified roster\".

Information necessary to establish the bidder's good faith efforts to meet the DVBE goals shall be included in the \"TELEPHONE LOG AND LIST OF REJECTED DVBEs\" form located in the Proposal and shall include:

1. The names, dates and times of notices of all certified DVBEs solicited by telephone for this project and the dates, times and methods used for following up initial solicitations to determine with certainty whether the DVBEs were interested.
2. The names of DVBEs who submitted bids which were not accepted and the reason for rejection of the DVBEs bid.

Bidders are cautioned that even though their submittal indicates they will meet the stated DVBE goal, their submittal should also include the telephone log and rejected DVBE 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.

It is the bidders responsibility to be available, by phone, both the day of and the day after the bid opening to answer questions and provide good faith effort clarification. The bidder shall also assure that listed DVBEs are available, by phone, on both days.

If it is found that the goal has not been met, the Department will review the information submitted with the bid to determine the bidder's good faith effort. In the event that the Department determines that a bidder has not made a good faith effort based on the information submitted with the bid and its independent investigation, the Department's decision will be final.

2-1.05 SMALL BUSINESS PREFERENCE

Attention is directed to \"Award and Execution of Contract\" elsewhere in 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 Certification and Resources, 1531 "I" Street, Second Floor, Sacramento, CA 95814.

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 Certification and Resources (OSBCR) 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:

1. The lowest responsible bid for the project exceeds $100 000; and
2. The project work to be performed requires a Class A or a Class B contractor's license; and
3. 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 accordance 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:

(1) Has its principal place of business in California.

(2) Has its principal place of business in a state in which there is no local contractor preference on construction contracts.

(3) 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 BRIDGE SEISMIC RETROFIT INFORMATION/QUESTIONNAIRE

The Department has established the need to obtain information regarding each bidder's qualifications for performing bridge seismic retrofit work contracts.

Bidders shall submit responses to the "Bridge Seismic Retrofit Information/Questionnaire" included in the Proposal. The responses to the Questionnaire shall be submitted with the bid.

In signing the signature page of the Proposal, the bidder certifies that the information and answers on the "Bridge Seismic Retrofit Information/Questionnaire" are complete and accurate.

SECTION 3. PRE-AWARD MEETING AND 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 the pre-award meeting and the award and execution of contract.

3-1.01A PRE-AWARD MEETING.--Bidders are advised that on July 15, 1999 at 10:00 a.m., in the third floor conference room, 1727 - 30th Street, Sacramento, CA 95816, the apparent low bidder shall participate in a pre-award qualifications review meeting conducted by an agent of the Director. Non-attendance to the qualifications 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 "Bridge Seismic Retrofit Information/Questionnaire" submitted with the bid. 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 seismic retrofit 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 seismic retrofit work, in a manner that is safe for the workers and the public, will be based on the bidder's experience, qualifications of on-site supervisory personnel, equipment, conceptual approach to the bridge seismic retrofit work and safety history of the bidder and its supervisory personnel. The decision of the Engineer regarding the bidder's qualifications shall be final.

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 12 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.

3-1.01B AWARD AND EXECUTION OF CONTRACT.--The award of contract, if it be awarded, will be to the lowest responsible bidder whose proposal complies with all the requirements prescribed and who has met the goal for DVBE participation or has demonstrated, to the satisfaction of the Department, good faith effort to do so and who has established to the satisfaction of the Engineer, the qualifications and ability to complete the seismic retrofit work on this project in a safe and timely manner. Meeting the goal for DVBE participation or demonstrating, to the satisfaction of the Department, good faith efforts to do so and establishing the qualifications and ability to complete the seismic retrofit work are conditions for being eligible for award of contract.

It is anticipated that this contract will be awarded within 10 days after the bid opening.

The contract shall be signed by the successful bidder and shall be received with contract bonds by the Department within **4 days**, including Saturdays, Sundays and legal holidays, after the bidder has received notice that the contract has been awarded. 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, P.O. Box 942874, Sacramento, CA 94274-0001, Attn: Office Engineer (MS 43)- Contracts.

Within 2 days, not including Saturdays, Sundays and legal holidays, of return of the executed contract and bonds, the Department will notify the successful bidder of either approval of the contract by the Attorney General or the attorney appointed and authorized to represent the Department of Transportation, or disapproval of the submittal. Should the Department fail to provide notification within said 2 days, the delay will be considered a right of way delay as specified in Section 8-1.09, \"Right of Way Delays,\" of the Standard Specifications.

A \"Vendor 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, vendor 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 \"Vendor 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 \"Vendor Data Record\" form is in addition to any other retention of payments due the Contractor.

Attention is also directed to \"Small Business Preference\" of these special provisions. Any bidder who is certified as a Small Business by the Department of General Services, Office of Small Business Certification and Resources will be allowed a preference in the award of this contract, if it be awarded, under the following conditions:

(1) The apparent low bidder is not certified as a Small Business, or has not filled out and signed the Request for Small Business Preference included with the bid documents and attached a copy of their Office of Small Business Certification and Resources (OSBCR) small business certification letter to the form; and

(2) The bidder filled out and signed the Request for Small Business Preference form included with the bid documents and attached a copy of their Office of Small Business Certification and Resources (OSBCR) small business certification letter to the form.

The small business preference will be a reduction in the bid submitted by the small business contractor, for bid comparison purposes, by an amount equal to 5 percent of the amount bid by the apparent low bidder, the amount not to exceed $50 000. If this reduction results in the small business contractor becoming the low bidder, then the contract will be awarded to the small business contractor on the basis of the actual bid of the small business contractor notwithstanding the reduced bid price used for bid comparison purposes.

Attention is also 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.

Small business bidders shall have precedence over nonsmall business bidders in that the application of the \"California company\" preference for which nonsmall business bidders may be eligible shall not result in the denial of the award to a small business bidder.

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

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

The Contractor shall begin work within 5 calendar days after the contract has been approved by the Attorney General or the attorney appointed and authorized to represent the Department of Transportation.

This work (except plant establishment work) shall be diligently prosecuted to completion before the expiration of

480 WORKING DAYS

beginning at 12:01 a.m. on the **FIRST WORKING DAY AFTER CONTRACT AWARD.**

The Contractor shall pay to the State of California the sum of $1700 per day, for each and every calendar day's delay in finishing the work in excess of the number of working days prescribed above.

The Contractor shall diligently prosecute all work (including plant establishment) to completion before the expiration of

605 WORKING DAYS

beginning at 12:01 a.m. on the **FIRST WORKING DAY AFTER CONTRACT AWARD.**

The Contractor shall pay to the State of California the sum of $250 per day, for each and every calendar day's delay in completing the work in excess of the number of working days prescribed above.

In no case will liquidated damages of more than $1700 per day be assessed.

The 72 hours advance notice before beginning work as referred to in said Section 8-1.03 is changed to 24 hours advance notice for this project.

SECTION 5. GENERAL

SECTION 5-1. MISCELLANEOUS

5-1.00 PLANS AND WORKING DRAWINGS

When the specifications require working drawings to be submitted to the Office of Structure Design, the drawings shall be submitted to: Office of Structure Design, Documents Unit, P.O. Box 942874, Mail Station 9, Sacramento, CA 94274-0001 (1801 30th Street, Sacramento, CA 95816), Telephone (916) 227-8252.

5-1.005 CONTRACT BONDS

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

The payment bond shall be in a sum not less than the following:

1. One hundred percent of the total amount payable by the terms of the contract when the total amount payable does not equal or exceed five million dollars ($5 000 000).
2. Fifty percent of the total amount payable by the terms of the contract when the total amount payable is not less than five million dollars ($5 000 000) and does not exceed ten million dollars ($10 000 000).
3. Twenty-five percent of the total amount payable by the terms of the contract when the total amount payable exceeds ten million dollars ($10 000 000).

5-1.01 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 $5,000 or more.

5-1.02 LABOR CODE REQUIREMENTS

Section 7-1.01A(1), "Hours of Labor," of the Standard Specifications is amended to read:

7-1.01A(1) Hours of Labor.— Eight hours labor constitutes a legal day's work. The Contractor or any subcontractor under the Contractor shall forfeit, as a penalty to the State of California, $25 for each worker employed in the execution of the contract by the respective Contractor or subcontractor for each calendar day during which that worker is required or permitted to work more than 8 hours in any one calendar day and 40 hours in any one calendar week in violation of the provisions of the Labor Code, and in particular, Section 1810 to Section 1815, thereof, inclusive, except that work performed by employees of Contractors in excess of 8 hours per day, and 40 hours during any one week, shall be permitted upon compensation for all hours worked in excess of 8 hours per day at not less than one and one-half times the basic rate of pay, as provided in Section 1815 thereof.

Section 7-1.01A(2), "Prevailing Wage," of the Standard Specifications is amended to read:

7-1.01A(2) Prevailing Wage.— The Contractor and any subcontractor under the Contractor shall comply with Labor Code Sections 1774 and 1775. Pursuant to Section 1775, the Contractor and any subcontractor under the Contractor shall forfeit to the State or political subdivision on whose behalf the contract is made or awarded a penalty of not more than fifty dollars ($50) for each calendar day, or portion thereof, for each worker paid less than the

prevailing rates as determined by the Director of Industrial Relations for the work or craft in which the worker is employed for any public work done under the contract by the Contractor or by any subcontractor under the Contractor in violation of the provisions of the Labor Code and in particular, Labor Code Sections 1770 to 1780, inclusive. The amount of this forfeiture shall be determined by the Labor Commissioner and shall be based on consideration of the mistake, inadvertence, or neglect of the Contractor or subcontractor in failing to pay the correct rate of prevailing wages, or the previous record of the Contractor or subcontractor in meeting their respective prevailing wage obligations, or the willful failure by the Contractor or subcontractor to pay the correct rates of prevailing wages. A mistake, inadvertence, or neglect in failing to pay the correct rate of prevailing wages is not excusable if the Contractor or subcontractor had knowledge of the obligations under the Labor Code. In addition to the penalty and pursuant to Labor Code Section 1775, the difference between the prevailing wage rates and the amount paid to each worker for each calendar day or portion thereof for which each worker was paid less than the prevailing wage rate shall be paid to each worker by the Contractor or subcontractor. If a worker employed by a subcontractor on a public works project is not paid the general prevailing per diem wages by the subcontractor, the prime contractor of the project is not liable for the penalties described above unless the prime contractor had knowledge of that failure of the subcontractor to pay the specified prevailing rate of wages to those workers or unless the prime contractor fails to comply with all of the following requirements:

1. The contract executed between the contractor and the subcontractor for the performance of work on the public works project shall include a copy of the provisions of Sections 1771, 1775, 1776, 1777.5, 1813, and 1815 of the Labor Code.
2. The contractor shall monitor the payment of the specified general prevailing rate of per diem wages by the subcontractor to the employees, by periodic review of the certified payroll records of the subcontractor.
3. Upon becoming aware of the subcontractor's failure to pay the specified prevailing rate of wages to the subcontractor's workers, the contractor shall diligently take corrective action to halt or rectify the failure, including, but not limited to, retaining sufficient funds due the subcontractor for work performed on the public works project.
4. Prior to making final payment to the subcontractor for work performed on the public works project, the contractor shall obtain an affidavit signed under penalty of perjury from the subcontractor that the subcontractor has paid the specified general prevailing rate of per diem wages to the subcontractor's employees on the public works project and any amounts due pursuant to Section 1813 of the Labor Code.

Pursuant to Section 1775 of the Labor Code, the Division of Labor Standards Enforcement shall notify the Contractor on a public works project within 15 days of the receipt by the Division of Labor Standards Enforcement of a complaint of the failure of a subcontractor on that public works project to pay workers the general prevailing rate of per diem wages. If the Division of Labor Standards Enforcement determines that employees of a subcontractor were not paid the general prevailing rate of per diem wages and if the Department did not retain sufficient money under the contract to pay those employees the balance of wages owed under the general prevailing rate of per diem wages, the contractor shall withhold an amount of moneys due the subcontractor sufficient to pay those employees the general prevailing rate of per diem wages if requested by the Division of Labor Standards Enforcement. The Contractor shall pay any money retained from and owed to a subcontractor upon receipt of notification by the Division of Labor Standards Enforcement that the wage complaint has been resolved. If notice of the resolution of the wage complaint has not been received by the Contractor within 180 days of the filing of a valid notice of completion or acceptance of the public works project, whichever occurs later, the Contractor shall pay all moneys retained from the subcontractor to the Department. These moneys shall be retained by the Department pending the final decision of an enforcement action.

Pursuant to the provisions of Section 1773 of the Labor Code, the Department has obtained the general prevailing rate of wages (which rate includes employer payments for health and welfare, pension, vacation, travel time, and subsistence pay as provided for in Section 1773.8 of the Labor Code, apprenticeship or other training programs authorized by Section 3093 of the Labor Code, and similar purposes) applicable to the work to be done, for straight time, overtime, Saturday, Sunday and holiday work. The holiday wage rate listed shall be applicable to all holidays recognized in the collective bargaining agreement of the particular craft, classification or type of workmen concerned. The general prevailing wage rates and any applicable changes to these wage rates are available at the Labor Compliance Office at the offices of the District Director of Transportation for the district in which the work is situated. For work situated in District 9, the wage rates are available at the Labor Compliance Office at the offices of the District Director of Transportation for District 6, located at Fresno. General prevailing wage rates are also available from the California Department of Industrial Relations' Internet Web Site at: http://www.dir.ca.gov.

The wage rates determined by the Director of Industrial Relations for the project refer to expiration dates. Prevailing wage determinations with a single asterisk after the expiration date are in effect on the date of advertisement for bids and are good for the life of the contract. Prevailing wage determinations with double asterisks after the expiration date indicate that the wage rate to be paid for work performed after this date has been determined. If work is to extend past this date, the new rate shall be paid and incorporated in the contract. The Contractor shall contact the Department of Industrial Relations as indicated in the wage rate determinations to obtain predetermined wage changes.

Pursuant to Section 1773.2 of the Labor Code, general prevailing wage rates shall be posted by the Contractor at a prominent place at the site of the work.

Changes in general prevailing wage determinations which conform to Labor Code Section 1773.6 and Title 8 California Code of Regulations Section 16204 shall apply to the project when issued by the Director of Industrial Relations at least 10 days prior to the date of the Notice to Contractors for the project.

The State will not recognize any claim for additional compensation because of the payment by the Contractor of any wage rate in excess of the prevailing wage rate set forth in the contract. The possibility of wage increases is one of the elements to be considered by the Contractor in determining the bid, and will not under any circumstances be considered as the basis of a claim against the State on the contract.

7-1.01A(2)(a) Travel and Subsistence Payments.— Attention is directed to the requirements of Section 1773.8 of the Labor Code. The Contractor shall make travel and subsistence payments to each workman, needed to execute the work, in accordance with the requirements in Labor Code Section 1773.8.

The first and second paragraphs of Section 7-1.01A(3), "Payroll Records," of the Standard Specifications are amended to read:

7-1.01A(3) Payroll Records.— Attention is directed to the provisions of Labor Code Section 1776, a portion of which is quoted below. Regulations implementing Labor Code Section 1776 are located in Sections 16016 through 16019 and Sections 16207.10 through 16207.19 of Title 8, California Code of Regulations.

"1776. (a) Each contractor and subcontractor shall keep accurate payroll records, showing the name, address, social security number, work classification, straight time and overtime hours worked each day and week, and the actual per diem wages paid to each journeyman, apprentice, worker, or other employee employed by him or her in connection with the public work. Each payroll record shall contain or be verified by a written declaration that it is made under penalty of perjury, stating both of the following:

(1) The information contained in the payroll record is true and correct.

(2) The employer has complied with the requirements of Sections 1771, 1811, and 1815 for any work performed by his or her employees on the public works project.

"(b) The payroll records enumerated under subdivision (a) shall be certified and shall be available for inspection at all reasonable hours at the principal office of the contractor on the following basis:

(1) A certified copy of an employee's payroll record shall be made available for inspection or furnished to the employee or his or her authorized representative on request.

(2) A certified copy of all payroll records enumerated in subdivision (a) shall be made available for inspection or furnished upon request to a representative of the body awarding the contract, the Division of Labor Standards Enforcement, and the Division of Apprenticeship Standards of the Department of Industrial Relations.

(3) A certified copy of all payroll records enumerated in subdivision (a) shall be made available upon request by the public for inspection or for copies thereof. However, a request by the public shall be made through either the body awarding the contract, the Division of Apprenticeship Standards, or the Division of Labor Standards Enforcement. If the requested payroll records have not been provided pursuant to paragraph (2), the requesting party shall, prior to being provided the records, reimburse the costs of preparation by the contractor, subcontractors, and the entity through which the request was made. The public shall not be given access to the records at the principal office of the contractor.

"(c) The certified payroll records shall be on forms provided by the Division of Labor Standards Enforcement or shall contain the same information as the forms provided by the division.

"(d) A contractor or subcontractor shall file a certified copy of the records enumerated in subdivision (a) with the entity that requested the records within 10 days after receipt of a written request.

"(e) Any copy of records made available for inspection as copies and furnished upon request to the public or any public agency by the awarding body, the Division of Apprenticeship Standards, or the Division of Labor Standards Enforcement shall be marked or obliterated in a manner so as to prevent disclosure of an individual's name, address, and social security number. The name and address of the contractor awarded the contract or the subcontractor performing the contract shall not be marked or obliterated.

"(f) The contractor shall inform the body awarding the contract of the location of the records enumerated under subdivision (a), including the street address, city and county, and shall, within five working days, provide a notice of a change of location and address.

"(g) The contractor or subcontractor shall have 10 days in which to comply subsequent to receipt of a written notice requesting the records enumerated in subdivision (a). In the event that the contractor or subcontractor fails to comply within the 10-day period, he or she shall, as a penalty to the state or political subdivision on whose behalf the contract is made or awarded, forfeit twenty-five dollars ($25) for each calendar day, or portion thereof, for each worker, until strict compliance is effectuated. Upon the request of the Division of Apprenticeship Standards or the Division of Labor Standards Enforcement, these penalties shall be withheld from progress payments then due. A contractor is not subject to a penalty assessment pursuant to this section due to the failure of a subcontractor to comply with this section."

The penalties specified in subdivision (g) of Labor Code Section 1776 for noncompliance with the provisions of Section 1776 may be deducted from any moneys due or which may become due to the Contractor.

5-1.03 CONTRACTOR'S LICENSING LAWS

The third paragraph of Section 7-1.01C, "Contractor's Licensing Laws," of the Standard Specifications is amended to read:

Attention is also directed to the provisions of Public Contract Code Section 10164. In all projects where Federal funds are involved, the Contractor shall be properly licensed at the time the contract is awarded.

5-1.035 INDEMNIFICATION AND INSURANCE

Section 7-1.12, "Responsibility for Damage," of the Standard Specifications is deleted.

The Standard Specifications is amended by adding the following Section 7-1.121, "Indemnification," and Section 7-1.122, "Insurance," before Section 7-1.125, "Legal Action Against the Department."

7-1.121 Indemnification.—With the exception that this section shall in no event be construed to require indemnification by the Contractor to a greater extent than permitted by law, the Contractor shall defend, indemnify and save harmless the State, including its officers, directors, agents (excluding agents who are design professionals), and employees, and each of them (Indemnitees), from any and all claims, demands, causes of action, damages, costs, expenses, actual attorneys' fees, losses or liabilities, in law or in equity, of every kind and nature whatsoever (Claims), arising out of or in connection with the Contractor's performance of this contract for:

A. Bodily injury including, but not limited to, bodily injury, sickness or disease, emotional injury or death to persons, including, but not limited to, the public, any employees or agents of the Contractor, State, Department, or any other contractor and;

B. Damage to property of anyone including loss of use thereof;

caused or alleged to be caused in whole or in part by any negligent or otherwise legally actionable act or omission of the Contractor or anyone directly or indirectly employed by the Contractor or anyone for whose acts the Contractor may be liable.

Except as otherwise provided by law, the indemnification provisions above shall apply regardless of the existence or degree of fault of Indemnitees. The Contractor, however, shall not be obligated to indemnify Indemnitees for Claims arising from conduct delineated in Civil Code section 2782. Further, the Contractor's indemnity obligation shall not extend to Claims to the extent they arise from any defective or substandard condition of the roadway which existed at or prior to the time the Contractor commenced work, unless this condition has been changed by the work or the scope of the work requires the Contractor to maintain existing Roadway facilities and the claim arises from the Contractor's failure to maintain. The Contractor's indemnity obligation shall extend to Claims arising after the work is completed and accepted only if these Claims are directly related to alleged acts or omissions of the Contractor which occurred during the course of the work. No inspection by the Department, its employees or agents shall be deemed a waiver by the Department of full compliance with the requirements of this section.

The Contractor's obligation to defend and indemnify shall not be excused because of the Contractor's inability to evaluate liability or because the Contractor evaluates liability and determines that the Contractor is not liable to the claimant. The Contractor will respond within 30 days to the tender of any claim for defense and indemnity by the State, unless this time has been extended by the State. If the Contractor fails to accept or reject a tender of defense and indemnity within 30 days, in addition to any other remedy authorized by law, so much of the money due the Contractor under and by virtue of the contract as shall reasonably be considered necessary by the Department, may be retained by the State until disposition has been made of the claim or suit for damages, or until the Contractor accepts or rejects the tender of defense, whichever occurs first.

With respect to third party claims against the Contractor, the Contractor waives any and all rights of any type to express or implied indemnity against the State, its directors, officers, employees, or agents (excluding agents who are design professionals).

7-1.122 Insurance.—Insurance shall conform to the following requirements:

7-1.122A Casualty Insurance.—The Contractor shall, at the Contractor's expense, procure and maintain insurance on all of its operations with companies acceptable to the Department as follows. All insurance shall be kept in full force and effect from the beginning of the work through final acceptance by the State. In addition, the Contractor shall maintain completed operations coverage with a carrier acceptable to the Department through the expiration of the patent deficiency in construction statute of repose set forth in Section 337.1 of the Code of Civil Procedure.

7-1.122A(1) Workers' Compensation and Employer's Liability Insurance.—Workers' Compensation insurance shall be provided as specified in Section 7-1.01A(6), "Workers' Compensation." Employer's Liability Insurance shall be provided in amounts not less than:

(a) $1,000,000 for each accident for bodily injury by accident.
(b) $1,000,000 policy limit for bodily injury by disease.
(c) $1,000,000 for each employee for bodily injury by disease.

If there is an exposure of injury to the Contractors' employees under the U.S. Longshoremen's and Harbor Workers' Compensation Act, the Jones Act or under laws, regulations or statutes applicable to maritime employees, coverage shall be included for such injuries or claims.

7-1.122A(2) Liability Insurance.—The Contractor shall carry General Liability and Umbrella or Excess Liability Insurance covering all operations by or on behalf of the Contractor providing insurance for bodily injury liability, and property damage liability for the limits of liability indicated below and including coverage for:

(a) premises, operations and mobile equipment
(b) products and completed operations

(c) broad form property damage (including completed operations)
(d) explosion, collapse and underground hazards
(e) personal injury
(f) contractual liability

7-1.122A(3) Liability Limits/Additional Insureds .—The limits of liability shall be at least:

(a) $1,000,000 for each occurrence (combined single limit for bodily injury and property damage).
(b) $2,000,000 aggregate for products-completed operations.
(c) $2,000,000 general aggregate. This general aggregate limit shall apply separately to the Contractor's work under this Agreement.
(d) $5,000,000 umbrella or excess liability. For projects over $25,000,000 only, an additional $10,000,000 umbrella or excess liability (for a total of $15,000,000). Umbrella or excess policy shall include products liability completed operations coverage and may be subject to $5,000,000 or $15,000,000 aggregate limits. Further, the umbrella or excess policy shall contain a clause stating that it takes effect (drops down) in the event the primary limits are impaired or exhausted.

The State and the Department, including their officers, directors, agents (excluding agents who are design professionals), and Department employees, shall be named as additional insureds under the General Liability and Umbrella Liability Policies with respect to liability arising out of or connected with work or operations performed by or on behalf of the Contractor under this contract. Coverage for such additional insureds shall not extend to liability:

(1) arising from any defective or substandard condition of the Roadway which existed at or prior to the time the Contractor commenced work, unless such condition has been changed by the work or the scope of the work requires the Contractor to maintain existing Roadway facilities and the claim arises from the Contractor's failure to maintain; or
(2) for claims occurring after the work is completed and accepted unless these claims are directly related to alleged acts or omissions of the Contractor which occurred during the course of the work; or
(3) to the extent prohibited by Section 11580.04 of the Insurance Code.

The policy shall stipulate that the insurance afforded the additional insureds shall apply as primary insurance. Any other insurance or self insurance maintained by the Department or State will be excess only and shall not be called upon to contribute with this insurance. Such additional insured coverage shall be provided by a policy provision or by an endorsement providing coverage at least as broad as Additional Insured (Form B) endorsement form CG 2010, as published by the Insurance Services Office (ISO).

7-1.122B Automobile Liability Insurance.—The Contractor shall carry automobile liability insurance, including coverage for all owned, hired and non-owned automobiles. The primary limits of liability shall be not less than $1,000,000 combined single limit each accident for bodily injury and property damage. The umbrella or excess liability coverage required under Section 7-1.122A(3), "Liability Limits/Additional Insureds," shall also apply to automobile liability.

7-1.122C Policy Forms, Endorsements and Certificates.—The Contractor's General Liability Insurance shall be provided under Commercial General Liability policy form no. CG0001 as published by the Insurance Services Office (ISO) or under a policy form at least as broad as policy form no. CG0001.

Evidence of insurance in a form acceptable to the Department, including the required "additional insured" endorsements, shall be furnished by the Contractor to the Department at or prior to the pre-construction conference. The evidence of insurance shall provide that there will be no cancellation, lapse, or reduction of coverage without thirty (30) days' prior written notice to the Department. Certificates of Insurance, as evidence of required insurance, for the General Liability, Auto Liability and Umbrella-Excess Liability policies shall set forth deductible amounts applicable to each policy and all exclusions which are added by endorsement to each policy. The Department may expressly allow deductible clauses, which it does not consider excessive, overly broad, or harmful to the interests of the State. Standard ISO form CG 0001 or similar exclusions will be allowed provided they are not inconsistent with the requirements of this section. Allowance of any additional exclusions is at the discretion of the Department. Regardless of the allowance of exclusions or deductions by the Department, the Contractor shall be responsible for

any deductible amount and shall warrant that the coverage provided to the Department is consistent with the requirements of this section.

7-1.122D Enforcement.—The Department may take any steps as are necessary to assure Contractor's compliance with its obligations. Should any insurance policy lapse or be canceled during the contract period the Contractor shall, within thirty (30) days prior to the effective expiration or cancellation date, furnish the Department with evidence of renewal or replacement of the policy. Failure to continuously maintain insurance coverage as herein provided is a material breach of contract. In the event the Contractor fails to maintain any insurance coverage required, the Department may, but is not required to, maintain this coverage and charge the expense to the Contractor or terminate this Agreement. The required insurance shall be subject to the approval of Department, but any acceptance of insurance certificates by the Department shall in no way limit or relieve the Contractor of the Contractor's duties and responsibilities under the Contract to indemnify, defend and hold harmless the State, its officers, agents, and employees. Insurance coverage in the minimum amounts set forth herein shall not be construed to relieve the Contractor for liability in excess of such coverage, nor shall it preclude the State from taking other actions as is available to it under any other provision of the contract or law. Failure of the Department to enforce in a timely manner any of the provisions of this section shall not act as a waiver to enforcement of any of these provisions at a later date.

7-1.122E Self-Insurance.—Self-insurance programs and self-insured retentions in insurance policies are subject to separate annual review and approval by the State of evidence of the Contractor's financial capacity to respond. Additionally, self-insurance programs or retentions must provide the State with at least the same protection from liability and defense of suits as would be afforded by first-dollar insurance.

7-1.122F Miscellaneous.—Nothing contained in the Contract is intended to make the public or any member thereof a third party beneficiary of the Insurance or Indemnity provisions of these Standard Specifications, nor is any term, condition or other provision of the Contract intended to establish a standard of care owed to the public or any member thereof.

5-1.04 ARBITRATION

The last paragraph in Section 9-1.10, "Arbitration," of the Standard Specifications is amended to read:

Arbitration shall be initiated by a Complaint in Arbitration made in compliance with the requirements of those regulations. A Complaint in Arbitration by the Contractor shall be made not later than 90 days after the date of service in person or by mail on the Contractor of the final written decision by the Department on the claim.

5-1.05 NOTICE OF POTENTIAL CLAIM

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

9-1.04 Notice of Potential Claim.--The Contractor shall not be entitled to the payment of any additional compensation for any act, or failure to act, by the Engineer, including failure or refusal to issue a change order, or for the happening of any event, thing, occurrence, or other cause, unless he shall have given the Engineer due written notice of potential claim as hereinafter specified. Compliance with this Section 9-1.04 shall not be a prerequisite as to matters within the scope of the protest provisions in Section 41.03, "Changes," or Section 81.06, "Time of Completion," or the notice provisions in Section 5-1.116, "Differing Site Conditions," or Section 8-1.07, "Liquidated Damages," or Section 8-1.10, "Utility and Non-Highway Facilities," nor to any claim which is based on differences in measurements or errors of computation as to contract quantities.

The written notice of potential claim shall be submitted to the Engineer prior to the time that the Contractor performs the work giving rise to the potential claim for additional compensation, if based on an act or failure to act by the Engineer, or in all other cases within 15 days after the happening of the event, thing, occurrence, or other cause, giving rise to the potential claim.

The written notice of potential claim shall be submitted on Form CEM-6201 furnished by the Department and shall be certified with reference to the California False Claims Act, Government Code Sections 12650 - 12655. The notice shall set forth the reasons for which the Contractor believes additional compensation will or may be due and the nature of the costs involved. Unless the amount of the potential claim has been stated in the written notice, the Contractor shall, within 15 days of submitting said notice, furnish an estimate of the cost of the affected work and impacts, if any, on project completion. Said estimate of costs may be changed or updated by the Contractor when

conditions have changed. When the affected work is completed, the Contractor shall submit substantiation of his actual costs. Failure to do so shall be sufficient cause for denial of any claim subsequently filed on the basis of said notice of potential claim.

It is the intention of this Section 9-1.04 that differences 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 such matters may be settled, if possible, or other appropriate action promptly taken. The Contractor hereby agrees that he shall have no right to additional compensation for any claim that may be based on any such act, failure to act, event, thing or occurrence for which no written notice of potential claim as herein required was filed.

Should the Contractor, in connection with or subsequent to the assertion of a potential claim, request inspection and copying of documents or records in the possession of the Department that pertain to the potential claim, Contractor shall make its records of the project, as deemed by the Department to be pertinent to the potential claim, available to the Department for inspection and copying.

5-1.06 PARTIAL PAYMENTS

The last paragraph of Section 9-1.06, "Partial Payments," of the Standard Specifications is amended to read:

Attention is directed to the prohibitions and penalties pertaining to unlicensed contractors as provided in Business and Professions Code Sections 7028.15(a) and 7031.

5-1.07 PAYMENT OF WITHHELD FUNDS

Section 9-1.065, "Payment of Withheld Funds," of the Standard Specifications, is amended by adding the following after the third paragraph:

Alternatively, and subject to the approval of the Department, the payment of retentions earned may be deposited directly with a person licensed under Division 6 (commencing with Section 17000) of the Financial Code as the escrow agent. Upon written request of an escrow agent that has not been approved by the Department under subdivision (c) of Section 10263 of the Public Contract Code, the Department will provide written notice to that escrow agent within 10 business days of receipt of the request indicating the reason or reasons for not approving that escrow agent. The payments will be deposited in a trust account with a Federally chartered bank or savings association within 24 hours of receipt by the escrow agent. The Contractor shall not place any retentions with the escrow agent in excess of the coverage provided to that escrow agent pursuant to subdivision (b) of Section 17314 of the Financial Code. In all respects not inconsistent with subdivision (c) of Section 10263 of the Public Contract Code, the remaining provisions of Section 10263 of the Public Contract Code shall apply to escrow agents acting pursuant to subdivision (c) of Section 10263 of the Public Contract Code.

5-1.08 FINAL PAYMENT AND CLAIMS

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 therein an itemization of said amount, segregated as to contract item quantities, extra work and any other basis for payment, and shall also show therein all deductions made or to be made for prior payments and amounts to be kept or retained under the provisions of the contract. All 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 all claims arising under or by virtue of the contract so that the Engineer receives such 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 such written approval or statement of claims by the Engineer shall not be later than close of business of the next business day. No claim will be considered that was not included in the written statement of claims, nor will any claim be allowed as to which a notice or protest is required under the provisions in Sections 4-1.03, "Changes," 8-1.06, "Time of Completion," 8-1.07, "Liquidated Damages," 5-1.116, "Differing Site Conditions," 8-1.10, "Utility and Non-Highway Facilities," and 9-1.04, "Notice of Potential Claim," unless the Contractor has complied with the notice or protest requirements in said sections.

On the Contractor's approval, or if he files no claim within said period of 30 days, the Engineer will issue a final estimate in writing in accordance 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. Such 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 said period of 30 days files claims, the Engineer will issue a semifinal estimate in accordance with the proposed final estimate submitted to the Contractor and within 30 days thereafter the State will pay the sum so found to be due. Such semifinal 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 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."

Claims filed by the Contractor shall be in sufficient detail to enable the Engineer to ascertain the basis and amount of said claims. If additional information or details are required by the Engineer to determine the basis and amount of said claims, the Contractor shall furnish such further information or details so that the information or details are received by the Engineer no later than the fifteenth day after receipt of the written request from the Engineer. If the fifteenth day falls on a Saturday, Sunday or legal holiday, then receipt of such information or details by the Engineer shall not be later than close of business of the next business day. Failure to submit such information and details to the Engineer within the time specified will be sufficient cause for denying the claim.

The Contractor shall keep full and complete records of the costs and additional time incurred for any work for which a claim for additional compensation is made. The Engineer or any designated claim investigator or auditor 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 such records shall be sufficient cause for denying the claims.

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.

Any claim for overhead type expenses or costs, in addition to being certified as stated above, shall be supported by an audit report of an independent Certified Public Accountant. Any such overhead claim shall also be subject to audit by the State at its discretion.

Any costs or expenses incurred by the State in reviewing or auditing any 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.

The District Director of the District which administers the contract will make the final determination of any claims which remain in dispute after completion of claim review by the Engineer. A board or person designated by said District Director will review such claims and make a written recommendation thereon to the District Director. The Contractor may meet with the review board or person to make a presentation in support of such claims.

Upon final determination of the claims, the Engineer will then make and issue his final estimate in writing and within 30 days thereafter the State will pay the entire sum, if any, found due thereon. Such 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."

5-1.09 INTEREST ON PAYMENTS

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

1. Unpaid progress payments, payment after acceptance and final payments shall begin to accrue interest 30 days after the Engineer prepares the payment estimate.
2. Unpaid extra work bills shall begin to accrue interest 30 days after preparation of the first pay estimate following the 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 accordance with the requirements of 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.
3. The rate of interest payable for unpaid progress payments, payments after acceptance, final payments and extra work payments shall be 10 percent per annum.
4. 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.

5-1.10 PUBLIC SAFETY

The Contractor shall provide for the safety of traffic and the public in accordance 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 any lane carrying public traffic and any excavation, obstacle, or storage area when the following conditions exist:

(1) Excavations.--Any excavation, the near edge of which is 12 feet or less from the edge of the lane, except:

(a) Excavations covered with sheet steel or concrete covers of adequate thickness to prevent accidental entry by traffic or the public.
(b) Excavations less than one foot deep.
(c) Trenches less than one foot wide for irrigation pipe or electrical conduit, or excavations less than one foot in diameter.
(d) Excavations parallel to the lane for the purpose of pavement widening or reconstruction.
(e) Excavations in side slopes, where the slope is steeper than 4:1.
(f) Excavations protected by existing barrier or railing.

(2) Temporarily Unprotected Permanent Obstacles.--Whenever 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 whenever the Contractor, for his

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.

(3) Storage Areas.--Whenever material or equipment is stored within 12 feet of the lane and such storage is not otherwise prohibited by the specifications.

The approach end of temporary railing (Type K), installed in accordance with the requirements in this section "Public Safety" and in Section 7-1.09, "Public Safety," of the Standard Specifications shall be offset a minimum of 15 feet 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 one foot transversely to 10 feet longitudinally with respect to the edge of the traffic lane. If the 15-foot 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 1995 Standard Plan T3 or 1997 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.

The fourteenth paragraph of Section 12-3.08, "Temporary Railing (Type K)," of the Standard Specifications is amended to read:

Each rail unit placed within 10 feet of a traffic lane shall have a reflector installed on top of the rail as directed by the Engineer. A Type P marker panel shall also be installed at each end of railing installed adjacent to a two-lane, two-way highway and at the end facing traffic of railing installed adjacent to a one-way roadbed. If the railing is placed on a skew, the marker shall be installed at the end of the skew nearest the traveled way. Type P marker panels shall conform to the provisions in Section 82, "Markers and Delineators," except that the Contractor shall furnish the marker panels.

Reflectors on temporary railing (Type K) shall conform to the provisions in "Prequalified and Tested Signing and Delineation Materials," of these special provisions.

Temporary crash cushion modules shall conform to the provisions in "Temporary Crash Cushion Module" elsewhere in 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 specifications:

Approach speed of public traffic (Posted Limit) (Miles Per Hour)	Work Areas
Over 45	Within 6 feet of a traffic lane but not on a traffic lane.
35 to 45	Within 3 feet 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 traffic lane, the line of cones or delineators shall be considered to be the edge of traffic lane, however, the Contractor shall not reduce the width of an existing lane to less than 10 feet 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 requirements 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.

5-1.11 SURFACE MINING AND RECLAMATION ACT

Attention is directed to the Surface Mining and Reclamation Act of 1975, commencing in Public Resources Code, Mining and Geology, Section 2710, which establishes regulations pertinent to surface mining operations.

Material from mining operations furnished for this project shall only come from permitted sites in compliance with the Surface Mining and Reclamation Act of 1975.

The requirements of this section shall apply to all materials furnished for the project, except for acquisition of materials in conformance with Section 4-1.05, "Use of Materials Found on the Work," of the Standard Specifications.

5-1.12 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, and shall immediately cease work in the affected area and report the condition to the Engineer in writing.

In accordance with Section 25914.1 of the Health and Safety Code, all such removal of asbestos or hazardous substances including any exploratory work to identify and determine the extent of such 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 such delay as provided in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

5-1.13 FINAL PAY QUANTITIES

Section 9-1.015, "Final Pay Quantities," of the Standard Specifications is amended to read:

9-1.015 Final Pay Items.—When an item of work is designated as (F) or (S-F) in the Engineer's Estimate, the estimated quantity for that item of work shall be the final pay quantity, unless the dimensions of any portion of that item are revised by the Engineer, or the item or any portion of the item is eliminated. If the dimensions of any portion of the item are revised, and the revisions result in an increase or decrease in the estimated quantity of that item of work, the final pay quantity for the item will be revised in the amount represented by the changes in the dimensions, except as otherwise provided for minor structures in Section 51-1.22, "Measurement." If a final pay item is eliminated, the estimated quantity for the item will be eliminated. If a portion of a final pay item is eliminated, the final pay quantity will be revised in the amount represented by the eliminated portion of the item of work.

The estimated quantity for each item of work designated as (F) or (S-F) in the Engineer's Estimate shall be considered as approximate only, and no guarantee is made that the quantity which can be determined by computations, based on the details and dimensions shown on the plans, will equal the estimated quantity. No allowance will be made in the event that the quantity based on computations does not equal the estimated quantity.

In case of discrepancy between the quantity shown in the Engineer's Estimate for a final pay item and the quantity or summation of quantities for the same item shown on the plans, payment will be based on the quantity shown in the Engineer's Estimate.

5-1.14 YEAR 2000 COMPLIANCE

This contract is subject to Year 2000 Compliance for automated devices in the State of California. Year 2000 compliance is defined as follows:

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

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

5-1.15 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 and certified correct by the Contractor or the Contractor's authorized representative, and shall be furnished to the Engineer.

5-1.155 PERFORMANCE OF DVBE SUBCONTRACTORS AND SUPPLIERS

The DVBEs listed by the Contractor in response to the requirements in Section 2-1.04, "Submission of DVBE Information," in 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:

(1) 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.
(2) The listed DVBE becomes bankrupt or insolvent.
(3) The listed DVBE fails or refuses to perform the subcontract or furnish the listed materials.
(4) 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.
(5) The work performed by the listed subcontractor is substantially unsatisfactory and is not in substantial accordance with the plans and specifications, or the subcontractor is substantially delaying or disrupting the progress of the work.
(6) The listed DVBE subcontractor is not licensed pursuant to the Contractor's License Law.
(7) It would be in the best interest of the State.

The Contractor shall not be entitled to any 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.

5-1.16 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,\" elsewhere in these special provisions and these special provisions.

The second sentence in the third paragraph of said Section 8-1.01 is amended to read:

When items of work in the Engineer's Estimate are preceded by the letters (S) or (S-F), said items are designated as "Specialty Items."

Section 8-1.01 of the Standard Specifications is amended by adding the following before the sixth paragraph:

Pursuant to the provisions of Section 6109 of the Public Contract Code, the Contractor shall not perform work on a public works project with a subcontractor who is ineligible to perform work on the public works project pursuant to Section 1777.1 or 1777.7 of the Labor Code.

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

1. No substitution of a DVBE subcontractor shall be made at any time without the written consent of the Department, and

2. If a DVBE subcontractor is unable to perform successfully and is to be replaced, the Contractor will be required to make good faith efforts to replace the original DVBE subcontractor with another DVBE subcontractor.

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

5-1.17 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 will be to maintain cooperative communication and mutually resolve conflicts at the lowest possible management level.

The Contractor may request the formation of such 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.

The costs involved in providing a facilitator and a workshop site will be borne equally by the State and the Contractor. The Contractor shall pay all compensation for the wages and expenses of the facilitator, and of the expenses for obtaining the workshop site. The State's share of such costs will be reimbursed to the Contractor in a change order written by the Engineer. Markups will not be added. All other costs associated with the "Partnering" relationship will be borne separately by the party incurring the costs.

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.

5-1.18 DISPUTES REVIEW BOARD

To assist in the resolution of disputes or potential claims arising out of the work of this project, a Disputes 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 set forth in the provisions of Section 9-1.04, "Notice of Potential Claim," and Section 9-1.07B, "Final Payment and Claims," of the Standard Specifications, as amended elsewhere in these special provisions. The DRB shall not be considered to serve as a substitute for any requirements in the specifications in regard to filing of potential claims. The requirements and procedures established in this special provision shall be considered as an essential prerequisite to filing a claim, for arbitration or for litigation prior or subsequent to project completion.

The DRB shall be utilized when dispute or potential claim resolution at the job level is unsuccessful. The DRB shall function until the day of acceptance of the contract, at which time the work of the DRB will cease except for completion of unfinished dispute hearings and reports. After acceptance of the contract any disputes or potential claims that the Contractor wants to pursue that have not been settled, 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, as amended elsewhere in these special provisions. The State will review those claims in accordance with Section 9-1.07B, of the Standard Specifications, as amended. Following the completion of the State's administrative claims procedure, the Contractor may resort to arbitration as provided in Section 91.10, "Arbitration," of the Standard Specifications.

Disputes, as used in this section, shall include all 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 claims not actionable against the State as specified in these special provisions. 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.

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

The first two DRB members shall select a third DRB member subject to the 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 selection of the third member is to complement the professional experience of the first two members, and to provide leadership for the DRB's activities.

No DRB member shall have prior direct involvement in this contract, and 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:

1. Compensation for services on this DRB.
2. 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.
3. Service as a member of other Disputes Review Boards on other contracts.
4. Retirement payments or pensions received from a party that are not tied to, dependent on or affected by the net worth of the party.
5. The above provisions apply to any party having a financial interest in this contract; including but not limited to contractors, subcontractors, suppliers, consultants, and legal and business services.

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

The State and the Contractor shall select their respective DRB members, in accordance with the terms and conditions of the Disputes Review Board Agreement and these 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 member along with the prospective member's written disclosure statement.

Before their appointments are final, the first two prospective DRB members shall submit complete disclosure statements to both the State and the Contractor. The statement shall include a resume of the prospective member's experience, together with a declaration describing all past, present and anticipated or planned future relationships, including indirect relationships through the prospective member's primary or full-time employer, to this project and with all parties involved in this construction contract; including, but not limited to, any relevant subcontractors or suppliers to the parties, the parties' principals or the parties' counsel. The DRB members shall also include a full disclosure of close professional or personal relationships with all key members of all parties to the contract. Either the Contractor or the State may object to the others nominee and that person will not be selected for the DRB. No reason need be given for the first objection. Objections to subsequent nominees must be based on a specific breech or violation of nominee responsibilities under this specification. A different person shall then be nominated within 14 Days. The third DRB member shall supply a full disclosure statement to the first two DRB members and to the parties prior to appointment. Either party may reject any of the three prospective DRB members who fail to fully comply with all required employment and financial disclosure conditions of DRB membership as described in the Disputes Review Board Agreement and elsewhere herein. A copy of the Disputes Review Board Agreement is included in this special provision.

The first duty of the State and Contractor selected members of the DRB is to select and recommend prospective third member(s) to the parties for final selection and approval. The first two 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 21 days of the notification.

An impasse shall be considered to have been reached if the parties are unable to approve a third member within 14 days of receipt of the recommendation of the first two DRB members, or if the first two members are unable to agree upon a recommendation within the 14 day time limit allowed in the preceding paragraph. In the event of an impasse in selection of the third DRB member, the State and the Contractor shall each propose three candidates for the third position. The parties shall select all 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 two DRB members shall then select one of the 6 proposed candidates in a blind draw.

The Contractor, the State, and all three members of the DRB shall complete and adhere to the Disputes Review Board Agreement in administration of this DRB within 14 days of the parties' concurrence in the selection of the third member. 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 Disputes Review Board Agreement.

The State and the Contractor shall bear the costs and expenses of the DRB equally. Each DRB board member shall be compensated at an agreed rate of $1,000.00 per day if time spent per meeting, including all on-site time plus one hour of travel time, is greater than four hours. Each DRB board member shall be compensated at an agreed rate of $600.00 per day

if time spent per meeting, including all on-site time plus one hour of travel time, is less than or equal to four 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, that has been specifically agreed to in advance by the parties, will be compensated at an agreed rate of $100.00 per hour. The agreed amount of $100.00 per hour shall include all incidentals including any expenses for telephone, fax and computer services. Members serving on more than one DRB, 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 Disputes Review Board Agreement state provisions for compensation and expenses of the DRB. All 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 its share of the costs. There will be no markups applied to any 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.

Service of a DRB member may be terminated at any time with not less than 14 days notice as follows:

1. The State may terminate service of the State appointed member.
2. The Contractor may terminate service of the Contractor appointed member.
3. Upon the written recommendation of the State and Contractor members for the removal of the third member.
4. Upon resignation of a member.

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 14 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 Disputes Review Board Agreement shall be amended to reflect the change of a DRB member.

The following procedure shall be used for dispute resolution:

1. If the Contractor objects to any decision, act or order of the Engineer, the Contractor shall give written notice of potential claim as specified in Section 9-1.04, "Notice of Potential Claim," of the Standard Specifications, as amended elsewhere in these special provisions, including provision of applicable cost documentation; or file written protests or notices pursuant to Sections 4-1.03A, "Procedure and Protest", 8-1.06, "Time of Completion", 8-1.07, "Liquidated Damages", or 8-1.10, "Utility and Non-Highway Facilities" of the Standard Specifications.
2. The Engineer will respond, in writing, to the Contractor's written protest or notice within 14 days of receipt of the written protest or notice.
3. Within 14 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.
4. Following the Contractor's objection to the Engineer's decision, 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 reply 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.
5. The Contractor, by failing to submit the written notice of referral of the matter to the DRB within 21 days after receipt of the State’s written reply, waives any future claims on the matter in contention.
6. 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 any written evidence or documentation to the DRB must furnish copies of such information to the other party a minimum of 14 days prior to the date the DRB is scheduled to convene the hearing for the dispute. Either party shall produce such additional evidence as the DRB may deem necessary to reach an understanding and 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 will not consider any evidence not furnished in accordance with the terms specified herein.

7. The DRB shall furnish a report, containing findings and recommendations as described in the Disputes Review Board Agreement, in writing to both the State and the Contractor. The DRB shall complete its reports, including minority opinion if any, and submit them to the parties within 30 days of the DRB hearing, 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, applicable laws and regulations, the pertinent provisions of the Contract and the actual costs and time incurred as shown on the Contractor's cost accounting records.
8. 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 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 by both parties, the DRB will 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 will 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.
9. 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 any individual DRB recommendation.
10. 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.
11. The State or the Contractor shall not call 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..
12. 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.
13. The DRB members shall have no claim against the State or the Contractor, or both, from any claimed harm arising out of the parties' evaluations of the DRB's report.

Disputes Involving Subcontractor Claims.—For purposes of this section, a "subcontractor claim" shall include any claim by a subcontractor (including also any pass through 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 claim, the dispute shall be processed and resolved in accordance with these special provisions and in accordance with the following:

1. The Contractor shall identify clearly in all submissions pursuant to this section, that portion of the dispute that involves a subcontractor claim or claims.
2. The Contractor shall include, as part of its submission pursuant to Step 4 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 claim. The Contractor also shall submit a certification that the subcontractor claim is acknowledged and forwarded by the Contractor. The form for these certifications are available from the Engineer.
3. At any DRB meeting on a dispute that includes one or more subcontractor claims, the Contractor shall require that each subcontractor that is involved in the dispute have present an authorized representative with actual knowledge of the facts underlying the subcontractor claim to assist in presenting the subcontractor claim and to answer questions raised by the DRB members or the Department's representatives.
4. Failure by the Contractor to declare a subcontractor claim on behalf of its subcontractor (including lower tier subcontractors' and suppliers' pass through claims) at the time of submission of the Contractor's claims, as provided hereunder, shall constitute a release of the Department by the Contractor on account of such subcontractor claim.

5. The Contractor shall include in all subcontracts under this contract that subcontractors and suppliers of any tier (a) agree to submit subcontractor claims to the Contractor in a proper form and in sufficient time to allow processing by the Contractor in accordance 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 claims; (c) agree that, to the extent a subcontractor 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 any 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 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, any subcontractor claim between the subcontractor(s) or supplier(s) and the Contractor that is not actionable by the Contractor against the Department.

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

DISPUTES REVIEW BOARD AGREEMENT

_____
(Contract Identification)

Contract No. _____

THIS DISPUTES 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 Disputes 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:

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.

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 which 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 accordance 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 the pertinent contract provisions, and the facts and circumstances involved in the dispute. The recommendations shall find one responsible party in a dispute; shared or “jury” determinations shall not be rendered.

The DRB shall refrain from officially giving any 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 any other affiliates (subcontractors, suppliers, etc.) who have a beneficial interest in the contract.

During scheduled meetings of the DRB as well as during dispute hearings, 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. Any such discussions or meetings shall be disclosed to both parties. Any 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. All scheduled progress meetings shall be held at or near the job site. The DRB shall meet at least once at the start of the project, and at least once every six 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 claims.

The STATE's representative will prepare minutes of all regular meetings and circulate them for revision and approval by all concerned.

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 DRB shall determine the time and location of DRB hearings, with due consideration for the needs and preferences of the parties while recognizing the paramount importance of speedy resolution of issues. If the matter is not urgent, it may be scheduled for the time of the next scheduled DRB visit to the project. For an urgent matter, and upon the request of either party, the DRB shall meet at its earliest convenience.

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

Both parties shall be given the opportunity to present their evidence at these hearings. It is expressly understood that the DRB members are to act impartially and independently in the consideration of the contract provisions, 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 hearing begins. A party furnishing any 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 hearings 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 any electronic means. Documents and verbal statements shall be received by the DRB in accordance with acceptance standards established by the DRB. Said standards need not comply with prescribed legal laws of evidence.

The third DRB member shall act as Chairperson for dispute hearings and all other DRB activities. The parties shall have a representative at all hearings. Failure to attend a duly noticed meeting by either of the parties shall be conclusively considered by the DRB as indication that the non-attending party considers any 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 may ask questions, seek clarification, or request further data from either of the parties. 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. Claims shall not necessarily be computed by merely subtracting bid price from the total cost of the affected work. However, if any claims are based on the "total cost method", then, to be considered by the DRB, they shall be supported by evidence furnished by the CONTRACTOR that (1) the nature of the dispute(s) makes it impossible or impracticable to determine cost impacts with a reasonable degree of accuracy, (2) the CONTRACTOR's bid estimate was realistic, (3) the CONTRACTOR's actual costs were reasonable, and (4) the CONTRACTOR was not responsible for the added expenses. As to any claims based on the CONTRACTOR's field or home office accounting records, those claims shall be supported by an audit report of an independent Certified Public Accountant unless the contract includes special provisions that provide for an alternative method to calculate unabsorbed home office overhead. Any of those claims shall also be subject to audit by the DRB with the concurrence of the parties. In large or complex cases, additional hearings 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 hearings, no DRB member shall express an opinion concerning the merit of any facet of the case. All DRB deliberations shall be conducted in private, with all interim individual views kept strictly confidential.

After hearings are concluded, the DRB shall meet in private and reach a conclusion supported by two 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 chairman shall complete and furnish a summary report to the DRB Program Manager, Construction Program, M.S. 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 any technical services, as agreed to by the parties, shall be borne equally by the two 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 any individual DRB recommendation. The DRB shall hear appeals in accordance with the terms described in the Section entitled "Disputes 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 14 days. This AGREEMENT will be amended to indicate change in DRB membership.

III
CONTRACTOR RESPONSIBILITIES

The CONTRACTOR shall furnish to each DRB member one copy of all pertinent documents which are or may become necessary for the DRB to perform their function. Pertinent documents are any 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 accordance with the terms outlined in the special provisions.

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.

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 any work under the terms of this AGREEMENT until authorized in writing by the STATE.

VI
PAYMENT

A. All Inclusive Rate Payment

The STATE and the CONTRACTOR shall bear the costs and expenses of the DRB equally. Each DRB board member shall be compensated at an agreed rate of $1,000.00 per day if time spent per meeting, including all on-site time plus one hour of travel time, is greater than four hours. Each DRB board member shall be compensated at an agreed rate of $600.00 per day if time spent per meeting, including all on-site time plus one hour of travel time, is less than or equal to four 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 $100.00 per hour. The agreed amount of $100.00 per hour shall include all incidentals including any expenses for telephone, fax and computer services. Members serving on more than one DRB, 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

All 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 any 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 three 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 three-year period, the cost records and accounts shall be retained until such litigation, claim, or audit involving the records is completed.

VII
ASSIGNMENT OF TASKS OF WORK

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

VIII
TERMINATION OF AGREEMENT, THE DRB, AND DRB MEMBERS

DRB members may resign from the DRB by providing not less than 14 days written notice of the resignation to the STATE and CONTRACTOR. DRB members may be terminated by their original appointing power, in accordance with the terms of the contract.

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.

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.

XI
DISPUTES

Any dispute 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.

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 any 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 accordance 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.

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 any private meetings or deliberations of the DRB.

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

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: _____

5-1.19 CLAIMS SUBMITTAL

Claims submittal may be made on work completed, except for plant establishment work, upon receiving relief from maintenance and responsibility for the completed work in lieu of acceptance by the Director as specified in Section 9-1.07B, "Final Payment and Claims," of the Standard Specifications. Claims submitted upon granting of relief from maintenance and responsibility will be processed in accordance with Section 9-1.07B of the Standard Specifications and these special provisions.

Upon the request of the Contractor, relief from maintenance and responsibility for work completed in accordance with the requirements of the contract and to the satisfaction of the Engineer may be granted as specified in Section 7-1.15, "Relief From Maintenance and Responsibility," of the Standard Specifications. Within 90 days of granting relief from maintenance and responsibility, the Engineer will issue to the Contractor, in writing, a progress pay estimate finalizing the completed items of work. Within 30 days after receiving the progress pay estimate, the Contractor may submit to the Engineer a written statement of the claims arising under the contract exclusive of plant establishment work. No claim arising from work which relief of maintenance and responsibility were granted will be considered that was not included in the written statement of claims.

The proposed final estimate for the contract will be submitted to the Contractor after acceptance of the work, including plant establishment. After submittal of the proposed final estimate, no claim will be considered except for those arising from plant establishment work or additional work ordered by the Engineer during the plant establishment period of the contract.

The process for resolution of the contract claims, including plant establishment work, by arbitration shall not begin until acceptance of the work by the Engineer and shall be in accordance with Section 9-1.10, "Arbitration," of the Standard Specifications.

5-1.20 PAYMENTS

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

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

Clay Sewer Pipe
Bar reinforcing steel
Structural steel
Miscellaneous metal

Plate steel for fabrication of structural steel, stored within the State of California, and fabricated elements for structural steel, fabricated and stored within the United States, 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.

5-1.21 SOUND CONTROL REQUIREMENTS

Sound control shall conform to the provisions in Section 7-1.0I, “Sound Control Requirements,” of the Standard Specifications and these special provisions.

Attention is directed to Section 12-1.17, "REGULATORY REQUIREMENTS", elsewhere in these special provisions,.

The noise level from any of the Contractor’s operations, between the hours of 8:00 p.m. and 8:00 a.m. shall not exceed 86 dBA, Lmax, when measured at a distance of 50 feet from the noise source. This requirement does not apply when placing or removing temporary railing (Type K) on the bridge and during partial removal and replacement of bridge deck, as shown on the contract plans. Said noise level requirement shall apply to all equipment on the job or related to the job and all operations, including but not limited to rivet removal, structural steel erection, bolting operations and painting operations. 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. Should the Contractor elect to schedule work between 8:00 p.m. and 8:00 a.m., a written Sound Control Plan (SCP) shall be submitted to the Engineer for review and approval. The SCP shall be submitted at least three weeks in advance of anticipated nighttime work operations. The Contractor shall allow the Engineer two weeks to review and approve the SCP. The Contractor shall allow an additional week for review and approval of any SCP re-submittals or revisions. The SCP shall be prepared and monitored by a noise control specialist, approved by the Engineer. The SCP shall include work to be performed, equipment to be used, planned work duration, mitigating

measures, noise monitoring procedures and contingency plan if mitigating measures are not effective. Mitigation shall be made at the noise source. Work shall not begin on any nighttime noise operations until the Engineer has approved the SCP.

Monitoring shall be performed using a Type 1 Sound Level Meter, as specified by the latest ANSI standards, measuring a dynamic range of 40-120 dB. Noise levels shall be A-weighted with a minimum sampling rate of 64 samples per second (Fast). Root Mean Square (RMS) sound pressure levels (SPLs) shall be expressed by the descriptors Lmax and Leq(h). Microphones shall be equipped with windscreens and shall be positioned 50 feet from the noise source as designated by the Engineer. Monitoring shall be performed for a duration of at least 5 minutes during each work operation. Additional spot readings shall be taken as directed by the Engineer to assure the noise level during work operations are within the allowable limits. Noise monitoring equipment shall be calibrated before and after each workshift. The noise monitor shall print data to a serial printer, providing immediate on-site results. The Contractor shall keep a copy of all documentation and submit one copy to the Engineer.

Should the noise level from any work operation performed between the hours of 8:00 p.m. and 8:00 a.m., except when placing and removing temporary tailing (Type K) and performing deck removal and replacement as noted above, exceed the allowable limits of 86 dBA, Lmax, the operation shall cease immediately. Prior to resuming this work, the Contractor shall submit a revised SCP plan detailing new, revised or additional measures to mitigate the noise. The Contractor shall not resume work until the Engineer has approved, in writing, the revised plan.

Noise mitigation measures shall be employed during all hours when rivet removal operations and bolting operations are being performed at Bents A and B. The Contractor shall furnish and install noise blankets meeting or exceeding the Sound Transmission Class (STC) rating 29 and a noise reduction coefficient (NRC) rating of 0.75. The blankets shall fully enclose the work area and shall extend a minimum of 12 feet above and below the point of noise generation. This requirement may be reduced to 8 feet if the top and bottom of the enclosures are covered. The blankets shall be in place prior to the commencement of rivet removal and bolting operations. Noise blankets shall be maintained for cleanliness, be free of graffiti, holes, cracks and tears. The Contractor shall take all measures necessary to secure the noise blankets around the work and prevent them from becoming loose or falling down. Information on suppliers of noise blankets is included in “Material Information”, available from the District Duty Senior at (510) 286-5549.

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.

5-1.22 HAZARDOUS MATERIAL, GENERAL

Attention is directed to "Earthwork", Sections 02080 and 02090 elsewhere in these special provisions regarding the removal and disposal of hazardous material.

Hazardous material, including lead in the soils within the work zone and lead in dust and debris on the structural members, has been discovered through testing within the project limits. Portions of the test results are included in the “Materials Information.” The complete reports entitled “Hazardous Waste Preliminary Site Investigation Report: Seismic Retrofit of the West End of the San Francisco - Oakland Bay Bridge“ and “Site Investigation Report: San Francisco - Oakland Bay Bridge West Span Tower Debris Investigation” are available for inspection at the Department of Transportation, Toll Bridge Duty Senior's Desk, 111 Grand Avenue, Oakland, California, (510) 286-5549. The levels of contaminants in excavated material designated as hazardous in the plans or in these special provisions characterize the material as hazardous waste as defined by State of California regulations. The materials are not regulated under the federal Resource Conservation and Recovery Act (RCRA). The levels of contaminants in the dust and debris on the structural members characterize the material as hazardous as defined by State of California regulations and RCRA.

Hazardous materials shall be transferred directly from the excavation to a registered transport vehicle, a storage container approved for transport of hazardous waste by the United States Department of Transportation, or a stockpile location approved by the Engineer. Stockpile locations shall be maintained in accordance with the following requirements:

The material shall not contain free liquids that separate readily from the material. The presence or absence of free liquids shall be demonstrated by United States Environmental Protection Agency Method 9095 as modified by Section 66264.314 of Title 22 of the California Code of Regulations (CCR).

The material shall be stored on undamaged 60-mil high density polyethylene or an equivalent impermeable barrier unless the stockpiling location is on a paved surface. If the location is on a paved surface the thickness of the barrier can be reduced to 20-mil high density polyethylene or its equivalent. The dimensions of the barrier shall exceed the dimensions of the stockpile at all times. Any seams in the barrier shall be sealed to prevent leakage.

At the end of each day and during storm events the material shall be covered with undamaged 12-mil polyethylene or an equivalent impermeable barrier to prevent windblown dispersion and contact with precipitation

run-off and run-on. When more than one sheet is required to cover the material, the sheets shall be overlapped a minimum of 1.5 feet in a manner that prevents water from flowing onto the material. The cover shall be secured in a manner that keeps it in place at all times. Driven anchors shall not be used except at the perimeter of the stockpile. The cover shall be inspected and maintained in accordance with the requirements of "Water Pollution Control" of these special provisions.

These stockpiling requirements apply to all temporary storage of hazardous material outside of an excavation or a transport container including, but not limited to, staging of excavated material next to the excavation prior to pick up by loading equipment, accumulating material for full transport loads, and awaiting test results required by a disposal facility. The removal of stockpiles shall begin within 30 days of accumulating 220 pounds of hazardous material. After final removal has occurred the Contractor shall be responsible for any cleanup deemed necessary by the Engineer.

All hazardous material on exteriors of transport vehicles shall be removed and placed either into the current transport vehicle or the excavation prior to the vehicle leaving the exclusion zone. No hazardous material shall be deposited on public roads. The Contractor shall indemnify the State from any costs due to spillage during the transport of the hazardous material to the disposal facility.

The Contractor shall monitor the air quality continuously during excavation operations at all locations containing hazardous material.

Disposal of additional material resulting from the Contractor's option to slope the excavations in lieu of shoring at locations where this is possible or any excavation operations outside structure excavation pay limits will be at the Contractor's expense. This resultant material shall be treated as hazardous material if the test results for the location indicate that the material being excavated is hazardous.

APPLICABLE RULES AND REGULATIONS.--Excavation, transport and disposal of hazardous material shall be in accordance with the rules and regulations of the following agencies:

United States Department of Transportation (USDOT)
United States Environmental Protection Agency (USEPA)
California Environmental Protection Agency (CAL-EPA)

1. Department of Toxic Substance Control (DTSC)
2. Integrated Waste Management Board
3. Regional Water Quality Control Board, Region 2 (RWQCB)
4. State Air Resources Board

Bay Area Air Quality Management District (BAAQMD)
California Division of Occupational Safety and Health Administration (CAL-OSHA)

PERMITS AND LICENSES .--The Contractor shall procure all permits and licenses, pay all charges and fees, and give all notices necessary and incident to the due and lawful prosecution of the work, including registration for transporting vehicles carrying the hazardous material. The California Environmental Quality Act (CEQA)of 1970 (Chapter 1433, Stats. 1970), as amended may be applicable to permits, licenses and authorizations which the Contractor shall obtain from all agencies in connection with performing the work of the contract. The Contractor shall comply with the provisions of said statutes in obtaining such permits, licenses and other authorizations.

The Engineer will obtain the Environmental Protection Agency Generator Identification No. and Board of Equalization Identification Number as the State is the Generator.

HEALTH, SAFETY AND WORK PLAN.--The Contractor shall prepare a detailed Health, Safety and Work Plan for all site personnel in accordance with the DTSC and CAL-OSHA regulations. The Health, Safety and Work Plan shall include a plot plan indicating the exclusion zones, contaminant reduction zones, and support zones, as described in the Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities published by the National Institute for Occupational Safety and Health, Occupational Safety and Health Administration, U.S. Coast Guard, and USEPA; an air monitoring plan; and site clean up procedures. The Health, Safety and Work Plan shall be submitted in accordance with the requirements of "Relations with the California Environmental Protection Agency, Department of Toxic Substances Control." Prior to submittal, the Contractor shall have the Health, Safety and Work Plan approved by a Civil Engineer, registered in the State of California and by a Certified Industrial Hygienist.

SAFETY.--Prior to performing any work at the locations that potentially contain material classified as hazardous, all personnel, including State Personnel, shall complete a safety training program which meets the requirements of Section

1910.120 of Title 29 of the Code of Federal Regulations and Sections 5192 and 5194 of Title 8 of the CCR covering the potential hazards as identified. The training shall be provided by the Contractor. The Contractor shall provide a certification of completion of the Safety Training Program to all personnel. Any personal protective equipment and medical surveillance required by the Contractor's Health, Safety and Work Plan for personnel working within the exclusion zone will be supplied to State personnel by the Contractor. The number of State personnel requiring the above mentioned safety training program, personal protective equipment, and medical surveillance will be 10.

The decontamination area shall be located outside of the exclusion zone. Water from decontamination procedures shall be collected and disposed of at an appropriate disposal site by the Contractor. Non-reusable protective equipment, once used by any personnel, including State personnel, shall be collected and disposed of at an appropriate disposal site by the Contractor.

SAMPLING AND ANALYSIS.--The Contractor shall test the material to be excavated at his own expense for any additional acceptance requirements put forth by the disposal facility. Sampling and analysis shall be performed using the sampling and analysis procedure required by the disposal facility and approved by the Engineer.

The Contractor may perform additional tests on the material to be excavated at his option and expense for confirmation of the material classification as hazardous. Sampling and analysis shall be the same or equivalent tests specified in the "Materials Information." The Contractor shall submit for approval by the Engineer, his sampling and analysis procedure and the name and address of the laboratory to be used fifteen working days prior to beginning any sampling or analysis. The laboratory used shall be certified by the California Department of Health Services.

MEASUREMENT AND PAYMENT.--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 affected by this section and no additional compensation will be allowed therefor.

5-1.23 ARCHAEOLOGICAL SENSITIVE AREA

The site location of the new pump station in Caltrans Paint Yard at Main and Bryant Streets is considered to be an archaeological sensitive area. All construction activities within the Archaeologically Sensitive Area (ASA) shall be performed in accordance with these special provisions and as directed by the Engineer.

GENERAL.--It is the intent of Caltrans under Section 106 of the National Historic Preservation Act of 1966 and the Caltrans Environmental Handbook (Vol. 2:1-2.2) that the ASA be monitored during construction and that the major impacts to archaeological resources be avoided or minimized. Spot and on-call archaeological monitoring will be required during construction activities by a Department staff archaeologist.

The California Public Resources Code Chapter 1.7, Section 5097.5, makes it a misdemeanor for anyone to knowingly disturb a historical feature. California Public Resources Code Sections 5097.98 and 5097.99 require protection of Native American remains which might be found, and outline procedures for handling any burials found.

The California Administrative Code, Title 14, Section 4307, mandates that no person shall disfigure any object of historical interest or value. The California Penal Code, Title 14, Part 1, Section 622-1/2 makes it a misdemeanor to destroy anything of historical value within any public place.

CONSTRUCTION.-- All construction activities are permissible within the project area. The Contractor, subcontractors and their employees are to cooperate with the archaeologists with regard to late discovery and evaluation of archaeological materials, if any are uncovered during construction. The Contractor shall cooperate and assist the archaeologists in their work. Contractor labor, equipment, and materials required in assisting the archaeologists will be paid as extra work as provided in Section 4-1.03D of the Standard Specifications, except for the work described as follows: 1) removal (including saw cutting) and disposal of asphalt, sidewalk, curb, and gutter; 2) handling and disposal of soils within the excavation limits; and 3) all forces provided by the Contractor in order that the work performed by both the Contractor and the archaeological team conforms to the requirements in "Hazardous Materials, General," and "Hazardous Material Excavation," elsewhere in these special provisions.

Full compensation for the 3 items of work listed above shall be considered as included in the contract prices paid for the various items of contract work involved and no additional compensation will be allowed therefor.

Subsurface disturbance shall include, but shall not be limited to, excavation, grading, and auger borings.

The Contractor will attend a meeting prior to the start of work on this contract with the Engineer and the Department's archaeologist. The purpose of the meeting is to acquaint contractor with possible buried resources within the ASA and to introduce the Department staff archaeologist to the Contractor.

The Contractor shall notify the Engineer at least 30 days in advance of commencing any subsurface work within the ASA. The notification shall include schedule of the hours and days to be worked, including Saturdays, Sundays and holidays.

Should archaeological finds be uncovered during construction operations, the Contractor's construction activities within 35 feet of the find shall be halted immediately until the find is evaluated by the archaeologist and shall not be resumed until so permitted, in writing, by the Engineer.

In the event that archaeological resources are found, if in the opinion of the Engineer, the Contractor's operation are delayed or interfered with by reason of these resources, the State will compensate the Contractor for such delays to the extent provided for in Section 8-1.09, "Right of Way Delays," of the Standard Specifications, and not otherwise, except as provided in Section 8-1.10, "Utility and Non-Highway Facilitates," of the Standard Specifications.

All archaeological artifacts found during project activities are the property of the State.

COOPERATION -- Archaeological testing will take place prior to commencement of work by the Contractor for the duration of approximately 5 days. The Contractor shall notify the Engineer at least 30 calendar days in advance of commencing any subsurface work within the ASA, and in turn the Engineer will notify Caltrans staff archaeologist in order for the archaeological team to mobilize. Contractor will cooperate and assist archaeologists as needed with labor, equipment, and materials.

5-1.24 INSURANCE

The Contractor shall carry Public Liability and Property Damage Liability Insurance at all times when work is being performed. Before beginning work, the Contractor shall provide the Engineer the name, address, and telephone number of the nearest claims adjusting office of the company which has issued his liability insurance.

5-1.25 AREAS FOR CONTRACTOR'S USE

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 all other contract requirements. Use of the Contractor's work areas and other State-owned property shall be at the Contractor's own risk, and the State shall not be held liable for any damage to or loss of materials or equipment located within such areas.

The Contractor shall remove all equipment, materials, and rubbish from the work areas and other State-owned property which he 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 his own expense any area required for storage of plant, equipment and materials, or for other purposes if sufficient area is not available to him within the contract limits.

5-1.26 TRANSPORTATION FOR THE ENGINEER

The Engineer shall have safe access to the work during its construction in accordance with the provisions in Section 5-1.08, “Inspection,” of the Standard Specifications and these special provisions.

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 rides will be taken only on boats which are making trips in connection with the Contractor’s operations. Special trips solely for the benefit of the Engineer or other State representatives will not be required.

Full compensation for conforming to the requirements 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.

5-1.27 UTILITIES

The Contractor shall make his own arrangements to obtain electrical power, water, compressed air and other utilities required for his operations and shall make and maintain the necessary service connections at his own expense. The Contractor shall not use any existing utilities on the bridge or within the contract limits, unless approved in writing by the Engineer.

5-1.28 USE OF EXISTING TRAVELER RAILS AND SCAFFOLDS

The Contractor shall not use the existing traveler scaffolds or other existing scaffolds.

Contractor's scaffolds, platforms, or other access devices may be placed on the existing traveler rails, provided they carry only personnel and hand tools. The traveler rails shall not be used to support the Contractor's formwork, to support protective covers where required, nor to hoist or transport structural steel or other materials. The design capacity for the traveler rails and their supports shall not be exceeded. Existing design capacities for the traveler rails and their supports are included in the "Materials Information" available to the Contractor as provided for in Section 2-1.03, "Examination of Plans, Specifications, Contract, and Site of Work," of the Standard Specifications.

The Contractor may strengthen the existing traveler rails and supports to increase their design capacity. Any modifications to the existing traveler rails or supports shall be fully compatible with the existing traveler scaffolds and conform to the provisions in Section 7-1.11, "Preservation of Property," and Section 7-1.14, "Cooperation," in the Standard Specifications and these special provisions.

The Contractor shall submit to the Engineer working drawings and design calculations of the Contractor's scaffold, platforms, other access devices to be supported on the existing traveler rails and any modifications to the existing traveler rails or supports. Such drawings and design calculations shall conform to the requirements in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications and be signed by an engineer who is registered as a Civil Engineer in the State of California. The number of sets of drawings and design calculations and times for review for the Contractor's scaffold, platforms, or other access devices shall be the same as specified for falsework working drawings in Section 51-1.06A, "Falsework Design and Drawings," of the Standard Specifications.

Working drawings for any part of the Contractor's scaffold, platforms, or other access devices shall include stress sheets, anchor bolt layouts, shop details, erection and removal plans.

The drawings shall include descriptions and values of all loads, including construction equipment loads, and construction activities that require the existing traveler rails. Any modifications to the traveler rails or supports shall be designed in accordance with AASHTO Load Resistance Factor Design (LRFD) Bridge Design Specifications.

The Contractor shall notify the Engineer immediately of any existing damage to the traveler rails or supports prior to using the damaged portion of rail or support.

Scaffolds, platforms or any other devices supported on the existing traveler rails and installed by the Contractor shall be removed after completion of the work and shall remain the property of the Contractor.

5-1.29 SANITARY PROVISIONS

State sanitary facilities will not be available for use by the Contractor's employees.

5-1.30 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 for the purpose of transporting materials and workmen directly to and from the jobsite.

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 all passes issued, and upon completion of the work, shall return all unused passes.

Attention is directed to Section 23302, "Evasion of Toll," of the Vehicle Code.

5-1.31 ACCESS TO JOBSITE

Prospective bidders may make arrangements to visit the jobsite by contacting the Toll Bridge Program Duty Senior, at telephone (510)286-5549.

5-1.32 DRAWINGS

Attention is directed to Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications and these special provisions.

When working drawings are required by these special provisions the drawings shall be submitted in accordance with the provisions specified elsewhere in these special provisions and the following:

At the completion of the contract, one set of all approved final working drawings in electronic form and in hard copies, including any revisions required after approval, shall be furnished to the Engineer.

Electronic files of working drawings shall be Microstation Version 5.0 or later design file format and shall be submitted on compact disk media.

An index prepared specifically for the working drawings for each portion of the work which requires working drawings, containing sheet numbers and titles shall be included on the compact disk media. Electronic files for working drawings shall be arranged in the order of drawing numbers shown in the index.

5-1.33 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:

San Francisco BCDC
NPDES
Port of San Francisco Building Permit No. 5321

Copies of these permits can be obtained at the Department of Transportation, Plans and Bid Documents, Room 0200, Transportation Building, 1120 N Street, P.O. Box 942874, Sacramento, California 95814-0001, and are available for inspection at the Toll Bridge Duty Senior's Desk, 111 Grand Avenue, Oakland, CA 94612, telephone no. (510) 286-5549.

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

5-1.34 RELATIONS WITH SAN FRANCISCO BAY REGIONAL WATER QUALITY CONTROL BOARD

The location of the San Francisco-Oakland Bay Bridge is within an area controlled by the San Francisco Bay Regional Water Quality Control Board. San Francisco Bay Regional Water Quality Control Board Order No. 94-098 has been issued covering work to be performed under this contract. The Contractor shall fully inform himself of all rules, regulations and conditions that may govern his operations in said area and shall conduct his work accordingly.

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 are available for inspection at the Toll Bridge Duty Senior's Desk, 111 Grand Avenue, Oakland, CA 94612, telephone no. (510) 286-5549.

Attention is directed to Sections 7-1.11, "Preservation of Property," and 7-1.12, "Responsibility for Damage," of the Standard Specifications.

Any change in the above listed conditions proposed by the Contractor shall be submitted to the Engineer for transmittal to the San Francisco Bay Regional Water Quality Control Board for their approval. Changes shall not be implemented until approved in writing by the San Francisco Bay Regional Water Quality Control Board.

5-1.35 RELATIONS WITH THE CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY, DEPARTMENT OF TOXIC SUBSTANCES CONTROL

Attention is directed to "Hazardous Material, General" and "Earthwork" of these special provisions.

The Department of Transportation has entered into a Voluntary Cleanup Agreement with the California Environmental Protection Agency, Department of Toxic Substances Control (DTSC) for this project. A copy of the Voluntary Cleanup Agreement (VCA), Docket No. HAS 97/98-024 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 is available for inspection at the office of Toll Bridge Program, Duty Senior's Desk at 111 Grand Avenue, Oakland, California 94612-3171, Telephone No. (510) 286-5549.

The Contractor shall fully inform himself of all rules, regulations and conditions that may govern his operations for handling, transportation and disposal of excavated material and for all other construction related activities which may disturb contaminated or hazardous soil within the project limits.

The Health, Safety and Work Plan prepared by the Contractor for the project shall be submitted to the Engineer and DTSC for review and comment. Throughout the review process the contractor shall provide 3 copies of the Health, Safety and Work Plan. The Contractor shall allow 10 days for review of the Health, Safety and Work Plan by the Engineer. Upon receipt of response comments by the Engineer, the Contractor shall make all necessary revisions and incorporate responses to all comments in the Health, Safety and Work Plan. The Health, Safety and Work Plan shall then be submitted to the DTSC via the Engineer for review and comment. The Contractor shall allow 20 days for review of the Health, Safety and Work Plan by the DTSC. Upon receipt of response comments by the DTSC, the Contractor shall make all necessary revisions and incorporate responses to all comments in the Health, Safety and Work Plan. If subsequent review is required by the DTSC, then the Contractor shall then resubmit the Health, Safety and Work Plan via the

Engineer to the DTSC and allow 15 days for their review. Upon receipt of the final response comments by the DTSC, the Contractor shall make all necessary revisions and incorporate responses to all comments in the final Health, Safety and Work Plan. The Contractor shall provide 8 copies of the final Health, Safety and Work Plan to the Engineer.

The Contractor shall also prepare a detailed Soil Management Plan and Transportation Plan for submittal to and review by the DTSC and the Engineer. The Soil Management Plan and Transportation Plan shall be prepared in accordance with the requirements of the VCA and guidance materials available for review at 111 Grand Avenue, Oakland, 94601. Contact the Toll Bridge Program Duty Senior at telephone number (510) 286-5549 to reserve a copy of the guidance materials at least 24 hours in advance. Throughout the review process the Contractor shall provide 3 copies of the Soil Management Plan and Transportation Plan. The Contractor shall allow 10 days for review of the Soil Management Plan and Transportation by the Engineer. Upon receipt of response comments by the Engineer, the Contractor shall make all necessary revisions and incorporate responses to all comments in the Soil Management Plan and Transportation Plan. The Soil Management Plan and Transportation Plan shall then be submitted to the DTSC via the Engineer for review and comment. The Contractor shall allow 20 days for review of the Soil Management Plan and Transportation by the DTSC. Upon receipt of response comments by the DTSC, the Contractor shall make all necessary revisions and incorporate responses to all comments in the Soil Management Plan and Transportation Plan. If subsequent review is required by the DTSC, then the Contractor shall then resubmit the Soil Management Plan and Transportation Plan to the DTSC via the Engineer and allow 15 days for their review. Upon receipt of the final response comments by the DTSC, the Contractor shall make all necessary revisions and incorporate responses to all comments in the final Soil Management Plan and Transportation. The Contractor shall provide 8 copies of the final Soil Management Plan and Transportation Plan to the Engineer.

The Contractor shall not perform any excavation work at locations containing material classified as contaminated or hazardous until written approvals by the DTSC for the final Soil Management Plan and Transportation Plan and the final Health, Safety and Work Plan have been received by the Engineer.

The Contractor shall prepare an Implementation Report for submittal to the DTSC via the Engineer within 30 days of completion of field activities. The Implementation Report shall provide a chronological summary of the soil management, health and safety, and soil transportation activities that have occurred on site. The Implementation Report shall be supplemented with photographs and field diaries that document the soil management, health and safety, and soil transportation activities. The Contractor shall allow 21 days for review of the Implementation Report by the Engineer and the DTSC. Upon receipt of the response comments by the DTSC and the Engineer, the Contractor shall make all necessary revisions and incorporate responses to all comments in the final Implementation Report. The Contractor shall provide 8 copies of the final Implementation Report to the Engineer.

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

5-1.36 COST REDUCTION INCENTIVE

Section 5-1.14, "Cost Reduction Incentive," of the Standard Specifications is amended by adding the following paragraph:

> Prior to preparing a cost reduction proposal, the Contractor shall request a meeting with the Engineer to discuss the proposal in concept and determine whether the cost reduction proposal will be considered by the Department. Items of discussion will also 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. Determination by the Engineer that a cost reduction proposal will not be considered further will be deemed rejection of the proposal.

5-1.37 FORCE ACCOUNT PAYMENT

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

To the total of the direct costs 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 a markup of 25 percent to the cost of labor, 10 percent to the cost of materials, and 10 percent to the equipment rental.

The above markups, together with payments made for time related overhead pursuant to "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 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," shall be deemed to be the actual cost of the work performed on a force account basis, and shall constitute full compensation therefor.

When extra work to be paid for on a force account basis is performed by a subcontractor, approved in accordance with the provisions in Section 8-1.01, “Subcontracting,” of the Standard Specifications, an additional markup of 5 percent will be added to the total cost of said extra work including all markups specified in this section "Force Account Payment". Said additional 5 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.

5-1.38 OVERHEAD

The Contractor will be compensated for overhead in accordance with these special provisions.

Attention is directed to "Force Account Payment" and "Progress Schedule (Critical Path)" of these special provisions.

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.

The quantity of time related overhead to be measured for payment will be the number of working days specified in "Beginning of Work, Time of Completion and Liquidated Damages" of these special provisions, adjusted only as a result of suspensions and adjustments of time which revise the current contract completion date and which are also any of the following:

1) suspensions of work ordered in accordance with Section 8-1.05, "Temporary Suspension of Work," of the Standard Specifications, except:

    a) suspensions ordered due to the failure on the part of the Contractor to carry out orders given, or to perform any provision of the contract; and
    b) suspensions ordered due to unsuitable weather conditions;

2) extensions of time granted by the State in accordance with the provisions of the fifth paragraph of Section 8-1.07, "Liquidated Damages," of the Standard Specifications; or
3) reductions in contract time set forth in approved contract change orders, in accordance with Section 4-1.03, "Changes," of the Standard Specifications.

The contract price paid for time related overhead shall include full compensation for time related overhead measured for payment as specified above, incurred by the Contractor and by any joint venture partner, subcontractor, supplier or other party associated with the Contractor.

No adjustment in compensation will be made for any increase or decrease in the quantities of time related overhead required, regardless of the reason for the increase or decrease. 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 time related overhead.

For progress payment purposes, the number of working days to be paid for time related overhead in each monthly estimate will be the number of working days specified above to be measured for payment that the Contractor performed work on the current controlling operation or operations as specified in Section 8-1.06, "Time of Completion," of the Standard Specifications. Working days specified above to be measured for payment, on which the Contractor did not perform work on the controlling operation or operations will be measured and included for payment in the first estimate made in accordance with Section 9-1.07, "Payment After Acceptance," of the Standard Specifications.

Full compensation for overhead other than time related overhead measured and paid for as specified above, and other than overhead costs for extra work performed pursuant to Section 4-1.03D of the Standard Specifications, shall be considered as included in the various items of work and no additional compensation will be allowed therefor.

SECTION 6. (BLANK)

SECTION 7. (BLANK)

SECTION 8. MATERIALS

SECTION 8-1. MISCELLANEOUS

8-1.01 PREQUALIFIED AND TESTED SIGNING AND DELINEATION MATERIALS

The Department maintains a trade name list of approved prequalified and tested signing and delineation materials and products. Approval of prequalified and tested products and materials shall not preclude the Engineer from sampling and testing of the signing and delineation materials or products at any time.

None of the listed signing and delineation materials and products shall be used in the work unless material or product is listed on the Department's List of Approved Traffic Products. A Certificate of Compliance shall be furnished as specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for signing and delineation materials and products. The certificate shall also certify that the signing and delineation material or product conforms to the prequalified testing and approval of the Department of Transportation, Division of Traffic Operations and was manufactured in conformance with the requirements in the approved quality control program.

Materials and products will be considered for addition to the approved prequalified and tested list if the manufacturer of the material or product submits to the Division of Traffic Operations a sample of the material or product. The sample shall be sufficient to permit performance of required tests. Approval of materials or products will be dependent upon a determination as to compliance with the specifications and test the Department may elect to perform.

The following is a listing of approved prequalified and tested signing and delineation materials and products:

PAVEMENT MARKERS, PERMANENT TYPE

REFLECTIVE

Apex, Model 921 (4"x4")
Pavement Markers, Inc., "Hye-Lite" (4"x4")
Ray-O-Lite, Models SS (4"x4"), RS (4"x4") and AA (4"x4")
Stimsonite, Models 88 (4" x4"), 911 (4"x4"), 953 (2.75"x4.5")
Ray-O-Lite, Model 2002 (2.2"x4.7")*
Stimsonite, Model 948 (2.3"x4.7")*

* Not to be used on asphalt concrete surfaces in desert regions as determined by the Engineer

REFLECTIVE WITH ABRASION RESISTANT SURFACE (ARS)

Ray-O-Lite "AA" ARS (4"x4")
Stimsonite, Models 911 (4"x4"), 953 (2.75"x4.5")
Ray-O-Lite, Model 2002 (2.2"x4.7")*
Stimsonite, Model 948 (2.3"x4.7")*

* Not to be used on asphalt concrete surfaces in desert regions as determined by the Engineer

REFLECTIVE WITH ABRASION RESISTANT SURFACE (ARS)
(Used for recessed applications)

Stimsonite, Model 948 (2.3"x4.7")
Ray-O-Lite, Model 2002 (2.2"x4.7")
Stimsonite, Model 944SB (2"x4")*
Ray-O-Lite, Model 2004 ARS (2"x4")*

* For use only in 4.5-inch wide (older) recessed slots

NON-REFLECTIVE FOR USE WITH EPOXY ADHESIVE

Apex Universal (Ceramic)
Highway Ceramics, Inc. (Ceramic)

NON-REFLECTIVE FOR USE WITH BITUMEN ADHESIVE

Apex Universal (Ceramic)
Apex Universal, Model 929 (ABS)
Elgin Molded Plastics, "Empco-Lite" Model 900 (ABS)
Highway Ceramics, Inc. (Ceramic)
Hi-Way Safety, Inc., Models P20-2000W and 2001Y (ABS)
Interstate Sales, "Diamond Back" (ABS)
Loomis Plastics, D-Dot (ABS)
Pavement Markers, Inc., (Marker Supply) - Models A1107 and AY1108 (ABS)
Road Creations, Model RCB4NR (Acrylic)

PAVEMENT MARKERS, TEMPORARY TYPE

TEMPORARY MARKERS FOR LONG TERM DAY/NIGHT USE (6 months or less)

Apex Universal, Model 924 (4"x4")
Davidson Plastics, Model 3.0 (4"x4")
Elgin Molded Plastics, "Empco-Lite" Model 901 (4" Round)
Highway Technologies, Megalites (4"x4")
Road Creations, Model R41C (4"x4")
Vega Molded Products "Temporary Road Marker" (3"x4")

TEMPORARY MARKERS FOR SHORT TERM DAY/NIGHT USE (14 days or less)
(For seal coat or chip seal applications, clear protective covers are required)

Apex Universal, Model 932
Davidson Plastics, Models T.O.M.,T.R.P.M. and "HH" (High Heat)
Hi-Way Safety, Inc., Model 1280/1281

STRIPING AND PAVEMENT MARKING MATERIALS

PERMANENT TRAFFIC STRIPING AND PAVEMENT MARKING TAPE

Advanced Traffic Marking, Series 300 and 400
Brite-Line, Series 1000
Swarco Industries, "Director 35" (For transverse application only)
Swarco Industries, "Director 60"
3M, "Stamark" Series 380 and 5730
3M, "Stamark" Series A320 Bisymetric (For use on low-volume roadways only)
3M, "Stamark" Series A420, A440, N420 and N440 (For transverse application only)

TEMPORARY REMOVABLE STRIPING AND PAVEMENT MARKING TAPE
(6 months or less)

Advanced Traffic Marking, ATM Series 200
Brite-Line, Series 100
P.B. Laminations, Aztec, Grade 102
Swarco Industries, "Director-2"
3M, "Stamark" Brand, Detour Grade, Series 5710 and Series A620

PREFORMED THERMOPLASTIC (Heated in place)

Flint Trading, "Premark" and "Premark 20/20 Flex"
Pavemark, "Hotape"

REMOVABLE TRAFFIC PAINT

Belpro, Series 250/252 and No. 93 Remover

CLASS 1 DELINEATORS

ONE-PIECE DRIVEABLE FLEXIBLE TYPE, 66"

Carsonite, Curve-Flex CFRM-400
Carsonite, Roadmarker CRM-375
Davidson Plastics, "Flexi-Guide Models 400 and 566"
GreenLine Model HWD1-66 and CGD1-66
J. Miller Industries, Model JMI-375 (with soil anchor)

SPECIAL USE FLEXIBLE TYPE, 48"

Carsonite, "Survivor" with 18" U-Channel anchor
FlexStake
GreenLine Models HWD and CGD (with 18" soil anchor)
Safe-Hit with 8" pavement anchor (SH248-GP1)
Safe-Hit with 15" soil anchor (SH248-GP2) and with 18" soil anchor (SH248-GP3)

SURFACE MOUNT FLEXIBLE TYPE, 48"

Bent Manufacturing Co., "Masterflex" Model MF-180EX-48"
Carsonite, "Super Duck II"
FlexStake, Surface Mount

CHANNELIZERS

SURFACE MOUNT TYPE, 36"

Bent Manufacturing Co., "Masterflex" Models MF-360-36(Round) and MF-180-36(Flat)
Carsonite, "Super Duck" (Flat SDF-436, Round SDR-336)
Carsonite, Super Duck II Model SDCF203601MB "The Channelizer"
Davidson Plastics, Flex-Guide FG300
FlexStake, Surface Mount
GreenLine, Model SMD-36
The Line Connection, "Dura-Post" Model DP36-3 (Permanent)
The Line Connection, "Dura-Post" Model DP36-3C (Temporary)
Repo, Models 300 and 400
Safe-Hit, Guide Post, Model SH236SMA

OBJECT MARKERS

TYPE "K", 18"

Carsonite, Model SMD-615
Repo, Models 300 and 400
Safe-Hit, Model SH718SMA

The Line Connection, Model DP21-4K

TYPE "K-4", 18"-24"
(Shown as "Q" in the Traffic Manual)

Carsonite, Super Duck II
Repo, Models 300 and 400
Safe-Hit, Models SH824SMA--WA and SH824GP3--WA
The Line Connection, Model "DP21-4Q"

TEMPORARY RAILING (TYPE K) REFLECTORS AND CONCRETE BARRIER MARKERS

IMPACTABLE TYPE

Astro Optics "FB"
Davidson Plastics, Model PCBM-12
Duraflex Corp., "Flexx 2020" and "Electriflexx"

NON-IMPACTABLE TYPE

Astro-Optics, JD Series
Stimsonite, Model 967 (with 3 1/4" Acrylic cube corner reflector)
Stimsonite, Model 967LS
Vega Molded Products, Models GBM and JD

THRIE BEAM BARRIER MARKERS (For use to the left of traffic)

Duraflex Corp., "Railrider"
Davidson Plastics, "Mini" (3"x10")

CONCRETE BARRIER DELINEATORS, 16"
(For use to the right of traffic. When mounted on top of barrier, top of reflective element at 48")

Davidson Plastics, Model PCBM T-16
Safe-Hit, Model SH216RBM

SOUND WALL DELINEATOR
(Applied to a vertical surface. Top of reflective element at 48")

Davidson Plastics, PCBM S-36

GUARD RAILING DELINEATOR
(For use to the right or left of traffic. Top of reflective element at 48")

WOOD POST TYPE

Carsonite, Model 427
Davidson Plastics FG 427 and FG 527
GreenLine GRD 27-inch
J. Miller Model JMI-375G
Safe-Hit, Model SH227GRD

STEEL POST TYPE

Carsonite, Model CFGR-327 with CFGRBK300 Mounting Bracket

REFLECTIVE SHEETING

CHANNELIZERS, BARRIER MARKERS AND DELINEATORS

3M, High Intensity
Reflexite, PC-1000, Metalized Polycarbonate
Reflexite, AC-1000, Acrylic
Reflexite, AP-1000, Metalized Polyester
Reflexite, AR-1000, Abrasion Resistant Coating)
Stimsonite, Series 6200 (For rigid substrate devices only)

TRAFFIC CONES, 13" Sleeves

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

TRAFFIC CONES, 4" and 6" Sleeves

3M Series 3840
Reflexite Vinyl or "TR" (Semi-transparent)

BARRELS AND DRUMS

Reflexite, "Super High Intensity"
3M Series 3810

BARRICADES, Type I, Engineer Grade

American Decal, Adcolite
Avery Dennison, 1500/1600
3M, Scotchlite, Series CW

SIGNS, Type II, Super Engineer Grade

Avery Dennison, "Fasign" 2500 Series
Kiwalite, Type II
Nikkalite 1800 Series

SIGNS, Type III, High Performance

3M, Series 3780

SIGNS, Type IV, High Performance

Stimsonite Series 6200

SIGNS, Roll-Up Signs

Reflexite, Vinyl (Orange), Reflexite "SuperBright" (Fluorescent orange)
3M Series RS34 (Orange) and RS20 (Fluorescent orange)

SIGN SUBSTRATE FOR CONSTRUCTION AREA SIGNS

ALUMINUM

FIBERGLASS REINFORCED PLASTIC (FRP)

Sequentia, "Polyplate"
Fiber-Brite

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.

Wherever the word "cement" is used in the Standard Specifications or the special provisions, and its use conforms to one of the following criteria, it shall be understood to mean "cementitious material":

A. When the cement content of portland cement concrete is specified and Section 90, "Portland Cement Concrete," of the Standard Specifications is referenced.
B. When the pounds of cement per cubic yard for portland cement concrete is specified and Section 90, "Portland Cement Concrete," of the Standard Specifications is referenced.

The above criteria shall not apply when the use of mineral admixture is not allowed.

Cementitious material to be used in portland cement concrete shall be a combination of "Type II Modified" portland cement and mineral admixture.

Section 90-1.01, "Description," of the Standard Specifications is amended to read:

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.

Unless otherwise specified, cementitious material to be used in portland cement concrete shall conform to the requirements for cement and mineral admixtures in Section 90-2, "Materials" and shall be either: 1) "Type IP (MS) Modified" cement; or 2) a combination of "Type II Modified" portland cement and mineral admixture.

Unless otherwise specified for precast, steam cured, or other high early strength concrete, mineral admixture will not be required if it has been determined by the Transportation Laboratory and documented in writing by the Engineer that the aggregate is from a source that is not alkali silica reactive.

Concrete for each portion of the work shall comply with the requirements for the Class, cementitious material content in pounds per cubic yard, 28-day compressive strength, minor concrete, or commercial quality concrete, as shown on the plans or specified in these specifications or the special provisions.

Class A concrete shall contain not less than 564 pounds of cementitious material per cubic yard.

Class B concrete shall contain not less than 470 pounds of cementitious material per cubic yard.

Class C concrete shall contain not less than 376 pounds of cementitious material per cubic yard.

Class D concrete shall contain not less than 658 pounds of cementitious material per cubic yard.

Minor concrete shall contain not less than 564 pounds of cementitious material per cubic yard 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 yard of concrete in structures or portions of structures shall conform to the following:

Use	Cementitious Material Content in pounds
Concrete which is designated by compressive strength:	
Deck slabs and slab spans of bridges	658 min., 800 max.
Roof sections of exposed top box culverts	658 min., 800 max.
Other portions of structures	564 min., 800 max.
Concrete not designated by compressive strength:	
Deck slabs and slab spans of bridges	658 min.
Roof sections of exposed top box culverts	658 min.
Prestressed members	658 min.
Seal courses	658 min.
Other portions of structures	564 min.

Whenever the 28-day compressive strength shown on the plans is 3,500 pounds per square inch or greater, the concrete shall be considered to be designated by compressive strength. If the plans show a 28-day compressive strength which is 4,500 pounds per square inch or greater, an additional 7 days will be allowed to obtain the specified strength. The 28-day compressive strengths shown on the plans which are less than 3,500 pounds per square inch, are shown for design information only and are not to be considered a requirement for acceptance of the concrete.

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

The Contractor shall determine the mix proportions for all concrete except pavement concrete. The Engineer will determine the mix proportions for pavement concrete.

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 accordance 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 used in the work has a cementitious material content, consisting of cement,-mineral admixture, or cement plus mineral admixture, which is less than the minimum required for the work, 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 $0.25 for each pound of cement, mineral admixture, or cement plus mineral admixture which is less than the minimum required for the work. The Department may deduct the amount from any monies 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 for cementitious material content will be made based on the results of California Test 518.

The requirements of the preceding paragraph shall not apply to minor concrete nor commercial quality concrete.

All concrete for which the mix proportions are determined either by the Contractor or the Engineer shall conform to the requirements of this Section 90.

Portland cement shall be "Type II Modified" portland cement.

The first paragraph in Section 90-2.01, "Portland Cement," of the Standard Specifications is amended to read:

90-2.01 Portland Cement.—Unless otherwise specified, portland cement shall be either "Type IP (MS) Modified" cement or "Type II Modified" portland cement.

"Type IP (MS) Modified" cement shall conform to the specifications for Type IP (MS) cement in ASTM Designation: C 595, and shall be comprised of an intimate mixture of Type II cement and not more than 25 percent of a mineral admixture. The type and minimum amount of mineral admixture used in the manufacture of "Type IP (MS) Modified" cement shall be in accordance with the provisions of Section 90-4.08, "Required Use of Mineral Admixtures."

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

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

A. The cement shall not contain more than 0.60 percent by weight of alkalis, 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 accordance with the requirements of ASTM Designation: C 114.
B. The autoclave expansion shall not exceed 0.50 percent.
C. Mortar, containing the cement to be used and Ottawa sand, when tested in accordance 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.

The second paragraph in Section 90-2.01, "Portland Cement," of the Standard Specifications is amended to read:

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

The third paragraph in Section 90-2.01, "Portland Cement," of the Standard Specifications is deleted.
The twelfth paragraph in Section 90-2.02, "Aggregates," of the Standard Specifications is deleted.
The first paragraph in Section 90-2.03, "Water," of the Standard Specifications is amended to read:

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 1,000 parts per million of chlorides as Cl, nor more than 1,300 parts per million of sulfates as SO_4. 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, nor more than 1,300 parts per million of sulfates as SO_4. 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 accordance with 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 accordance with ASTM Designation: C 109, when compared to the results obtained with distilled water, tested in accordance with ASTM Designation: C 109.

The following section is added to Section 90-2, "Materials," of the Standard Specifications:

90-2.04 Admixture Materials.—Admixture materials shall conform to the requirements of the ASTM Designations shown below:

Chemical Admixtures—ASTM Designation: C 494.
Air-entraining Admixtures—ASTM Designation: C 260.
Calcium Chloride—ASTM Designation: D 98.
Mineral Admixtures—Coal fly ash, raw or calcined natural pozzolan as specified in ASTM Designation: C 618, except that the loss on ignition shall not exceed 4 percent, or, silica fume as specified in ASTM Designation: C 1240, with reduction of mortar expansion of 80 percent, minimum, using the cement from the proposed mix design.

Mineral admixtures shall be used in accordance with the provisions in Section 90-4.08, "Required Use of Mineral Admixtures."

Section 90-4.02, "Materials," of the Standard Specifications is amended to read:

90-4.02 Materials.—Admixture materials shall be as specified in Section 90-2.04, "Admixture Materials."

Section 90-4.05, "Optional Use of Chemical Admixtures," of the Standard Specifications is amended to read:

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:

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 weight except that the resultant cementitious material content shall be not less than 470 pounds per cubic yard.

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.

Section 90-4.07, "Optional Use of Air-entraining Admixtures," of the Standard Specifications is amended to read:

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."

The minimum amount of mineral admixture to be combined with cement shall not be less than 25 percent by weight of the total amount of cementitious material to be used in the mix.

Section 90-4.08, "Required Use of Mineral Admixtures," of the Standard Specifications is amended to read:

90-4.08 Required Use of Mineral Admixtures.—Unless otherwise specified, mineral admixture shall be combined with cement to make cementitious material for use in portland cement concrete.

The calcium oxide content of mineral admixtures shall not exceed 10 percent and the available alkali, as sodium oxide equivalent, shall not exceed 1.5 percent when measured in conformance with the requirements of ASTM Designation: C 618.

The amounts of cement and mineral admixture used in cementitious material for portland cement concrete 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:

The minimum amount of cement shall not be less than 75 percent by weight of the specified minimum cementitious material content.

The minimum amount of mineral admixture to be combined with cement shall be determined using one of the following criteria:

A. When the calcium oxide content of a mineral admixture, measured in conformance with the requirements of ASTM Designation: C 618 and Section 90-2.04, "Admixture Materials," is equal to or less than 2 percent by weight, the amount of mineral admixture shall not be less than 15 percent by weight of the total amount of cementitious material to be used in the mix.
B. When the calcium oxide content of a mineral admixture, measured in conformance with the requirements of ASTM Designation: C 618 and Section 90-2.04, "Admixture Materials," is greater than 2 percent , the amount of mineral admixture shall not be less than 25 percent by weight of the total amount of cementitious material to be used in the mix.
C. When a mineral admixture is used, which conforms to the requirements 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 weight of the total amount of cementitious material to be used in the mix.

If more than the required amount of cementitious material is used, the balance of the additional cementitious material in the mix may be either cement, mineral admixture or a combination of both; however, the maximum amount of mineral admixture shall not exceed 35 percent by weight 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 pounds per cubic yard, the total weight of cement and mineral admixture per cubic yard shall not exceed the specified maximum cementitious material content.

Section 90-4.09, "Optional Use of Mineral Admixture," of the Standard Specifications is deleted.

Section 90-4.11, "Storage, Proportioning, and Dispensing of Mineral Admixtures," of the Standard Specifications is amended to read:

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 interlocks are required for cement and mineral admixture charging mechanisms by Section 90-5.03A, "Proportioning for Pavement," and cement and mineral admixtures are weighed cumulatively, their charging mechanisms shall be interlocked to prevent the introduction of mineral admixture until the weight of cement in the cement weigh hopper is within the tolerances specified in Section 90-5.02, "Proportioning Devices."

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.

Section 90-5.02, "Proportioning Devices," of the Standard Specifications is amended to read:

90-5.02 Proportioning Devices.—All 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, any automatic weighing systems used shall comply with the requirements for automatic proportioning devices in Section 90-5.03A, "Proportioning for Pavement." These 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 insure 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 weight of each batch of material shall not vary from the weight 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 weight 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 weight 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 weight 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 weights. Equipment for measuring water shall have a zero tolerance of ±0.5 percent of its designated weight or volume.

The weight 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 weight of the aggregate. Aggregates weighed individually shall be within 1.5 percent of their respective designated batch weights.
B. Cement shall be within 1.0 percent of its designated batch weight. When weighed individually, mineral admixture shall be within 1.0 percent of its designated batch weight. 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 weight, and the total for cement and mineral admixture shall be within 1.0 percent of the sum of their designated batch weights.
C. Water shall be within 1.5 percent of its designated weight 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 weight not exceeding the maximum permissible weight variation above, except that no scale shall be required having a capacity of less than 1,000 pounds, with one-pound graduations.

Section 90-5.03, "Proportioning," of the Standard Specifications is amended to read:

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 weight.

At the time of batching, all 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 weight.

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, that conforms to the requirements in Section 90-2.01, "Portland Cement," shall be weighed in an individual hopper and shall be kept separate from the aggregates until the ingredients are released for discharge. Except as otherwise noted below, the cement hoppers may be attached to a separate scale for individual weighing. If the cement is weighed cumulatively, the cement shall be weighed before the other ingredients.

Bulk cement to be blended with mineral admixture for use in portland cement concrete for pavement and structures shall be proportioned by one of the following methods:

1. Bulk cement and mineral admixture shall be weighed in individual weigh-hoppers and shall be kept separate from each other and from the aggregates until the ingredients are released for discharge into the mixer. 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 a weight indicator to constitute an individual and independent material weighing device. The aggregate, the cement, and the mineral admixture shall be discharged into the mixer simultaneously.
2. Bulk cement and mineral admixture may be weighed in the same weigh hopper if the mix uniformity conforms to the requirements of Annex "A1, Concrete Uniformity Requirements," of ASTM Designation: C 94 as tested by the Contractor. The capability of the mixing methods and devices shall be established before starting production of portland cement concrete for contract work. Mix uniformity sampling and testing shall be done in the presence of the Engineer. The Engineer shall approve the mixing methods and devices as a supplement to California Test 109. The time between tests for mix uniformity testing shall be the same as that required by California Test 109 for portland cement concrete batch plant scale calibration.

The scale and weigh hopper for bulk weighing cement, mineral admixture, and cement plus mineral admixture shall be separate and distinct from the aggregate weighing equipment.

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

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

A. Separate boxes and separate dial or beam scale and indicator for weighing each size of aggregate.
B. Single box and dial or multiple beam type 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 weights, the gross weight and tare weight 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.

Section 90-5.03A, "Proportioning for Pavement," of the Standard Specifications is amended to read:

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 weight by means of automatic proportioning devices of approved type conforming to the requirements specified in this Section 90-5.03A.

The Contractor shall install and maintain in operating condition an electrically 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 weight 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 weights which are 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 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 weight 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.

The third paragraph in Section 90-6.01, "General," of the Standard Specifications is amended to read:

All 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.

The third and fourth paragraphs in Section 90-6.02, "Machine Mixing," of the Standard Specifications are amended to read:

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, or in accumulation of cementitious materials on surfaces of conveyors or hoppers, or in other conditions which reduce or vary the required quantity of cementitious material in the concrete mixture.

The sixth paragraph in Section 90-6.02, "Machine Mixing," of the Standard Specifications is amended to read:

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 seventh and eighth paragraphs in Section 90-6.03, "Transporting Mixed Concrete," of the Standard Specifications are amended to read:

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 comes 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 85° F., or above, a time less than 1.5 hours may be required.

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 85° F., or above, the time between the introduction of cement to the aggregates and discharge shall not exceed 45 minutes.

The ninth and tenth paragraphs in Section 90-6.03, "Transporting Mixed Concrete," of the Standard Specifications are amended to read:

Each load of concrete delivered at the jobsite shall be accompanied by a ticket showing the mix identification number, non-repeating load number, date and time at which the materials were batched, the total amount of water (gallons) 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 ticket shall also show the actual scale weights (pounds) for the ingredients batched or the calculated portland cement concrete volume (cubic yards) calculated from actual scale weights. Theoretical or target batch weights shall not be used as a substitute for actual scale weights. When showing a calculated portland cement concrete volume on the delivery ticket, the Contractor shall maintain and have available a record of the following information for each batched load:

1. Mix identification number, specific to the contract.
2. Load number shall match the load number on the delivery ticket.
3. Date and time the load was batched.
4. Actual batch weight (pounds) for each ingredient.
5. Any water (gallons) added at the plant, in addition to the water proportioned for the batch.

When requested, the Contractor shall submit the recorded information for calculated portland cement concrete volumes to the Engineer. The information shall be provided in printed form, or if acceptable to the Engineer, data may be submitted in electronic media. Electronic media shall be presented in a tab delimited format on a 3.5-inch diskette with a capacity of at least 1.4 megabytes. Captured data, for the ingredients represented by each batch shall be LFCR (one line, separate record) with allowances for sufficient fields to satisfy the amount of data required by these specifications.

Section 90-6.05, "Hand-Mixing," of the Standard Specifications is amended to read:

90-6.05 Hand-Mixing.—Hand-mixed concrete shall be made in batches not more than one-third cubic yard 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 one foot 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.

The second paragraph in Section 90-6.06, "Amount of Water and Penetration," of the Standard Specifications is amended to read:

The amount of free water used in concrete shall not exceed 312 pounds per cubic yard, plus 20 pounds for each required 100 pounds of cementitious material in excess of 564 pounds per cubic yard.

The fourth paragraph in Section 90-6.06, "Amount of Water and Penetration," of the Standard Specifications is amended to read:

Where there are adverse or difficult conditions which 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 yard of concrete. The increase in water and cementitious material shall be at a ratio not to exceed 30 pounds of water per added 100 pounds of cementitious material per cubic yard. 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.

Section 90-9.01, "General," of the Standard Specifications is amended to read:

90-9.01 General.—Concrete compressive strength requirements consist of a minimum strength which must 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 elsewhere or are shown on the plans.

The compressive strength of concrete will be determined from test cylinders which have been fabricated from concrete sampled in accordance with California Test 539. Test cylinders will be molded and initial field cured in accordance with California Test 540. Test cylinders will be cured and tested after receipt at the testing laboratory in accordance with 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 accordance 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 $10.00 for each in-place cubic yard 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 $15.00 for each in place cubic yard 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. All concrete represented by a single test which indicates a compressive strength of less than 85 percent of the specified 28-day compressive strength will be rejected in accordance 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 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 accordance with the specifications of ASTM Designation: C 42.

No single compressive strength test shall represent more than 300 cubic yards.

When a precast concrete member is steam cured, the compressive strength of the concrete will be determined from test cylinders which have been handled and stored in accordance 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, must 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, must 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 600 pounds per square inch 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 which 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.

All tests shall be performed in accordance with either the appropriate California Test methods or the comparable ASTM test methods. All 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 yards and the weight, 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.

All certified test data and trial batch test reports shall be signed by an official of the firm which 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 any changes which, in the judgment of the Engineer, could result in a lowering of the strength of the 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.

Section 90-10.02A, "Portland Cement," of the Standard Specifications is renamed "Cementitious Material" and amended to read:

90-10.02A Cementitious Material.—Cementitious material shall conform to the provisions in Section 90-1.01, "Description." Compressive strength requirements consist of a minimum strength which must 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 elsewhere or are shown on the plans.

The fifth paragraph in Section 90-10.02B, "Aggregate," of the Standard Specifications is deleted.
Section 90-10.03, "Production," of the Standard Specifications is amended to read:

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, which will result in concrete that is thoroughly and uniformly mixed, that is suitable for the use intended, and which 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 California Department of Transportation.

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 any 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 90° F. will be considered as 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 nor 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 ticket which shall be delivered to the Engineer at the discharge location of the concrete, unless otherwise directed by the Engineer. The ticket 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 in accordance with 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 all contract requirements, including minimum cementitious material content specified.

The third and fourth paragraphs in Section 90-11.02, "Payment," of the Standard Specifications are amended to read:

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.

Should the Contractor use admixtures as permitted under Sections 90-4.05, "Optional Use of Chemical Admixtures;" or 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 in the concrete at the Contractor's expense and no additional compensation will be allowed therefor.

SECTION 8-3. WELDING

8-3.01 WELDING ELECTRODES

Flux core welding electrodes conforming to the requirements of AWS A5.20 E6XT-4 or E7XT-4 shall not be used to perform any type of welding for this project.

8-3.02 WELDING QUALITY CONTROL

Welding quality control shall conform to the requirements in the AWS welding codes, the Standard Specifications and these special provisions.

Welding quality control shall apply when any work is welded in conformance with the provisions in 1) Section 52, "Reinforcement," or 2) Section 55, "Steel Structures," of the Standard Specifications.

Welding quality control, as specified herein, shall not apply when welding is performed at a permanent fabrication facility that is certified under the AISC Quality Certification Program, Category III, Major Steel Bridges.

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	1996
D1.4	1992
D1.5	1995
D1.5 (metric only)	1996

All 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.

The welding of all fracture critical members (FCMs) shall conform to the provisions specified in the Fracture Control Plan (FCP) and herein.

The Contractor shall designate in writing a welding Quality Control Manager (QCM). The QCM shall be responsible directly to the Contractor for the quality of welding, including materials and workmanship, performed by the Contractor and all subcontractors.

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.

No welding inspection personnel or nondestructive testing (NDT) firms to be used in the work shall 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 shall be the sole individual responsible to the Contractor for submitting and receiving all correspondence and required submittals and reports regarding welding to and from the Engineer.

Prior to submitting the Quality Control Plan (QCP) required herein, a pre-welding meeting shall be held between the Engineer, Contractor and any welding subcontractors to be used in the work to discuss the requirements for the QCP.

Prior to performing any welding, the Contractor shall submit to the Engineer, in accordance with the provisions of Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications, 3 copies of a separate QCP for each item of work for which welding is to be performed. As a minimum, each QCP shall include the following:

1. The name of the welding firm and the NDT firm to be used;
2. A manual prepared by the NDT firm that shall include equipment, testing procedures, code of safe practices, the Written Practice of the NDT firm, and the names, qualifications and documentation of certifications for all personnel to be used;
3. The name of the QCM and the names, qualifications and documentation of certifications for all Quality Control (QC) Inspectors and Assistant Quality Control Inspectors to be used;
4. An organizational chart showing all QC personnel and their assigned QC responsibilities;
5. The methods and frequencies for performing all required quality control procedures, including QC inspection forms to be used, as required by the specifications including:

   (a) all visual inspections;
   (b) all NDT including radiographic geometry, penetrameter and shim selection, film quality, film processing, radiograph identification and marking system, and film interpretation and reports; and
   (c) calibration procedures and calibration frequency for all NDT equipment;

6. A system for the identification and tracking of all welds, NDT and any required repairs, and a procedure for the reinspection of any repaired welds. The system shall have provisions for 1) permanently identifying each weld and the person who performed the weld and 2) placing all identification and tracking information on each radiograph;
7. Standard procedures for performing noncritical repair welds. Noncritical repair welds are defined as welds to deposit additional weld beads or layers to compensate for insufficient weld size and to fill limited excavations that were performed to remove unacceptable edge or surface discontinuities, rollover or undercut. The depth of these excavations shall not exceed 65 percent of the specified weld size;
8. The welding procedure specification (WPS), including documentation of all supporting Procedure Qualification Record (PQR) tests performed, and the name of the testing laboratory who performed the tests, to verify the acceptability of the WPS. The submitted WPS shall be within the allowable period of effectiveness;

9. Documentation of all certifications for welders for each weld process and position that will be used. Certifications shall list the electrodes used, test position, base metal and thickness, tests performed, and the witnessing authority. All certifications shall be within the allowable period of effectiveness; and
10. One copy each of all AWS welding codes and the FCP which are applicable to the welding to be performed. These codes and the FCP shall become the permanent property of the Department.

The Engineer shall have 10 working days to review the QCP submittal after a complete plan has been received. No welding shall be performed until the QCP is approved in writing 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 QCP, the delay will be considered a right of way delay as specified in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

An amended QCP or addendum shall be submitted to, and approved in writing by the Engineer, for any proposed revisions to the approved QCP. An amended QCP or addendum will be required for any revisions to the QCP, including but not limited to a revised WPS, additional welders, changes in NDT firms or procedures, QC or NDT personnel, or updated systems for tracking and identifying welds. The Engineer shall have 3 working days to complete the review of the amended QCP or addendum. Work that is affected by any of the proposed revisions shall not be performed until the amended QCP or addendum has been approved. 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 amended QCP or addendum, the delay will be considered a right of way delay as specified in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

After final approval of the QCP, amended QCP or addendum, the Contractor shall submit to the Engineer 7 copies each of these approved documents.

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, and 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 Quality Control Inspector shall also be included in the log.

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 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 QCP.

The following items shall be included in a Welding Report that is to be submitted to the Engineer within 7 days following the performance of any welding:

1. Reports of all visual weld inspections and NDT;
2. Radiographs and radiographic reports, and other required NDT reports;
3. Documentation that the Contractor has evaluated all radiographs and other nondestructive tests, corrected all rejectable deficiencies, and all repaired welds have been reexamined by the required NDT and found acceptable; and
4. Daily production log.

All reports regarding NDT, including radiographs, shall be signed by both 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 shall review the Welding Report to determine if the Contractor is in conformance with the QCP. Except for steel piling, the Engineer shall be allowed 7 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 QCP, the Contractor may encase in concrete or cover any 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. Any material not conforming to these requirements will be subject to rejection. Should the Contractor elect to wait to encase or cover any welds pending notification by the Engineer, and should the Engineer fail to complete the review and provide notification within this time allowance, and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in notification, the delay will be considered a right of way delay as specified in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

Sections 6.1.1 through 6.1.3.3 of AWS D 1.1, Sections 7.1.1 and 7.1.2 of AWS D 1.4, and Sections 6.1.1.1 through 6.1.3.3 of AWS D 1.5 are replaced with the following:

Quality Control (QC) shall be the responsibility of the Contractor. As a minimum, the Contractor shall perform inspection and testing prior to welding, during welding and after welding as specified in this section and additionally as necessary to ensure that materials and workmanship conform to the requirements of the contract documents.

The Quality Control (QC) Inspector shall be the duly designated person who performs inspection, testing, and quality 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.

All QC Inspectors shall be responsible for quality control acceptance or rejection of materials and workmanship, and shall be currently certified as AWS Certified Welding Inspectors (CWI) in accordance with the provisions of AWS QC1, "Standard and Guide for Qualification of Welding Inspectors."

The QC Inspector may be assisted by an Assistant QC Inspector provided that this individual is currently certified as an AWS Certified Associate Welding Inspector (CAWI) in accordance with the provisions of AWS QC1, "Standard and Guide for Qualification of Welding Inspectors," or has equivalent qualifications. The QC Inspector shall monitor the Assistant QC Inspector's work, and shall be responsible for signing all reports.

When the term "Inspector" is used without further qualification, it shall refer to the QC Inspector.

Section 6.14.7, "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 amended to read:

Personnel performing NDT shall be qualified in accordance with the current edition of the American Society for Nondestructive Testing (ASNT) Recommended Practice No. SNT-TC-1A and the Written Practice of the NDT firm. Only individuals who are 1) qualified for NDT Level II, or 2) Level III technicians who have been directly certified by the ASNT and are authorized to perform the work of Level II technicians, shall perform NDT, review the results, and prepare the written reports.

Section 6.5.4, "Scope of Examination," of AWS D 1.1 and Section 7.5.4 of AWS D 1.4 are amended to read:

The QC Inspector shall inspect and approve the joint preparation, assembly practice, welding techniques, and 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.

Section 6.5.4 of AWS D 1.5 is amended to read:

The QC Inspector shall inspect and approve the joint preparation, assembly practice, welding techniques, and 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 section 3 and 9.21. The size and contour of 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.

The Engineer shall have the authority to verify the qualifications or certifications of any welder, Quality Control Inspector, or NDT personnel to specified levels by retests or other means.

A sufficient number of QC Inspectors shall be provided to ensure continuous inspection when any welding is being performed. Continuous inspection, as a minimum, shall include (1) having QC Inspectors continually present on all shifts when any welding is being performed, or (2) having a QC Inspector within such close proximity of all welding operations 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 the joint preparation, assembly practice, welding techniques, and performance of each welder, welding operator, and tack welder shall be documented by the QC Inspector on a daily basis for each day that welding is performed.

The QC Inspector shall provide reports to the QCM on a daily basis for each day that welding is performed.

Except for noncritical weld repairs, base metal repairs, or any other type of repairs not submitted in the QCP, the Engineer shall be notified immediately in writing when any welding problems or deficiencies are discovered and also of the proposed repair procedures to correct them. The Engineer shall have 5 working days to review these procedures. No remedial work shall begin until the repair procedures are approved in writing 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 proposed repair procedures, the delay will be considered a right of way delay as specified in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

When joint details that are not prequalified by the applicable AWS codes are proposed for use in the work, all welders using these details shall perform a qualification test plate using the approved WPS variables and the joint detail to be used in production. The test plate shall be the maximum thickness to be used in production. The test plate shall be mechanically or radiographically tested as directed by the Engineer. Mechanical and radiographic testing and acceptance criteria shall be as specified in the applicable AWS codes.

The period of effectiveness for a welder's or welding operator's qualification shall be a maximum of 3 years for the same weld process, welding position, and weld type. A valid qualification at the beginning of work on a contract will be acceptable for the entire period of the contract, as long as the welder's work remains satisfactory.

All qualification tests for welders, welding operators, and WPSs used in welding operations will be witnessed by the Engineer or an independent third party acceptable to the Engineer.

Section 6.6.5, "Nonspecified Nondestructive Testing Other Than Visual," of AWS D 1.1, Section 6.6.5 of AWS D 1.4 and Section 6.6.5 of AWS D 1.5 shall not apply.

For any welding, the Engineer may direct the Contractor to perform NDT that is in addition to the visual inspection or NDT specified in the AWS welding codes, in the Standard Specifications or in these special provisions. Additional NDT required by the Engineer, will be paid for as extra work in accordance with Section 4-1.03D, "Extra Work," of the Standard Specifications. Should any welding deficiencies be discovered by this additional NDT, the cost of the testing will not be paid for as extra work, and shall be at the Contractor's expense.

All required repair work to correct welding deficiencies, whether discovered by the required visual inspection or NDT, or by additional NDT directed by the Engineer, and any associated delays or expenses caused to the Contractor by performing these repairs, shall be at the Contractor's expense.

At the completion of all welding, the QCM shall sign and furnish to the Engineer, a certificate of compliance in accordance with 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 accordance with the details shown on the plans and the provisions of the Standard Specifications and these special provisions.

Full compensation for conforming to all of the requirements of this section, Welding Quality Control, 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.

SECTION 9. DESCRIPTION OF BRIDGE WORK

The bridge work to be done consist, in general of seismic retrofitting portions of the following bridge, as shown on the plans:

San Francisco-Oakland Bay Bridge
(Bridge No. 34-0003)

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 "Maintaining Traffic", "Temporary Pavement Delineation", Section 12-1.28, "Time Allowed For Completion" and Section 12-1.29, "Liquidated Damages" of these special provisions and to the stage construction sheets of the plans.

The work shall be performed in conformance with the stages of construction shown on the plans. Nonconflicting work in subsequent stages may proceed concurrently with work in preceding stages, provided satisfactory progress is maintained in said preceding stages of construction and approval is granted by the Engineer.

In each stage, after completion of the preceding stage, the first order of work shall be the removal of existing pavement delineation as directed by the Engineer. Pavement delineation removal shall be coordinated with new delineation so that lane lines are provided at all times on traveled ways open to public traffic.

Before obliterating any pavement delineation that is to be replaced on the same alignment and location, as determined by the Engineer, such pavement delineation shall be referenced by the Contractor, with a sufficient number of control points to reestablish the alignment and location of the new pavement delineation. The references shall also include the limits or changes in striping pattern, including one- and two-way barrier lines, limit lines, crosswalks and other pavement markings. Full compensation for referencing pavement delineation shall be considered as included in the contract prices paid for new pavement delineation and no additional compensation will be allowed therefor.

At Location 2, all work within the temporary construction easement shall be limited to Monday through Friday between 8:00 a.m. and 6:00 p.m. and Saturday and Sunday between 9:00 a.m. and 6:00 p.m. The weekend hours shall be limited to one weekend per month.

At Locations 1, 2 and 3, there shall be no work performed between the hours of 7:00 p.m. and 7:00 a.m. for exceptions to these hours, the Contractor may apply for a night work permit from the City and County of San Francisco, Bureau of Streets and Mapping, telephone number (415) 554-5816.

Temporary crash cushion modules and temporary railing (Type K) shall be in place at locations shown on the plans prior to starting any adjacent construction activities.

Temporary supports at Bent A shall not be removed and installed at Bent B until the seismic isolation bearings have been placed at Bent A.

Attention is directed to "Furnish Seismic Isolation Bearing" elsewhere in these special provisions. Temporary keeper plates on seismic isolation bearings shall remain in place until all new bracing has been installed, complete in place, between Towers A and B on both the northside and the southside.

New cross bracing shall not be installed until all seismic retrofit work of existing columns, including installation of seismic isolation bearings, has been completed.

The pump plant at Pier W1 shall be kept in continuous operation except as provided in these special provisions.

The work shall be performed in conformance with the stages of construction shown on the plans. Nonconflicting work in subsequent stages may proceed concurrently with work in preceding stages, provided satisfactory progress is maintained in said preceding stages of construction.

10-1.02 NON-STORM WATER DISCHARGES.

Non-storm water discharges shall conform to the requirements in Section 7-1.01G, “Water Pollution," of the Standard Specifications and these special provisions

Conformance with the requirements of this section shall in no way relieve the Contractor from the Contractor's responsibilities, as provided in Section 7-1.11, "Preservation of Property," and Section 7-1.12, "Responsibility for Damage," of the Standard Specifications.

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 incorporated within the Storm Water Pollution Prevention Plan (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 at least every 90 calendar days.

Liquids, Residues and Debris.--Attention is directed to “Remove Painted Traffic Stripes and Pavement Markings,” “Plane Asphalt Concrete Pavement,” “Bridge Removal (Portion),” “Remove Rivet,” “Waterproofing,” “Steel Jacket (Concrete),” “Steel Structures,” “Clean and Paint Structural Steel,” “Miscellaneous Metal (Bridge),” and “Pesticides” of these special provisions.

The control and disposal of liquids, residues, and debris associated with “Remove Painted Traffic Stripes and Pavement Markings,” “Plane Asphalt Concrete Pavement,” “Bridge Removal (Portion),” “Remove Rivet,” “Waterproofing,” “Steel Jacket (Concrete),” “Steel Structures,” “Clean and Paint Structural Steel,” “Miscellaneous Metal (Bridge),” and “Pesticides” shall be described within the SWPPP, as specified in “Water Pollution Control” of these special provisions. 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 liquids, residues, and debris are not conveyed into or become present in drainage systems, San Francisco Bay, or other water bodies.

Concrete Wastes.--Attention is directed to “Remove Concrete,” “Concrete Structures,” “Drill and Bond Dowels,” “Core Concrete,” “Core and Bond Dowels,” and “Steel Jacket (Concrete)” of these special provisions.

The control and disposal of water, abrasives, and residues associated with “Remove Concrete,” “Concrete Structures,” “ Drill and Bond Dowels,” “Core Concrete,” “Core and Bond Dowels,” and “Steel Jacket (Concrete)” shall be described within the SWPPP, as specified in “Water Pollution Control” of these special provisions. The SWPPP shall, at a minimum, depict and describe the procedural and structural methods of detaining, collecting, and disposing of all concrete wastes. Sufficient redundancy shall be incorporated into the procedural and structural methods such that concrete wastes are not conveyed into or become present in drainage systems, San Francisco Bay, or other water bodies.

Measurement and Payment.--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 affected by this section and no additional compensation will be allowed therefor.

10-1.03 WATER POLLUTION CONTROL

Water pollution control work shall conform to the requirements in Section 7-1.01G, "Water Pollution," of the Standard Specifications and these special provisions.

This project shall conform to the requirements of Permit No. CAS029998 issued by the San Francisco Bay Regional (Region 2) Water Quality Control Board. This permit, hereafter referred to as the "Permit," regulates storm water discharges associated with construction activities.

Water pollution control work shall conform to the requirements in the Construction Contractor's Guide and Specifications of the Caltrans Storm Water Quality Handbooks, dated April 1997, and addenda thereto issued up to and including the date of advertisement of the project, hereafter referred to as the "Handbook". Copies of the Handbook 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.

Copies of the Handbook and the Permit are also available for review at 111 Grand Avenue, Oakland, California 94601. Please call the Toll Bridge Duty Senior, telephone number (510) 286-5549, to reserve a copy of the documents at least 24 hours in advance.

The Contractor shall become fully informed of and comply with the applicable provisions of the Handbook, Permit and Federal, State and local regulations that govern the Contractor's operations and storm water discharges from both the project site and areas of disturbance outside the project limits during construction. The Contractor shall maintain a copy of the Permit at the project site and shall make the Permit available during construction activities.

Unless arrangements for disturbance of areas outside the project limits are made by the Department and made part of the contract, it is expressly agreed that the Department assumes no responsibility to the Contractor or property owner whatsoever with respect to any arrangements made between the Contractor and property owner to allow disturbance of areas outside the project limits.

The Contractor shall be responsible for the costs and for any liability imposed by law as a result of the Contractor’s failure to comply with the requirements set forth in this section "Water Pollution Control", including but not limited to, compliance with the applicable provisions of the Handbook, Permit and Federal, State and local regulations. For the purposes of this paragraph, 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 any remedy authorized by law, so much of the money due the Contractor under the contract that shall be considered necessary by the Department may be retained by the State of California until disposition has been made of the costs and liabilities.

The retention of money due the Contractor shall be subject to the following:

1. The Department will give the Contractor 30 days notice of its intention to retain funds from any partial payment which may become due to the Contractor prior to acceptance of the contract. Retention of funds from any payment made after acceptance of the contract may be made without prior notice to the Contractor.
2. 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.

3. 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 at the legal rate of interest for the period of the retention.

Conformance with the requirements of this section "Water Pollution Control" shall not relieve the Contractor from the Contractor's responsibilities, as provided in Section 7-1.11, "Preservation of Property," and Section 7-1.12, "Responsibility for Damage," of the Standard Specifications.

The Contractor shall, at reasonable times, allow authorized agents of the California Regional Water Quality Control Board, State Water Resources Control Board, U. S. Environmental Protection Agency and local storm water management agency, upon the presentation of credentials and other documents as may be required by law, to:

1. Enter upon the construction site and the Contractor's facilities pertinent to the work;
2. Have access to and copy any records that must be kept as specified in the Permit;
3. Inspect the construction site and related soil stabilization practices and sediment control measures; and
4. Sample or monitor for the purpose of ensuring compliance with the Permit.

The Contractor shall notify the Engineer immediately upon request from regulatory agencies to enter, inspect, sample, monitor or otherwise access the project site or the Contractor's records.

STORM WATER POLLUTION PREVENTION PLAN PREPARATION, APPROVAL AND UPDATES.—As part of the water pollution control work, a Storm Water Pollution Prevention Plan, hereafter referred to as the "SWPPP," is required for this contract. The SWPPP shall conform to the requirements in Section 7-1.01G, "Water Pollution," of the Standard Specifications, the requirements in the Handbook, the requirements of the Permit and these special provisions. Upon the Engineer's approval of the SWPPP, the SWPPP shall be deemed to fulfill the requirements of 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, as determined by the Engineer, shall be performed until the SWPPP has been approved by the Engineer.

Within 20 days after the approval of the contract, the Contractor shall submit 3 copies of the SWPPP to the Engineer. The Contractor shall allow 15 days for the Engineer to review the SWPPP. If revisions are required, as determined by the Engineer, the Contractor shall revise and resubmit the SWPPP within 10 days of receipt of the Engineer’s comments and shall allow 10 days for the Engineer to review the revisions. Upon the Engineer’s approval of the SWPPP, 3 additional copies of the SWPPP, incorporating the required changes, shall be submitted to the Engineer.

The objectives of the SWPPP shall be to identify pollution sources that may adversely affect the quality of storm water discharges associated with the project and to identify, construct, implement and maintain water pollution control measures, hereafter referred to as control measures, to reduce to the extent feasible pollutants in storm water discharges from the construction site both during and after construction is completed under this contract.

The SWPPP shall incorporate control measures in the following categories:

1. Soil stabilization practices;
2. Sediment control practices;
3. Sediment tracking control practices;
4. Wind erosion control practices;
5. Non-storm water management; and
6. Waste management and disposal control practices.

Specific objectives and minimum requirements for each category of control measures are contained in the Handbook.

The Contractor shall consider the objectives and minimum requirements presented in the Handbook for each of the above categories. The special minimum requirements listed below supersede the minimum requirements listed in the Handbook for the same category. When minimum requirements are listed for any category, the Contractor shall incorporate into the SWPPP, and implement on the project, one or more of the listed minimum controls required in order to meet the pollution control objectives for the category. In addition, the Contractor shall consider other control measures presented in the Handbook and shall incorporate into the SWPPP and implement on the project the control measures necessary to meet the objectives of the SWPPP. The Contractor shall document the selection process in accordance with the procedure specified in the Handbook. The following special minimum requirements are established:

Category:	Minimum Requirements:
Non-Storm Water and Waste Management Controls	CD9(2) Structure Construction and Painting CD10(2) Material Delivery and Storage, CD11(2) Material Use, CD12(2) Spill Prevention and Control, CD13(2) Solid Waste Management, CD16(2) Concrete Waste Management, CD17(2) Sanitary/Septic Waste Management, CD18(2) Vehicle and Equipment Cleaning, CD19(2) Vehicle and Equipment Fueling, CD20(2) Vehicle and Equipment Maintenance, CD22(2) Scheduling, CD44(2) Illicit Discharge/Illegal Dumping Reporting, CD46(2) Liquid Waste Management
Erosion & Sediment Source Controls	CD26B(2) Geotextiles, Mats/Plastic Covers & Erosion Control Blankets
Wind Erosion Controls	CD26B(2) Geotextiles, Mats/Plastic Covers & Erosion Control Blankets
Sediment Treatment Controls	CD40(2) Storm Drain Inlet Protection

The SWPPP shall include, but not be limited to, the following items as described in the Handbook and Permit:

1. Source Identification;
2. Erosion and Sediment Controls;
3. Non-Storm Water Management;
4. Waste Management and Disposal;
5. Maintenance, Inspection and Repair;
6. Training;
7. List of Contractors and Subcontractors;
8. Post-Construction Storm Water Management;
9. Preparer;
10. Copy of the Local Permit;
11. BMP Consideration Checklist;
12. SWPPP Checklist;
13. Schedule of Values; and
14. Water Pollution Control Drawings.

The Contractor shall amend the SWPPP, graphically and in narrative form, whenever there is a change in construction activities or operations which may affect the discharge of significant quantities of pollutants to surface waters, ground waters, municipal storm drain systems, or when deemed necessary by the Engineer. The SWPPP shall also be amended if it is in violation of any condition of the Permit, or has not effectively achieved the objective of reducing pollutants in storm water discharges. Amendments shall show additional control measures or revised operations, including those in areas not shown in the initially approved SWPPP, which are required on the project to control water pollution effectively. Amendments to the SWPPP shall be submitted for review and approval by the Engineer in the same manner specified for the initially approved SWPPP. Approved amendments shall be dated and logged in the SWPPP. Upon approval of the amendment, the Contractor shall implement the additional control measures or revised operations.

The Contractor shall keep a copy of the SWPPP and approved amendments at the project site. The SWPPP shall be made available upon request of a representative of the Regional Water Quality Control Board, State Water Resources Control Board, U.S. Environmental Protection Agency or local storm water management agency. Requests by the public shall be directed to the Engineer.

By June 15 of each year, the Contractor shall submit an annual certification to the Engineer stating compliance with the requirements governing the Permit. If the project is in non-compliance at any time, the Contractor shall make a written report to the Engineer within 48 hours of identification of non-compliance.

SCHEDULE OF VALUES.—The Contractor shall submit with the SWPPP, for approval by the Engineer, a schedule of values detailing the cost breakdown of the contract lump sum item for water pollution control. The schedule of values shall reflect the items of work, quantities and costs for control measures shown in the SWPPP, except for critical temporary controls and permanent control measures which are shown on the project plans and for which there is a contract item of work. Adjustments in the items of work and quantities listed in the schedule of values shall be made when required to address approved amendments to the SWPPP.

The sum of the amounts for the units of work listed in the schedule of values shall be equal to the contract lump sum price for water pollution control.

If approved in writing by the Engineer, the schedule of values will be used to determine progress payments for water pollution control during the progress of the work, and as the basis for calculating any adjustment in compensation for the contract item for water pollution control due to changes in the work ordered by the Engineer.

SWPPP IMPLEMENTATION.—Upon approval of the SWPPP, the Contractor shall be responsible throughout the duration of the project for installing, constructing, inspecting and maintaining the control measures included in the SWPPP and any amendments thereto and for removing and disposing of temporary control measures. Unless otherwise directed by the Engineer or specified in these special provisions, the Contractor's responsibility for SWPPP implementation shall continue throughout any temporary suspension of work ordered in accordance with Section 8-1.05, "Temporary Suspension of Work," of the Standard Specifications. Requirements for installation, construction, inspection, maintenance, removal and disposal of control measures are specified in the Handbook and these special provisions.

Soil stabilization practices and sediment control measures, including minimum requirements, shall be provided throughout the winter season, defined as between September 15 and May 1.

Implementation of soil stabilization practices and sediment control measures for soil-disturbed areas of the project site shall be completed, except as provided for below, no later than 20 days prior to the beginning of the winter season or upon start of applicable construction activities for projects which begin either during or within 20 days of the winter season.

Throughout the winter season, the active, soil-disturbed area of the project site shall be no more than 2.5 acres. The Engineer may approve, on a case-by-case basis, expansions of the active, soil-disturbed area limit. The Contractor shall demonstrate the ability and preparedness to fully deploy soil stabilization practices and sediment control measures to protect soil-disturbed areas of the project site before the onset of precipitation. The Contractor shall maintain a quantity of soil stabilization and sediment control materials on site equal to 125 percent of that sufficient to protect unprotected, soil-disturbed areas on the project site and shall maintain a detailed plan for the mobilization of sufficient labor and equipment to fully deploy control measures required to protect unprotected, soil-disturbed areas on the project site prior to the onset of precipitation. The Contractor shall include a current inventory of control measure materials and the detailed mobilization plan as part of the SWPPP.

Throughout the winter season, soil-disturbed areas of the project site shall be considered to be nonactive whenever soil disturbing activities are expected to be discontinued for a period of 5 or more days and the areas are fully protected. Areas that will become nonactive either during the winter season or within 20 days thereof shall be fully protected with soil stabilization practices and sediment control measures within 10 days of the discontinuance of soil disturbing activities or prior to the onset of precipitation, whichever is first to occur.

Throughout the winter season, active soil-disturbed areas of the project site shall be fully protected at the end of each day with soil stabilization practices and sediment control measures unless fair weather is predicted through the following work day. The weather forecast shall be monitored by the Contractor on a daily basis. The National Weather Service forecast shall be used, or an alternative weather forecast proposed by the Contractor may be used if approved by the Engineer. If precipitation is predicted prior to the end of the following work day, construction scheduling shall be modified, as required, and the Contractor shall deploy functioning control measures prior to the onset of the precipitation.

The Contractor shall implement, year-round and throughout the duration of the project, control measures included in the SWPPP for sediment tracking, wind erosion, non-storm water management and waste management and disposal.

The Engineer may order the suspension of construction operations which create water pollution if the Contractor fails to conform to the requirements of this section "Water Pollution Control" as determined by the Engineer.

MAINTENANCE.—To ensure the proper implementation and functioning of control measures, the Contractor shall regularly inspect and maintain the construction site for the control measures identified in the SWPPP. The Contractor shall identify corrective actions and time frames to address any damaged measures or reinitiate any measures that have been discontinued.

A construction site inspection checklist will be provided by the Engineer, shall be used to ensure that the necessary measures are being properly implemented, and to ensure that the control measures are functioning adequately. The Contractor shall submit one copy of each site inspection record to the Engineer.

Inspections of the construction site shall be conducted by the Contractor to identify deficient measures, as follows:

1. Prior to a forecast storm;
2. After each storm event;
3. At 24 hour intervals during extended precipitation events; and
4. Routinely, on a weekly basis.

If the Contractor or the Engineer identifies a deficiency in the deployment or functioning of an identified control measure, the deficiency shall be corrected by the Contractor immediately, or by a later date and time if requested by the Contractor and approved by the Engineer in writing, but not later than the onset of subsequent precipitation events. The correction of deficiencies shall be at no additional cost to the State.

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 shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Attention is directed to Sections 9-1.06, "Partial Payments," and 9-1.07, "Payment After Acceptance," of the Standard Specifications. Payments for prepare storm water pollution prevention plan will be made as follows:

1. 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; and
2. After acceptance of the contract pursuant to Section 7-1.17, "Acceptance of Contract," the remaining 25 percent of the contract item price for prepare storm water pollution prevention plan will be made in accordance with 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, maintaining, removing and disposing of control measures, except those shown on the project plans and for which there is a contract item of work, and excluding developing, preparing, obtaining approval of, revising and amending the SWPPP, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Changes in control measures required by an approved amendment to the SWPPP, except changes to those control measures shown on the project plans and for which there is a contract item of work, will be considered extra work, in accordance with Section 4-1.03D of the Standard Specifications and the following:

If the control measure is listed in the approved SWPPP schedule of values, an adjustment in compensation for the contract item for water pollution control will be made by applying the increase or decrease in quantities to the approved schedule of values. No adjustment of compensation will be made to the unit price listed for any item in the schedule of values due to any increase or decrease in the quantities, regardless of the reason for the increase or decrease. The provisions in Section 4-1.03B, "Increased or Decreased Quantities," shall not apply to items listed in the schedule of values.

If the control measure is not listed in the approved SWPPP schedule of values, payment will be made by force account.

Those control measures which are shown on the project plans and for which there is a contract item of work will be measured and paid for as that item of work.

The Engineer will retain an amount equal to 25 percent of the estimated value of the contract work performed during estimate periods in which the Contractor fails to conform to the requirements of this section "Water Pollution Control" as determined by the Engineer.

Retentions for failure to conform to the requirements of this section "Water Pollution Control" shall be in addition to the other retentions provided for in the contract. The amounts retained for failure of the Contractor to conform to the

requirements of this section will be released for payment on the next monthly estimate for partial payment following the date that an approved SWPPP has been implemented and maintained, and water pollution is adequately controlled, as determined by the Engineer.

WATER POLLUTION CONTROL SCHEDULE OF VALUES

Contract No. 04 - 043554

UNIT DESCRIPTION	UNIT	QUANTITY	VALUE	AMOUNT
CD9(2) STRUCTURE CONSTRUCTION AND PAINTING	LS	LUMP SUM		
CD10(2) MATERIAL DELIVERY AND STORAGE	LS	LUMP SUM		
CD11(2) MATERIAL USE	LS	LUMP SUM		
CD12(2) SPILL PREVENTION AND CONTROL	LS	LUMP SUM		
CD13(2) SOLID WASTE MANAGEMENT	LS	LUMP SUM		
CD16(2) CONCRETE WASTE MANAGEMENT	LS	LUMP SUM		
CD17(2) SANITARY / SEPTIC WASTE MANAGEMENT	LS	LUMP SUM		
CD18(2) VEHICLE AND EQUIPMENT CLEANING	LS	LUMP SUM		
CD19(2) VEHICLE AND EQUIPMENT FUELING	LS	LUMP SUM		
CD20(2) VEHICLE AND EQUIPMENT MAINTENANCE	LS	LUMP SUM		
CD22(2) SCHEDULING	LS	LUMP SUM		
CD26B(2) GEOTEXTILES, MATS/PLASTIC COVERS & EROSION CONTROL BLANKETS	SQ.YD.			
CD40(2) STORM DRAIN INLET PROTECTION	EA			
CD44(2) ILLICIT DISCHARGE / ILLEGAL DUMPING REPORTING	LS	LUMP SUM		
CD46(2) LIQUID WASTE MANAGEMENT	LS	LUMP SUM		

TOTAL _____

10-1.04 TEMPORARY FENCES AND GATES

Temporary fences and gates shall be furnished and 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 fences and gates shall conform to the plan details and the specifications for permanent fences of similar character as provided in Section 80, "Fences," of the Standard Specifications.

Used materials may be used providing such used materials are good, sound, and are suitable for the purpose intended.

Materials may be commercial quality providing the dimensions and sizes of said materials are equal to, or greater than, the dimensions and sizes shown on the plans or specified by the specifications.

Posts shall be metal.

Galvanizing and painting of steel items will not be required.

Concrete footings for metal posts will not be required.

Temporary fences and gates that are damaged from any cause during the progress of the work shall be repaired or replaced by the Contractor at his expense.

When no longer required for the work as determined by the Engineer, temporary fences and gates 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 fences shall be backfilled in accordance with the provisions in the second paragraph of Section 15-1.02, "Preservation of Property," of the Standard Specifications.

The various types and kinds of temporary fences and gates will be measured and paid for in the same manner specified for permanent fences and gates of similar character as provided in Section 80, "Fences," of the Standard Specifications.

Full compensation for maintaining, removing, and disposing of temporary fences and gates shall be considered as included in prices paid for temporary fence (Type CL-6) and temporary 10' chain link gate (Type CL-6) and no additional compensation will be allowed therefor.

10-1.05 PRESERVATION OF PROPERTY

Attention is directed to the provisions in Section 7-1.11, "Preservation of Property," of the Standard Specifications and these special provisions.

Existing trees, shrubs and other plants, that are not to be removed as shown on the plans or specified elsewhere in these special provisions, and are injured or damaged by reason of the Contractor's operations, shall be replaced by the Contractor. The minimum size of tree replacement shall be 24 inch box and the minimum size of shrub replacement shall be 15-gallon. Replacement ground cover plants shall be from flats and shall be planted 12 inches on center. Replacement planting shall conform to the requirements in Section 20-4.07, "Replacement," of the Standard Specifications.

Damaged or injured plants shall be removed and disposed of outside the highway right of way in accordance with the provisions in Section 7-l.13 of the Standard Specifications.

Replacement planting of injured or damaged trees, shrubs and other plants shall be completed prior to the start of the plant establishment period and shall conform to the provisions in Section 20-4.05, "Planting," of the Standard Specifications.

10-1.06 RELIEF FROM MAINTENANCE AND RESPONSIBILITY

The Contractor may be relieved of the duty of maintenance and protection for those items not directly connected with plant establishment work, except highway planting and irrigation systems in accordance with the provisions in Section 7-1.15, "Relief From Maintenance and Responsibility," of the Standard Specifications.

10-1.07 COOPERATION

Attention is directed to Sections 7-1.14, "Cooperation," and 8-1.10, "Utility and Non-Highway Facilities," of the Standard Specifications and these special provisions.

It is anticipated that work will be in progress by other contractors within or adjacent to the project limits of this contract.

Contracts which may be in progress during the working period of this contract include but are not necessarily limited to the following:

Contract No. 04-043534. West Bound Approach Bent 54-57.

Contract No. 04-133331. West Bound Main Lane Approach & On Ramps in San Francisco. Construction is scheduled for September, 2000.

Contract No. 04-043544. Work is located on Route 80 on the San Francisco-Oakland Bay Bridge This is a Seismic Retrofit (Caissons) project. Construction is scheduled for Spring 1998.

Contract No. 04-0435U4. Work is located on Route 80 on the San Francisco-Oakland Bay Bridge This is a Seismic Retrofit (Towers & Superstructure) project. Construction is scheduled for Fall 1998.

Contract No. 04-043474. Work is located on Route 80 on the San Francisco-Oakland Bay Bridge This is a Seismic Retrofit (Yerba Buena Island Tunnel Approaches) project. Construction is scheduled for Spring 1998.

Contract No. 04-044504. Work is located on Route 80 on the San Francisco-Oakland Bay Bridge This is a crack sealing project at Pier W-1. Construction is scheduled for Fall 1998.

Contract No. 04-043004, Interim Retrofit at East Span.

Work by State forces will also be in progress within the contract limits during the working period for this contract.

Progress schedules for other work in progress, if available, may be inspected by the Contractor upon approval by the Engineer. Such progress schedules are tentative and cannot be guaranteed accurate.

The Contractor shall attend joint weekly meetings, to be organized by the Engineer with other contractors on adjacent projects in order to minimize potential conflicts. The Contractor shall coordinate with and accommodate other segment contractors when preparing operations and work schedules.

In the event of a loss caused to the Contractor due to unnecessary delays or failure to finish the work within the time specified for completion caused by another contractor under contract with the Department performing work for the State, the State will reimburse the delayed contractor in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications. Deductions will be made from any moneys due or that may become due to the contractor causing the loss or delay.

10-1.08 PHOTOGRAPHY

The Contractor shall provide time-lapse video and still photography to document pre-construction conditions, and progress and completion of the work, 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.

10-1.09 PROGRESS SCHEDULE (CRITICAL PATH)

Progress schedules will be required for this contract. Progress schedules shall utilize the Critical Path Method (CPM).

Definitions - The following definitions apply to this section "Progress Schedule (Critical Path)":

1) Activity: Any task, or portion of a project which takes time to complete.
2) Baseline Schedule: The initial CPM schedule representing the Contractor's original work plan, as accepted by the Engineer.
3) Critical Path Method: A mathematical calculation to determine the longest path of work and relative float represented by a graphic representation of the sequence of activities that shows the interrelationships and interdependencies of the elements composing a project.
4) Current Contract Completion Date: The 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.
5) Early Completion Time: The difference in time between the current contract completion date and the Contractor's scheduled early completion date as shown on the accepted baseline schedule, or schedule updates and revisions.
6) 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.
7) Fragnet: A section or fragment of the network diagram comprised of a group of activities.
8) Free Float: The amount of time an activity can be delayed before affecting a subsequent activity.
9) Hammock Activity: An activity added to the network to span an existing group of activities for summarizing purposes.

10) 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.
11) Revision: A change in the future portion of the schedule that modifies logic, adds or deletes activities, or alters activities, sequences, or durations.
12) Tabular Listing: A report showing schedule activities, their relationships, durations, scheduled and actual dates, and float.
13) Total Float: The amount of time that an activity may be delayed without affecting the total project duration of the critical path.
14) Update: The modification of the CPM progress schedule through a regular review to incorporate actual progress to date by activity, approved time adjustments, and projected completion dates.

Preconstruction Scheduling Conference - 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, and any deviations it proposes to make from the Stage Construction Plans. At this meeting, the Contractor shall submit its proposed work breakdown structure, the associated alpha-numeric coding structure to implement the work breakdown structure and the activity identification system for labeling all work activities. The Engineer shall review and comment on the work breakdown structure, the coding structure and activity identification system within seven days after submission by the Contractor. The Contractor shall make all modifications to the proposed work breakdown structure, the coding structure and activity identification system that are requested by the Engineer, and shall employ that coding, structure and system in its baseline schedule submission.

Interim Baseline Schedule - Within 10 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. 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 submittals required early in the project, and shall provide for all permits, and other non-work activities necessary to begin the work. The interim baseline schedule submittal shall include a 3 l/2 inch floppy diskette which contains the data files used to generate the schedule.

The Engineer shall be allowed 15 calendar days to review and accept or reject the interim baseline schedule submitted. Rejected schedules shall be resubmitted to the Engineer within 5 calendar days of receipt by the Contractor of the Engineer's comments, at which time a new 15-calendar day review period by the Engineer will begin.

Baseline Schedule - Within 30 days after approval of the contract, the Contractor shall submit to the Engineer a baseline project schedule. The baseline schedule shall include the activities shown on the interim baseline schedule in the same order and logical relationship as shown in the interim baseline schedule. The baseline project schedule shall have a data date of the day prior to the first working day of the contract and shall not include any completed work to-date. The baseline progress schedule shall meet interim target dates, milestones, 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.

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.

The baseline progress schedule shall be supplemented with resource allocations for every 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 use average composite crews to display the labor loading of on-site construction activities. The Contractor shall optimize and level labor to reflect a reasonable plan for accomplishing the work of the contract and to assure that resources are not duplicated in concurrent activities. The Contractor shall require each subcontractor to submit in writing a statement certifying that the subcontractor has concurred with the Contractor's CPM, including major updates, and that the subcontractor's related schedule has been incorporated accurately, including the duration of activities and labor and equipment loading. Along with the baseline progress schedule, the Contractor shall also submit to the Engineer time-scaled resource histograms of the labor crafts and equipment classes to be utilized on the contract.

The baseline schedule submittal shall include a 3 l/2 inch floppy diskette which contains the data files used to generate the schedule.

The Engineer shall be allowed 15 calendar days to review and accept or reject the baseline project schedule submitted. Rejected schedules shall be resubmitted to the Engineer within 5 calendar days, at which time a new 15-calendar day review period by the Engineer will begin.

Project Schedule Reports - Schedules submitted to the Engineer including baseline and interim baseline schedules shall include time scaled network diagrams. Network diagrams shall be based on early start and early finish dates of activities shown. The network diagrams submitted to the Engineer shall also be accompanied by the computer-generated mathematical analysis tabular reports for each activity included in the project schedule. Three different report sorts shall be provided: Early Start, Free Float, Total Float, and Activity Number, which shall show all predecessors and successors for each activity. The mathematical analysis tabular reports (8 1/2" x 11" size) shall be submitted to the Engineer and shall include, at a minimum, the following for each activity:

1) Data date
2) Predecessor and successor activity numbers and descriptions;
3) Activity number and description;
4) Activity codes;
5) Schedule, and actual and remaining duration for each activity;
6) Earliest start date (by calendar date);
7) Earliest finish date (by calendar date);
8) Actual start date (by calendar date);
9) Actual finish date (by calendar date);
10) Latest start date (by calendar date);
11) Latest finish date (by calendar date);
12) Identify actual non-working days
13) Identify activity calendar type
14) Total Float and Free Float, in work days;
15) Percentage of activity complete and remaining duration for incomplete activities; and
16) Imposed constraints.

Networks shall be drafted time scaled to show a continuous flow of information from left to right. The primary paths of criticality shall be clearly and graphically identified on the networks. The network diagram shall be prepared on E-size sheets (36" x 48"), 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 shall be subject to the approval of the Engineer.

Schedule network diagrams and computer tabulations shall be submitted to the Engineer for acceptance in the following quantities:

a) 2 sets of the Network Diagrams;
b) 2 copies of the computer tabulation reports (8 1/2" x 11" size); and
c) 3 computer diskettes.

Should the baseline schedule or schedule update, submitted for acceptance, show variances from the requirements of the contract, the Contractor shall make specific mention of the variations in the letter of transmittal, in order that, if accepted, proper adjustments to the project schedule can be made. The Contractor will not be relieved of the responsibility for executing the work in strict accordance with the requirements of the contract documents. In the event of a conflict between the requirements of the contract documents and the information provided or shown on an accepted schedule, the requirements of the contract documents shall take precedence.

Each schedule submitted to the Engineer shall comply with all limits imposed by the contract, with all specified intermediate milestone and 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:

1) Physical breakdown of the project;
2) 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;

3) Type of work to be performed, the sequences, and the major subcontractors involved;
4) All purchase, submittals, submittal reviews, manufacture, tests, deliver, and installation activities for all major materials and equipment.
5) Preparation, submittal and approval of shop and working drawings and material samples, showing time, as specified elsewhere, for the Engineer's review. The same time frame shall be allowed for at least one resubmittal on all major submittals so identified in the contract documents;
6) 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;
7) 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.
8) Actual tests, submission of test reports, and approval of test results;
9) All start-up, testing, training, and assistance required under the Contract;
10) Punchlist and final clean-up;
11) 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; and
12) 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.

Each construction activity shall have a duration of not more than 20 working days, and not less than one working day unless permitted otherwise by the Engineer. 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. The baseline schedule shall not attribute negative float to any activity. Float shall not be considered as time for the exclusive use of or benefit of either the State or the Contractor but shall be considered as a jointly owned, expiring resource available to the project and shall not be used to the financial detriment of either party. Any accepted schedule, revision or update having an early completion date shall show the time between the early completion date and the current Contract Completion Date as "project float".

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, and the omission or error is discovered by either the Contractor or the Engineer, it shall be corrected by the Contractor at the next monthly update or revision of the schedule.

Monthly Update Schedules - The Contractor shall submit a Monthly Update Schedule to the Engineer once in each month. The proposed update schedule prepared by the Contractor shall include all information available as of the 20th calendar day of the month, or other date as established by the Engineer. A detailed list of all proposed schedule changes such as logic, duration, lead/lag, additions and deletions shall be submitted with the update.

The monthly update schedule submitted to the Engineer shall be accompanied by a Schedule Narrative Report. The Schedule Narrative 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 predictions, and an explanation of potential delays or problems and their estimated impact on performance, milestone completion dates 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:

1) Contractor's Transmittal Letter
2) Work completed during the period
3) Description of the current critical path
4) Description of problem areas
5) Current and anticipated delays
   a) Cause of the delay
   b) Corrective action and schedule adjustments to correct the delay

c) Impact of the delay on other activities, milestones, and completion dates

6) Changes in construction sequences
7) Pending items and status thereof
   a) Permits
   b) Change Orders
   c) Time Extensions
   d) Non-Compliance Notices
8) Contract completion date(s) status
   a) Ahead of schedule and number of days
   b) Behind schedule and number of days
9) Include updated Network Diagram and Reports

The Contractor shall provide to the Engineer a 31/2" electronic disk of the schedule, together with printed copies of the network diagrams and tabular reports described under "Project Schedule Reports", and the Schedule Narrative Report.

The monthly update of the schedule shall be for the period from the last update to the current cut-off date, and for the remainder of the project. The current period's activities shall be reported as they actually took place and designated as actually complete, if actually completed, in the schedule updates.

Portions of the network diagram on which all activities are complete need not be reprinted and submitted in subsequent updates. However, the electronic disk file of the submitted schedule and the related reports shall constitute a clear record of progress of the work from award of contract to final completion.

The Contractor will be permitted to show early or late completion on schedule updates and revisions. The Engineer may use the updates and revisions, and other information available, in evaluating the effect of changes, delays, or time savings on the critical path and the accepted schedule current at the time to determine if there is an applicable adjustment of time, if any, to any target date or completion date due to the changes, delays, or time savings.

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 will review the updated schedule and will discuss the content of the Narrative Report. The Engineer shall be allowed 15 days after the meeting to review and accept or reject the update schedule submitted. Rejected schedules shall be resubmitted to the Engineer within 15 calendar days, at which time a new 15-calendar day review period by the Engineer will begin.

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 the affected portions of the project schedule and an analysis to show the effect on the entire project. The Engineer will provide a response within 10 days. No revision to the accepted baseline schedule or the schedule updates shall be made without the prior written approval of the Engineer.

The Engineer will request the Contractor to submit a proposed revised schedule within 15 days when:

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 30 calendar days 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 15 days to review and accept or reject a schedule revision. Rejected schedule revisions shall be revised and resubmitted to the Engineer within 15 calendar days, at which time a new 15-calendar 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.

Schedule Time Extension Requests - When the Contractor requests a time extension due to contract change orders or delays, the Contractor shall submit to the Engineer a written Time Impact Analysis illustrating the influence of each change or delay on the current contract completion date or milestone completion date, utilizing the current accepted schedule. Each Time Impact Analysis shall include a fragnet demonstrating how the Contractor proposes to incorporate the Change Order or delay into the current schedule. The fragnet shall include the sequence of new and existing activity revisions that are proposed to be added to the accepted baseline project schedule or current schedule in effect at the time the change or delay is encountered, to demonstrate the influence of the delay and the proposed method for incorporating the delay and its impact into the schedule.

Each Time Impact Analysis shall demonstrate the estimated time impact based on the events of delay, the anticipated 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 at the time of actual delay, or at the time the contract change order work is performed. Float time is not for the exclusive use or benefit of the Engineer or the Contractor, but is an expiring resource available to all parties as needed to meet contract milestones and the contract completion date. 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 applicable current contract completion date and the most recent date predicted for completion of the project on the accepted schedule update current as of the time of the delay or as of the time of issuance of the contract change order.

Time Impact Analyses shall be submitted in triplicate within 15 days after the delay occurs or after issuance of the contract change order.

Approval or rejection of each Time Impact Analysis by the Engineer will be made within 15 days after receipt of the Time Impact Analysis, unless the review is delayed by subsequent meetings and negotiations. A copy of the Time Impact Analysis approved by the Engineer shall be returned to the Contractor and the accepted schedule revisions illustrating the influence of the contract change orders or delays shall be incorporated into the project schedule during the first update after approval.

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. 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:

1) Complete computer system, including keyboard, mouse, 17 inch color SVGA monitor (1,024x768 pixels), Intel Pentium 266 MHZ micro processor chip, or equivalent, or better;

2) Computer operating system software, compatible with the selected processing unit, for Windows 98 or later, or equivalent;

3) Minimum sixty-four (64) megabytes of random access memory (RAM);

4) A 3.2-gigabyte minimum hard disk drive, a 1.44 megabyte 3 l/2 inch floppy disk drive, 24x speed minimum CD-ROM drive, ethernet card and 56.6 / 14.4 modem;

5) A color-ink-jet plotter with a minimum 8 megs RAM, capable of 600 dots per inch color, 600 dots per inch monochrome, or equivalent plotter capable of printing fully legible, timescaled charts, and network diagrams, in four colors, with a minimum size of 36 inches by 48 inches (E size) and is compatible with the selected system; and

6) CPM software shall be Primavera Project Planner, version 2.0 for Windows 95, or later.

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 by the first submission of the baseline schedule. 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. The training shall be performed by an authorized vendor of Primavera Project Planner Software and shall be completed not more than 30 days after approval of the contract.

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 furnishing 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; 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:

Interim baseline schedule accepted, then 10 percent payment for progress schedule (critical path) will be made.

Baseline schedule accepted, then 10 percent payment for progress schedule (critical path) will be made.

Monthly update schedules accepted, then 75 percent payment for progress schedule (critical path) will be made equally for each update.

Final schedule update accepted, then 5 percent payment for progress schedule (critical path) will be made.

The Department will retain an amount equal to 25 percent of the estimated value of the work performed during the first estimate period in which the Contractor fails to submit an interim baseline, baseline, revised or updated CPM schedule conforming to the requirements of this section, as determined by the Engineer. Thereafter, on subsequent successive estimate periods the percentage the Department will retain will be increased at the rate of 25 percent per estimate period in which acceptable CPM progress schedules have not been submitted to the Engineer. Retentions for failure to submit acceptable CPM progress schedules shall be additional to all other retentions provided for in the contract. The retention for failure to submit acceptable CPM progress schedules will be released for payment on the next monthly estimate for partial payment following the date that acceptable CPM progress 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.

10-1.10 ELECTRONIC MOBILE DAILY DIARY SYSTEM DATA DELIVERY

Attention is directed to Sections 5-1.10, "Equipment and Plants," and 7-1.OIA(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 upon 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 with a State mobile daily diary computer system and it will not relieve the Contractor and subcontractors from all 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 11 days after the contract award for its own personnel and equipment, and not later than 5 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.--

1. The Contractor shall provide the following basic information for itself and for each subcontractor that will be used on the contract:

Company name.	Alphanumeric; up to 30 characters.
Company Type. (Prime or Subcontractor)	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 characters.
Address (2-letter state code).	Alphanumeric; up to 2 characters.
Address (zip code)	Alphanumeric; up to 14 characters.
Contact name.	Alphanumeric; up to 30 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.
DBE status (Caltrans-supplied codes)	Alphanumeric; up to 20 characters.
Ethnicity for DBE status (Caltrans-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:

XYZ Company, Inc.
Prime Contractor
1240 9th Street
Suite 600
Oakland
CA
94612
John Smith
(510) 834-9999
XYZ
Paving
MBE
Black

2.The Contractor shall provide the following information for each laborer who will be used on the contract:

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 initial.	Alphanumeric; up to 1 characters.
Labor classification (Department-provided codes).	Alphanumeric; up to 10 characters.
Hourly rate.	Alphanumeric; up to (6,2)
Trainee status (Y/N).	Alphanumeric; up to 1 characters
Ethnicity (Department-provided codes).	Alphanumeric; up to 20 characters.
Gender.	Alphanumeric; up to 1 characters.

For example, one such set of information might be:

XYZ
Gonzalez
Rector
V
OPR
22.75
N
Hispanic
M

3.The Contractor shall provide the following information for each piece of equipment that will be used on the contract:

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
Hourly rate.	Alphanumeric; up to (6,2)
Rental flag	Alphanumeric; up to 1 character

For example, one such set of information might be:

XYZ
B043
CAT TRACTOR D-6C
TRACC
CAT
D-6C
3645
28.08
N

Data Delivery Requirements.--

1. All data described in "Data Requirements" of this section shall be delivered to the Department electronically, on 3 1/4" 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.

2. Data of each type of described in the previous section (contractor, labor, and equipment information) will 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).

3 . The file format for all files delivered to Caltrans shall be standard tab-delimited, plain text files. Characteristics of this type of file are:

- All data is in the form of plain ASCII characters.
- Each row of data (company, person, equipment) is delimited by a carriage return character.
- Within rows, each column (field) of data is delimited by a tab character. This type of file is the most standard type for interchange of formatted data; it can be created and read by all desktop spreadsheet and desktop database applications.

For example, one such set of information might be:

XYZ
B043
CAT TRACTOR D-6C
TRACC
CAT
D-6C
3645
28.08

4. The files shall have the following columns (i.e., each row shall have the following fields):

- Contractor info: 11 columns (fields) as specified in “Data Requirements #l”, above.
- Labor info: 9 columns (fields) as specified in "Data Requirements #2", above.
- Equipment info: 8 columns (fields) as specified in "Data Requirements #3 ", above.

For each 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 may contain column headers (in plain text) rather than data, if desired.

5. Column (field) contents must 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:

- Labor classification codes must conform to a list of standard codes that will be supplied by Caltrans.
- DBE status codes must conform to a list of standard codes that will be supplied by Caltrans.
- Ethnicity codes must conform to standard codes that will be supplied by Caltrans.
- Data in the "trainee status" column must be either "Y" or "N".
- Data in the "gender" column must be either "M" or "F".
- Data in laborer last name, first name and middle initial fields shall be all uppercase. Any letters in the equipment number field shall likewise be uppercase.
- 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.)
- 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 upon 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.

6. The name of each file must indicate its contents, e.g., "XYZlab.txt" for laborers from XYZ Company, Inc. 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.-- Payment for providing electronic mobile daily diary computer system data delivery will be made on a lump sum basis. The lump sum bid price for electronic mobile daily diary computer system data delivery will be made according to the following schedule:

The Contractor will receive not more than 4 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 per cent 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 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.

In the event the Contractor fails to deliver complete weekly electronic mobile daily diary computer system data in each month , the Department will retain 4 percent of the total bid price for electronic mobile daily diary computer system data delivery until the data is delivered.

10-1.11 OBSTRUCTIONS

Attention is directed to Sections 8-1.10, "Utility and Non-Highway Facilities," and 15, "Existing Highway Facilities," of the Standard Specifications and these special provisions.

The Contractor's attention is directed to the existence of certain underground facilities that may require special precautions be taken by the Contractor to protect the health, safety and welfare of workmen 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 (6 inches) in diameter or pipelines operating at pressures greater than 415 kPa (60 psi) gauge; underground electric supply system conductors or cables, with potential to ground of more than 300 volts, either directly buried or in duct or conduit which do not have concentric grounded conductors or other effectively grounded metal shields or sheaths.

If such facilities are not located on the plans in both alignment and elevation, no work shall be performed in the vicinity of said facilities, except as provided herein for conduit to be placed under pavement, until the owner, or his representative, has located the facility by potholing, probing, or other means that will locate and identify the facility. Any conduit to be installed under pavement in the vicinity of such facilities shall be placed by the trenching method as specified in Section entitled "Conduit" elsewhere in these special provisions.

The Contractor shall notify the Engineer and the appropriate regional notification center for operators of subsurface installations at least 5 working days, but not more than 14 calendar days, prior to performing any excavation or other work close to any underground pipeline, conduit, duct, wire or other structure. Regional notification centers include but are not limited to the following:

Notification Center	Telephone Number
Underground Service Alert-Northern California (USA)	1-800-642-2444 1-800-227-2600
Underground Service Alert-Southern California (USA)	1-800-422-4133 1-800-227-2600

It is anticipated that the following utility facilities will be relocated prior to the dates shown.

Utility	Location	Date
SF Bureau of Heat, Lighting &Power (Street Light)	Spear Street	10/98

The following utility facilities will be relocated during the progress of the contract. The Contractor shall notify the Engineer in writing prior to doing any work in the vicinity of the facility. The utility facility will be relocated within the listed working days, as defined in Section 8-1.06, "Time of Completion," of the Standard Specifications, after said notification is received by the Engineer and the utility owner.

Utility	Telephone	Location	Working Days	Advance Notice Days	Total Days
Pacific Bell (fiber optic)	(209) 578-3895	Spear St. (Pier W-1)	20	20	40
PG&E (electric)	(415) 695-3550	Spear St. (Pier W-1)	20	20	40

The Contractor shall place a temporary fence enclosing the construction area around Pier W-1 after PG&E relocates its overhead electric lines and removes its poles, and prior to Pacific Bell placing a temporary pole for relocating its facilities.

The Contractor shall coordinate with the Engineer and Pacific Bell to place a temporary fence along Spear Street southwest of Pier W-1, to allow Pacific Bell access to its conduits across Spear Street and to the location of its proposed trench along the fence on the northwest side of Pier W-1.

The Contractor shall dispose all hazardous materials removed by trenching conducted by Pacific Bell in accordance with the provisions elsewhere in these special provisions, and these special provisions. Disposal of the hazardous materials will be paid for as extra work.

In the event that the utility facilities mentioned above are not removed or relocated by the times specified and, if in the opinion of the Engineer, the Contractor's operations are delayed or interfered with by reason of the utility facilities not being removed or relocated by said times, the State will compensate the Contractor for such delays to the extent provided in Section 8-1.09, "Right of Way Delays," of the Standard Specifications, and not otherwise, except as provided in Section 8-1.10, "Utility and Non-Highway Facilities," of the Standard Specifications.

10-1.12 MOBILIZATION

Mobilization shall conform to the provisions in Section 11, "Mobilization," of the Standard Specifications.

10-1.13 CONSTRUCTION AREA SIGNS

Construction area signs shall be furnished, installed, maintained, and removed when no longer required in accordance with the provisions in Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications and these special provisions.

The Contractor shall notify the appropriate regional notification center for operators of subsurface installations at least 2 working days, but not more than 14 calendar days, prior to commencing any 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

All 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" elsewhere in these special provisions.

Type IV reflective sheeting for sign panels for portable construction area signs shall conform to the requirements specified under "Prequalified and Tested Signing and Delineation Materials" elsewhere in these special provisions.

"Tow Away-No Stopping" construction area signs as shown on the plans shall be placed at least 72 hours prior to the effective date and time of the tow away-no stopping zone. The tow away-no stopping signs shall be installed at 25 foot intervals on existing fences, poles, existing posts, or other supports (including barricades) approved by the Engineer. The tow away-no stopping signs shall be installed only in areas where the work is actively in progress. Attention is directed to "Maintaining Traffic" elsewhere in these special provisions concerning the tow away-no stopping signs.

Full compensation for other supports (including barricades) for mounting sidewalk closure and tow away-no stopping signs shall be considered as included in the contract lump sum price paid for construction area signs and no separate payment will be made therefor.

10-1.14 MAINTAINING TRAFFIC

Attention is directed to Sections 7-1.08, "Public Convenience," 7-1.09, "Public Safety," 12, "Construction Area Traffic Control Devices," of the Standard Specifications and to the Sections entitled "Public Safety" and “Cooperation” elsewhere in 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.

The minimum size specified for Type II flashing arrow signs in the table following the second paragraph of Section 12-3.03, "Flashing Arrow Signs," of the Standard Specifications is amended to read "36 inches by 72 inches."

In the Standard Plans, Note 10 on Standard Plan T10, Note 9 on Standard Plan T10A, Note 5 on Standard Plan T11, Note 6 on Standard Plan T12, Note 5 on Standard Plan T13, and Note 4 on Standard Plan T14 are revised to read:

> All traffic cones used for night lane closures shall have reflective cone sleeves as specified in the specifications.

The second and third paragraphs of Section 12-3.10, "Traffic Cones," of the Standard Specifications are amended to read:

> During the hours of darkness traffic cones shall be affixed with reflective cone sleeves. The reflective sheeting of sleeves on the traffic cones shall be visible at 1,000 feet at night under illumination of legal high beam headlights, by persons with vision of or corrected to 20/20.
>
> Reflective cone sleeves shall conform to the following:
>
> 1. Removable flexible reflective cone sleeves shall be fabricated from the reflective sheeting specified in the special provisions, have a minimum height of 13 inches and shall be placed a maximum of 3 inches from the top of the cone. The sleeves shall not be in place during daylight hours.
> 2. Permanently affixed semitransparent reflective cone sleeves shall be fabricated from the semitransparent reflective sheeting specified in the special provisions, have a minimum height of 13 inches, and shall be placed a maximum of 3 inches from the top of the cone. Traffic cones with semitransparent reflective cone sleeves may be used during daylight hours.
> 3. Permanently affixed double band reflective cone sleeves shall have 2 white reflective bands. The top band shall be 6 inches in height, placed a maximum of 4 inches from the top of the cone. The lower band shall be 4 inches in height, placed 2 inches below the bottom of the top band. Traffic cones with double band reflective cone sleeves may be used during daylight hours.
>
> The type of reflective cone sleeve used shall be at the option of the Contractor. Only one type of reflective cone sleeve shall be used on the project.

The C16 and C17 designations of the signs shown on the detail "Entrance Ramp Without Turning Pockets" of Standard Plan T14 are amended to designate the signs as R16 and R17, respectively.

Lane closures shall conform to the provisions in the section of these special provisions entitled "Traffic Control System for Lane Closure."

NOTIFICATION OF ALTERED HORIZONTAL AND VERTICAL CLEARANCES

The Contractor shall provide the Engineer with a 21 day written notice prior to making any temporary or permanent changes at the work site that will affect existing horizontal and vertical clearances on any highway, freeway, ramp, connector, city street, utility or railroad facility. The notice shall be in sufficient detail to show existing and proposed measurements of the alteration and the location where the measurements were taken. Within 24 hours after a change, the Contractor shall provide the Engineer with a written notice indicating the actual horizontal and vertical clearances as changed. The above notification requirements includes the removal of any temporary conditions or restrictions affecting horizontal and vertical clearances.

Temporary changes having an effect on horizontal and vertical clearances include, but are not limited to: installation of false-work, temporary bridges and pedestrian walkways; placement of temporary detours with vertical grade changes and structures, concrete barriers (temporary railing (type K), including glare screen if applicable) encroaching on a lane, shoulder, ramp or connector widths; lane shifts or widening; detours, and closure or realignment of ramps.

Permanent clearance alterations include, but are not limited to, pavement overlays under structures, erection of new sign structures or modifications to existing sign structures, seismic retrofit modifications over the traveled way, and construction of new structures.

This requirement is separate and in addition to the requirements of the “Closure Requirements and Conditions” section included in these special provisions. Failure to comply with these requirements will result in disapproved closures and no compensation will be allowed therefor.

Compensation for compliance with notification requirements

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

CLOSURE REQUIREMENTS AND CONDITIONS

General. The Engineer reserves the authority to disapprove any closure schedule request, deny or abort any closure on any portion of the traveled way or shoulder of a highway, freeway, ramp, connector, city street, utility or railroad facility 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 forces performing work within the State right of way.

The traffic control required for lane closure on the bridge deck of San Francisco-Oakland Bay Bridge in this contract will be provided only by another state contractor.

A lane closure, as used in this section, is defined as the closure of any lane or lanes, ramp or connector, city street or any combination thereof within a single temporary traffic control system.

The Contractor shall not pursue contract work requiring a closure on any portion of the traveled way or shoulder of a highway, freeway, ramp, connector, city street, utility or railroad facility outside the time limits specified in herein.

Lane Closure Schedules. On or before each Monday at noon, the Contractor shall furnish to the Engineer a written schedule of all closures for the week period beginning the following Saturday and ending on the following Friday. This schedule shall identify in advance all planned closures required in the performance of contract work.

The written schedule shall show the locations and times when the proposed closures are to be in effect. The Contractor will be provided with copies of "Closure Request Form" (Form 4CD-170) for this purpose. Proposed closures not conforming to the time limits specified elsewhere in these special provisions or submitted with incomplete, unintelligible or inaccurate information will be returned for correction. The Contractor will be notified promptly of any disapproved closures, or any closure that will require coordination with other parties as a condition of approval. The Contractor will also be notified whenever California Highway Patrol (CHP) assistance is scheduled in conjunction with the approved lane closure schedules.

Contingency Plans. The Contractor shall provide the Engineer a practicable contingency plan for reopening all closed lanes to public traffic in the event of an equipment breakdown, shortage of or lack of production of materials or any other production failure or when it becomes necessary to provide the lanes, ramps, or connectors for use by public traffic. If the nature of the operations in progress makes the reopening of the traffic lanes impractical, then the Contractor shall provide a plan for the management of public traffic until reopening can be accomplished. The Contractor shall

submit a contingency plan to the Engineer a minimum of 5 days in advance of the related lane closures. The contingency plan shall be approved in writing by the Engineer prior to the Contractor implementing the scheduled lane closures

Acceptance of the contingency plan by the Engineer shall not relieve the Contractor from the requirement of opening the lane or lanes to public traffic as specified in "Traffic Control System for Lane Closure" of these special provisions. Full compensation for providing the contingency plan and implementing the plan shall be considered as included in the various items of work.

Additions and Cancellations. Requests for additional lane closures submitted three or more business days in advance of the intended closures and not included in the Lane Closure Schedule will be approved only if they do not conflict with any requested closure. Requests made within three business days will not be approved.

The Contractor shall confirm all scheduled closures at least 3 business days prior to the date on which the closure of traffic lanes is to be made. A business day is defined as Monday through Friday excluding designated holidays and excluding the following days: third Monday in January, February 12th, second Monday in October, and November 11th. All scheduled lane closures not confirmed as scheduled shall be considered cancelled. If the confirmation or approval day falls on a non-business day, the confirmation or approval will occur on the preceding business day.

The written notice to the Engineer of changes or cancellations to any lane closure shall be made between the hours of 7:00 a.m. and 3:00 p.m., Monday through Friday, excluding designated holidays.

All confirmed closures that are cancelled for inclement weather will be rescheduled by the Contractor and submitted to the Engineer for approval.

Late Reopening of Closed Lanes. If the Contractor causes a delay to the state contractor providing traffic control such that a freeway lane closure is not reopened to public traffic by the specified time, then all work shall be suspended in accordance with Section 8-1.05 of the Standard Specifications, "Temporary Suspension of the Work." The Contractor shall not be allowed to work in any freeway closures until the Engineer has accepted a Work Plan, submitted by the Contractor, that will insure that future freeway closures will be reopened to public traffic at the specified time. The Engineer shall have 2 working days to accept or reject the Contractor's proposed Work Plan.

Should the Contractor fail to provide all freeway lanes ready for use by the public traffic at the times specified in the "Lane requirements and Hours of Work Charts" for Lane Closure Charts included in "Maintaining Traffic," of these special provisions, damages will be assessed. For each 10 minute period, or fraction thereof, that all freeway lanes are not available for use by public traffic, damages will amount to $7,700 up to a maximum of $139,000 per day, and the Department will deduct such amount from any moneys due, or that may become due, from the Contractor. These damages will not be assessed on the lane closures for City streets. The damages for clearing lane closures on City street later than scheduled will be assessed as per the Contractor's construction permit and agreement with the City. It is expressly agreed by the parties that these specific damages to public traffic are uncertain and cannot be ascertained with any degree of accuracy and that, therefore, they are liquidated damages established at the time of entering the contract.

This liquidated damages herein provided for are in addition to those specified in "Beginning of Work, Time of Completion and Liquidated Damages" and "Traffic Control System for Lane Closure" elsewhere in these special provisions.

DENIAL OF PREVIOUSLY REQUESTED OR APPROVED LANE CLOSURES

Denied Closures. If the Contractor is denied a requested lane closure included in a Lane Closure Schedule or is directed by the Engineer to not use or install a previously approved closure because it becomes necessary to provide the lanes, shoulders, ramps, or connectors for use by public traffic due to congested conditions or for any other reason, except weather, beyond, the control of the Contractor, as determined by the Engineer, and if the Contractor sustains a loss which could not have been avoided by rescheduling the affected closure, or by judicious handling of forces, equipment and plant, compensation will be determined as provided herein. No compensation for lane closures requested as additional lane closures that were not included in a Lane Closure Schedule, if denied because of conflicts with other scheduled closures will be made.

Terminated Closures. If an approved closure is in place within the approved closure times and it becomes necessary to provide the lanes, shoulders, ramps, or connectors for use by public traffic due to congested conditions or for any reason, except weather, beyond the control of the Contractor, as determined by the Engineer, the Contractor will be compensated for the cost of implementing the contingency plan, furnishing, placing and removal of any temporary materials as provided herein.

The Contractor will be granted an extension of contract time commensurate with the delay in accordance with the provisions of Section 8-1.07, "Liquidated Damages," of the Standard Specifications and the "Progress Schedule (Critical Path)" section of these special provisions.

The Contractor will be compensated for the idle time of forces and equipment in accordance with the provisions of Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

Personal vehicles of the Contractor's employees shall not be parked within the right of way.

The Contractor shall notify local authorities of the Contractor's intent to close any City street at least 7 days prior to each closures. The Contractor shall cooperate with local authorities relative to handling traffic through the area and shall make all arrangements relative to keeping the working area clear of parked vehicles. The Contractor shall contact the City and County of San Francisco, Department of Traffic Engineering Division at (415) 554-2331 and the Chief Harbor Engineer of the Port of San Francisco at (415) 274-0541.

Whenever vehicles or equipment are parked on the shoulder within 6 feet of a traffic lane, the shoulder area shall be closed as shown on the plans.

Route 80 lanes and ramps shall be closed only during the hours shown on the charts included in this section "Maintaining Traffic." Except for the work required under Sections 7-1.08, “Public Convenience,” and 7-1.09, “Public Safety,” of the Standard Specifications, work that interferes with public traffic shall be performed only during the hours shown for lane closures. Simultaneous ramp closures are not permitted unless a ramp closure chart specifically permits such simultaneous closures.

No work in traffic on local streets shall be performed between 7 a.m. and 10:00 a.m. nor between 2:00 p.m. and 7:00 p.m. Monday through Friday, except work required under said Section 7-1.08 and 7-1.09 of the Standard Specifications.

The Contractor shall obtain written approval from the City of San Francisco, Department of Public Works, telephone number (415) 554-9928 at least 72 hours in advance of the effective date and time for closing lanes and for placing tow away-no stopping signs.

During the installation of the cross bracing between bents A and B (Location 1and 2), Main Street shall be closed to both vehicular and pedestrian traffic, as shown on the plans, for a maximum period of 7 consecutive days. Main Street shall be allowed to be closed, if required, for an additional 2 weekends (Saturday and Sunday) for painting. During these closures, work shall be performed only between 8:00 a.m. and 7:00 p.m. The Contractor shall notify the San Francisco Municipal Railway at telephone no. (415) 923-6262 at least 14 days in advance of closing Main Street in order that arrangements may be made for re-routing bus service.

Advance information signs (with dates and time of closure) informing public traffic of future street closures shall be installed as shown on the plans, a minimum of 7 days in advance of the intended street or ramp closure.

Pedestrian access facilities shall be provided through construction areas within the right of way as shown on the plans and as specified herein. Pedestrian walkways (including temporary sidewalks) shall be provided with surfacing of asphalt concrete, portland cement concrete or timber. Lighting shall be provided as required in Section 86-6 of the Standard Specifications. Surface shall be skid resistant and free of irregularities. Hand railing shall be provided on each side of pedestrian walkways as necessary to protect pedestrian traffic from hazards due to construction operations or adjacent vehicular traffic. Protective overhead covering shall be provided as necessary to insure protection from falling objects and drip from overhead structures.

The Contractor shall provide pedestrian facilities during all bridge retrofit, pump station relocation and pump station demolition operations. At least one walkway shall be available at all times. If the Contractor's operations require the closure of one walkway, then another walkway shall be provided nearby, off the traveled roadway.

Railings shall be constructed of wood, S4S, and shall be painted white. Railings and walkways shall be maintained in good condition by the Contractor. Walkways shall be kept clear of obstructions.

Full compensation for providing said pedestrian facilities including wheelchair access 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.

Designated holidays for the purpose of determining allowable lane closure hours are: January 1st, the third Monday in February, the last Monday in May, July 4th, the first Monday in September, Thanksgiving Day, the day after Thanksgiving day, and December 25th. When a designated holiday falls on a Sunday, the following Monday shall be a designated holiday.

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 them in writing. All other modifications will be made by contract change order.

Pursuant to Standard Specifications Section 7-1.09 "Public Safety" and Section 7-1.12 "Responsibility for damage" the Contractor assumes all liability for accidents in or resulting from the lane closures, including but not limited to property damage, injuries or death to all workers performing work within the Contractor's traffic control system.

10-1.15 TRAFFIC CONTROL SYSTEM FOR LANE CLOSURE

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 Sections entitled "Public Safety" and “Cooperation” elsewhere in these special provisions, and these special provisions.

The provisions in this section will not relieve the Contractor from the responsibility to provide such additional devices or take such measures as may be necessary to comply with the provisions in Section 7-1.09, "Public Safety," of the Standard Specifications.

A traffic control system shall consist of closing traffic lanes and ramps in accordance with the details shown on the plans, the provisions of Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications, the provisions under "Maintaining Traffic" and "Construction Area Signs" elsewhere in these special provisions.

The traffic control required for work on the bridge deck of San Francisco-Oakland Bay Bridge in this contract within the contract limits of this contract will be provided only by another state contractor. Maintenance work by State forces shall be permitted where such work will not impact the Contractor's operations or when emergency work by State forces is required. The Contractor shall coordinate his operations with maintenance forces and other contractors performing work within the contract limits of this contract. If the provided freeway lane closure is not used by the Contractor for the approved scheduled work for lane closure, the cost for providing a freeway lane closure will be deducted from the money due to the Contractor.

The Contractor shall coordinate the lane closure schedule with the state Contractor providing the traffic control at the San Francisco-Oakland Bay Bridge. The Contractor shall be responsible for all costs incurred to other contractors and State forces in the event that the work for this contract is not finished as scheduled and the lane closures can not be removed as per the approved closure schedule.

All access to the work from either the upper or lower deck of the bridge, which may be contemplated by the Contractor, will be subject to coordination with other contracts, which may be in progress during this contract. The determination of which of the lanes will be closed for access to the work will be made in accordance with these special provisions, subsections "Closure Scheduling and Notification", "Work" and "Contingency Plan".

The Contractor shall provide traffic control required for the city street closures in this project.

At various San Francisco city street intersections, there shall be stationed a uniformed San Francisco Department of Parking and Traffic, Parking Control Officers for the closure of the Main Street. The exact locations and requirements for the Parking Control Officers shall conform to the provisions in "Traffic Control Utilizing Special Forces," elsewhere in these special provisions.

The contract lump sum price paid for traffic control system for the city streets 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 as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The adjustment in compensation 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. Such 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, will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

Chart No 1
Multilane Lane Requirements

Location: Eastbound Route 80 on the San Francisco-Oakland Bay Bridge.

	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																									
Fridays																									
Saturdays																									
Sundays																									
Day before designated legal holiday																									
Designated legal holidays																									

Legend:

Provide at least two adjacent lanes of traffic.

Provide at least three adjacent lanes of traffic.

Provide at least four adjacent lanes of traffic.

Provide at least four adjacent lanes of traffic. (See Remarks)

No lane closure permitted.

REMARKS: Weekday daytime lane closures are subject to the following:
May not be installed between 7:00 a.m. and 9:00 a.m. (if the closure is not in place by 7:00 a.m., installation of the closure shall not begin until after 9:00 a.m.

Chart No. 2
Ramp Lane Requirements

Location: Eastbound Route 80. On the Essex St. On-Ramp or First Street On-Ramp.

	a.m.												p.m.												
FROM HOUR TO HOUR	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays																									
Fridays																									
Saturdays																									
Sundays																									
Day before designated legal holiday																									
Designated legal holidays																									

Legend:

Ramp may be completely closed and traffic detoured.

No ramp closure permitted.

REMARKS: See detour in plans.

Chart No. 3
Ramp Lane Requirements

Location: Eastbound Route 80. On the Sterling St. On-Ramp.

	a.m.												p.m.												
FROM HOUR TO HOUR	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	■	■	■	■	■	■	■														■	■	■	■	
Fridays	■	■	■	■	■	■	■															■	■	■	
Saturdays	■	■	■	■	■	■	■	■	■	■	■	■	■	■								■	■	■	
Sundays	■	■	■	■	■	■	■	■	■	■	■	■	■	■							■	■	■	■	
Day before designated legal holiday	■	■	■	■	■	■	■															■	■	■	
Designated legal holidays	■	■	■	■	■	■	■	■	■	■	■	■	■	■							■	■	■	■	

Legend:

■ Ramp may be completely closed and traffic detoured.

□ No ramp closure permitted.

REMARKS: See detour in plans.

Chart No. 4
Ramp Lane Requirements

Location: Eastbound Route 80. Simultaneous closure of both the Essex St On-Ramp and the First St On-Ramp.

	a.m.												p.m.												
FROM HOUR TO HOUR	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	■	■	■	■	■	■																			
Fridays	■	■	■	■	■	■																			
Saturdays				■	■	■	■	■																	
Sundays				■	■	■	■	■	■																
Day before designated legal holiday	■	■	■	■	■	■																			
Designated legal holidays				■	■	■	■	■	■																

Legend:

■ Ramps may be completely closed and traffic detoured.

□ No ramp closure permitted.

REMARKS: See detour in plans.

10-1.16 TEMPORARY PAVEMENT DELINEATION

Temporary pavement delineation shall be furnished, placed, maintained and removed in accordance with the provisions in Section 12-3.01, "General," of the Standard Specifications and these special provisions. Nothing in these special provisions shall be construed as to reduce the minimum standards specified in the Manual of Traffic Controls published by the Department or as relieving the Contractor from the responsibilities specified in Section 7-1.09, "Public Safety," of the Standard Specifications.

GENERAL.--Whenever the work causes obliteration of pavement delineation, temporary or permanent pavement delineation shall be in place prior to opening the traveled way to public traffic. Laneline or centerline pavement delineation shall be provided at all times for traveled ways open to public traffic.

All work necessary, including any required lines or marks, to establish the alignment of temporary pavement delineation shall be performed by the Contractor. Surfaces to receive temporary pavement delineation shall be dry and free of dirt and loose material. Temporary pavement delineation shall not be applied over existing pavement delineation or other temporary pavement delineation. Temporary pavement delineation shall be maintained until superseded or replaced with a new pattern of temporary pavement delineation or permanent pavement delineation.

Temporary pavement markers and removable traffic tape which is applied to the final layer of surfacing or existing pavement to remain in place or which conflicts with a subsequent or new traffic pattern for the area shall be removed when no longer required for the direction of public traffic, as determined by the Engineer.

TEMPORARY LANELINE AND CENTERLINE DELINEATION.--Whenever lanelines or centerlines are obliterated and temporary pavement delineation to replace the lines is not shown on the plans, the minimum laneline and centerline delineation to be provided for that area shall be temporary reflective pavement markers placed at longitudinal intervals of not more than 24 feet. The temporary reflective pavement markers shall be the same color as the laneline or centerline the pavement markers replace. Temporary reflective pavement markers shall be, at the option of the Contractor, one of the temporary pavement markers listed for short term day/night use (14 days or less) or long term day/night use (6 months or less) in "Prequalified and Tested Signing and Delineation Materials" elsewhere in these special provisions.

Temporary reflective pavement markers shall be placed in accordance with the manufacturer's instructions and shall be cemented to the surfacing with the adhesive recommended by the manufacturer, except epoxy adhesive shall not be used to place pavement markers in areas where removal of the pavement markers will be required.

Temporary laneline or centerline delineation consisting entirely of temporary reflective pavement markers placed on longitudinal intervals of not more than 24 feet, shall be used on lanes opened to public traffic for a maximum of 14 days. Prior to the end of the 14 days the permanent pavement delineation shall be placed. If the permanent pavement delineation is not placed within the 14 days, the Contractor shall provide additional temporary pavement delineation and the cost thereof shall be borne by the Contractor. The additional temporary pavement delineation to be provided shall be equivalent to the pattern specified for the permanent pavement delineation for the area, as determined by the Engineer.

Full compensation for furnishing, placing, maintaining and removing the temporary reflective pavement markers, used for temporary laneline and centerline delineation for those areas where temporary laneline and centerline delineation is not shown on the plans and for providing equivalent patterns of permanent traffic lines for those areas when required, shall be considered as included in the contract prices paid for the items of work that obliterated the laneline and centerline pavement delineation and no separate payment will be made therefor.

TEMPORARY TRAFFIC STRIPE (PAINT).--Temporary traffic stripe consisting of painted traffic stripe shall be applied and maintained at the locations shown on the plans. The painted temporary traffic stripe shall be complete in place at the location shown, prior to opening the traveled way to public traffic. Removal of painted temporary traffic stripe in areas to be planed and resurfaced with asphalt concrete will not be required.

Temporary painted traffic stripe shall conform to "Paint Traffic Stripes and Pavement Markings" of these special provisions, except for payment and the number of coats shall be, at the option of the Contractor, either one or 2 coats regardless of whether on new or existing pavement.

At the Contractor's option, temporary removable striping tape listed in "Prequalified and Tested Signing and Delineation Materials" elsewhere in these special provisions may be used instead of painted temporary traffic stripes. When traffic stripe tape is used in place of painted temporary traffic stripes, the tape will be measured and paid for as temporary traffic stripe (paint).

When painted traffic stripe is specified for temporary left edgeline delineation, temporary reflective pavement markers placed at longitudinal intervals of not more than 6 feet may be used in place of the temporary painted traffic stripe. Temporary reflective pavement markers shall be one of the types of temporary pavement markers listed for long term day/night use (6 months or less) in "Prequalified and Tested Signing and Delineation Materials" elsewhere in these special provisions. When temporary reflective pavement markers are used in place of temporary painted traffic stripe, payment for those temporary pavement markers will be made on the basis of the theoretical quantity of temporary traffic stripe (paint), required for the left edgeline the temporary pavement markers replace.

TEMPORARY PAVEMENT MARKING (PAINT).--Temporary pavement marking consisting of painted pavement marking shall be applied and maintained at the locations shown on the plans. The painted temporary pavement marking shall be complete in place at the location shown, prior to opening the traveled way to public traffic. Removal of painted temporary pavement marking will not be required.

Temporary painted pavement marking shall conform to "Paint Traffic Stripes and Pavement Markings" of these special provisions, except for payment and the number of coats shall be, at the option of the Contractor, either one or two coats regardless whether on new or existing pavement.

At the Contractor's option, temporary removable pavement marking tape or permanent pavement marking tape listed in "Prequalified and Tested Signing and Delineation Materials" elsewhere in these special provisions may be used instead of painted temporary pavement markings. When pavement marking tape is used, regardless of which type of tape is placed, the tape will be measured and paid for as temporary pavement marking (paint).

MEASUREMENT AND PAYMENT.--Temporary traffic stripe (paint) and temporary pavement marking (paint) will be measured and paid for in the same manner as specified for paint traffic stripe (1-coat) and paint pavement marking (1-coat) specified in Section 84-3.06, "Measurement," and Section 84-3.07, "Payment," of the Standard Specifications.

10-1.17 BARRICADES

Barricades shall be furnished, placed, and maintained at the locations designated by the Engineer, shown on the plans, or specified and shall conform to the provisions in Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications and these special provisions.

Type II reflective sheeting for stripes on barricade rail faces shall conform to the requirements specified under "Prequalified and Tested Signing and Delineation Materials," elsewhere in these special provisions.

Construction area sign and marker panels conforming to the requirements in Section 12-3.06, "Construction Area Signs," of the Standard Specifications shall be installed on barricades as directed by the Engineer at the locations shown on the plans.

Sign panels for construction area signs and marker panels installed on barricades shall conform to the requirements of sign panels for stationary mounted signs in Section 12-3.06A, "Stationary Mounted Signs," of the Standard Specifications.

Full compensation for furnishing, installing, maintaining, and removing construction area signs and markers on barricades shall be considered as included in the contract unit price or prices paid for the type or types of barricade and no separate payment will be made therefor.

10-1.18 TEMPORARY PARKING METER POST

Temporary parking meter posts shall be installed, maintained, and later removed as shown on the plans and as provided in these special provisions.

The posts and base caps shall be from the removed posts and base caps as provided in “Reset Parking Meter Post” elsewhere in these special provisions.

Holes shall be cored in concrete as shown on the plans. The holes shall be cored by methods that will not chip or damage the existing concrete.

Concrete for the temporary parking meter post foundation and for plugging holes in sidewalk shall conform to the provisions in Section 90-10, “Minor Concrete,” of the Standard Specifications.

When temporary parking meter posts and base caps are no longer required for the work as determined by the Engineer, they shall be removed and reset as shown on the plans and in accordance with “Reset Parking Meter Post” elsewhere in these special provisions.

Holes caused by the removal of temporary parking meter posts shall be backfilled to the limits shown on the plans with embankment as provided for in “Earthwork” elsewhere in these special provisions.

The Contractor shall make arrangements with the Port of San Francisco at least 7 days in advance of the Port placing and removing the parking meters to and from the posts. The telephone number of the Port of San Francisco is (415) 274-0400.

The quantity of temporary parking meter post will be determined as units from actual count.

The contract unit price paid for temporary parking meter post shall include full compensation for furnishing all labor, materials, tolls, equipment, and incidentals, and for doing all the work involved in installing, maintaining, and removing parking meter posts and base caps, as shown on the plans, as specified in the Standard Specifications and these special provisions and as directed by the Engineer.

10-1.19 TEMPORARY CURB RAMP

Temporary curb ramp shall be placed in accordance with the details shown on the plans and shall conform to these special provisions.

Asphalt concrete for temporary curb ramp shall be type A and shall conform to the provisions in “Asphalt Concrete,” elsewhere in these special provisions.

Paint binder will not be required.

A layer of commercial quality building paper suitable for the purpose intended shall be placed prior to placing the temporary curb ramp as directed by the Engineer.

Plastic pipe shall be placed in the existing gutter flow line and shall be polyvinyl chloride (PVC) of commercial quality.

When no longer required for passage of pedestrian traffic, temporary curb ramp, plastic pipe and building paper shall be removed and disposed of outside the right of way in accordance with the provisions in Section 7-1.13, “Disposal of Material Outside the Highway Right of Way,” of the Standard Specifications.

The quantity of temporary curb ramp will be determined as units from actual count.

The contract unit price paid for temporary curb ramp shall include full compensation for furnishing all labor, materials (including furnishing and placing building paper, and plastic pipe), tools, equipment, and incidentals and for doing all the work involved in placing and removing temporary curb ramp, complete in place, as shown on the plans, as specified in the Standard Specifications, in these special provisions, and as directed by the Engineer.

10-1.20 TEMPORARY RAILING

Temporary railing (Type K) shall be placed at the locations shown on the plans, specified in these special provisions or in the Standard Specifications or ordered by the Engineer, and shall conform to the provisions in Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications and these special provisions.

Temporary railing (Type K) fabricated prior to January 1, 1993, with one longitudinal No. 5 reinforcing steel bar near the top in lieu of the 2 longitudinal No. 5 reinforcing steel bars near the top, as shown on the plans, may be used.

The Contractor's attention is directed to the provisions in "Public Safety" and "Order of Work" elsewhere in these special provisions.

Temporary railing (Type K) placed in accordance with the provisions in "Public Safety" elsewhere in these special provisions will not be measured nor paid for.

Reflectors for temporary railing (Type K) shall be furnished by the Contractor. Reflectors shall be, at the option of the Contractor, one of the non-impactable concrete delineators listed in “Prequalified and Tested Signing and Delineation Materials” elsewhere in these special provisions. Adhesive for mounting reflectors shall be per manufacturers recommendations and as approved by the Engineer.

Full compensation for reflectors and adhesive shall be considered as included in the contract price paid per linear foot for temporary railing (Type K) and no separate payment will be made therefor.

10-1.21 TEMPORARY CRASH CUSHION MODULE

This work shall consist of furnishing, installing and maintaining sand filled temporary crash cushion modules in groupings or arrays at each location shown on the plans, specified in the special provisions or directed by the Engineer. The grouping or array of sand filled modules shall form a complete sand filled temporary crash cushion in accordance with the details shown on the plans and these special provisions.

Attention is directed to "Public Safety" and "Order of Work" of these special provisions.

GENERAL.--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 15 feet 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.

MATERIALS.--At the Contractor's option, the modules for use in sand filled temporary crash cushions shall be either of the following types or equal:

Energite Inertial Modules

Manufacturer:

Energy Absorption
Systems, Inc.
One East Wacker Drive
Chicago, IL 60601-2076
Telephone (312) 467-6750

Distributor(Northern):

Traffic Control Service,
Inc.
8585 Thys Court
Sacramento, CA 95828
Telephone (800) 884-8274
FAX (916) 387-9734

Distributor(Southern):

Traffic Control Service,
Inc.
1881 Betmor Lane
Anaheim, CA 92805
Telephone (800) 222-8274

or Fitch Inertial Modules

National Distributor:	Distributor:
Roadway Safety Service, Inc. 700-3 Union Parkway Ronkonkoma, NY 11779	Singletree Sales Company 1533 Berger Drive San Jose, CA 95112 Telephone (800) 822-7735

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 above 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 accordance with the manufacturer's directions, and to the sand capacity in pounds for each module as 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 his 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 his expense.

INSTALLATION.--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 crash cushion array is within 12 feet of the traveled way. The marker panel, when required, shall be firmly fastened to the crash cushion with commercial quality hardware or by other methods approved by the Engineer.

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 permanent work.

MEASUREMENT AND PAYMENT.--Temporary crash cushion modules will be measured by the unit determined from the actual count of modules used in the work or ordered by the Engineer at each location. Temporary crash cushion modules placed in accordance with the provisions in "Public Safety" elsewhere in these special provisions and modules placed in excess of the number specified or shown will not be measured nor paid for.

Repairing modules damaged by public traffic will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications. Modules damaged beyond repair by public traffic, when ordered by the Engineer, shall be removed and replaced immediately by the Contractor. Modules replaced due to damage by public traffic will be measured and paid for as temporary crash cushion module.

If the Engineer orders a lateral move of sand filled temporary crash cushions and the repositioning is not shown on the plans, moving the sand filled temporary crash cushion will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications and such temporary crash cushion modules will not be counted for payment in the new position.

The contract unit price paid for temporary crash cushion module shall include full compensation for furnishing all labor, materials (including sand, pallets or frames and marker panels), tools, equipment and incidentals, and for doing all work involved in furnishing, installing, maintaining, moving and resetting during a work period for access to the work, and removing from the site of the work when no longer required (including those damaged by public traffic) the sand filled temporary crash cushion modules, complete in place, as shown on the plans, as specified in these special provisions and as directed by the Engineer.

10-1.22 EXISTING HIGHWAY FACILITIES

The work performed in connection with various existing highway facilities shall conform to the provisions in Section 15, "Existing Highway Facilities," of the Standard Specifications and these special provisions.

Plans of the existing bridges may be requested by fax from the Office of Structure Maintenance and Investigations, 1801 30th Street, Sacramento, California, Fax (916) 227-8357.

Plans of the existing bridge available to the Contractor are reproductions of the original contract plans and working drawings and do not necessarily show normal construction tolerances and variances. Where dimensions of new construction required by this contract are dependent on the dimensions of existing bridges, the Contractor shall verify field dimensions for all members prior to submitting working drawings and ordering, fabricating or installing material. The Contractor shall be responsible for adjusting dimensions of the work to fit existing conditions.

Attention is directed to Section 7-1.06, "Safety and Health Provisions," of the Standard Specifications. Work practices and worker health and safety shall conform to the Cal/OSHA Safety Orders Title 8, of the California Code of Regulations including Section 5158, "Other Confined Space Operations."

The existing paint systems on Bridge Number 34-003 consist of lead, chromium and zinc. Any work that disturbs the existing paint system will expose workers to health hazards and will (1) produce debris containing heavy metal in amounts that exceed the thresholds established in Titles 8 and 22 of the California Code of Regulations or (2) produce toxic fumes when heated. All debris produced when the existing paint system is disturbed shall be contained as specified herein.

DEBRIS CONTAINMENT AND COLLECTION PROGRAM.—Prior to starting work, the Contractor shall submit to the Engineer a debris containment and collection program for debris produced when the existing paint system is disturbed in accordance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. The program shall identify materials, equipment and methods to be used when the existing paint system is disturbed and shall include working drawings of any containment system, loads applied to the bridge by any containment structure, and provisions for ventilation and air movement for visibility and worker safety.

If the measures being taken by the Contractor are inadequate to provide for the containment and collection of debris produced when the existing paint system is disturbed, the Engineer will direct the Contractor to revise the operations and the debris containment and collection program. The directions will be in writing and will specify the items of work for which the Contractor's debris containment and collection program are inadequate. No further work shall be performed on the items until the debris containment and collection programs are adequate and, if required, a revised program has been approved for the containment and collection of debris produced when the existing paint system is disturbed.

The Engineer will notify the Contractor of the approval or rejection of any submitted or revised debris containment and collection program within 2 weeks of submittal of the Contractor's program or revised program.

The State will not be liable to the Contractor for failure to approve all or any portion of an originally submitted or revised debris containment and collection program, nor for any delays to the work due to the Contractor's failure to submit acceptable programs.

SAFETY AND HEALTH PROVISIONS.—Attention is directed to Section 7-1.06, "Safety and Health Provisions," of the Standard Specifications. Work practices and worker health and safety shall conform to the Construction Safety Orders Title 8, of the California Code of Regulations including Section 1532.1, "Lead."

The Contractor shall furnish to the Engineer a written Code of Safe Practices, and have an Injury and Illness Prevention Program, and a Hazard Communication Program in accordance with the provisions of Construction Safety Orders 1509 and 1510.

Prior to starting work that disturbs the existing paint system and at such times when revisions to the program are required by Section 1532.1, "Lead," the Contractor shall submit the compliance programs required in subsection (e)(2), "Compliance Program," of Section 1532.1, "Lead," of the Construction Safety Orders to the Engineer in accordance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. The compliance programs shall include the data specified in subsections (e)(2)(B) and (e)(2)(C) of Section 1532.1, "Lead." Approval of the compliance programs by the Engineer will not be required. The compliance programs shall be reviewed and signed by a Certified Industrial Hygienist (CIH) who is certified in comprehensive practice by the American Board of Industrial Hygiene (ABIH). Copies of all air monitoring or jobsite inspection reports made by or under the direction of the CIH in accordance with Section 1532.1, "Lead," shall be furnished to the Engineer within 10 days after date of monitoring or inspection.

The CIH 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 CIH may be an employee of the Contractor.

DEBRIS HANDLING.—Temporary storage on the ground of the debris produced when the existing paint system is disturbed will not be permitted. Debris accumulated inside the containment system shall be removed before the end of

each work shift. Debris shall be stored in approved leak proof containers and shall be handled in such a manner that no spillage will occur.

Disposal of debris produced when the existing paint system is disturbed shall be performed in accordance with all applicable Federal, State and Local hazardous waste laws. Laws that govern this work include:

1. Health and Safety Code, Division 20, Chapter 6.5 (California Hazardous Waste Control Act).
2. Title 22; California Code of Regulations, Chapter 30 (Minimum Standard for Management of Hazardous and Extremely Hazardous Materials).
3. Title 8, California Code of Regulations.

Except as otherwise provided below, debris produced when the existing paint system is disturbed shall be disposed of by the Contractor at an approved Class 1 disposal facility in accordance with the requirements of the disposal facility operator. The debris shall be hauled by a transporter currently registered with the California Department of Toxic Substances Control using correct manifesting procedures and vehicles displaying current certification of compliance. The Contractor shall make all arrangements with the operator of the disposal facility and perform any testing of the debris required by the operator.

At the option of the Contractor, the debris produced when the existing paint system is disturbed may be disposed of by the Contractor at a facility equipped to recycle the debris, subject to the following requirements:

Copper slag abrasive blended by the supplier with a calcium silicate compound shall be used for blast cleaning.

The debris produced when the existing paint system is disturbed shall be tested by the Contractor to confirm that the solubility of the heavy metals is below regulatory limits and that the debris may be transported to the recycling facility as a non-hazardous waste.

The Contractor shall make all arrangements with the operator of the recycling facility and perform any testing of the debris produced when the existing paint system is disturbed that is required by the operator.

WORK AREA MONITORING.—The Contractor shall perform work area monitoring of the ambient air and soil in and around the work area at the bridge site to verify the effectiveness of the containment system. The work area monitoring shall consist of collecting, analyzing and reporting of air and soil test results, and recommending any required corrective action when specified exposure levels are exceeded. The work area monitoring shall be carried out under the direction of a CIH. The samples shall be collected at locations designated by the Engineer.

Air samples shall be collected and analyzed in accordance with National Institute for Occupational Safety and Health (NIOSH) methods. Lead air samples shall be collected and analyzed in accordance with NIOSH Method 7082, with a limit of detection of at least 0.5 $\mu g/m^3$. Air samples for other metals shall be collected and analyzed in accordance with NIOSH Method 7300, with a limit of detection of at least one percent of the appropriate Permissible Exposure Limits (PELs) of California/Occupational Safety and Health Administration (Cal/OSHA). Alternative methods of sample collection and analysis, with equivalent limits of detection, may be used at the option of the Contractor.

The airborne metals exposure, outside either the containment system or work areas, shall not exceed the lower of either: (1) 10 percent of the Action Level specified for lead by Section 1532.1, "Lead," or (2) 10 percent of the appropriate PELs specified for other metals by Cal/OSHA.

The air samples shall be collected once prior to beginning of work that disturbs the existing paint system and at least once per week during progress of work that disturbs the existing paint system. All air samples shall be analyzed within 48 hours at a facility accredited by the Environmental Lead Laboratory Accreditation Program of the American Industrial Hygiene Association (AIHA). When corrective action is recommended by the CIH, additional samples may be required by the Engineer to be taken, at the Contractor's expense.

Four soil samples at each bent and pier location shall be collected prior to start of work, and four soil samples at each bent and pier location shall be collected within 36 hours following completion of cleaning operations of existing structural steel. Where the cleaning operations extend over large areas of soil or many separate areas of soil at each bridge site, the samples shall be collected at various times during the contract, as determined by the Engineer. A soil sample shall consist of 5 plugs, each 3/4 inch diameter and 1/2 inch deep, taken at each corner and center of a one foot square area. Soil samples shall be analyzed for total lead, chromium and zinc in accordance with Method 3050 in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846 published by the United States Environmental Protection Agency.

There shall be no increase in the concentrations of heavy metal in the soil in the area affected when the existing paint system is disturbed. When soil sampling, after completion of work that disturbs the existing paint system, shows an increase in the concentrations of heavy metal, the area affected shall be cleaned and resampled at the Contractor's

expense until soil sampling and testing shows concentrations of heavy metal less than or equal to the concentrations collected prior to start of work.

In areas where there is no exposed soil, there shall be no visible increase in the concentrations of heavy metal on the area affected when the existing paint system is disturbed. Any visible increase in the concentrations of heavy metal, after completion of work that disturbs the existing paint system, shall be removed at the Contractor's expense.

Air and soil sample laboratory analysis results, including results of additional samples taken after corrective action as recommended by the CIH, shall be submitted to the Engineer. The results shall be submitted both verbally within 48 hours after sampling and in writing with a copy to the Contractor, within 5 days after sampling. Sample analysis reports shall be prepared by the CIH as follows:

For both air and soil sample laboratory analysis results, the date and location of sample collection, sample number, contract number, bridge number, full name of the structure as shown on the contract plans, and District-County-Route-Post mile will be required.

For air sample laboratory analysis results, the following will be required:

1. List of emission control measures in place when air samples were taken.
2. Air sample results shall be compared to the appropriate PELs.
3. Chain of custody forms.
4. Corrective action recommended by the CIH to ensure airborne metals exposure, outside either the containment system or work areas, is within specified limits.

For soil sample laboratory analysis results, the concentrations of heavy metal expressed as parts per million will be required.

CONTAINMENT SYSTEM.—The containment system shall consist of, at the option of the Contractor, (1) a ventilated containment structure, or (2) vacuum shrouded surface preparation equipment and drapes, tarps or other materials, or (3) equivalent containment system. The containment system shall contain all water, resulting debris, and visible dust produced when the existing paint system is disturbed.

The containment system shall provide the clearances specified under "Maintaining Traffic" of these special provisions, except that when no clearances are specified a vertical clearance of 15 feet and a horizontal clearance of 32 feet shall be provided for the passage of public traffic.

Falsework or supports for the ventilated containment structure shall not extend below the vertical clearance level nor to the ground line at any location within the roadbed.

The ventilated containment structure shall conform to the provisions for falsework in Section 51-1.06, "Falsework," of the Standard Specifications.

The minimum total design load of the ventilated containment structure shall consist of the sum of the dead and live vertical loads. Dead load shall consist of the actual weight of the ventilated containment structure. Live loads shall consist of a uniform load of not less than 45 pounds per square foot, which includes 20 pounds per square foot of sand load, applied over the area supported, and in addition, a moving 1000 pound concentrated load shall be applied to produce maximum stress in the main supporting elements. Assumed horizontal loads need not be included in the design of the ventilated containment structure.

The ventilated containment structure shall be supported with either rigid or flexible supports. The rigid or flexible containment materials on the containment structure shall retain air borne particles but may allow air flow through the containment materials. Flexible materials shall be supported and fastened to prevent escape of abrasive and blast materials due to whipping from traffic or wind and to maintain the clearances.

All mating joints between the ventilated containment structure and the bridge shall be sealed. Sealing may be by overlapping of seams when using flexible materials or by using tape, caulking, or other sealing measures.

Multiple flap overlapping door tarps shall be used at entry ways to the ventilated containment structure to prevent dust or debris from escaping.

Baffles, louvers, flapper seals or ducts shall be used at make-up air entry points to the ventilated containment structure to prevent escape of abrasives and resulting surface preparation debris.

The ventilated containment structure shall be properly maintained while work is in progress and shall not be changed from the approved working drawings without prior approval of the Engineer.

The ventilation system in the ventilated containment structure shall be of the forced input air flow type with fans or blowers.

Negative air pressure shall be employed within the ventilated containment structure and will be verified by visual methods by observing the concave nature of the containment materials while taking into account wind effects, or by using smoke or other visible means to observe air flow. The input air flow shall be properly balanced with the exhaust capacity throughout the range of operations.

The exhaust air flow of the ventilation system in the ventilated containment structure shall be forced into dust collectors (wet or dry) or bag houses.

PROTECTIVE WORK CLOTHING AND HYGIENE FACILITIES.—Wherever there is exposure or possible exposure to heavy metals or silica dust at the bridge site, the Contractor shall, for not more than 5 State personnel: (1) furnish, clean and replace protective work clothing and (2) provide access to hygiene facilities. The furnishing, cleaning and replacement of protective work clothing, and hygiene facilities shall conform to the provisions of subsections (g), "Protective work clothing and equipment," and (i), "Hygiene facilities and practices," of Section 1532.1, "Lead," of the Construction Safety Orders.

The protective work clothing and access to hygiene facilities shall be provided during exposure or possible exposure to heavy metals or silica dust at the bridge site and application of the undercoats of paint.

Protective work clothing and hygiene facilities shall be inspected and approved by the Engineer before being used by State personnel.

The protective work clothing shall remain the property of the Contractor at the completion of the contract.

PAYMENT.—Full compensation for the containment system, protective work clothing and access to hygiene facilities for State personnel; and handling of debris produced when the existing paint system is disturbed, including testing, hauling, treatment, disposal fees and local taxes, shall be considered as included in the contract price paid for the item of work requiring the disposal of the debris produced when the existing paint system is disturbed and no additional compensation will be allowed therefor.

Work area monitoring will be paid for on the basis of a lump sum price.

The contract lump sum price paid for work area monitoring shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in collecting and analyzing of samples of ambient air and soil for heavy metals, complete in place, including reporting the test results, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.22A REMOVE CHAIN LINK FENCE

Existing chain link fence, including barbed wire supporting arms and barbed wire, where shown on the plans to be removed, shall be removed and disposed of.

10-1.21B REMOVE PAINTED TRAFFIC STRIPES AND PAVEMENT MARKINGS

Painted traffic stripes and pavement markings to be removed will be designated by the Engineer.

Where blast cleaning is used for the removal of painted traffic stripes and pavement markings or for removal of objectionable material, and such removal operation is being performed within 10 feet of a lane occupied by public traffic, the residue including dust shall be removed immediately after contact between the sand and the surface being treated. Such removal shall be by a vacuum attachment operating concurrently with the blast cleaning operation.

Nothing in these special provisions shall relieve the Contractor from his responsibilities as provided in Section 7-1.09, "Public Safety," of the Standard Specifications.

10-1.22C REMOVE DRAINAGE FACILITIES

Existing manhole, where shown on the plans to be removed, shall be completely removed and disposed of.

10-1.22D RECONSTRUCT CHAIN LINK FENCE

Existing chain link fence, including barbed wire supporting arms and barbed wire, shall be removed and reconstructed as shown on the plans.

Fence, including barbed wire supporting arms and barbed wire, removed in excess of that required for reconstructing chain link fence shall be disposed of. Full compensation for removing and disposing of excess fence shall be considered as included in the contract price paid per linear foot for reconstruct chain link fence and no separate payment will be made therefor.

10-1.22E RESET PARKING METER POST

Existing parking meter posts shall be removed and reset as shown on the plans.

Some of the removed parking meter posts and base caps shall be used on Main Street for temporary parking meter posts as provided in “Temporary Parking Meter Post” elsewhere in these special provisions. The remainder of the removed posts and base caps shall be retained by the Contractor for resetting at a later date as directed by the Engineer.

Holes, as required, shall be cored in concrete as shown on the plans. The holes shall be cored by methods that will not chip or damage the existing concrete.

Concrete for the parking meter post foundation and for plugging holes in sidewalk shall conform to the provisions in Section 90-10, "Minor Concrete," of the Standard Specifications.

Holes caused by the removal of reset parking meter post and not required for future use, shall be backfilled to the limits shown on the plans with embankment as provided for in "Earthwork" elsewhere in these special provisions.

The Contractor shall make arrangements for the removal of the parking meters from the posts on Spear Street with the Port of San Francisco at least 7 days in advance of the Port removing the parking meters from the posts. After the parking meter posts are reset, the Contractor shall make arrangements with the Port of San Francisco at least 7 days in advance to have the parking meters reinstalled. The telephone number of the Port of San Francisco is (415) 274-0400.

The Contractor shall make arrangements for the removal of the parking meters from the posts on Main Street with the City and County of San Francisco, Parking and Traffic Department at least 7 days in advance of the City removing the parking meters from the posts. After the parking meter posts are reset, the Contractor shall make arrangements with the Parking and Traffic Department at least 7 days in advance to have the parking meters reinstalled. The telephone number of the Parking and Traffic Department is (415) 554-2300.

Full compensation for coring holes in concrete and backfilling when no longer required shall be considered as included in the contract unit price paid for reset parking meter post and no additional compensation will be allowed therefor.

10-1.22F RESET SEAT BOLLARD

Existing seat bollard shall be removed and reset as shown on the plans and as directed by the Engineer.

Concrete for the seat bollard foundation shall conform to the provisions in Section 90-10, "Minor Concrete," of the Standard Specifications.

The threaded stainless steel rods, as shown on the plans, shall be commercial quality suited for the purpose intended.

The quantity of reset seat bollard will be determined as units from actual count.

The contract unit price paid for reset seat bollard shall include full compensation for furnishing all labor, materials (including furnishing threaded stainless steel rods), tools, equipment, and incidentals and for doing all the work involved in removing and resetting seat bollards, complete in place, as shown on the plans, as specified in the Standard Specifications, in these special provisions, and as directed by the Engineer.

10-1.22G PLANE ASPHALT CONCRETE PAVEMENT

Existing asphalt concrete pavement shall be planed at the locations and to the dimensions shown on the plans.

Except as provided herein, planing asphalt concrete pavement shall be performed, at the option of the Contractor, either by the cold planing or heater planing method. The use of the heater planing method shall be subject to approval of the local Air Pollution Control Officer.

Cold planing machines shall be equipped with a cutter head not less than 30 inches in width and shall be operated so as not to produce fumes or smoke. The cold planing machine shall be capable of planing the pavement without requiring the use of a heating device to soften the pavement during or prior to the planing operation.

Heater planing machines shall have, in combination or separately, a means for heating and cutting the asphalt concrete surface and blading the displaced material into windrows in one continuous forward motion. Heat shall be applied uniformly to the area to be planed and shall be accurately controlled according to conditions and road surfacing being planed. The cutting width of the blade shall be not less than 3 feet.

Heater planing operations shall not be performed at any time where there is danger of igniting entrapped gases from sewers or gas mains, if an open flame is used in the heater. The heater planing method shall not be used in areas where the heat generated by the heater planing equipment may damage adjacent shrubs or the foliage on overhanging tree limbs.

The depth, width and shape of the cut shall be as indicated on the typical cross sections or as directed by the Engineer. The final cut shall result in a uniform surface conforming to the typical cross sections. The outside lines of the planed area shall be neat and uniform. Planing asphalt concrete pavement operations shall be performed without damage to the surfacing to remain in place.

Planed widths of pavement shall be continuous except for intersections at cross streets where the planing shall be carried around the corners and through the conform lines. Following planing operations, a drop-off of more than 0.15-foot will not be allowed at any time between adjacent lanes open to public traffic.

Where transverse joints are planed in the pavement at conform lines no drop-off shall remain between the existing pavement and the planed area when the pavement is opened to public traffic. If asphalt concrete has not been placed to the level of existing pavement before the pavement is to be opened to public traffic a temporary asphalt concrete taper shall be constructed. Asphalt concrete for temporary tapers shall be placed to the level of the existing pavement and tapered on a slope of 30:1 or flatter to the level of the planed area.

Asphalt concrete for temporary tapers shall be commercial quality and may be spread and compacted by any method that will produce a smooth riding surface. Temporary asphalt concrete tapers shall be completely removed, including the removal of all loose material from the underlying surface, before placing the permanent surfacing. Such removed material shall be disposed of outside the highway right of way in accordance with the provisions in Section 7-1.13 of the Standard Specifications.

Operations shall be scheduled such that not more than 7 days shall elapse between the time when transverse joints are planed in the pavement at the conform lines and the permanent surfacing is placed at such conform lines.

The material planed from the roadway surface, including material deposited in existing gutters or on the adjacent traveled way, shall be removed and disposed of outside the highway right of way in accordance with the provisions in Section 7-1.13 of the Standard Specifications. Removal operations of planed material shall be concurrent with planing operations and follow within 50 feet of the planer, unless otherwise directed by the Engineer.

Planing asphalt concrete pavement will be measured by the square yard. The quantity to be paid for will be the actual area of surface planed irrespective of the number of passes required to obtain the depth shown on the plans.

The contract price paid per square yard for plane asphalt concrete pavement shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all work involved in planing asphalt concrete surfacing and disposing of planed material, including furnishing the asphalt concrete for and constructing, maintaining, removing, and disposing of temporary asphalt concrete tapers, as specified in these special provisions and as directed by the Engineer.

10-1.22H BRIDGE REMOVAL (PORTION)

Removing portions of bridge shall conform to the requirements in Section 15-4, "Bridge Removal," of the Standard Specifications and these special provisions.

Bridge removal (portion) shall consist of removing portions of the bridge as shown on the plans, including cutting, grinding, and milling of existing steel, removing existing concrete, and removing rivet heads flush where the rest of the rivet shall remain.

All removed materials that are not to be salvaged or used in the reconstruction shall become the property of the Contractor and shall be disposed of outside the highway right of way in accordance with the provisions in Section 7-1.13 of the Standard Specifications.

10-1.22I TEMPORARY SUPPORTS

Temporary supports shall consist of furnishing, installing, removing and salvaging the support towers and performing jacking operations as shown on the plans.

Temporary supports shall include jacking assemblies and appurtenant items necessary to jack and support the structure.

Temporary supports shall conform to the requirements in "Steel Structures," of these special provisions.

Temporary supports shall be cleaned and painted as specified in "Clean and Paint Structural Steel," of these special provisions. Finish coats will be required. Painting shall be completed prior to jacking the superstructure.

At the completion of the retrofit work and installation of the seismic isolator bearings, the temporary support shall be removed and salvaged. Temporary support members and fasteners shall be identified with permanent markings which correspond to the erection and removal sequence plan. Damage to the paint shall be repaired as specified in "Clean and Paint Structural Steel," of these special provisions. The members and fasteners shall be hauled to the Anchorage House on Pier W4 and stockpiled. The openings at Pier W4 are approximately 8 feet wide and 10 feet high. The openings are located on the east and west faces at approximately elevation 25 feet. The Contractor shall notify the Engineer not less than 48 hours before any salvaged material is to be hauled to the Anchorage House.

GENERAL--Attention is directed to "Order of Work," “Maintaining Traffic,” and "Bridge Removal (Portion)," elsewhere in these special provisions.

The Contractor shall be responsible for the methods and equipment used to jack the existing superstructure. The jacking equipment shall accommodate the load requirements shown on the plans and any additional loadings due to the Contractor’s operations. The jacking system shall provide total stability of the structure throughout the jacking operation.

The Contractor shall submit to the Engineer working drawings and design calculations for jacking the bridge, for each bent location. Such drawings and design calculations shall be signed by an engineer who is registered as a Civil Engineer in the State of California. The working drawings and design calculations shall conform to the requirements in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. The number of sets of drawings and design calculations and times for review for jack bridge working drawings shall be the same as specified for falsework working drawings in Section 51-1.06A, "Falsework Design and Drawings," of the Standard Specifications.

The working drawings for jacking operations shall include descriptions and values of all loads, including construction equipment loads, descriptions of equipment to be used, complete details and calculations for jacking and supporting the existing structure, and descriptions of the displacement monitoring system. The description of the displacement monitoring system shall include equipment to be used, location of control points, method and schedule of taking measurements, and shall also include provisions to jack the structure should settlement occur.

Jacking assemblies and load bearing elements shall remain in place to support the existing superstructure until column retrofit and isolator bearing installation has been completed.

MANUFACTURED ASSEMBLIES--Manufactured assemblies shall conform to the provisions in Section 51-1.06A(2), of the Standard Specifications and these special provisions.

Each jack shall be equipped with either a pressure gage or a load cell for determining the jacking force. Pressure gages shall have an accurately reading dial at least 6-inches in diameter. Each jack and corresponding pressure gage or load cell shall be calibrated as a unit 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 corresponding 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. The range of the load cell shall be such that the lower 10 percent of the manufacturer's rated capacity will not be used in determining the jacking stress.

JACKING OPERATIONS.--Construction sequence and application of jacking loads shall be as shown on the plans. Proposed changes to the construction sequence and application of jacking loads shall be subject to the Engineer's approval.

Prior to proceeding with Bridge removal, an engineer for the Contractor who is registered as a Civil Engineer in the State of California shall inspect the temporary supports, including jacking and displacement monitoring systems, for conformity with the working drawings. The Contractor's registered engineer shall certify in writing that the temporary supports, including jacking 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 available at the site of the work at all times.

The Contractor's registered engineer shall be present at the bridge site at all times when jacking operations or adjustments are in progress and when bridge removal operations are in progress. The Contractor's registered engineer shall inspect the jacking and removal operation and report in writing on a daily basis the progress of the operation and the status of the remaining structure. A copy of the daily report shall be available at the site of the work at all times. Should an unplanned event occur, the Contractor's registered engineer shall submit immediately to the Engineer for approval, the procedure or proposed operation to remedy the occurrence.

Contractor shall perform an initial survey as part of the displacement monitoring system to record the location of the existing structure prior to the commencement of any work. Initial survey data shall consist of elevations of each control point relative to a fixed point established on the existing column. Two copies of the survey shall be signed by an engineer, who is registered as a Civil Engineer in the State of California, and submitted to the Engineer at least 2 days prior to jacking operations.

Vertical and horizontal displacements of the temporary supports and the existing structure shall be monitored continuously during jacking operations. Elevations shall be taken prior to the start of jacking operations, immediately after jacking is complete and after the temporary supports have been removed. As a minimum, the existing structure shall

be monitored at the bent and at mid-span of both adjoining spans. Control points at each location shall be located near the center and at both edges of the superstructure.

Prior to jacking the superstructure, a force equal to the initial jacking load shown on the plans shall be applied to the lower deck and held until all initial compression and settlement of the jacking system has occurred.

The superstructure shall be jacked and adjusted to grade uniformly and in such a manner that a roadway satisfactory for the use of public traffic is provided in conformance with the provisions in Section 7-1.08, "Public Convenience," of the Standard Specifications.

Should unanticipated displacements, cracking or other damage occur, the jacking operations shall be discontinued until corrective measures satisfactory to the Engineer are performed. Damage to the structure as a result of the Contractor's operations shall be repaired by the Contractor according to the requirements in Section 7-1.11, "Preservation of Property," of the Standard Specifications.

Following removal of the jacks, the monitored control points shall not deviate from the vertical position by more than 1/4 inch from the initial survey elevations or elevations as modified by the Engineer.

PAYMENT.--The contract lump sum price paid for temporary supports shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in designing, constructing, maintaining, and removing the temporary supports, including jacks, jacking the existing structure, monitoring displacements and salvaging the temporary supports, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Removing and replacing portions of the deck, steel curb and stringer as shown on the plans and directed by the engineer to facilitate temporary support installation will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

10-1.22J REMOVE RIVET

Removing rivets shall conform to the requirements in Section 15, "Existing Highway Facilities," and Section 55, "Steel Structures," of the Standard Specifications and these special provisions.

Attention is directed to Section 7-1.09, “Public Safety,” and Section 7-1.12, “Responsibility for Damage,” of the Standard Specifications.

Furnishing and installing bolts at rivet removal locations, as shown on the plans, will be measured and paid for as specified in "Steel Structures," elsewhere in these special provisions.

Sound control shall conform to the provisions in "Sound Control Requirements" elsewhere in these special provisions.

The Contractor shall submit to the Engineer for approval the proposed method for rivet removal in accordance with the requirements in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. Rivet removal will not be permitted until the removal method has been approved by the Engineer. The Engineer will notify the Contractor one week after receipt of the Contractors submittal whether the proposed methods are approved or rejected. In the event that the Engineer determines that rivet removal work is resulting in damage to the existing steel, the Contractor shall cease rivet removal operations until a new proposed method for rivet removal has been approved by the Engineer.

Rivets to be removed shall have their head chipped off and the shank driven, drilled, or cored out as required. Care shall be taken not to enlarge rivet holes or to damage remaining material. Burning will not be permitted. The Contractor shall demonstrate removal methods using heat to the Engineer. Heat resulting from any removal method shall not damage rivet holes or the surrounding materials.

Where existing rivets are removed, and the resulting holes require enlargement, the holes shall be enlarged by not more than 1/16 inch in diameter greater than the nominal bolt diameter shown on the plans. Holes shall be enlarged by reaming.

At locations where surrounding material has been damaged as a result of the Contractor's operations, the surrounding material shall be repaired. When reaming of more than 1/16-inch in diameter greater than the nominal bolt diameter shown on the plans and installing an oversize bolt is required for the repair, the reaming, furnishing and installing of oversized bolts shall be at the Contractor's expense.

At locations where rivet holes contain cracked, torn, or otherwise damaged material due to conditions other than the Contractor’s operations, the Contractor shall ream the hole and install an oversized bolt. Additional reaming more than 1/16 inch in diameter than the nominal bolt diameter shown on the plans, including the difference between the actual cost of the bolt shown on the plans and the oversized bolt, shall be done as directed by the Engineer and will be paid for as extra work as provided in Section 4-1.03 D of the Standard Specifications. Installing oversized bolts shall be at the Contractor's expense.

Inside surfaces of holes remaining after rivet removal shall be painted in accordance to and be measured and paid for as specified for existing steel surfaces in “Clean and Paint Structural Steel" elsewhere in these special provisions.

Remove rivet will be measured and paid for by unit.

The contract unit price paid for remove rivet shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all work involved in removing rivets, including submitting the proposed method for rivet removal, as shown on the plans, as specified in these special provisions, and as directed by the Engineer.

Full compensation for enlarging rivets holes by not more than 1/16 inch in diameter greater than the nominal bolt diameter shown on the plans, shall be considered as included in the contract lump sum price paid for remove rivet and no additional compensation will be allowed therefor.

10-1.22K REMOVE CONCRETE

Concrete, designated on the plans to be removed, shall be removed.

The pay quantities of concrete to be removed will be measured by the cubic yard, measured before and during removal operations.

Concrete removed shall be disposed of outside the highway right of way in accordance with the provisions in Section 7-1.13 of the Standard Specifications.

Where no joint exists between concrete to be removed and concrete to remain in place, the concrete shall be cut in a neat line to a minimum depth of 0.17-foot with a power driven saw before concrete is removed.

Concrete to be removed which has portions of the same structure both above and below ground will be considered as concrete above ground for compensation.

10-1.23 EARTHWORK

Earthwork shall conform to the provisions in Section 19, "Earthwork," of the Standard Specifications and these special provisions.

Attention is directed to "Hazardous Material, General," elsewhere in these special provisions.

Difficult excavation and sheet pile installation is anticipated due to the presence of existing seal course, wood, and other debris.

Attention is directed to Section 7-1.11, "Preservation of Property," of the Standard Specifications. Pile cap and grade beam at the ventilation building shall be located and exposed prior to any excavation below elevation +9.0 at Bent B. No additional lateral pressure shall be placed on the concrete ducts at Bent B during the excavation. The concrete ducts shall be protected from damage until all seismic retrofit work at Bent B has been completed.

Structure backfill placed beneath the pump plant at Pier W1 shall be compacted to a relative compaction of not less than 95 percent.

Where a portion of existing surfacing is to be removed, the outline of the area to be removed shall be cut on a neat line with a power-driven saw to a minimum depth of 0.17-foot before removing the surfacing. Full compensation for cutting existing surfacing shall be considered as included in the contract price paid per cubic yard for roadway excavation and no additional compensation will be allowed therefor.

If structure excavation or structure backfill involved in bridges is not otherwise designated by type, and payment for such structure excavation or structure backfill has not otherwise been provided for in the Standard Specifications or these special provisions, such structure excavation or structure backfill will be paid for at the contract price per cubic yard for structure excavation (DH) or structure backfill (bridge).

Structure excavation, designated as (Type DH), for footings at the locations shown on the plans will be measured and paid for as structure excavation (Type DH). Ground water or surface water is expected to be encountered at these locations, but seal course concrete is not shown or specified. Structure excavation for footings at locations not designated on the plans as structure excavation (Type DH) and where ground or surface water is encountered will be measured and paid for as structure excavation (DH).

Full compensation for protecting the concrete ducts at Bent B shall be considered as included in the contract price paid per cubic yard for structure excavation (Type DH) and no additional compensation will be allowed therefor.

HAZARDOUS MATERIAL EXCAVATION.--All hazardous material excavated as shown on the plans and as described in these special provisions shall be transported to a disposal facility permitted to accept such material.

Attention is directed to "Hazardous Material, General" elsewhere in these special provisions regarding handling of hazardous material.

Attention is directed to the "Preliminary Site Investigation Summary Table" shown below for the vertical extent of material designated as hazardous. Attention is directed to the "Materials Information" for information on the concentration of other contaminants found in the areas to be excavated.

Upon completion of hazardous material excavation, personal protective equipment, when no longer required, as determined by the Engineer, shall be removed from the job site.

Preliminary Site Investigation

SUMMARY TABLE

SEISMIC RETROFIT OF THE WEST END OF THE SAN FRANCISCO - OAKLAND BAY BRIDGE

Zone (bgs)	Sample Depth (bgs)	Sample ID	Lead Concentration (mg/kg)	Classification
Pier W1& Pump Station				
0 to 7.6 m (0 to 25 feet)	5 feet	B1-5	15	**HAZARDOUS**
		B2-5	48	
		B3-5	560 {<0.2}	
		B4-5	160 (7.9)	
		B5-5	55 (11)	
		B6-5	190 (<0.2)	
	10 feet	B1-10	23	
		B2-10	140 (8.1)	
		B3-10	190 (13)	
		B4-10	640 (7.5) {3.0}	
		B5-10	1000 {<0.2}	
		B6-10	560 (23)	
	15 feet	B1-15	19	
		B2-15	150 (15)	
		B3-15	230 (33)	
		B4-15	62 (1.1)	
		B5-15	1400	
		B6-15	75 (1.9)	
	20 feet	B1-20	34	
		B2-20	810 {0.6}	
		B3-20	430	
		B5-20	24	
		B6-20	410 (14)	
	25 feet	B1-25	22	
		B2-25	6.1	
		B3-25	15	
		B4-25	23	
		B5-25	71 (<0.2)	
		B6-25	110	

7.6 to 12.8+ m (25 to 42+ feet)	30 feet	B1-30	6.7	**NON-HAZARDOUS**
		B2-30	6.7	
		B3-30	7.8	
		B4-30	12	
		B5-30	8.1	
		B6-30	15	
	35 feet	B2-35	38	
		B6-35	12	
	40 feet	B2-40	34	
		B6-40	4.6	
	42 feet	B2-42	21	
		B6-42	5.1	
Bent A				
0 to 6.1 m (0 to 20 feet)	5 feet	B11-5	79 (8.2)	**HAZARDOUS**
		B12-5	170 (5.1)	
		B13-5	98 (4.1)	
		[redacted]	8	
	10 feet	B11-10	1100	
		[redacted]	36	
		B13-10	94 (4.6)	
		[redacted]	32	
	15 feet	B11-15	170 (2.1)	
		[redacted]	52 (5.9)	
		B13-15	340	
		[redacted]	440 (15)	
	20 feet	B11-20	79 (4.5)	
		[redacted]	33	
		B13-20	35	
		[redacted]	12	
6.1 to 10.7+ m (20 to 35+ feet)	25 feet	B11-25	1	**NON-HAZARDOUS**
		[redacted]	1	
		B13-25	34	
		[redacted]	3	
	30 feet	B11-30	20	
		[redacted]	1	
		B13-30	2	
		[redacted]	2.7	

	35 feet	B12-35	3	
		B13-35	1	
		[redacted]	<1.0	
Bent B				
0 to 4.6 m (0 to 15 feet)	5 feet	B7-5	64 (12)	**HAZARDOUS**
		B8-5	23,000	
		B9-5	75 (4.2)	
		B10-5	17	
	10 feet	B7-10	5	
		B8-10	48	
		B9-10	97 (3.7)	
		B10-10	220 (10)	
	15 feet	B7-15	5.4	
		B8-15	37	
		B9-15	19	
		B10-15	59 (<0.2)	
4.6 to 10.6+ m (15 to 35+ feet)	20 feet	B7-20	51 (0.9)	**NON-HAZARDOUS**
		B8-20	8.4	
		B9-20	4.5	
		B10-20	89 (0.5)	
	25 feet	B7-25	71 (1.8)	
		B8-25	100 (4.7)	
		B9-25	2.8	
		B10-25	1.1	
	30 feet	B7-30	1.8	
		B8-30	3	
		B9-30	3.2	
		B10-30	1.9	

35 feet	B7-35	<1.0	
	B8-35	4.3	
	B9-35	5.6	
	B10-35	3	

Notes:

<0.01 = not detected at or above the laboratory detection limits

ND = Not Detected at or above the laboratory detection limits

(3.3) = Soluble concentration after a waste extraction test (WET), presented in milligrams per liter (mg/l)

{3.3} = Soluble concentration after a toxicity characteristic leaching procedure (TCLP), presented in mg/l

Hazardous: Concentration classified as hazardous waste under California Code of Regulations (Title 22)

The Contractor shall dispose of all hazardous material removed by trenching conducted by Pacific Bell. Removing hazardous material trenched by Pacific Bell will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

MEASUREMENT AND PAYMENT.--Full compensation for loading, transporting, and disposing of hazardous material shall be considered as included in the contract price paid per cubic yard for structure excavation (Type DH) and no additional compensation will be allowed therefor.

10-1.24 MODIFY WATER AND AIR LINES (BRIDGE)

Modify water and air lines shall consist of modifying water lines, air lines, removing Bent A wash rack system and installing a tank truck filler station.. Water and air lines shall be of the size shown and shall conform to the details shown on the plans, the provisions in Section 20-5, "Irrigation Systems," of the Standard Specifications and these special provisions.

Working drawings.--The Contractor shall submit complete working drawings to the Office of Structure Design, Documents Unit, P.O. Box 942874, Sacramento, CA 94274-0001 (1801 30th Street, Sacramento, CA 95816), telephone (916) 227-8230, in accordance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications.

The working drawings shall show the temporary support of the water and air lines and shall be supplemented by manufacturer's descriptive data, performance data and installation instructions for the following:

Pipe and fittings
Air hose coupler
Gate valve
Ball valve
Vacuum breaker
Extension piece
Flexible hose
Valve box

For initial review, 5 sets of drawings shall be submitted. After review, between 6 and 12 sets, if requested by the Engineer, shall be submitted to the said Office for final approval and use during construction.

MATERIALS:--

Pipe and fittings for water and air line.--Pipe and fittings for water and air line shall be schedule 40 galvanized steel pipe conforming to ASTM Designation: A 53 or A 106, with 150-pound galvanized malleable iron banded screwed fittings

and galvanized steel couplings. The weight of the zinc coating shall be not less than 90 percent of that specified in ASTM Designation: A 53.

Where shown on the plans, flanges shall be ANSI class 125.

Flexible hose.-- Flexible hose shall be PVC flat roll discharge type, synthetic reinforcing cord, and rated for 50 psi minimum. Hose nipple shall be 316 stainless steel, male NPT x hose shank. Hose clamps for flexible hose shall be stainless steel and rated for 50 psi minimum.

Gate valve.-- Gate valve shall be AWWA iron body with bronze trim, double disc, hub or rubber ring type, removable bonnet and non-rising stem, equipped with operating nut for below ground installations or oversize wheel above ground, 200-pound working pressure, and Tee handle wrench for each below ground valve. Valve shall be Mueller, A-2380; American Valve, Model 28; or equal.

Ball valve.-- Ball valve shall be two piece, minimum 400-pound WOG, stainless steel body and chrome plated or brass ball with full size port.

Vacuum breaker.--Vacuum breaker shall be 90 degree atmospheric type, brass body, threaded fittings, full size orifice, and silicone disk.

Pipe supports.--Pipe supports shall be channel type and shall be 1 5/8" x 1 5/8", 12-gage galvanized steel with 17/32 inch diameter bolt holes, 1 1/2 inches on center in the base of the channel. Clamps shall be 2 piece bolted with rubber isolator between pipe and clamp.

Anchor chair pipe supports shall be galvanized v-notched chair type with U-bolt, designed for anchoring pipe to structural members.

Pipe clamps shall be two piece, heavy duty, galvanized steel, with bolted connections on each side. Pipe clamps shall have sufficient space for extension piece. Extension piece shall be galvanized malleable iron, threaded rod end to be minimum 3/4 inch, width of pivot end to be 5/8 inch maximum.

Valve box.-- Valve box shall be precast high density concrete with polyethylene face and cast iron traffic rated cover marked "WATER," "GAS" or "CO-SS" as applicable. Extension shall be provided as required. Valve box shall be Christy, B3; Brooks Products Company, 3TL; Frazer, 3; or equal.

Structural Steel.--Miscellaneous structural steel, including plate, angle iron, and threaded rod shall conform to the provisions in Section 55, "Steel Structures," of the Standard Specifications. Miscellaneous nuts, bolts and related hardware shall be hot dip galvanized, ASTM Designation: A 325.

INSTALLATION:--

Water and air lines on bridge structures shall be supported as shown on the plans and in conformance with these special provisions.

Water and air main lines shall be capped as soon as branch lines are removed. Each 4-inch or 6-inch main line may be depressurized a maximum of 5 days (total) for removal of all branch lines and a maximum of 5 days (total) during installation of all new branch lines. The days may be taken concurrently.

Water and air main lines shall be fitted with caps or plugs such that the main lines can be re-energized to provide compressed air or water to other portions of the bridge.

Cleaning and closing of 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.

Thrust blocks.--Thrust blocks shall be placed at all underground changes of direction and shall be formed by pouring concrete between pipe and trench wall. Thrust blocks shall be sized and so placed as to take all thrusts created by maximum internal water pressure. Rebar shall be #4 minimum and shall be looped around the fitting.

Exterior valves.--Exterior valves located underground shall be installed in a valve box marked "Water" or “Air” as appropriate. Extensions shall be provided as required.

TESTING.--

Water and air lines less than 12-inch diameter shall be tested in accordance with the provisions in Section 20-5.03H(1), "Method A," of the Standard Specifications, except that the initial testing period shall be 4 hours minimum with no leakage or pressure drop.

The Contractor shall furnish and remove temporary pipe anchorages, if required, to resist thrust forces during testing. All leaks shall be repaired and all defective materials shall be replaced by the Contractor at his expense.

Branch lines shall be tested individually from ball valve to upper deck outlet. Main lines and those portions of the branch lines upstream of the ball valve shall be tested as a whole or in sections.

MEASUREMENT AND PAYMENT.--The contract lump sum price paid for modify water and air line (bridge) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all work involved in modifying water lines, air lines, removing Bent A wash rack system and installing a tank truck filler station, complete in place, as shown on the plans, and as specified in these specifications and the special provisions, and as directed by the Engineer.

Full compensation for removing piping, equipment, curbing, and strip drainage; furnishing and installing pipe, pipe supports, steel hangers, and other fittings, concrete supports, testing and checking, shall be considered as included in the contract lump sum price paid for modify water and air line (bridge) and no additional compensation will be allowed therefor.

10-1.25 AGGREGATE BASE

Aggregate base shall be Class 3 and shall conform to the provisions in Section 26, "Aggregate Bases," of the Standard Specifications and these special provisions.

The first paragraph of Section 26-1.02B, "Class 3 Aggregate Base," of the Standard Specifications is amended by adding the following sentences:

> Aggregate may include or consist of material processed from reclaimed asphalt concrete, portland cement concrete, lean concrete base, cement treated base, glass or a combination of any of these materials. Aggregate base incorporating reclaimed glass shall not be placed at locations where surfacing will not be placed over the aggregate base.

Said Section 26-1.02B is amended by adding the following paragraph:

> The grading of aggregate for Class 3 aggregate base shall, at the option of the Contractor, conform either to the grading specified in the special provisions or to either the 1 1/2-inch maximum or the 3/4 inch maximum grading for Class 2 aggregate base as provided in Section 26-1.02 A, "Class 2 Aggregate Base." Once a grading is selected, said grading shall not be changed without written approval of the Engineer.

Aggregate for Class 3 aggregate base shall conform to the following requirements:

Grading Requirements (Percentage Passing)

Sieve Sizes	3/4” Maximum		1 1/2” Maximum	
	Operating Range	Contract Compliance	Operating Range	Contract Compliance
2”	------	------	100	100
1 1/2”	------	------	90-100	87-100
1”	100	100	------	------
3/4”	90-100	87-100	50-85	45-90
No. 4	35-60	30-65	25-45	20-50
No. 30	10-30	5-35	10-25	6-29
No. 200	2-11	0-14	2-11	0-14

Except for the grading requirements all requirements pertaining to Class 2 aggregate base as given in Section 26-1.02A, "Class 2 Aggregate Base," of the Standard Specifications shall apply to Class 3 aggregate base.

The aggregate shall not be treated with lime, cement or other chemical material before the Durability Index test is performed. Untreated reclaimed asphalt concrete and portland cement concrete will not be considered to be treated with lime, cement or other chemical material for purposes of performing the Durability Index test.

10-1.26 ASPHALT CONCRETE

Asphalt concrete shall be Type A and shall conform to the provisions in Section 39, "Asphalt Concrete," of the Standard Specifications and these special provisions.

The last sentence of the first paragraph in Section 39-2.01, "Asphalts," of the Standard Specifications and the fifth, sixth, seventh and eighth paragraphs of Section 39-3.03, "Proportioning," of the Standard Specifications shall not apply.

The second paragraph in Section 39-3.05, "Asphalt Concrete and Asphalt Concrete Base Storage," of the Standard Specifications is amended to read:

> Storage silos shall be equipped with a surge-batcher sized to hold a minimum of 4,000 pounds of material. A surge-batcher consists of equipment placed at the top of the storage silo which catches the continuous delivery of the completed mix and changes it to individual batch delivery and prevents the segregation of product ingredients as the completed mix is placed into storage. The surge-batcher shall be center loading and shall be thermally insulated or heated or thermally insulated and heated to prevent material buildup. Rotary chutes shall not be used as surge-batchers.
>
> The surge-batcher shall be independent and distinct from conveyors or chutes used to collect or direct the completed mixture being discharged into storage silos and shall be the last device to handle the material before it enters the silo. Multiple storage silos shall be served by an individual surge-batcher for each silo. Material handling shall be free of oblique movement between the highest elevation (conveyor outfall) and subsequent placement in the silo. Discharge gates on surge-batchers shall be automatic in operation and shall discharge only after a minimum of 4,000 pounds of material has been collected and shall close before the last collected material leaves the device. Discharge gate design shall prevent the deflection of material during the opening and closing operation.

The amount of asphalt binder to be mixed with the aggregate for Type A asphalt concrete will be determined by the Engineer in accordance with California Test 367 using the samples of aggregates furnished by the Contractor in conformance with Section 39-3.03, "Proportioning," of the Standard Specifications.

The amount of asphalt binder used in asphalt concrete placed in dikes shall be increased one percent by weight of the aggregate over the amount of asphalt binder determined for use in asphalt concrete placed on the traveled way.

Aggregate for asphalt concrete dikes shall conform to the 3/8 inch maximum grading as specified in Section 39-2.02, "Aggregate," of the Standard Specifications.

If the finished surface of the asphalt concrete on the city street traffic lanes and on the parking lots 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), (2) removal and replacement, or (3) placing an overlay of asphalt concrete. The method will be selected by the Engineer. The corrective work shall be at the Contractor's expense.

If abrasive grinding is used to bring the finished surface to 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 4 paragraphs in Section 42-2.02, "Construction," of the Standard Specifications.

10-1.27 PORTLAND CEMENT CONCRETE BASE

Portland cement concrete base shall conform to the provisions for concrete pavement in Section 40, "Portland Cement Concrete Pavement," of the Standard Specifications and these special provisions.

The concrete for concrete base shall contain a minimum of 517 pounds of portland cement per cubic yard.

Weakened plane joints shall be constructed at 30-foot intervals.

If the Contractor elects to place 2-lane monolithic base, a longitudinal joint will not be required in the center of such base.

Concrete shall be spread and shaped by any suitable powered finishing machines, supplemented by hand work as necessary. Consolidation of such concrete shall be performed by means of high-frequency internal vibrators within 15 minutes after it is deposited on the subgrade. Vibrating shall be performed with care and in such manner as to assure adequate consolidation across the full paving width. Use of vibrators for extensive shifting of the mass of concrete will not be permitted. Methods of spreading, shaping and compacting that result in segregation, voids or rock pockets, shall

be discontinued, and the Contractor shall adopt methods which will produce dense homogeneous base conforming to required cross section.

The finished surface shall not vary more than 0.02-foot from the undersurface of a 12-foot straightedge placed parallel with the center line.

Except as above provided, the finishing provided in Sections 40-1.09, "Preliminary Finishing," and 40-1.10, "Final Finishing," of the Standard Specifications will not be required for the concrete base, but in lieu thereof, the surface of the base shall be broomed with a heavy broom to produce a uniform, rough surface. The surface shall not be broomed until the concrete has set sufficiently as determined by the Engineer.

Curing shall commence as soon as free water leaves the surface of the concrete base, but not later than 3 hours following the depositing of the concrete base on the subgrade.

The base shall be cured by applying either RS1 type or SS1 type asphaltic emulsion applied in conformance with the provisions in Section 94, "Asphaltic Emulsions," of the Standard Specifications. The curing seal shall be applied at a rate between 0.15- and 0.25-gallon per square yard of surface. The exact rate of application will be determined by the Engineer. Any areas of the curing seal that are damaged shall be covered immediately with additional seal by the Contractor at his expense. The curing seal shall be allowed to remain on the base to serve as paint binder when surfacing is placed thereon.

Portland cement concrete base will be measured and paid for by the cubic yard in the same manner specified for concrete pavement as provided for in Sections 40-1.13, "Measurement," 40-1.135, "Pavement Thickness," and 40-1.14, "Payment," of the Standard Specifications.

Full compensation for furnishing and applying curing seal, as specified herein, will be included in the contract price per cubic yard paid for portland cement concrete base and no additional payment will be allowed therefor.

10-1.28 CONCRETE STRUCTURES

Portland cement concrete structures shall conform to the provisions in Section 51, "Concrete Structures," of the Standard Specifications and these special provisions.

GENERAL.--

Formlines of exposed concrete surfaces shall match in general the formlines of exposed existing concrete surfaces.

The Contractor shall provide protective devices such as tarpaulins, screens, covers or other means, as necessary, to control dust and prevent damage to the work and to other property or persons from all concrete structure operations.

Shotcrete shall not be used as an alternative construction method for reinforced concrete members unless otherwise specified.

The first sentence of the tenth paragraph in Section 51-1.05, “Forms,” of the Standard Specifications is amended to read:

> Form panels for exposed surfaces shall be plywood conforming to or exceeding the requirements of U.S. Product Standard PS 1 for Exterior B-B (Concrete Form) Class I Plywood or any material which will produce a smooth uniform concrete surface substantially equal to that which would result from the use of such plywood.

The third paragraph in Section 51-1.15, "Drains in Walls," of the Standard Specifications is amended to read:

> In addition to the drain holes and weep holes specified in the preceding paragraph, holes approximately 3 inches in diameter for relief of hydrostatic pressure shall be provided at the bottom of walls, immediately above the footing, at approximately 15-foot centers.

The second paragraph in Section 51-1.22, "Measurement," of the Standards Specifications is amended to read:

> The estimated quantity of concrete for minor structures designated as final pay in the Engineer's Estimate will not be revised as specified in Section 91.015, "Final Pay Items," of the Standard Specifications, when the constructed height of said minor structure, including revisions by the Engineer, is within 0.5-foot of the vertical dimension shown on the plans.

When a roughened concrete surface is shown on the plans, the existing concrete surface shall be roughened to a full amplitude of approximately 1/4-inch by abrasive blasting, water blasting or mechanical equipment.

MEASUREMENT AND PAYMENT.--Measurement and payment for concrete in structures shall conform to the provisions in Sections 51-1.22, "Measurement," and 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 1/4-inch, where shown on the plans, shall be considered as included in the contract price paid per cubic yard for structural concrete, bridge and no separate payment will be made therefor.

San Francisco standard catch basins will be measured and paid for as Class A concrete (minor structure) and will be determined as units from actual count.

The contract unit price paid for Class A concrete (minor structure) shall include full compensation for furnishing all labor, materials (excluding the frame and cover), tools, equipment, and incidentals and for doing all the work involved constructing San Francisco standard catch basin, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.29 MINOR CONCRETE (PIPE COVER)

Concrete for Minor Concrete (Pipe Cover) shall conform to the provisions in Section 90-10, "Minor Concrete," of the Standard Specifications and these special provisions.

Minor concrete shall contain not less than 658 pounds of cement per cubic yard.

Calcium chloride conforming to the provisions of Section 90-4.04 of the Standard Specifications shall be added to the minor concrete (pipe cover).

The concrete shall be placed in the trench against undisturbed material at the sides of the trench. Foreign material which falls into the trench, prior to or during placing of the concrete, shall be immediately removed. Where necessary, earth plugs shall be constructed and compacted at the ends of the planned concrete to contain the concrete within the trench.

The surface of the minor concrete (pipe cover) shall be broomed with a heavy broom to produce a uniform rough surface.

Minor concrete (pipe cover) shall be placed and compacted without segregation and the finished surface shall not vary more than 0.05-foot above or below the grade established by the Engineer.

Minor concrete (pipe cover) shall be cured by applying SS1 type asphaltic emulsion applied in conformance with the provisions in Section 94, "Asphaltic Emulsions", of the Standard Specifications. The curing seal shall be applied at a rate between 0.15- and 0.25-gallon per square yard of surface. The exact rate of application will be determined by the Engineer. Any areas of the curing seal that are damaged shall be covered immediately with additional seal by the Contractor at his expense. The curing seal shall be allowed to remain on the minor concrete (pipe cover) to serve as a paint binder when surfacing is placed thereon.

Minor concrete (pipe cover) will be measured and paid for by the cubic yard in the same manner specified for minor concrete (backfill) in Section 65-1.10, "Payment," of the Standard Specifications.

Full compensation for curing seal and calcium chloride shall be considered as included in the contract price paid per cubic yard for minor concrete (pipe cover) and no separate payment will be made therefor.

10-1.30 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.

Epoxy-coated reinforcing steel dowels shall conform to the provisions for bar reinforcement in "Epoxy-Coated Reinforcement" of these special provisions.

If reinforcement is encountered during drilling, before specified depth is attained, the Engineer shall be notified. Unless the Engineer approves coring through the reinforcement, the hole will be rejected and a new hole, in which reinforcement is not encountered, shall be drilled adjacent to the rejected hole to the depth shown on the plans.

The Contractor shall provide protective devices such as tarpaulins, screens, covers or other means, as necessary to control dust and prevent damage to the work and to other property or persons from all concrete structure operations.

Unless otherwise provided, dowels to be bonded into drilled holes will be paid for as bar reinforcing steel (epoxy-coated) (bridge).

Unless otherwise provided, drilling and bonding dowels will be measured and paid for by the linear foot determined by the number and the required depth of holes as shown on the plans, or as ordered by the Engineer.

The contract price paid per linear foot for drill and bond dowel shall include full compensation for furnishing all labor, materials (except reinforcing steel dowels), tools, equipment, and incidentals, and for doing all the work involved in drilling the holes, coring through reinforcement when approved by the Engineer, providing protective cover and bonding

the dowels, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.31 CORE CONCRETE

Coring concrete shall consist of coring holes through concrete bridge members as shown on the plans and in conformance with the requirements in these special provisions.

For cored holes greater than 10 feet in length, the following shall apply:

Prior to coring, the Contractor shall submit, in accordance with Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications, the methods and equipment to be used in the coring operations.

The deviation in alignment of cored holes from that shown on the plans shall not be more than 1/2 inch per 10 feet of cored hole length with a maximum deviation of not more than 3 inches.

Difficult coring is anticipated due to the presence of vertical reinforcement.

The holes shall be cored by methods that will not shatter or damage the concrete adjacent to the holes.

Water for core drilling operations shall be from the local domestic water supply or shall not contain more than 1,000 parts per million of chlorides as Cl, nor more than 1,300 parts per million of sulfates as SO_4, nor shall it contain any impurities in a sufficient amount to cause discoloration of the concrete or produce etching of the surface.

Water from core drilling operations shall not be permitted to fall into the bay, or on public traffic, to flow across shoulders or lanes occupied by public traffic, or to flow into gutters or other drainage facilities.

10-1.32 CORE AND BOND DOWELS

Coring 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.

Epoxy-coated reinforcing steel dowels shall conform to the provisions for bar reinforcement in "Epoxy-Coated Reinforcement" of these special provisions.

The holes shall be cored by methods that will not shatter or damage the concrete adjacent to the holes.

For cored holes greater than 10 feet in length, the following shall apply:

Prior to coring, the Contractor shall submit, in accordance with Section 5-10.2, "Plans and Working Drawings," of the Standard Specifications, the methods and equipment to be used in the coring operations.

The deviation in alignment of cored holes from that shown on the plans shall not be more than 1/2 inch per 10 feet of cored hole length with a maximum deviation of not more than 3 inches.

Water for core drilling operations shall be from the local domestic water supply or shall not contain more than 1,000 parts per million of chlorides as Cl, nor more than 1,300 parts per million of sulfates as SO_4, nor shall it contain any impurities in a sufficient amount to cause discoloration of the concrete or produce etching of the surface.

Water from core drilling operations shall not be permitted to fall on public traffic, to flow across shoulders or lanes occupied by public traffic, or to flow into gutters or other drainage facilities.

Unless otherwise provided, dowels to be bonded into cored holes will be paid for as bar reinforcing steel (epoxy-coated) (bridge).

Coring concrete and bonding dowels will be measured and paid for by the linear foot as core and bond dowel of the sizes listed in the Engineer's Estimate. The cored concrete will be measured along the centerline of the hole without deduction for expansion joints.

The contract price paid per linear foot for core and bond dowel shall include full compensation for furnishing all labor, materials (except reinforcing steel dowels), tools, equipment, and incidentals, and for doing all the work involved in coring the holes, and bonding the dowels, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.33 CORE AND PRESSURE GROUT DOWELS

Coring and pressure grouting dowels shall consist of coring holes through concrete, placing dowels, and filling the holes with pressurized grout, as shown on the plans and in conformance with the requirements in these special provisions.

Dowels to be placed in the cored holes shall conform to the provisions for high strength threaded rods in "Miscellaneous Metal (Bridge)" elsewhere in these special provisions.

Dowels to be pressure grouted in cored holes will be paid for as miscellaneous metal (bridge).

The holes shall be cored by methods that will not shatter or damage the concrete adjacent to the holes.

For cored holes greater than 10 feet in length, the following shall apply:

Prior to coring, the Contractor shall submit, in accordance with Section 5-10.2, "Plans and Working Drawings," of the Standard Specifications, the methods and equipment to be used in the coring operations.

The deviation in alignment of cored holes from that shown on the plans shall not be more than 1/2 inch per 10 feet of cored hole length with a maximum deviation of not more than 3 inches.

Water for core drilling operations shall be from the local domestic water supply or shall not contain more than 1,000 parts per million of chlorides as Cl, nor more than 1,300 parts per million of sulfates as SO_4, nor shall it contain any impurities in a sufficient amount to cause discoloration of the concrete or produce etching of the surface.

Concrete areas and steel surfaces to be in contact with the grout shall be cleaned of all loose or foreign material that would in any way prevent bonding, and concrete holes shall be flushed with water and allowed to dry to a surface dry condition immediately prior to grouting.

Grout shall conform to the requirements of either ASTM Designation: C 1107, Grade B, or ASTM Designation: C 845, Type K, and shall provide a minimum compressive strength of 5000 pounds per square inch at 28 days when tested by California Test 551. The grout shall be mixed in accordance with the manufacturer's recommendations. Water shall comply with the provisions for water for prestressed concrete work as specified in Section 90-2.03, "Water," of the Standard Specifications.

Admixtures shall not contain more than 500 parts per million of chlorides as Cl, when tested by California Test 422, and shall not contain more than 2000 parts per million of sulfates as SO_4, when tested by California Test 417.

After dowel placement, the ends of the cored hole containing the dowel shall be sealed. A vent tube shall be placed at one end and one injection feed tube at the other end. The vent tube and injection feed tube shall be placed in the same end for cored holes that have only one end. The tubes shall be placed in the hole in a manner which will allow the air to vent and the hole to be completely filled with grout. Sufficient pressure shall be achieved to ensure that the hole is free of voids. Grout shall be pumped into the holes and continually wasted until no visible slugs or other visible evidence of water or air are ejected.

Grout or water shall not be permitted to flow into any waterway, on to public traffic, across shoulders or lanes occupied by public traffic, or into gutters or other drainage facilities.

Coring and pressure grouting dowels will be measured and paid for by the linear foot. The cored concrete will be measured along the centerline of the hole.

The contract price paid per linear foot for core concrete and pressure grout shall include full compensation for furnishing all labor, materials, except dowels, tools, equipment, and incidentals, and for doing all work involved in coring the holes, and pressure grouting the holes, including control of water from core drilling, as shown on the plans, as specified in these special provisions, and as directed by the Engineer.

10-1.34 FURNISH SEISMIC ISOLATION BEARING

Furnish seismic isolation bearing shall consist of furnishing prototype, production and replacement bearings designed, fabricated, transported to and from the testing facility, and temporarily stored prior to delivery to the job-site or final storage location, in conformance with the details and requirements shown on the plans and specified in these special provisions, and as shown on the approved working drawings.

GENERAL.--Attention is directed to "Progress Schedule (Critical Path)," "Order of Work," "Install Seismic Isolation Bearing," and "Steel Structures" elsewhere in these special provisions.

Prototype bearings shall be tested as specified in "Prototype and Proof Testing" elsewhere in these special provisions.

Production bearings are defined as those bearings that are installed in the structure as part of this contract.

The replacement bearing shall be as specified in "Replacement Bearing" elsewhere in these special provisions.

FRICTION PENDULUM BEARINGS.—Friction pendulum bearings are the only bearings known to the State that can meet the requirements and time constraints of this contract.

Friction pendulum bearings shall be as detailed on the plans, as specified in "Materials and Fabrication" elsewhere in these special provisions, and generally described as follows:

Friction pendulum bearings consist of an articulated slider which slides along a stainless steel concave cylindrical surface. The articulated slider is semi-spherical in shape with a convex cylindrical surface, which matches the stainless steel concave cylindrical sliding surface, and an opposing convex spherical surface that allows articulation in its housing. A self-lubricating bearing liner material is bonded to the sliding surface of the articulated slider and to its housing.

The manufacturer shall provide bolt holes, and a method for future viewing of the interior bearing surfaces. The bearing shall be assembled at the factory and suitable temporary keeper plates shall be provided so that the entire assembly is shipped as a unit and remains intact when un-crated and installed.

Friction pendulum bearings shall be substantially manufactured as complete units by the manufacturer of the bearing, including all required components.

Friction pendulum bearings are manufactured and supplied by Earthquake Protection Systems, Incorporated (EPS). Preliminary working drawings have been submitted for the friction pendulum bearings by EPS that have been reviewed and determined to be satisfactory by the Engineer.

The address and phone number for Earthquake Protection Systems, Incorporated is as follows:

Earthquake Protection Systems, Incorporated
2801 Giant Road, Bldg A
Richmond, CA 94806
Attention: Victor Zayas
(510) 232-5993
Fax: (510) 232-6577

Earthquake Protection Systems, Incorporated has agreed to furnish the friction pendulum bearings and other services described in these special provisions at the guaranteed price of $53,000 per bearing.

The bearing price includes design and fabrication of prototype, production, and replacement bearings; and transporting bearings to and from the designated testing facility and interim storage site; all as specified elsewhere in these special provisions. The bearing price also includes special inspection by a qualified representative of the manufacturer at the job-site during installation of all bearings, and final inspection by the manufacturer of installed bearings.

The bearing price does not include prototype and proof testing of bearings; furnishing materials and fabricating adapter plates to facilitate testing at the SRMD testing facility; delivery of the production and replacement bearings to the Contractor's on-site storage, to the job-site or to the final storage location from the interim storage site; or installation of the bearings, including furnishing and installing anchorage components and associated installation hardware.

Prototype and proof testing will be performed by the State independent of this contract as specified in the "Prototype and Proof Testing" section of these special provisions.

The above price includes sales taxes and will be guaranteed for orders placed with EPS on or before January 1, 2000, provided delivery for proof testing is accepted on or before June 1, 2001. The total price will be increased 5 percent for orders placed with EPS on or before January 1, 2001, provided delivery for proof testing is accepted on or before June 1, 2002.

Use of friction pendulum bearings is contingent on approval of the contract specific working drawing submittal and successful performance of the bearings under prototype and proof testing.

Development of the working drawings submittal will be at the Contractor’s expense.

The Contractor and bearing manufacturer shall verify the controlling field dimensions and shall be responsible for adjusting dimensions of the work to fit existing conditions in conformance with the requirements in "Existing Highway Facilities" of these special provisions.

WORKING DRAWINGS SUBMITTAL.-- The Contractor shall submit complete working drawings for the bearings to the Office of Structure Design, Documents Unit, P.O. Box 942874, MS #9, Sacramento, CA 94274-0001 (1801 30th Street, Sacramento, CA 95816), Phone (916) 227-8230 in accordance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. For initial review, 6 sets of drawings shall be submitted. After review, between 6 and 12 sets, as requested by the Engineer, shall be submitted to the Office for final approval and use during construction.

Working drawings shall be 11" x 17" in size and each drawing and calculation sheet shall include the State assigned designations for the contract number, bridge number, full name of the structure as shown on the contract plans, and District-County-Route-Post mile. The name of the manufacturer of the bearings, address, and phone number shall be shown on the working drawings. Each sheet shall be numbered in the lower right hand corner and shall contain a blank space in the upper right hand corner for future contract sheet numbers. All drawings, written documentation and supplemental calculations shall be provided in English, including units of measure.

The working drawings shall contain all information required for verification of the design and quality assurance of the manufacture of the bearings, including details for mounting to the structure, but excluding proprietary information. The working drawings shall be supplemented with a quality control program and with a certified copy of the results of all prototype tests performed on the bearings. The working drawings shall be supplemented with a fully defined performance hysteresis loop, calculations for the bearing, and the manufacturer's commentary. Each working drawing or calculation sheet shall be signed by an Engineer who is registered as a Civil or Mechanical Engineer in the State of California.

The working drawings and supplements shall be submitted in 2 parts within the following time limits:

ITEMS	TIME LIMIT
PART 1: Working drawings, including proposed fully defined hysteresis loop, supplemental calculations, supplemental commentary, lateral stiffness under non-seismic lateral loads, initial vertical displacement under service loads, long-term vertical displacement under service loads, proof of 1 year satisfactory bearing system service at 3 major structures, and a preliminary quality control program.	Within 3 weeks after contract award.
PART 2: A certified copy of all prototype test results performed as specified in "Prototype and Proof Testing" of these special provisions, samples of the self-lubricating liner material as specified in "Materials and Fabrication" of these special provisions, a revised quality control program, and an inspection and maintenance manual.	Within 50 weeks after contract award.

The Contractor shall allow 3 weeks following the complete submittal of Part 1 for the Engineer's review and approval of the working drawings and supplements.

The Contractor shall not start fabrication of prototype and production bearings until the Engineer has reviewed and approved the submittal of Part 1.

The Contractor shall allow 3 weeks following the complete submittal of Part 2 for the Engineer's review and approval.

The time limit for delivery of Part 2 of the working drawings and the delivery of the bearings will be extended if, in the opinion of the Engineer, either of the following conditions occurs:

1. The Engineer fails to review the complete submittal of Part 1 of the working drawings within the time frame specified above.

A. The testing and review and approval of test results meets any of the following conditions:

A. The SRMD test facility is not available to perform prototype and proof testing within in time required to meet the specified time limit.

B. The prototype or proof testing is not completed within the time specified in "Prototype and Proof Testing" of these special provisions.

C. The Engineer fails to review and approve prototype or proof test results within the time specified in "Prototype and Proof Testing" of these special provisions.

The bearing manufacturer shall have satisfied the requirement of notifying the SRMD facility 21 calendar days in advance of shipping the bearings for testing in order for a time extension to be granted.

The time extension will be determined by the Engineer and will be commensurate with the delay incurred to the bearing manufacturer in meeting the specified time limit.

Working drawings, supplemental calculations and commentary for the bearings shall contain all information required for verification of the design and quality assurance of the manufacture of the bearings, excluding proprietary information.

Working drawings shall include, but not limited to, the following:

1. Full details of the bearing, consisting of non-proprietary material properties and dimensions of bearing structural components and wind locks.
2. Recommended welding procedures and weldability analysis for all welded materials.
3. Information on the initial vertical displacement and long-term vertical displacement under anticipated service loading, and design lateral displacement due to seismic loading.
4. Complete list of the components that will be permanently deformed during prototype or proof testing with calculations showing the anticipated stress and displacement in the components at each increment of the maximum design lateral displacement.

Supplemental calculations and commentary to the working drawings shall include, but not limited to, the following:

1. A proposed fully defined performance hysteresis loop for the bearing.
2. Analysis using bearing design criteria shown on the plans, for the design of the bearing. The analysis results shall include, but not limited to, the anticipated energy dissipated per cycle (EDC), fully defined hysteresis loop, effective and restoring bearing stiffness, bearing yield point or break-away and dynamic friction coefficients, curvature of concave surfaces, maximum design lateral displacement, maximum design lateral force transmitted through the bearing, and associated downward loads.
3. Calculations or statements to support the manufacturer's design of the following material components of the bearing. Calculations and statements shall relate to pressure, velocity, displacement, surface temperature during excitation, and total energy dissipated.

    a) Thickness of Type B self-lubricating bearing liner to be used on the slider.
    b) Thickness of Type B self-lubricating bearing liner to be used on the articulated slider housing.
    c) Criteria for selecting thickness of stainless steel surfaces of the spherical concave surface opposing the articulated slider and articulating surface of the articulated slider.

A Quality Control Program for the bearings shall be submitted in Part 1 and Part 2 of the working drawing submittal. The Quality Control Program submitted in Part 2 of the working drawing submittal shall reflect revisions based on the results of prototype testing. Each Quality Control Program shall include descriptions, details and procedures for the following:

1. Certificates of compliance in accordance with Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for all structural materials used in the bearings.
2. Schedule identifying the dates for submittal of working drawings and supplements (Part 1 and Part 2), delivery of production and replacement bearings for proof testing, and availability of production and replacement bearings for the Contractor's transportation to the on-site storage facility or final storage location. This schedule is to be identified in the CPM progress schedule in accordance with "Progress Schedule (Critical Path)" elsewhere in these special provisions.
3. Methods and equipment for handling, storage, and delivery of each bearing.
4. Handling instructions and precautions, including methods for protection of production bearings from heat and debris during installation and methods of protection for the replacement bearing in the final storage location, or other conditions that may affect the bearing performance.
5. Tolerances on bearing external and structural dimensions, alignment, and allowable working stresses.
6. Tolerances on material properties including, but not limited to, break-away friction and dynamic friction coefficients or yield point, modulus of elasticity and other properties related to bearing performance.

The bearing shall be designed to satisfy the seismic isolation bearing design criteria for the loading conditions, maximum allowable lateral forces, and displacements, and maximum energy dissipated per cycle (EDC_{max}) shown on the plans. The design of the bearing shall be supplemented with a proposed fully defined performance hysteresis loop, design lateral force, design lateral displacement, design downward seismic load, design EDC per bearing, and design period of vibration. The bearing design shall be confirmed by the certified prototype test results for the bearing. In addition, if the plans or these special provisions indicate limiting parameters for a bearing, the bearing shall conform to those parameters.

Each shipment of bearings shall be accompanied by a Certificate of Compliance as provided in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications. The certificate shall include a statement that the bearings conform to the prequalified design and material requirements and were manufactured in accordance with the approved quality control program. The certificate shall include a copy of the results of all the proof tests performed on the bearing and its materials.

The Contractor shall notify the Engineer in writing at least 14 days prior to start of bearing fabrication.

Within 3 weeks after final working drawing approval, one set of good quality corrected reduced prints on 20 pound (minimum) bond paper (11" x 17" in size) of all working drawings prepared by the bearing manufacturer, shall be furnished to the Office of Structure Design, Documents Unit.

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.

No bearing shall be installed until the Engineer has reviewed and approved, in writing, the working drawings, the prototype testing, and the proof testing of the bearing to be used.

Should the Engineer fail to review the complete working drawing submittals within the times specified and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in reviewing the working drawing submittal, the delay will be considered a right of way delay as specified in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

INSPECTION AND MAINTENANCE MANUAL.--The Contractor shall submit 6 copies of the inspection and maintenance manual for review and approval by the Engineer with Part 2 of the working drawings submittal. The inspection and maintenance manual shall include the following:

1. Inspection requirements for the bearings, including the following: 1) the method and recommended frequency of inspection; 2) list of all parts to be inspected; 3) the specific observations to be made; 4) the methods for measuring wear or damage; and 5) the acceptable ranges of values for damage or wear tolerances of parts.
2. Maintenance requirements for the bearings, including the method and recommended frequency of maintenance.
3. The part replacement plans shall include procedures for replacing worn out or damaged parts.
4. Contacts and telephone numbers for maintenance and inspection questions.

Within 3 weeks after final inspection and maintenance manual approval, 4 bound copies of the manual shall be furnished to the Engineer.

MATERIALS AND FABRICATION.--The friction pendulum bearing system is a proprietary bearing system.

Structural Steel.--Structural steel material for the concave dish and housing plates of the bearing shall conform to ASTM Designation: A 36, or equivalent having minimum yield capacity of 36 ksi.

Other structural steel components shall conform to the requirements of “Steel Structures” elsewhere in these special provisions.

Surfaces designated on the plans to be milled to bear shall have a milled surface finish with a roughness value not exceeding 500, as defined in ANSI/ASME B46.1. The flatness of such surfaces shall be controlled so that, when a precision straight edge is laid across the surface, the maximum gap under the straight edge is less than 1/16-inch over the steel to steel bearing area.

Cleaning and Painting Steel.--Metal surfaces of bearings exposed to the atmosphere in the completed work, except stainless steel surfaces, shall be cleaned and painted prior to erection with inorganic zinc coating in accordance with the provisions in “Clean and Paint Structural Steel,” elsewhere in these special provisions and the following:

The color of the final application of inorganic zinc coating shall essentially match Federal Standard 595B No. 36373.

Finish coats will not be required on the bearings.

Painted surfaces damaged or burned during installation and all areas where mudcracking occurs in the inorganic zinc coating shall be blast cleaned and repainted with inorganic zinc coating to the specified thickness.

Bearing Surfaces.--The bearing shall use no added liquid or gel lubricants. The bearing liner shall be identified as Type B, or equivalent, having dynamic and wear characteristics required to meet the specified bearing performance, as determined by the Engineer. The thickness of the bearing liner shall be determined by the manufacturer in order to sufficiently meet the specified bearing performance criteria shown on the plans, but in no case shall be less than 0.06 inches.

In addition to the requirements elsewhere in these special provisions, the manufacturer of the friction pendulum bearings shall submit samples of the bearing liner material as follows:

1. Four samples from each lot of bearing liner material used to fabricate the prototype, production, and replacement bearings shall be submitted to the Transportation Laboratory. Samples shall be submitted at least 10 working days prior to the delivery of the prototype bearing to be tested, again at least 10 working days after prototype testing (Part 2 in "Working Drawing Submittal" section in these special provisions), and again at least 10 working days prior to the delivery of the production and replacement bearings to be proof tested.
2. Each sample shall be accompanied by a Certificate of Compliance conforming to the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications identifying the lot number of the liner and the bearings in which it was used.
3. Each sample shall measure one-inch square, unless otherwise proposed by the manufacturer and approved by the Engineer.

The infrared scan for the bearing liner material shall indicate that the material substantially matches the bearing liner material previously scanned by the Transportation Laboratory for the type of bearing liner submitted. Also, the infrared scan for the bearing liner material used for the production bearings shall indicate that the material substantially matches the bearing liner material used in successfully prototype tested bearings. If the infrared scan indicates that the bearing liner material does not substantially match the bearing liner material previously scanned, as determined by the Transportation Laboratory, bearings having such liner will be rejected. No payment will be made for rejected bearings.

Stainless steel sheet on the cylindrical concave surface opposing the articulated slider shall conform to the requirements of ASTM Designation: A 240, Type 316.

The articulated slider shall be stainless steel conforming to the requirements of ASTM Designation: Type 304, or of a type designation having equivalent yield strength, as approved by the Engineer.

Bonding the bearing liner to steel surfaces shall be as recommended by the bearing manufacturer. The bond of the bearing liner to steel surfaces shall be such that full bonding is retained through prototype and proof testing. After completion of the bonding operation the surface shall be smooth and free from bubbles, ripples, undulations or other imperfections.

The surfaces of the bearing elements shall be controlled such that upon completion of the bearing assembly, the bearing liner to stainless steel interface shall be in full contact when loaded in any position.

Damaged bearings and bearings with mating surface scratches exceeding a depth of 0.01 inches shall be returned to the factory for replacement or resurfacing.

The concave mating surface of the friction pendulum bearings shall be located at the top of the bearing.

Temporary Keeper Plates.--Temporary keeper plates shall be designed by the bearing manufacturer and shall conform to the following:

Keeper plates shall consist of structural steel shapes with high strength cap screws. High strength cap screws shall conform to the requirements of ASTM Designation: A 449, and shall be mechanically galvanized. Cap screws shall be tightened to a tension equal to 75 percent of the tension required for slip-critical connections as designated for ASTM A 325 bolts in the "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts," approved by the Research Council on Structural Connections of the Engineering Foundation.

Keeper plates shall be designed by the bearing manufacturer to resist at least the non-seismic lateral force shown on the plans.

STORAGE AND HANDLING.--The bearings shall be furnished with suitable temporary keeper plates. The bearing manufacturer shall transport the bearings to and from the testing facility and provide interim storage of the bearings until

delivery is scheduled to the Contractor's on-site storage facility or final storage location. The Contractor shall provide verification of placement of bearings in the storage facility or the final storage location to the Engineer at such time as each bearing or group of bearings is placed in the storage facility.

The Contractor shall provide an on-site storage facility for the bearings and shall transport the bearings from the manufacturer's interim storage to the on-site storage facility or the final storage location. The Contractor shall handle and store the bearings in conformance with the requirements outlined by the manufacturer in the approved working drawing submittal.

PROTOTYPE AND PROOF TESTING.--Prototype and proof testing will be performed by the State, independent of this contract, at the Powell Structural Research Laboratories located at the University of California, San Diego, using the Seismic Response Modification Device Test System (SRMD).

The Contractor shall notify the SRMD facility and the Engineer, in writing, at least 21 calendar days prior to shipment of seismic isolation bearings for prototype or proof testing. In addition, the Contractor shall coordinate with the SRMD facility, telephone (619) 822-3029, and make arrangements for drop-off and pick-up of the bearings. There is no interim storage available at the site of the SRMD facility.

The Contractor shall coordinate with the SRMD facility for the design and delivery of the adapter plates to be used to attach the bearings to the test apparatus in conformance with the following:

1. The design and working drawings for the adapter plates will be developed by SRMD in cooperation with the bearing manufacturer.
2. The bearing manufacturer shall deliver said plates to the SRMD testing facility within the time frame agreed upon between the SRMD and the bearing manufacturer.
3. After testing, all adapter plates will become the property of the State and shall remain at the SRMD facility.

Fabricating the adapter plates including furnishing all necessary labor, materials, tools, equipment and incidentals, except designing adapter plates (including working drawings) and delivering adapter plates to the SRMD facility, will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

Prototype and proof test specimens of seismic isolation bearing systems shall be conditioned for 12 hours at 65°±15° F. prior to testing, and the ambient temperature shall be maintained at 65°±15° F. during testing.

Prototype and proof tested seismic isolation bearings shall be permanently marked on 2 of 4 sides. The markings shall consist of production lot number, date of fabrication, design dead plus live load, weight of device, and contract number.

If applicable, components in any bearing system which are permanently deformed during prototype or proof testing shall be replaced with identical components prior to final installation or storage, as approved by the Engineer.

Should any component require replacement as a result of prototype or proof tests, the Contractor shall document such replacement. The Contractor shall submit documentation to the Engineer indicating which components are replaced prior to proof testing or final installation.

The Contractor shall allow 3 weeks for the SRMD facility to perform the prototype testing on each bearing. The Contractor shall allow one week for the SRMD facility to perform each seismic isolation bearing proof test. The Contractor shall coordinate the testing with the SRMD facility specifying the quantity of seismic isolation bearings needed at pre-set times to meet the construction schedule.

The Contractor shall allow 2 weeks following the completion of prototype testing for the Engineer's review and approval.

The Contractor shall allow 2 weeks following the completion of proof testing for the Engineer's review and approval.

Prototype Testing: A complete series of prototype tests shall be performed on at least two full-size bearings (each specimen shall be tested individually) in the presence of the Engineer, unless otherwise directed in writing, for the performance criteria shown on the plans and as defined in the approved working drawings and supplements. Any prototype test bearings that fail any of the required tests shall be rejected. For each cycle of tests, the load, displacement, rotation, and hysteretic behavior of the prototype specimen shall be continuously recorded.

The following prototype tests shall be performed in the sequence shown for the prescribed number of cycles, at 1.0 times the vertical dead load shown on the plans, unless otherwise specified:

Prototype Test 1--Breakaway. Apply static vertical load in the undisplaced position for 4 hours, follow with one fully reversed sinusoidal cycle at 1.0 times the Maximum Seismic Longitudinal Displacement. The velocity during the

first 0.25 inches of displacement shall not exceed 0.02 inches per second. The peak velocity shall be 2 inches per second or as directed by the Caltrans Testing Monitor.

Prototype Test 2--Thermal. Three fully reversed cycles at the lateral displacement corresponding to the Maximum Thermal Longitudinal Displacement shown on the plans. The peak velocity shall not exceed 0.02 inches per second.

Prototype Test 3--Wind and Braking. Twenty fully reversed cycles between limits of plus and minus the Non-seismic Lateral Force (Wind Load) shown on the plans for a total duration of not less than 40 seconds. After the cyclic testing, the maximum load shall be held for one minute. This test is to be conducted in the Transverse direction.

Prototype Test 4--Seismic #1. Three fully reversed sinusoidal cycles at each of the following multiples of the Maximum Seismic Lateral Displacement shown on the plans: 1.0, 0.25, 0.50, 0.75, 1.0 in this sequence. The peak velocity shall be 2 inches per second or as directed by the Caltrans Testing Monitor.

Prototype Test 5--Seismic #2. Three continuous fully reversed sinusoidal cycles at 1.0 times the Maximum Seismic Longitudinal Displacement shown on the plans. The peak velocity shall be the Peak Dynamic Testing Velocity shown on the plans.

Prototype Test 6--Seismic #3. Apply the Longitudinal displacement and axial load time history predicted by analysis, immediately followed by one fully reversed sinusoidal cycle at 1.0 times the Maximum Seismic Longitudinal Displacement at 1.0 times the vertical load DL as shown on the plans.

Prototype Test 7--Seismic #4. Three fully reversed sinusoidal cycles at 1.0 times the Maximum Seismic Longitudinal Displacement shown on the plans with an applied average lateral load of the Maximum Transverse Shear Force for Device shown on the plans. The peak velocity shall be 2 inches per second or as directed by the Caltrans Testing Monitor.

Prototype Test 8 --Stability. One fully reversed cycle of loading at 1.0 times the Maximum Seismic Longitudinal Displacement shown on the plans at 1.0 the vertical load combination of 1.2DL+1.0LL+1.0EQ. The DL, LL, and EQ loads are shown on the plans. The test shall be conducted at a velocity of 0.2 inches per second.

Prototype Test 9 --Seismic Performance Verification. Repeat Prototype Test 5.

Acceptance Criteria for Prototype Testing: A complete series of prototype tests shall be performed on at least two full-size bearings. Each bearing shall satisfy the acceptance criteria stated for all tests.

Restoring stiffness shall be measured from the best fit straight line determined by the "least- squares method".

The acceptance criteria for each test is as follows:

Prototype Test 1--Breakaway. The lateral force at breakaway shall not exceed the Maximum Seismic Longitudinal Force shown on the plans.

Prototype Test 2--Thermal. The lateral force shall not exceed 1.15 times the Maximum Thermal Longitudinal Force as shown on the plans.

Prototype Test 3--Wind and Braking. The bearing shall not displace more than the Non-Seismic Displacement shown on the plans.

Prototype Test 4--Seismic #1. The load displacement plots shall have a positive incremental lateral stiffness (incremental lateral load divided by incremental displacement). At each displacement increment specified (1.0, 0.25, 0.50, 0.75, 1.0) there shall be no more than a 15% change in the restoring stiffness between the first cycle and any subsequent cycle. For the cycles at 1.0 times the maximum seismic lateral displacement (D_T) the average of the restoring stiffnesses shall be within plus or minus 15% of the design value specified on the plans. The energy dissipated per cycle (EDC) for each cycle at 1.0 times the maximum seismic lateral displacement (D_T) shall not be greater than 115 % of the value of design EDC shown on the plans. The maximum lateral force resulting from the test shall not exceed 1.15 times the Maximum Seismic Longitudinal Force shown on the plans.

Prototype Test 5--Seismic #2. The load displacement plots shall have a positive incremental lateral stiffness (incremental lateral load divided by incremental displacement). There shall be no more than a 10% change in the restoring stiffness between the first cycle and any subsequent cycle. The average of the restoring stiffnesses shall be within plus or minus 15% of the design value specified on the plans. The energy dissipated per cycle (EDC) for each cycle at 1.0 times the maximum seismic lateral displacement (D_T) shall not be greater than 115% of the value of design EDC shown on the plans. The maximum lateral force resulting from the test shall not exceed 1.15 times the Maximum Seismic Longitudinal Force shown on the plans.

Prototype Test 6--Seismic #3. For the cycle at 1.0 times the Maximum Seismic Longitudinal Displacement (D_T) and vertical load DL: the energy dissipated per cycle (EDC) shall not be greater than 115% of the value of the design

EDC shown on the plans. The restoring stiffness shall be within plus or minus 15% of the design value specified on the plans. The maximum lateral force resulting from the test shall not exceed 1.15 times the Maximum Seismic Longitudinal Force shown on the plans.

Prototype Test 7--Seismic #4. The resulting longitudinal force shall not exceed the Maximum Allowable Longitudinal Force shown on the plans.

Prototype Test 8--Stability. The test specimen shall maintain a positive incremental lateral stiffness under all loading conditions. The test specimen shall be free of structural cracks and damage.

Prototype Test 9--Seismic Performance Verification. Same as Test 5.

If a seismic isolation bearing that is prototype tested fails to meet any of the acceptance criteria for testing as determined by the Engineer, said bearing will be rejected. If rejected, the Contractor shall modify the bearing design or manufacturing procedures and submit revised working drawings which include the modifications, and shall repeat the prototype tests on another seismic isolation bearing from the same system. Seismic isolation bearing prototype testing operations shall not begin until the Engineer has approved the revised working drawings in writing. No extension of time or compensation will be made for modifying working drawings or supplemental calculations, for resubmittal and review of working drawings and supplemental calculations, and for designing, manufacturing, furnishing, and testing additional bearings.

Test Submittals of Prototype Tests: At the completion of a prototype test, the Contractor shall submit to the Engineer eight copies of the complete test results for the seismic isolation bearings tested. Data for each test shall list the location of test, key personnel, test loading equipment, complete record of load, displacement, rotation, hysteretic behavior and period of load application for each cycle of test.

Proof Testing: Prior to installation of any seismic isolation bearing, the seismic isolation bearing system shall be proof tested and evaluated at an approved laboratory in the presence of the Engineer, unless otherwise directed.

Each production bearing shall be designed and proof tested for the seismic isolation bearing performance criteria shown on the plans. The tests shall be performed on individual bearings.

Seismic isolation bearings shall be proof tested as follows:

Proof compression test: Two 5-minute sustained proof load tests on each production bearing shall be required at zero displacement and at maximum seismic lateral displacement (D_T). The compressive load for each test shall be 1.5 times the sum of the dead load plus live load (DL+LL) shown on the plans.

Proof combined compression and shear test: Three fully reversed cycles of loading at 1.0 times the maximum seismic lateral displacement (D_T) shown on the plans for each seismic isolation bearing. The compressive load for the test shall be 1.0 times the vertical dead load shown on the plans. The peak velocity shall be 2 inches per second or as directed by the Caltrans Testing Monitor.

Acceptance Criteria for Proof Testing: The bearing shall satisfy all aspects of the proof tests. Should any component require replacement as a result of proof tests, the Contractor shall document such replacement. The Contractor shall submit documentation to the Engineer indicating which components are replaced prior to final installation.

Proof tests shall satisfy the following conditions:

The average restoring stiffness (K_R) of an individual bearing subjected to the proof combined compression and shear test shall be within ±15 percent of the values used in design of the bearing. The average EDC shall not be greater than 115% of the value of EDC_{max} shown on the plans. The maximum lateral force resulting from the test shall not exceed 1.15 times the maximum seismic lateral force.

Specimens for all proof tests shall remain stable and without splits or fractures at all loading conditions. If the bearing demonstrates signs of distress during the proof tests, the bearing will be rejected. Signs of distress include, but are not limited to, debonding of bearing liner from the steel surface, scoring of the stainless steel surface with depths in excess of 0.01”, and any permanent structural deformation.

If a bearing that is proof tested fails to meet any of the acceptance criteria for testing as determined by the Engineer, then that bearing will be rejected and the Contractor shall submit another bearing to be proof tested. No extension of time or compensation will be made for manufacturing, furnishing, and testing additional bearings.

Test Submittals of Proof Tests: At the completion of a proof test, the Contractor shall submit to the Engineer eight copies of the complete test results for the seismic isolation bearings tested. Data for each test shall list location of test, key personnel, test loading equipment, complete record of load, displacement, rotation, hysteretic behavior and period of load application for each cycle of test.

PROTOTYPE BEARING USED FOR PRODUCTION BEARING.--Unless otherwise directed by the Engineer, one of the production bearings furnished may be one of the prototype bearings for this contract. This bearing shall be refurbished after completion of prototype testing as described in the “Prototype and Proof Testing” section in these special provisions. Additionally, this bearing shall be proof tested as specified in the “Prototype and Proof Testing” section in these special provisions.

After successful proof testing the bearing, it shall be temporarily stored at the interim storage facility until such time that the production bearing is installed in the contract as specified in "Install Seismic Isolation Bearing" elsewhere in these special provisions.

If the prototype bearing is damaged beyond repair after prototype testing, as determined by the Engineer, the bearing shall be replaced in conformance with the contract requirements for new bearings at no additional cost to the State.

REPLACEMENT BEARING.--One bearing shall be furnished as a replacement bearing.

Unless otherwise directed by the Engineer, the replacement bearing may be one of the prototype bearings for this contract. This bearing shall be refurbished after completion of prototype testing as described in the “Prototype and Proof Testing” section in these special provisions. Additionally, this bearing shall be proof tested as specified in the “Prototype and Proof Testing” section in these special provisions.

After successful proof testing the bearing, it shall be temporarily stored at the interim storage facility until such time that the replacement bearing is hauled to the final storage facility as specified in "Install Seismic Isolation Bearing" elsewhere in these special provisions.

If the prototype bearing is damaged beyond repair after prototype testing, as determined by the Engineer, the bearing shall be replaced in conformance with the contract requirements for new bearings at no additional cost to the State.

ALTERNATIVE BEARING.--At the Contractor's option, an alternative bearing may be substituted for the friction pendulum bearings provided 1) the quality of the alternative and its suitability for the intended application are at least equal to the friction pendulum bearings specified in these special provisions, 2) the bearing fits within the vertical space and within the differing horizontal footprints above and below the placement of the bearing as shown on the plans, 3) the Contractor’s written request for substitution of an alternative bearing is approved by the Engineer, 4) acceptable working drawings and supplemental calculations are furnished as specified herein, 5) successful performance of the alternative bearing under testing is achieved, and 6) that the alternative bearing conforms to the following requirements:

Due to the time constraints on this contract, only one alternative bearing request for substitution will be accepted for review.

Only one alternative bearing design, from the same manufacturer, shall be used for all bearings.

The determination as to the acceptability, quality, and suitability of an alternative bearing will be made in accordance with the provisions of Section 6-1.05, "Trade Names and Alternatives," of the Standard Specifications.

The complete written request for substitution shall include a description of the alternative bearing; the name of the bearing manufacturer; verification that the qualifications specified herein have been met by the manufacturer for the alternative bearing; proposed changes to the "Time Limits" under Part 2 of the “Working Drawing Submittal” section of these special provisions; in order to conform to the required working day schedule; proposed changes to the “Prototype and Proof Testing” section of these special provisions; and a copy of the manufacturer's list of materials and standards used to manufacture the alternative bearing.

As part of the Contractor’s written request for substitution of an alternative bearing, as specified herein, the manufacturer of the bearing shall submit verification that they have met the following qualifications for the alternative bearing submitted for consideration prior to the contract advertising date:

1. Be a participant in a seismic isolation bearing testing program approved by the California Department of Transportation for that bearing. The testing program shall be performed in accordance with "A Test Plan for the Characterization and Qualification of Highway Bridge Seismic Isolator and Damping Devices" dated February 23, 1995. A copy of "A Test Plan for the Characterization and Qualification of Highway Bridge Seismic Isolator and Damping Devices" is available to the Contractor as provided in Section 21.03, “Examination of Plans, Specifications, Contract, and Site of Work,” of the Standard Specifications. The

Contractor's request for this document shall be by facsimile to the Specifications and Estimates Branch Duty Senior at (916) 227-8089.

2. Provide proof that the alternative bearing has had at least one year of satisfactory in-situ service for three major structures.
3. The seismic performance of the alternative bearing has been verified by tests conducted at a recognized research facility, with analytically predicted responses.
4. The seismic performance of the alternative bearing is provided by a single bearing at each location.

The following information shall be submitted as part of the Contractor's written request for substitution of an alternative bearing:

Items required under Part 1 of the "Working Drawing Submittal" section of these special provisions.

The working drawing submittal shall be supplemented with data as stated below. The State will use this information to evaluate the performance characteristics of the alternative bearing in the structure by using the State's three-dimensional time history non-linear analysis computer model.

1. Dynamic and static restoring (longitudinal) stiffnesses.
2. Friction values between the contact surfaces (or applicable components of the device which pertain to friction).
3. Hold down apparatus requirements to prevent rocking under vertical loading.
4. Any unique bearing characteristics that may affect the behavior of the device.

The performance characteristics of the alternative bearings in the structure shall be compatible with the structure as shown on the plans, and shall provide acceptable results, as determined by the Engineer, for the following:

1. Maximum and residual bearing displacements.
2. Force and moment transfer through the bearings.
3. Force levels in the substructure and superstructure members.

A plan, with a schedule, showing the manufacturer's ability to provide prototype bearings, prototype testing, and production and replacement bearings, and proof testing all within the time constraints of the contract.

Materials and design information including:

1. Manufacturer's recommendations for environmental protection.
2. Manufacturer's recommendations for inspection and a maintenance plan.
3. Materials information on all components of the bearing and, if applicable, related systems. Such information shall include metallurgical or other appropriate materials reports describing the corrosion, yield, and fatigue properties of the materials. Information shall also document any variations in material properties due to temperature changes.
4. Any modifications to connection or installation details required to adapt the alternative bearing to the structure detailed on the plans.

Development of the Contractor's written request for substitution of an alternative bearing, preparation and submittal of complete working drawings and supplemental information, and testing will be at the Contractor's expense. There will be no compensation and no extension of contract time allowed for the development and review processes to evaluate the proposed substitution of an alternative bearing.

The Contractor shall share in the Department's cost of investigating the suitability of a proposed alternative bearing whether approved or rejected, including the costs involved in evaluating the performance characteristics of the alternative bearing in the structure by using the State's three-dimensional time history non-linear analysis computer model and the costs for review of the Contractor's substitution proposal. The Contractor shall indicate the Contractor's acceptance thereof in writing and such acceptance shall constitute full authority for the Department to deduct amounts owed to the Department from any monies due or that may become due to the Contractor under the contract.

After the Contractor's written request for substitution of an alternative bearing has been approved by the Engineer, two full scale bearings, shall be furnished for prototype testing. Prototype testing shall be as specified in the "Prototype and Proof Testing" section of these special provisions, or as otherwise approved by the Engineer. It is expected that the testing facility will be ready to begin prototype testing September 1, 1999. It is expected that the duration for prototype testing will be three weeks per prototype bearing.

All costs associated with the manufacture and prototype testing of alternative bearings shall be the Contractor's responsibility. However, if alternative bearings satisfy all aspects of prototype testing, the State will reimburse the Contractor for the costs of prototype testing one round of tests on 2 prototype bearings found to be satisfactory.

Proof testing of the alternative bearings shall be as specified in the "Prototype and Proof Testing" section of these special provisions, or as approved by the Engineer.

Part 2 submittals shall be as specified in the "Working Drawing Submittal" section of these special provisions, or as approved by the Engineer.

The Contractor shall submit the complete written request for the substitution of an alternative bearing to the Engineer within 35 days after the contract award date. The Contractor shall allow 6 weeks after the complete written request for substitution and all complete data are submitted for the review of the request.

Should the Engineer fail to review the complete written request for the substitution of an alternative bearing within the time specified and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in reviewing the working drawing submittal, the delay will be considered a right of way delay as specified in Section 8-1.09, "Right of Way Delays," of the Standard Specifications. An incomplete written request for the substitution of an alternative bearing submitted by the Contractor will not be grounds for consideration as a right of way delay.

No alternative bearing shall be installed until the Engineer has reviewed and approved, in writing, the working drawings, the prototype testing, and the proof testing of the bearing to be used.

MEASUREMENT AND PAYMENT.--Furnish seismic isolation bearing will be measured and paid for by the unit as furnish seismic isolation bearing. The quantity of seismic isolation bearings will be determined from actual count of the production bearings and replacement bearings that have been successfully proof tested and furnished at the manufacturer's interim storage facility.

The contract unit price paid for furnish seismic isolation bearing shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, (except adapter plates for testing at the SRMD test facility) and for doing all the work involved in furnishing seismic isolation bearings, including designing, and redesigning, if necessary, fabricating, furnishing, replacing rejected or damaged components of prototype and proof tested bearings, inspection and advice by a qualified representative of the bearing manufacturer, transportation of the bearings for testing and delivery to the manufacturer's interim storage facility, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

No payment will be made for bearings that fail to meet any of the acceptance criteria.

Full compensation for cleaning and painting of the bearings shall be considered as included in the contract unit price paid for furnish seismic isolation bearing and no separate payment will be made therefor.

Transportation and delivery of the production bearings to the on-site storage facility, transportation and delivery of the replacement bearing to the final storage location, and bearing installation will be paid for as install seismic isolation bearing as specified elsewhere in these special provisions.

If a portion or all of seismic isolation bearings are fabricated or tested at a site more than 300 air miles from both Sacramento and Los Angeles, additional shop inspection expenses will be sustained by the State. All testing shall be performed in the continental United States. Payment to the Contractor for seismic isolation bearings will be reduced $5,000 for each fabrication and testing site located more than 300 air miles from both Sacramento and Los Angeles, or in the case of each fabrication and testing site located more than 3,000 air miles from both Sacramento and Los Angeles, payment will be reduced $15,000.

Full compensation for modifications to bridge members or elements, made necessary by the use of an alternative bearing shall be considered as included in the contract price paid for furnish seismic isolation bearing and no separate payment will be made therefor.

Full compensation for furnishing alternative bearings, shall be considered as included in the contract price paid for furnish seismic isolation bearing and no additional compensation will be allowed therefor.

Full compensation for coordinating prototype and proof testing with the SRMD testing facility, for coordinating with SRMD to design and develop working drawings, as necessary, for the adapter plates required for testing, and for delivering the adapter plates to the testing facility within the time frame agreed upon between the SRMD and the bearing

manufacturer shall be considered as included in the contract price paid for furnish seismic isolation bearing and no additional compensation will be allowed therefor.

10-1.35 INSTALL SEISMIC ISOLATION BEARING

Install seismic isolation bearing shall consist of removing and disposing of existing bearings, transporting seismic isolation bearings from interim storage to the Contractor's on-site storage and to the job-site, transporting and placing the replacement bearing in the final storage location, and installing the seismic isolation bearings, in conformance with the details and requirements shown on the plans and specified in these special provisions, and as shown on the approved working drawings.

Existing bearings shall be removed and disposed of at locations where seismic isolation bearings are to be installed. Removal and disposal of existing bearings shall be in conformance with the details shown on the plans and the requirements in "Bridge Removal (Portion)" of these special provisions.

The Contractor shall install the number of bearings detailed on the plans, at the locations shown on the plans.

Attention is directed to "Order of Work," "Progress Schedule (Critical Path)," "Temporary Supports," and "Furnish Seismic Isolation Bearing," elsewhere in these special provisions.

The replacement bearing shall be transported from the bearing manufacturer's interim storage facility and stockpiled in the Anchorage House on Pier W4. The openings at Pier W4 are approximately 8 feet wide and 10 feet high. The openings are located on the east and west faces at approximately elevation 25 feet. The Contractor shall notify the Engineer a minimum of 48 hours prior to hauling the replacement bearing to the Anchorage House.

Anchorage components and associated installation hardware shall conform to the requirements in "Steel Structures" elsewhere in these special provisions.

A qualified representative of the bearing manufacturer shall be present at the job-site during installation of all bearings, and shall provide advice in the final inspection of all installed bearings.

WORKING DRAWING SUBMITTAL.--The Contractor shall submit complete working drawings for the bearing installation, including any required calculation sheets, to the Office of Structure Design, Documents Unit, P.O. Box 942874, MS #9, Sacramento, CA 94274-0001 (1801 30th Street, Sacramento, CA 95816), Phone (916) 227-8230 in accordance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. For initial review, 6 sets of drawings shall be submitted. After review, between 6 and 12 sets, as requested by the Engineer, shall be submitted to the Office for final approval and use during construction.

Working drawings shall be 11" x 17" in size. Each working drawing shall include the State assigned designations for the contract number, bridge number, full name of the structure as shown on the contract plans, and District-County-Route-Post mile. The Contractor's name, address, and phone number shall be shown on the working drawings. Each sheet shall be numbered in the lower right hand corner and shall contain a blank space in the upper right hand corner for future contract sheet numbers. All drawings, written documentation and supplemental calculations shall be provided in English including units of measure.

The working drawings shall contain all information required for the proper installation of the bearings, including details of and any required revisions or additions to concrete, reinforcement or other facilities. Each working drawing or calculation sheet shall be signed by an engineer who is registered as a Civil or Mechanical Engineer in the State of California.

Working drawings shall include, but are not limited to, the following:

1. Bearing installation plan.
2. Details for attaching the bearing to the substructure, including anchor bolts and associated installation hardware, and leveling procedure.
3. Details for attaching the bearing to the superstructure.
5. Tolerances on installation and component dimensions, alignment, and allowable working stresses.

The bearing installation plan shall include information on the methods and equipment for handling, delivery, storage, and installation of each bearing. The bearing installation plan shall be compatible with the work space shown on the plans. The bearing installation plan shall also include a step-by-step procedure describing all aspects of bearing installation including methods for removing existing bearings, materials, personnel, and equipment. The bearing installation plan shall include installation instructions and precautions, including methods for protecting bearings from heat and debris during installation, and other conditions that may adversely affect the bearing performance.

Installation procedure and materials specified for use in installing bearings shall conform to the requirements in Section 55-3.19, "Bearings and Anchorages," of the Standard Specifications and these special provisions. When the

Standard Specifications are not fully applicable, the section(s) shall be cited and the exceptions noted on the working drawings. If no applicable Standard Specification is available, ASTM or other industry standard specifications shall be referenced.

The Contractor shall verify all dimensions required for installation of the bearings and shall adjust steel plate thickness, at each bearing as required for installation of the bearings.

The working drawings shall be submitted sufficiently in advance of the start of the work to allow time for review by the Engineer and correction by the Contractor of the working drawings without delaying the work.

The Contractor shall allow 6 weeks following the complete submittal of the working drawings for the Engineer's review and approval of the working drawings.

Should the Engineer fail to review the complete working drawing submittals within the times specified and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in reviewing the working drawing submittal, the delay will be considered a right of way delay as specified in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

Within 3 weeks after final working drawing approval, one set of good quality corrected reduced prints on 20 pound (minimum) bond paper (11" x 17" in size) of all working drawings prepared by the bearing manufacturer, shall be furnished to the Office of Structure Design, Documents Unit.

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.

No bearing shall be installed until the Engineer has reviewed and approved the working drawings, in writing.

MATERIALS.--Steel supports shall conform to the provisions in “Steel Structures,” elsewhere in these special provisions. The flatness of the contact surfaces of the steel plates shall be controlled such that upon completion of the system, all plate interfaces shall have full contact.

INSTALLATION.--The bearings shall be installed at locations shown on the plans, and as shown on the approved working drawings and bearing installation plan.

MEASUREMENT AND PAYMENT.--Install seismic isolation bearing will be measured and paid for by the unit as install seismic isolation bearing. The quantity of seismic isolation bearings will be determined from actual count of the bearings installed in place in the completed work.

The contract unit price paid for install seismic isolation bearings shall include full compensation for furnishing all labor, materials and anchorage components (except for steel supports, anchorage bolts and associated installation hardware), tools, equipment and incidentals, and for doing all the work involved in transporting seismic isolation bearings from interim storage to the job-site, and installing the seismic isolation bearings, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Furnishing steel supports, anchorage bolts and associated installation hardware will be paid for as furnish structural steel (bridge).

Installing steel supports, anchorage bolts and associated installation hardware will be paid for as erect structural steel (bridge).

Full compensation for removing and disposing of existing bearings shall be considered as included in the contract unit price paid for install seismic isolation bearing and no separate payment will be allowed therefor.

Full compensation for transporting the replacement bearing from the interim storage facility to the final storage location and stockpiling the bearing, including loading and unloading, shall be considered as included in the contract unit price paid for install seismic isolation bearing and no separate payment will be allowed therefor.

Full compensation for installing alternative bearings shall be considered as included in the contract price paid for install seismic isolation bearing and no additional compensation will be allowed therefor.

10-1.36 REINFORCEMENT

Reinforcement shall conform to the provisions in Section 52, "Reinforcement," of the Standard Specifications and these special provisions.

Attention is directed to "Welding Quality Control" elsewhere in these special provisions.

The first paragraph of Section 52-1.02A, "Bar Reinforcement," of the Standard Specifications is amended as follows:

Reinforcing bars shall be low-alloy steel deformed bars conforming to the specifications of 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 40 or 60, may be used as reinforcement in the following:

1. Slope and channel paving;
2. Minor structures;
3. Sign and signal foundations (pile and spread footing types);
4. Roadside rest facilities; and
5. Concrete barrier Type 50 and Type 60 series and temporary railing.

Deformations specified in ASTM Designation: A 706/A 706M will not be required on bars used as spiral or hoop reinforcement in structures and concrete piles.

Section 52-1.02C, "Welded Wire Fabric," of the Standard Specifications is amended to read:

52-1.02C Welded Wire Fabric.—Welded wire fabric shall be either plain or deformed conforming to the requirements in ASTM Designation: A 185 or ASTM Designation: A 497, respectively.

Section 52-1.02D, "Reinforcing Wires and Plain Bars," of the Standard Specifications is amended to read:

52-1.02D Reinforcing Wire.—Wire used as reinforcement in structures and concrete piles, as shown on the plans, shall be cold drawn steel wire conforming to the specifications of ASTM Designation: A 82.

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

Whenever a portion of an assemblage of bar reinforcing steel that is not encased in concrete exceeds 20 feet 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 not less than 20 pounds per square foot on the gross projected area of the assemblage.

The sixth paragraph of Section 52-1.08, “Splicing,” of the Standard Specifications is amended to read:

Except when otherwise specified, mechanical lap splicing shall conform to the details shown on the plans, the requirements for mechanical butt splices as specified in this Section 52-1.08, and Sections 52-1.08C, “Mechanical Butt Splices,” 52-1.08D, “Qualification of Welding and Mechanical Splicing,” and 52-1.08E, “Job Control Tests,” and the following:

The mechanical lap splice shall be a unit consisting of a sleeve, in which the reinforcing bars are positioned, and a wedge driven through holes in the sleeve and between the reinforcing bars. The mechanical lap splice shall only be used for splicing non-epoxy-coated deformed reinforcing bars Nos. 4, 5 and 6. One mechanical lap splice unit per splice shall be used.

The eighth and ninth paragraphs of Section 52-1.08, "Splicing," of the Standard Specifications are amended to read:

Unless otherwise shown on the plans or approved by the Engineer, 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 length required for a lapped splice in the largest bar. The minimum distance between staggered butt splices shall be 2 feet. All distances shall be measured between the midpoints of the splices along a line which is centered between the axes of the adjacent bars.

Completed butt splices shall develop a minimum tensile strength, based on the nominal bar area, of 63,000 psi for ASTM Designation: A 615/A 615M Grade 40 bars, and of 80,000 psi for ASTM Designation: A 615/A 615M Grade 60 and ASTM Designation: A 706/A 706M bars. If butt splices are made between two bars of dissimilar strengths, the minimum required tensile strength for the splice shall be that required for the weaker bar.

The second sentence of the eleventh paragraph of Section 52-1.08, "Splicing," of the Standard Specifications is amended to read:

Job control tests shall be made on sample splices representing each lot of mechanical butt splices as provided in Section 52-1.08E, "Job Control Tests."

Section 52-1.08B, "Butt Welded Splices," of the Standard Specifications is replaced with the following:

52-1.08B Butt Welded Splices.— All butt welded splices in reinforcing bars shall be complete joint penetration butt welds conforming to the requirements in AWS D1.4, and the requirements of these specifications and the special provisions. At the option of the Contractor, shop produced resistance butt welds that are produced by a fabricator who is approved by the Transportation Laboratory may be used. These welds shall conform to the requirements of these specifications and special provisions.

Only the joint details and dimensions as shown in Figure 3.2, "Direct Butt Joints," of AWS D1.4-92, shall be used for making complete joint penetration butt welds of bar reinforcement. Split pipe backing shall not be used.

Material used as backing for complete joint penetration butt welds of bar reinforcement shall be a flat plate conforming to the requirements of ASTM Designation: A 709, Grade 36. The flat plate shall be 0.25-inch thick with a width, as measured perpendicular to the axis of the bar, equal to the nominal diameter of the bar, and a length which does not exceed twice the nominal diameter of the bar. The flat plate backing shall be fitted tightly to the bar with the root of the weld centered on the plate. Any bar deformation or obstruction preventing a tight fit shall be ground smooth and flush with the adjacent surface. Tack welds used to fit backing plates shall be within the weld root area so that they are completely consumed by the finished weld. Backing plates shall not be removed.

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 1/8-inch in convexity.

Before any electrodes or flux-electrode combinations are used, the Contractor, at the Contractor's expense, shall furnish certified copies of test reports for all the pertinent tests specified in AWS A5.1, AWS A5.5, AWS A5.18 or AWS A5.20, whichever is applicable, made on electrodes or flux-electrode combinations of the same class, brand and nearest specified size as the electrodes to be used. The tests may have been made for process qualification or quality control, and shall have been made within one year prior to manufacture of the electrodes and fluxes to be used. The report shall include the manufacturer's certification that the process and material requirements were the same for manufacturing the tested electrodes and the electrodes to be used. The forms and certificates shall be as directed by the Engineer.

Electrodes for manual shielded metal arc welding of ASTM Designation: A 615/A 615M, Grade 60 bars shall conform to the requirements of AWS A5.5 for E9018-M or E10018-M electrodes.

Electrodes for manual shielded metal arc welding of A 706/A 706M bars shall conform to the requirements of AWS A5.5 for E8016-C3 or E8018-C3 electrodes.

Solid and composite electrodes for semiautomatic gas metal-arc and flux-cored arc welding of Grade 40 reinforcing bars shall conform to the requirements of AWS A5.18 for ER70S-2, ER70S-3, ER70S-6 or ER70S-7 electrodes; or AWS A5.20 for E70T-1, E70T-5, E70T-6 or E70T-8 electrodes.

Electrodes for semiautomatic welding of ASTM Designation: A 615/A 615M, Grade 60 and ASTM Designation: A 706/A 706M bars shall produce a weld metal deposit with properties conforming to the requirements of Section 5.3.4 of AWS D1.1-96 for ER80S-Ni1, ER80S-Ni2, ER80S-Ni3, ER80S-D2, E90T1-K2 and E91T1-K2 electrodes.

Reinforcing bars shall be preheated for a distance of not less than 6 inches on each side of the joint prior to welding.

For all welding of ASTM Designation: A 615/A 615M, Grade 40 or Grade 60 bars, the requirements of Table 5.2, "Minimum Preheat and Interpass Temperatures," of AWS D1.4-92 are superseded by the following:

The minimum preheat and interpass temperatures shall be 400° F. for Grade 40 bars and 600° F. for Grade 60 bars. Immediately after completing the welding, at least 6 inches 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 200° F.

When welding different grades of reinforcing bars, the electrode shall conform to Grade 40 bar requirements and the preheat shall conform to the Grade 60 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.

All 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.

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

52-1.08C Mechanical Butt Splices.—Mechanical butt splices shall be the sleeve-filler metal type, the sleeve-threaded type, the sleeve-swaged type, the sleeve-filler grout type, the sleeve-lockshear bolt type, the two-part sleeve-forged bar type, or the two-part sleeve-friction bar type, at the option of the Contractor.

The following is added after the third paragraph of Section 52-1.08C, “Mechanical Butt Splices,” of the Standard Specifications:

Slip requirements shall not apply to mechanical lap splices.

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

4. A statement that the splicing systems and materials used in accordance with the manufacturer's procedures will develop not less than the minimum tensile strengths, based on the nominal bar area, of 63,000 psi for ASTM Designation: A 615/A 615M, Grade 40 bars and 80,000 psi for ASTM Designations: A 615/A 615M, Grade 60 and A 706/A 706M bars, and will comply with the total slip requirements and the other requirements in these specifications.

The following is added after Section 52-1.08C(3), "Sleeve-Swaged Mechanical Butt Splices," of the Standard Specifications:

52-1.08C(4) Sleeve-Filler Grout Mechanical Butt Splices.—The sleeve-filler grout type of mechanical butt splices shall consist of a steel splice sleeve that fits closely over the reinforcing bars with a non-shrink grout filler in the annular space between the reinforcing bars and the sleeve and between the ends of the reinforcing bars.

No vibration or movement of the reinforcing steel or sleeve at the splice shall be allowed while the splice is developing sufficient strength to support the reinforcing bars. The Contractor shall submit complete details of the bracing and clamping system to eliminate all vibration or movement at the splice during setup of the filler in accordance with the provisions in Section 5-1.02, "Plans and Working Drawings."

52-1.08C(5) Sleeve-Lockshear Bolt Mechanical Butt Splices.—The sleeve-lockshear bolt type of mechanical butt splices shall consist of a seamless steel sleeve, 2 serrated steel strips welded to the inside of the sleeve, center hole with centering pin, and bolts that are tightened until the bolt heads shear off and the bolt ends are embedded in the reinforcing bars.

52-1.08C(6) Two-Part Sleeve-Forged Bar Mechanical Butt Splices.— The two-part sleeve-forged bar type of mechanical butt splices shall consist of a shop machined two-part threaded steel sleeve that interlocks two hot-forged reinforcing bars ends. The forged bar ends may be either shop produced or field produced.

52-1.08C(7) Two-Part Sleeve-Friction Bar Mechanical Butt Splices.— The two-part sleeve-friction bar type of mechanical butt splices shall consist of a shop machined two-part threaded steel sleeve whose ends are friction welded, in the shop, to the reinforcing bars ends.

The third paragraph of Section 52-1.08D, "Qualification of Welding and Mechanical Splicing," of the Standard Specifications is replaced with the following:

Each operator qualification test for mechanical splices shall consist of 2 sample splices. Each mechanical splice procedure test shall consist of 2 sample splices.

For sleeve-filler, sleeve-threaded, sleeve-lockshear bolt and two-part sleeve friction bar mechanical butt splices, all sample splices shall be made on the largest reinforcing bar size to be spliced by the procedure or operator being tested except that No. 14 bars may be substituted for No. 18 bars.

For sleeve-swaged and two-part sleeve-forged mechanical butt splices, and mechanical lap splices, all sample splices shall be made on the largest reinforcing bar size of each deformation pattern to be spliced by the procedure or operator being tested. When joining new reinforcing bars to existing reinforcement, the qualification test sample bars shall be made with the deformation pattern of the new reinforcement to be joined.

Section 52-1.08E, "Job Control Tests," of the Standard Specifications is replaced with the following:

52-1.08E Job Control Tests.— When mechanical butt splices, shop produced complete joint penetration butt welded splices, or shop produced resistance butt welded splices are used, the Contractor shall furnish job control tests from a local qualified testing lab. A job control test shall consist of the fabrication, under conditions used to produce the splice, and the physical testing of 3 sample splices for each lot of 150 splices.

A lot of mechanical butt splices is defined as 150, or fraction thereof, of the same type of mechanical butt splices used for each combination of bar size and bar deformation pattern that is used in the work.

A lot of shop produced complete joint penetration butt welded splices, or shop produced resistance butt welded splices, is defined as 150, or fraction thereof, of the same type of welds used for each combination of bar size and bar deformation pattern that is used in the work.

When joining new reinforcing bars to existing reinforcement, the job control test shall be made with the deformation pattern of the new reinforcement to be joined.

A sample splice shall consist of a splice made at the job site to connect two 30-inch, or longer, bars using the same splice materials, position, location, and equipment, and following the same procedures as are being used to make splices in the work. Shorter sample splice bars may be used if approved by the Engineer.

Sample splices shall be made and tested in the presence of the Engineer or the Engineer's authorized representative.

Sample splices shall be suitably identified with weatherproof markings prior to shipment to the testing laboratory.

For sleeve-threaded mechanical butt splices, the reinforcing bars to be used for job control tests shall be fabricated on a random basis during the cutting of threads on the reinforcing bars of each lot and shipped to the job site with the material they represent.

For shop produced complete joint penetration butt welds, shop produced resistance butt welded splices and all types of mechanical butt splices, except the sleeve-threaded type, the Engineer will designate when samples for job control tests are to be fabricated, and will determine the limits of the lot represented by each job control test.

Should the average of the results of tests made on the 3 sample splices or should more than one sample splice in any job control test fail to meet the requirements for splices, all splices represented by that test will be rejected in accordance with the provisions in Section 6-1.04, "Defective Materials," of the Standard Specifications. This rejection shall prevail unless the Contractor, at the Contractor's expense, obtains and submits evidence, of a type acceptable to the Engineer, that the strength and quality of the splices in the work are acceptable.

Section 52-1.08F, "Nondestructive Splice Tests" of the Standard Specifications is replaced with the following:

52-1.08F Nondestructive Splice Tests.—All required radiographic examinations of complete joint penetration butt welded splices shall be performed by the Contractor in accordance with the requirements of AWS D1.4 and these specifications.

Prior to radiographic examination, welds shall meet the requirements of Section 4.4, "Quality of Welds," of AWS D1.4-92.

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 100 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.

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 accordance with the requirements of AWS D1.4.

Radiographic examinations will not be required for either shop produced complete joint penetration butt welds or shop produced resistance butt welded splices of No. 8 or smaller bars used as spiral or hoop reinforcement.

In addition to radiographic examinations performed by the Contractor, any mechanical or welded splice may be subject to inspection or nondestructive testing by the Engineer. The Contractor shall provide sufficient access facilities in the shop and at the jobsite to permit the Engineer or his agent to perform the inspection or testing.

The Contractor shall notify the Engineer in writing 48 hours prior to performing any radiographic examinations.

The radiographic procedure used shall conform to the requirements of ASME Boiler and Pressure Vessels Code, Section V, Article 2 and the following:

Two exposures shall be made for each complete joint penetration butt welded splice. For each of the two 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." When obstructions prevent a zero degree placement of the radiation source for the first 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. The second exposure shall be at 90 degrees to the "0" station mark and shall be identified with a station mark of "90."

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 0.175-inch 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 insure 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 three 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 1/8 inch 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.

All 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. Development on the jobsite 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.

All radiographs shall be interpreted and graded by a Level II or Level III technician who is qualified in accordance with the American Society for Nondestructive Testing's Recommended Practice No. SNT-TC-1A**.** The results of these interpretations shall be recorded on a signed certification and a copy kept with the film packet.

Technique sheets prepared in accordance with 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.

All radiographic envelopes shall have clearly written on the outside of the envelope the following information: name of the Contractor's Quality Control Manager (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 Contractor's Quality Control Plan (QCP). In addition, all innerleaves shall have clearly written on them the part description and all included weld numbers, as detailed in the Contractor's QCP.

10-1.37 EPOXY-COATED REINFORCEMENT

Epoxy-coated reinforcement shall conform to the provisions in Section 52, "Reinforcement," of the Standard Specifications and these special provisions.

Section 52-1.02B, "Epoxy-coated Bar Reinforcement," of the Standard Specifications is replaced with the following:

52-1.02B Epoxy-coated 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," for the location or type of structure involved. The epoxy-coated bar reinforcement shall conform to the provisions of ASTM Designation: A 775/A 775M, except as provided herein. Fabrication and jobsite handling of the epoxy-coated bar reinforcement shall conform to the provisions of ASTM Designation: D 3963/D 3963M, 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 and Plain Bars," for the location or type of structure involved. The coated wire reinforcement shall conform to the provisions for Class A, Type 1 coating of ASTM Designation: A 884/A 884M except as provided herein.

Appendices X1, "Guidelines For Job-Site Practices," of ASTM Designations: A 775/A 775M and A 884/A 884M shall apply except as provided herein. The term "shall" shall replace the term "should" in these appendices. Sections X1.2 shall not apply.

All coatings shall be light green in color.

Except for field welding of butt splices, all welding of reinforcement shall be complete prior to epoxy coating the reinforcement.

When any portion of a reinforcing bar or wire requires epoxy coating, the entire bar or wire shall be coated.

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 4-ounce 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 30-inch long samples of coated bar or wire reinforcement from each size and from each load shipped to the jobsite shall be furnished to the Engineer 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. Such 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 or wire reinforcement tested for coating thickness or for flexibility of coating fails to meet the requirements for coated bars in Section 8 of ASTM Designation: A 775/A 775M or A 884/A 884M, respectively, 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.

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 1000 feet of ocean or tidal water for more than 2 months.

All visible damage to the coatings caused by shipping, handling or installation shall be repaired as required for repairing coating damaged prior to shipment as specified in ASTM Designation: A 775/A 775M 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 one foot 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 bar reinforcement coating, or shall be accompanied by a Certificate of Compliance certifying that the material is compatible with the bar reinforcement coating. Damaged areas shall be patched in accordance with the patching material manufacturer's recommendations. If damage to a bar occurs during field bending the area shall be patched immediately with the prequalified patching material.

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 accordance with the manufacturer's recommendations and as directed by the Engineer. The list is available from the Office of Materials Engineering and Testing Services, 5900 Folsom Boulevard, Sacramento, CA 95819, telephone (916) 227-7000.

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

10-1.38 WATERPROOFING

Waterproofing shall conform to the provisions in Section 54, "Waterproofing," of the Standard Specifications and these special provisions.

Membrane waterproofing shall be applied to the painted undercoat of steel jackets to the limits shown on the plans, in the same manner as provided for waterproofing concrete surfaces.

The exposed surfaces of the membrane waterproofing applied to steel jackets shall be of uniform height above ground without unsightly bulges, depressions, or other imperfections.

At the option of the Contractor, a preformed membrane waterproofing system may be furnished and applied in lieu of the asphalt membrane waterproofing specified above. Preformed membrane waterproofing shall conform to the requirements in these special provisions.

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 preformed membrane sheet. The Certificate of Compliance shall include the following information: (1) type of preformed membrane sheet, and (2) the conditioner or primer application rates.

The preformed membrane waterproofing system shall consist of an adhesive, conditioner or primer applied to a prepared surface; a preformed membrane sheet of rubberized asphalt, or polymer modified bitumen; mastic or tape for sealing the edges of the sheet; and a protective covering over the sheet held by an adhesive.

The preformed membrane sheet shall be either permanently applied to a polyethylene film or reinforced with a polypropylene mesh fabric, polyester/polypropylene fabric or a fiberglass mesh fabric. The membrane sheet shall conform to the following requirements:

Property	Test	Requirement	
		Polyethylene Film	Fabric Reinforced
Tensile Strength (Minimum)(1)	ASTM D 882 (2)	20 lbs/in. (3)	20 lbs/in. (3)
Percent Elongation at break (Minimum) (4)	ASTM D 882 (2)	150 percent (3)	25 percent (3)
Pliability	ASTM D 146 (5)	No cracks	No cracks
Thickness (Minimum) (6)		60 mils	60 mils
Rubberized Asphalt Softening Point (Minimum)	AASHTO T 53	165° F.	165° F
Polymer Modified Bitumen Softening Point (Minimum)	AASHTO T 53	210° F	210° F

Notes:
(1) Breaking factor in machine direction.
(2) Method A, average 5 samples.
(3) At 73.4° F. ± 3.6° F.
(4) Machine direction.
(5) 180-degree bend over a one-inch mandrel at 10° F.
(6) Total thickness of preformed membrane sheet and polyethylene film or fabric reinforcement.

Adhesives, conditioners, primers, mastics and sealing tapes shall be manufactured for use with the respective preformed membrane sheet materials and shall be applied according to the manufacturer's recommendations.

The protective covering shall be 1/8 inch hardboard or other material that furnishes equivalent protection. Backfill material and equipment shall not cut, scratch, depress or cause any other damage to the preformed membrane.

Surfaces designated to receive preformed membrane waterproofing shall be thoroughly cleaned of dirt, dust, loose or unsound concrete and other extraneous material and shall be free from fins, sharp edges and protrusions that would, in the opinion of the Engineer, puncture or otherwise damage the membrane. Sharp corners to be covered shall be rounded (outside) or chamfered (inside).

Surfaces shall be dry when components of the preformed membrane waterproofing system are applied.

Preformed membrane waterproofing shall not be applied to any surface until the Contractor is prepared to follow its application with the placing of the protective covering and backfill within a sufficiently short time that the membrane will not be damaged by men or equipment, exposure to weathering, or from any other cause. Damaged membrane or protective covering shall be repaired or replaced by the Contractor at his expense.

All projecting pipe, conduits, sleeves or other facilities passing through the preformed membrane waterproofing shall be flashed with prefabricated or field-fabricated boots, fitted coverings or other devices as necessary to provide watertight construction.

All conditioner or primers shall be thoroughly mixed and continuously agitated during application. Conditioner, primers or adhesive shall be allowed to dry to a tack free condition prior to placing membrane sheets.

The surfaces shall be recoated if membrane sheets are not placed over primer, conditioner or adhesive within the time recommended by the manufacturer.

The preformed membrane sheet shall not be applied in wet or foggy weather, nor when the ambient temperature is below 40° F.

Preformed membrane material shall be placed starting at the bottom and lapped by a minimum of 6 inches at splices and at repairs to holes or tears.

Exposed edges of membrane sheets shall have a trowelled bead of manufacturer's recommended mastic or sealing tape applied after the membrane is placed.

The surface of the preformed membrane shall be cleaned free of dirt and other deleterious material before the protective covering is placed.

The protective covering shall be placed on a coating of adhesive of a type recommended by the manufacturer. The adhesive shall be applied at a rate sufficient to hold the protective covering in position until the backfill is placed.

10-1.39 STEEL JACKET (CONCRETE)

Steel jacket (concrete) shall consist of cleaned and painted structural steel shells filled with concrete as shown on the plans and conforming to the provisions in Section 55, "Steel Structures," of the Standard Specifications and these special provisions.

Concrete used to fill steel jackets shall conform to the provisions in "Concrete Structures" of these special provisions.

Attention is directed to "Welding Quality Control" elsewhere in these special provisions.

The requirements of the first sentence of paragraph 3.13.2 of AWS D1.5 will not apply for the field welding of steel jackets.

Structural steel for steel jackets (concrete) shall conform to ASTM Designation: A 36/A 36M, or at the Contractor's option, ASTM Designation: A 709/A 709M, Grade 36.

Drain extension pipe shall conform to the provisions for drainage piping in Section 75-1.03, "Miscellaneous Bridge Metal," of the Standard Specifications.

The spaces to be occupied by the steel jacket materials shall be cleared of plants and other materials prior to encasing the column.

Removed plants and other materials shall be disposed of outside the highway right of way in accordance with the provisions in Section 7-1.13 of the Standard Specifications.

The same information that is on existing columns shall be painted on steel jackets in accordance with the provisions in Section 51-1.21, "Bridge Name, Number and Bent Numbers," of the Standard Specifications.

CLEAN AND PAINT STRUCTURAL STEEL.--All new metal surfaces, except where galvanized, shall be cleaned and painted in accordance with the provisions in Section 91, "Paint," of the Standard Specifications, "Clean and Paint Structural Steel" of these special provisions and these special provisions.

Steel jacket surfaces in contact with grout shall not be considered embedded in concrete.

Steel jacket surfaces to be painted with waterborne inorganic zinc coating shall be blast cleaned and painted with the single undercoat prior to shipment to the job-site.

CLEANING.--The surfaces to be cleaned and painted shall be dry blast cleaned in accordance with the provisions of Surface Preparation Specification No. 10, "Near White Blast Cleaning," of the Steel Structures Painting Council. Blast cleaning shall leave all surfaces with a dense, uniform, angular, anchor pattern of no less than 1 1/2 mils as measured in accordance with ASTM Designation: D 4417.

PAINTING.--All blast cleaned surfaces shall receive a single undercoat, and exposed surfaces shall receive a minimum of 2 finish coats of an exterior grade latex paint supplied by the manufacturer of the inorganic zinc coating. The single undercoat shall consist of a waterborne inorganic zinc coating conforming to the provisions of AASHTO Designation M 300, Type II, except that the first 3 sentences of Section 4.7, "Primer Field Performance Requirement," and the entire Section 4.7.1 of the AASHTO Specification shall not apply. The inorganic zinc coating shall be listed on the qualified products list which may be obtained from the Transportation Laboratory, Telephone No. (916) 227-7000.

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 45° F or more than 85° F or 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 single undercoat of inorganic zinc coating shall be not less than 4 mils nor more than 8 mils.

All damaged areas and areas where mudcracking occurs in the inorganic zinc coating shall be blast cleaned and repainted with inorganic zinc coating to the specified thickness.

Except as approved by the Engineer, a minimum curing time of 72 hours shall be allowed between application of inorganic zinc coating and pressure rinsing with fresh water.

All exposed areas of inorganic zinc coating, where finish coats are specified, shall be thoroughly rinsed in conformance with the provisions in Section 59-1.03, "Application," of the Standard Specifications.

The inorganic zinc coating shall be tested for adhesion and cure. The locations of the tests will be determined by the Engineer. The sequence of the testing operations shall be determined by the Contractor. The testing for adhesion and cure will be performed no sooner than 72 hours after application of the single undercoat of inorganic zinc coating. At the Contractor's expense, satisfactory access shall be provided to allow the Engineer to locate the tests and to test the inorganic zinc coating cure. The inorganic zinc coating shall pass both of the following tests:

The inorganic zinc coating shall have a minimum adhesion to steel of 600 psi when measured at 6 locations on each steel jacket in accordance with 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.

The inorganic zinc coating cure will be checked by the Engineer. 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.

The first finish coat shall be applied within 48 hours following the pressure rinsing with fresh water.

The finish coat paint shall be formulated for application to inorganic zinc coating and shall conform to the following:

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 77°F, 50% RH, 4 mil wet film Set to touch, minutes Dry through, hours	 30 max. 1 max.	D 1640
Adhesion	4A	D 3359, Procedure A

No visible color change in the finish coats shall occur when tested according to 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 140° F and 4 hours of condensate exposure at 104° F.

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. 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 2 mils.

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 all applications of the second finish coat shall be not less than 2 mils.

The second finish coat color for the contrast paint shall closely match the color of the existing aesthetic treatment as approved by the Engineer.

The 2 finish coats shall be applied in 3 or more applications to a total dry film thickness of not less than 4 mils nor more than 8 mils.

The total dry film thickness of all applications of inorganic zinc coating and finish coat paint shall be not less than 8 mils nor more than 14 mils.

MEASUREMENT AND PAYMENT.--Steel Jacket (Concrete) will be measured and paid for in accordance with the provisions in Section 55-4.01, "Measurement," of the Standard Specifications and these special provisions.

The contract price paid per pound for steel jacket (concrete) shall include full compensation for furnishing all labor, materials (Except reinforcement, concrete, and threaded rods with associated hardware), tools, equipment, and incidentals, and for doing all the work involved in steel jacket (concrete) filled with concrete, complete in place, including drilling holes in steel jackets and stud connectors, and cleaning and painting of structural steel, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Concrete used to fill steel jackets will be measured and paid for as structural concrete, bridge footing.

10-1.40 STEEL STRUCTURES

Construction of steel structures shall conform to the provisions in Section 55, "Steel Structures," of the Standard Specifications and these special provisions.

GENERAL

Fabricators of structural steel shall be certified under the AISC Quality Certification Program, Category Cbr, Major Steel Bridges.

All manufacturing processes for steel fastener and high strength steel fastener assemblies furnished for incorporation into the work on this project shall occur in the United States; with the exception that pig iron and processed, pelletized and reduced iron ore manufactured outside of the United States may be used in the domestic manufacturing process for such steel and iron materials. The application of coatings, such as epoxy coating, galvanizing, painting and any other coating that protects or enhances the value of such steel material shall be considered a manufacturing process subject to these requirements.

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

Any existing steel damaged as result of the Contractor's operation shall be repaired. Prior to repairing the existing steel, the Contractor shall determine the carbon equivalency (CE) of the steel local to the damaged area in accordance with Section 5.4 of AWS D 1.5.

The Contractor shall submit to the Engineer for approval the CE test results and the proposed method to repair the damaged existing steel based upon the CE test results in accordance with the requirements in Section 5-1.02, “Plans and Working Drawings,” of the Standard Specifications. No remedial work shall begin until the repair method has been approved by the Engineer.

Working drawings for bumper pads at Bents A and B shall be submitted to the Engineer for approval as provided in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. Three sets of drawings shall be submitted. These drawings shall show the pad dimensions, connection details, pad deflection at the loading shown on the plans and include manufacturer engineering data and material properties.

Attention is directed to “Welding Quality Control” of these special provisions.

The first paragraph in Section 55-1.02, "Drawings," of the Standard Specifications is amended to read:

> **55-1.02 Drawings.—** The Contractor shall submit working drawings for structural steel to the Office of Structure Design (OSD) for approval in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings." For initial review, 6 sets of the drawings shall be submitted for highway bridges and 10 sets shall be submitted for railroad bridges. After review, between 6 and 12 sets, as requested by the Engineer, shall be submitted to OSD for final approval and for use during construction.

The first sentence of the seventh paragraph in Section 55-1.02, "Drawings," of the Standard Specifications is amended to read:

At the completion of each structure on the contract, one set of reduced prints on 20 pound (minimum) bond paper, 11 inches x 17 inches in size, of the corrected original tracings of all working drawings for each structure shall be furnished to the Engineer.

Paragraphs 7 through 9 of Section 55-1.02, "Drawings," of the Standard Specifications are amended to read:

At the completion of each structure on the contract, one set of reduced prints on 20 pound (minimum) bond paper, 11 inches by 17 inches in size, of the corrected original tracings of all working drawings for each structure 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.

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.

For railroad bridges, in addition to the reduced prints of the working drawings, the Contractor shall furnish to the Engineer one set of working drawings consisting of either ink tracings on cloth, ink tracings on polyester base drafting film, silver sensitized cloth duplicate tracings, or silver sensitized polyester based reproduction films with matte surface on both sides.

The Contractor shall submit structural steel working drawings to the Engineer for approval in conformance with the provisions in Section 55-1.02, “Drawings,” and these special provisions.

The Contractor shall submit to the Engineer a schedule of structural steel working drawing submittals conforming to the following requirements:

The first schedule shall be submitted no more than 60 days after contract approval and at least 30 days prior to submitting any working drawings on the contract, unless otherwise approved in writing by the Engineer.

The schedule shall then be updated and submitted to the Engineer at least every 90 calendar days until all structural steel working drawings have been approved.

Each schedule shall project the submittal of all working drawings for at least one year. All working drawings submittals shall appear on the schedule a minimum of 30 days prior to their submittal for review. The schedule shall include the following information:

1. the dates the working drawing submittals are to be submitted,
2. the approximate number of sheets to be included in each submittal,
3. the location where the work is to be performed,
4. a general description of the work to be performed.

In addition, the Contractor shall submit a written "Notification of Working Drawings" to the Engineer at least 30 calendar days in advance of submitting any working drawing submittal. The advance notification shall include the following information:

1. the date the working drawing submittal or submittals are to be submitted,
2. the number of sheets to be included in each submittal,
3. the location where the work is to be performed,
4. a description of the work to be performed.

In addition to the requirements of Section 55-1.02, "Drawings," of the Standard Specifications and these special provisions, the following requirements shall apply:

The Contractor shall allow the review times specified herein after complete working drawings and all supporting data are submitted to the Engineer. Complete drawings shall be fully detailed to complete the fabrication and erection of the required structural steel work including all field dimensions verified by the Contractor.

The review time for a set of working drawings will be considered as starting when the Engineer has received the 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, then the drawings will be rejected and returned to the Contractor for correction. The review time on a set of returned drawings will be considered stopped 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, revisions 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, plus 3 weeks.

Any time during the review process, a request for information, regarding the working drawings, may be submitted to the Contractor by the Engineer. The working drawing review time will continue with no interruptions unless the Contractor does not respond to the Engineer's request for information within 3 working days, at which time the review time will stop.

The review time for a set of working drawings will be considered as completed on the date the working drawings have been reviewed, approved, and mailed to the Contractor with a date stamp by the Engineer.

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.

Working drawings shall be submitted in sets not exceeding 20 sheets. Each set of working drawings shall be identified with a unique and sequential number. Multiple sets of working drawings may be submitted simultaneously.

In the event several sets of working drawings are submitted simultaneously, or additional sets of drawings are submitted for review before the review of the previously submitted sets of drawings have been completed, the Contractor shall designate the sequence in which all of the sets of drawings which have been submitted are to be reviewed.

The Contractor may choose to change the priority of the set of working drawings that is designated as top priority. The Contractor shall submit a written notification outlining his proposal for reprioritization of working drawing submittal reviews in conformance with the following requirements:

1) All sets of working drawings under review shall be reprioritized by the Contractor.
2) The proposed reprioritization, including review time for each submittal, shall be agreed upon by the Engineer and the Contractor before it is approved and implemented.
3) The review time for the new top priority set will restart and will not exceed 6 weeks from the time that the Contractor's reprioritization proposal has been approved, unless the set is returned for revisions.
4) The review time for each submittal will be adjusted based on the Contractor's reprioritization and the total number of working drawings under review at the time of the written notification.

When the total number of working drawings under review is less than 60 sheets, then the time to be provided for review for each set of drawings in the sequence shall not exceed 6 weeks for the top priority set, and not exceed 8 weeks from the original date received by the Engineer for each set of lower priority drawings which is still under review.

When the total number of working drawings under review exceeds 60 sheets, then the time to be provided for review for each set of drawings in the sequence shall not exceed 6 weeks for the top priority set, and not exceed 12 weeks from the original date received by the Engineer for each set of lower priority which is still under review.

Should the Engineer fail to review the complete working drawing submittal within the time specified and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in reviewing the working drawing submittal, an extension of time commensurate with the delay in completion of the work thus caused will be granted in accordance with Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

The first sentence of the second paragraph in Section 55-1.03, "Inspection," of the Standard Specifications is amended to read:

The Contractor shall furnish to the Engineer a copy of mill orders, certified mill test reports, a Certificate of Compliance for all fabricated structural steel to be used in the work, other than steel which is to be used under the

provisions in Section 55-2.07, "Unidentified Stock Material, " and other reports or certificates required by the specifications.

MATERIALS

The first paragraph, including the material table, in Section 55-2.01, "Description," of the Standard Specifications is amended to read:

55-2.01 Description.—The various materials shall conform to the specifications of ASTM as listed in the following tabulation with certain modifications and additions as specified:

MATERIAL	SPECIFICATION
Structural steel	ASTM Designation: A 709/A 709M, Grade 36 [250] or {A 36/A 36M}[(a)]
High strength low alloy columbium vanadium steel	ASTM Designation: A 709/A 709M, Grade 50 [345] or {A 572/A 572M, Grade 50 [345]}[(a)]
High strength low alloy structural steel	ASTM Designation: A 709/A 709M, Grade 50W [345 W] or {A 588/A 588M}[(a)]
High-yield strength, quenched and tempered alloy steel plate suitable for welding	ASTM Designation: A 709/A 709M, Grade 100 [690] and Grade 100W [690W] or {A 514/A 514M}[(a)]
Steel fastener components for general applications:	
Bolts and studs which include threaded rods and nonheaded anchor bolts	ASTM Designation: A 307 or AASHTO Designation: M 314, Grade 36 or 55 including supplementary requirements
High-strength bolts and studs which include threaded rods and nonheaded anchor bolts	ASTM Designation: A 449
Nuts	ASTM Designation: A 563 including Appendix X1[(b)]
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[(b)] or A 563M including Appendix X1[(b)]
Hardened washers	ASTM Designation: F 436 or F 436M ASTM Designation: F 959 or F 959M, zinc coated

Direct tension indicators	

Carbon steel for forgings, pins and rollers	ASTM Designation: A 668/A 668M, Class D
Alloy steel for forgings	ASTM Designation: A 668/A 668M, Class G
Pin nuts	ASTM Designation: A 36/A 36M
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
Carbon steel structural tubing	ASTM Designation: A 500, Grade B or A 501
Steel pipe (Hydrostatic testing will not apply)	ASTM Designation: A 53, Type E or S, Grade B; A 106, Grade B; or A 139, Grade B
Stud connectors	ASTM Designation: A 108 and ANSI/AASHTO/AWS D1.5
(a) Grades that may be substituted for the equivalent ASTM Designation: A 709 steel, at the Contractor's option, subject to the modifications and additions specified and to the requirements of A 709. (b) 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.	

The second paragraph in Section 55-2.01, "Description," of the Standard Specifications is deleted.
The fifth paragraph in Section 55-2.01, "Description," of the Standard Specifications is amended to read:

All structural steel plate used for the fabrication of tension members, tension flanges, eyebars and hanger plates and for splice plates of tension members, tension flanges and eyebars shall meet the longitudinal Charpy V-notch impact value requirements specified herein. Sampling procedures shall conform to the provisions in ASTM Designation: A 673/A 673M. The H (Heat) frequency of testing shall be used for structural steels conforming to ASTM Designations: A 709/A 709M, Grades 36, 50 and 50W. The P (Piece) frequency of testing shall be used for structural steel conforming to ASTM Designation: A 709/A 709M, Grades 100 and 100W. Charpy V-notch impact values shall be determined in accordance with ASTM Designation: E 23.

The first paragraph in Section 55-2.02, "Structural Steel," of the Standard Specifications is amended to read:

55-2.02 Structural Steel.—Unless otherwise specified or shown on the plans, all structural steel plates, shapes and bars shall conform to ASTM Designation: A 709/A 709M, Grade 36.

High-strength fastener assemblies, and other bolts attached to structural steel with nuts and washers shall be zinc-coated.

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 each heat of maximum thickness of:

Cover plates and splice plates at tower diagonals
Cover plates and splice plates at tower legs.

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. If the Contractor requests that samples be removed at the rolling mill, the Contractor will be charged for the cost of providing State inspection at the mill to witness the removal of samples, as provided in "Measurement and Payment" of these special provisions.

Unless otherwise directed, material for check samples shall be removed by the Contractor in the presence of the Engineer. Check samples for plates wider than 24 inches shall be 14 inches wide and 18 inches long with the long dimension transverse to the direction of rolling. Check samples for all other products shall be 18 inches 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 and preferably when it is still being prepared for fabrication. 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.

Unless otherwise directed, 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 10 working days of delivery to the Transportation Laboratory. In the event several samples are submitted on the same day, an additional day will be added for each 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 specified minimum or 5 percent above specified maximum requirements except that if the initial check test results vary more than 5 percent but not more than 10 percent from the specified requirements, a re-test may be performed on another sample from the same heat and thickness. The results of the re-test 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.

FABRICATION

The first paragraph of Section 55-3.05, "Facing and Bearing Surfaces," of the Standard Specifications is amended to read:

55-3.05 Flatness of Faying (Contact) and Bearing Surfaces.—Surfaces of bearing and base plates and other metal surfaces that are to come in contact with each other or with ground concrete surfaces or with asbestos sheet packing shall be flat to within 1/32 inch tolerance in 12 inches and to within 1/16 inch tolerance overall. Surfaces of bearing and base plates and other metal bearing surfaces that are to come in contact with preformed fabric pads, elastomeric bearing pads or portland cement mortar shall be flat to within 1/8 inch tolerance in 12 inches and to within 3/16 inch tolerance overall.

Paragraphs 1 through 5, excluding Section 55-3.14A, of Section 55-3.14, "Bolted Connections," of the Standard Specifications are amended to read:

55-3.14 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. These fastener assemblies shall consist of either 1) a high-strength steel bolt, nut and hardened washer or 2) a tension control bolt, nut and hardened washer. A direct tension indicator (DTI) may be used with the high-strength bolt, nut and hardened washer assembly.

Bolted connections using fastener assemblies shall conform to the "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, and the provisions of these special provisions.

When reference is made to the RCSC Specification, the "Allowable Stress Design" version shall be used when allowable stress design is shown on the plans and the "Load and Resistance Factor Design" version shall be used when load factor design or load and resistance factor design is shown on the plans.

All connections made with fastener assemblies shall be tensioned and inspected after tensioning, whether classified as a slip critical or bearing type connection, unless otherwise designated on the plans.

The hardened washer shall be installed under the nut or bolt head, whichever is the element turned in tightening. Nuts shall be located, wherever practicable, on the side of the member that will not be visible from the traveled way. Nuts for bolts that will be partially embedded in concrete shall be located on the side of the member that will be encased in concrete.

Each length and diameter of fastener assemblies used in any one joint of a high-strength bolted connection shall be from the same rotational capacity lot. The Contractor shall keep a record of which rotational capacity lots are used in each joint.

The Contractor shall provide, calibrate and maintain the equipment and tools necessary for the preliminary testing, installation and inspection of all fasteners.

Bolt tension measuring devices and torque wrenches shall be calibrated within one year prior to first being used on the job, and a minimum of once each year thereafter. This calibration shall be done by a qualified independent laboratory or authorized warranty repair and calibration center recognized by the tool manufacturer. Bolt tension measuring devices shall be calibrated, to within one percent of the actual tension value, with a minimum of 4 verification readings evenly spaced over a range of 20 to 80 percent of full scale. Torque wrenches shall have either a dial gage or digital read-out. Torque wrenches shall be calibrated, to within 2 percent of the actual torque value, with a minimum of 4 verification readings evenly spaced over a range of 20 to 100 percent of full scale. Test equipment used for certification and calibration standards shall be traceable to the National Institute of Standards and Technology.

Prior to the use of bolt tension measuring devices or torque wrenches, the Contractor shall furnish to the Engineer certificates of calibration with plots of verification readings for each device or wrench.

In addition to the submittals required in Section 55-1.03, "Inspection," of the Standard Specifications, the Contractor shall furnish certified test reports of tests on fastener components and fastener assemblies performed prior to shipment to the job-site. Certified test reports for fastener components and fastener assemblies shall be furnished to the Engineer prior to use of the fastener assembly. The certified test reports shall include the rotational capacity lot numbers for fastener assemblies supplied and test reports specified in the "Certification," "Report," "Number of Tests and Retests," and "Certification and Test Report" sections in the appropriate ASTM specifications for the fastener components.

For all bolted connections, the contact surfaces shall be cleaned and coated before assembly in conformance with the provisions for cleaning and painting structural steel in the special provisions.

High-strength steel fasteners shall consist of a tension control bolt, nut and hardened washer, whenever practicable. Direct tension indicators shall not be used at any location. Tension control bolt heads shall be round (button-head) abd shall be oriented to match the appearance of the existing adjacent rivets, whenever practicable.

High-strength bolted connections using A 490 bolts shall be installed with two hardened washers on the side of the member that will be visible from the traveled way.

Holes for bolted connections in structural steel joints consisting of new and existing structural steel or existing structural steel may consist of both sub-punched or sub-drilled holes and holes punched or drilled full size as approved by the Engineer and shall conform to these special provisions.

The finished holes in structural steel plates nearest to the nut or bolt head shall not be more than 1/16 inch larger than the nominal diameter of the bolt.

When the holes in other existing structural steel plate are 1/16 inch larger than the nominal diameter of the bolt, the holes may be reamed to slots conforming to the provisions for short-slotted holes as defined in "Specification for Structural Joints Using ASTM A325 or A490 Bolts" (RCSC Specification) approved by the Research Council on Structural Connections. The axis of the slot in short-slotted holes in existing interior plies shall be normal to the direction of the load.

Bolts with diameters up to 1/4 inch larger than the diameter of the bolt shown on the plans may be used, provided that the required clearances and edge distances are not reduced below that required for the larger bolt and the remaining net section of the structural steel plate is adequate.

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

55-3.14B Installation.—If water soluble lubricants are used on components of the fastener assemblies, fastener installation will not be permitted when surface moisture is present at a high-strength bolted connection. The Engineer may require the Contractor to perform additional installation tension tests and rotational capacity tests before fastener installation and tensioning is performed at any high-strength bolted connection during inclement weather.

Bolts shall be tightened to the required tension by use of a tension control bolt installation wrench, a pneumatic or hydraulic wrench, a calibrated manual torque wrench, the turn-of-nut method, or by using mechanically zinc coated direct tension indicators. The pneumatic or hydraulic wrench shall have an adjustable control unit that can be set to positively shut off at the desired torque.

The threaded ends of fastener assemblies projecting past the outer face of the nut (thread stickout), where first full formed threads are present, shall be at least flush with, but not extend more than 1/4 inch beyond, the outer face of the nut. A maximum of one hardened washer, in addition to the single washer required under the turned element,

may be installed under the non-turning element of the fastener assembly. The thread stickout of studs, rods and anchor bolts, shall be at least 1/8 inch , and there shall be a minimum of 3 full threads located within the grip of the connection. In addition, a minimum of 3 full threads shall be located between the bearing surfaces of the bolt head and nut. The total stickout shall not be excessive.

Larger bolts, having diameters up to 1/4 inch greater than the diameter of the bolt shown on the plans, may be used if approved by the Engineer provided that spacing and edge distance requirements for the larger bolt are met and the net section is adequate.

When DTIs are used, one DTI shall be installed under each bolt head with the DTI protrusions contacting the bearing surface of the bolt head. To tension the bolt, the bolt head shall be held stationary and the nut turned. Unless otherwise specified, manufacturer's installation procedures shall be followed. Each bolt shall be tensioned in at least 2 tightening stages until at least 50% of the gaps on each DTI are greater than zero and less than 0.005 inch. Complete crushing of all DTI protrusions (0 gaps) on any given DTI will be cause for rejection.

Any tools used to snug tight tension control bolts shall not engage the spline end of the bolt.

The same head orientation shall be used within any one high-strength bolted connection.

55-3.14C Rotational Capacity Testing Prior to Shipment to Job Site.—Rotational capacity tests on fastener assemblies shall be performed as specified in the special provisions.

55-3.14D Installation Tension Testing and Rotational Capacity Testing After Arrival to Job Site.—Installation tension tests and rotational capacity tests on fastener assemblies shall be performed as specified in the special provisions.

55-3.14E Inspection.—For all types of fastener assemblies, at least 10%, but no fewer than 2 bolts of each rotational capacity lot used in each high-strength bolted connection shall be inspected after tensioning in conformance with the requirements of Section 9, "Inspection," of the RCSC Specification. The inspection of a completed joint shall be performed within 48 hours after all fasteners in this joint have been tensioned. The Contractor shall be responsible for determining the job inspecting torque as specified in Section 9(b), "Arbitration Inspection," of the RCSC Specification. A separate inspecting torque shall be determined and used for each different rotational capacity lot of fasteners. The procedure described for determining arbitration torque in steps 1 through 9 of the "Arbitration of Disputes Inspection Torque Method-Short Bolts," section of the "Structural Bolting Handbook," published by the Steel Structures Technology Center, Incorporated shall replace Section 9(b)(2) of the RCSC Specification for determining the job inspecting torque for short bolts. Bolt tension shall be checked at locations selected by the Engineer. Work required to perform such inspection shall be done by the Contractor in the presence of the Engineer and in such a manner that the Engineer can read the torque wrench gage or access the DTI gaps during inspection.

Rotational Capacity Testing Prior to Shipment to Job Site.—Rotational capacity tests shall be performed on all lots of high-strength fastener assemblies prior to shipment to the job site. Galvanized assemblies shall be tested as galvanized. One hardened washer shall be used under each nut for the tests.

Each combination of bolt production lot, nut lot and washer lot shall be tested as an assembly.

A rotational capacity lot number shall be assigned to each combination of lots tested. Each shipping unit of fastener assemblies shall be plainly marked with the rotational capacity lot number.

Two fastener assemblies from each rotational capacity lot shall be tested.

The following equipment, procedure and acceptance criteria shall be used to perform rotational capacity tests on, and determine acceptance of long bolts. Fasteners are considered to be long bolts when full nut thread engagement can be achieved when installed in a bolt tension measuring device.

Long Bolt Test Equipment:

1. Calibrated bolt tension measuring device with adequate tension capacity for the bolts being tested.
2. Calibrated dial or digital torque wrench. A torque multiplier may be required for large diameter bolts.
3. Spacer washers or bushings. When spacer washers or bushings are required, they shall have the same inside diameter and equal or larger outside diameter as the appropriate hardened washers conforming to the requirements of ASTM Designation: F436.
4. Steel beam or member, such as a girder flange or cross frame, to which the bolt tension measuring device will be attached. The device shall be accessible from the ground.

Long Bolt Test Procedure:

1. Measure the bolt length. The bolt length is defined as the distance from the end of the threaded portion of the shank to the underside of the bolt head.
2. Install the nut on the bolt so that 3 to 5 full threads of the bolt are located between the bearing face of the nut and the underside of the bolt head. Measure and record the thread stickout of the bolt. Thread stickout is determined by measuring the distance from the outer face of the nut to the end of the threaded portion of the shank.
3. Insert the bolt into the bolt tension measuring device and install the required number of washers, and additional spacers as needed, directly beneath the nut to produce the thread stickout measured in Step 2.
4. Tighten the nut using a hand wrench to a snug-tight condition. The snug tension shall not be less than the Table A value but may exceed the Table A value by a maximum of 2 kips.

Table A

High-Strength Fastener Assembly Tension Values to Approximate Snug-Tight Condition	
Bolt Diameter (inches)	Snug Tension (kips)
1/2	1
5/8	2
3/4	3
7/8	4
1	5
1 1/8	6
1 1/4	7
1 3/8	9
1 1/2	10

5. Match-mark the assembly by placing a mark on one corner of the nut and a heavy reference start line on the face plate of the bolt tension measuring device which aligns with the mark on the nut. Place an additional mark on the outside of the socket that overlays the mark on the nut corner. It will be visible while turning the nut. Make an additional mark on the face plate, either 2/3 of a turn, one turn, or 1 1/3 turn clockwise from the heavy reference start line, depending on the bolt length being tested as shown in Table B.

Table B

Required Nut Rotation for Rotational Capacity Tests[a,b]	
Bolt Length (measured in Step 1)	Required Rotation (turn)
4 bolt diameters or less	2/3
Greater than 4 bolt diameters but no more than 8 bolt diameters	1
Greater than 8 bolt diameters, but no more than 12 bolt diameters[c]	1 1/3

(a) Nut rotation is relative to bolt, regardless of the element (nut or bolt) being turned. For bolts installed by 1/2 turn and less, the tolerance shall be plus or minus 30 degrees; for bolts installed by 2/3 turn and more, the tolerance shall be plus or minus 45 degrees.
(b) Applicable only to connections in which all material within grip of the bolt is steel.
(c) When bolt length exceeds 12 diameters, the required rotation shall be determined by actual tests in a suitable tension device simulating the actual conditions.

6. Turn the nut to achieve the applicable minimum bolt tension value listed in Table C. After reaching this tension, record the moving torque, in foot-pounds, required to turn the nut, and also record the corresponding bolt tension value in pounds. Torque shall be measured with the nut in motion. Calculate the value, T (in ft-lbs), where T=[(the measured tension in pounds) x (the bolt diameter in inches) / 48 in/ft].

Table C

Minimum Tension Values for High-Strength Fastener Assemblies	
Bolt Diameter (inches)	Minimum Tension (kips)
1/2	12
5/8	19
3/4	28
7/8	39
1	51
1 1/8	56
1 1/4	71
1 3/8	85
1 1/2	103

7. Turn the nut further to increase bolt tension until the rotation listed in Table B is reached. The rotation is measured from the heavy reference line made on the face plate after the bolt was snug-tight. Record this bolt tension.
8. Loosen and remove the nut and examine the threads on both the nut and bolt.

Long Bolt Acceptance Criteria:

An assembly shall pass the following requirements to be acceptable: 1) the measured moving torque (Step 6) shall be less than or equal to the calculated value, T (Step 6), 2) the bolt tension measured in Step 7 shall be greater than or equal to the applicable turn test tension value listed in Table D, 3) the nut shall be able to be removed from the bolt without signs of thread stripping or galling after the required rotation in Step 7 has been achieved, 4) the bolt does not shear from torsion or fail during the test and 5) the assembly does not seize before the final rotation in Step 7 is reached. Elongation of the bolt in the threaded region between the bearing face of the nut and the underside of the bolt head is expected and will not be considered a failure. Both fastener assemblies tested from one rotational capacity lot shall pass for the rotational capacity lot to be acceptable.

Table D

Turn Test Tension Values	
Bolt Diameter (inches)	Turn Test Tension (kips)
1/2	14
5/8	22
3/4	32
7/8	45
1	59
1 1/8	64
1 1/4	82
1 3/8	98
1 1/2	118

The following equipment, procedure and acceptance criteria shall be used to perform rotational capacity tests on and determine acceptance of short bolts. Fasteners are considered to be short bolts when full nut thread engagement cannot be achieved when installed in a bolt tension measuring device.

Short Bolt Test Equipment:

1. Calibrated dial or digital torque wrench. A torque multiplier may be required for large diameter bolts.
2. Spud wrench or equivalent.
3. Spacer washers or bushings. When spacer washers or bushings are required, they shall have the same inside diameter and equal or larger outside diameter as the appropriate hardened washers conforming to the requirements of ASTM Designation: F436.
4. Steel plate or girder with a hole to install bolt. The hole size shall be 1/16 inch greater than the nominal diameter of the bolt to be tested. The grip length, including any plates, washers, and additional spacers as needed, shall provide the proper number of threads within the grip, as required in Step 2 below.

Short Bolt Test Procedure:

1. Measure the bolt length. The bolt length is defined as the distance from the end of the threaded portion of the shank to the underside of the bolt head.
2. Install the nut on the bolt so that 3 to 5 full threads of the bolt are located between the bearing face of the nut and the underside of the bolt head. Measure and record the thread stickout of the bolt. Thread stickout is determined by measuring the distance from the outer face of the nut to the end of the threaded portion of the shank.
3. Install the bolt into a hole on the plate or girder and install the required number of washers, and additional spacers as needed, between the bearing face of the nut and the underside of the bolt head to produce the thread stickout measured in Step 2.
4. Tighten the nut using a hand wrench to a snug-tight condition. The snug condition shall be the full manual effort applied to the end of a 12 inch long wrench. This applied torque shall not exceed 20 percent of the maximum allowable torque in Table E.

Table E

Maximum Allowable Torque for High-Strength Fastener Assemblies	
Bolt Diameter (inches)	Torque (ft-lbs)
1/2	145
5/8	285
3/4	500
7/8	820
1	1220
1 1/8	1500
1 1/4	2130
1 3/8	2800
1 1/2	3700

5. Match-mark the assembly by placing aligning marks, one on a corner of the nut, a radial line across the flat on the end of the bolt, and a heavy reference start line on the steel plate or girder. Place an additional mark on the outside of the socket that overlays the mark on the nut corner. It will be visible while turning the nut. Make 2 additional small marks on the steel plate or girder, one 1/3 of a turn and one 2/3 of a turn clockwise from the heavy reference start line on the steel plate or girder.
6. Using the torque wrench, tighten the nut to the rotation value listed in Table F. The rotation is measured from the heavy reference line described in Step 5 made after the bolt was snug-tight. A second wrench shall be used to prevent rotation of the bolt head during tightening. Measure and record the moving torque after this rotation has been reached. The torque shall be measured with the nut in motion.

Table F

Nut Rotation Required for Turn-of-Nut Installation[a,b]	
Bolt Length (measured in Step 1)	Required Rotation (turn)
4 bolt diameters or less	1/3
(a) Nut rotation is relative to bolt, regardless of the element (nut or bolt) being turned. For bolts installed by 1/2 turn and less, the tolerance shall be plus or minus 30 degrees. (b) Applicable only to connections in which all material within grip of the bolt is steel.	

7. Tighten the nut further to the 2/3 turn mark as indicated in Table G. The rotation is measured from the heavy reference start line made on the plate or girder when the bolt was snug-tight. Verify that the radial line on the bolt end is still in alignment with the start line.

Table G

Required Nut Rotation for Rotational Capacity Test	
Bolt Length (measured in Step 1)	Required Rotation (turn)
4 bolt diameters or less	2/3

8. Loosen and remove the nut and examine the threads on both the nut and bolt.

Short Bolt Acceptance Criteria:

An assembly shall pass the following requirements to be acceptable: 1) the measured moving torque from Step 6 shall be less than or equal to the maximum allowable torque from Table E, 2) the nut shall be able to be removed from the bolt without signs of thread stripping or galling after the required rotation in Step 7 has been achieved, 3) the bolt does not shear from torsion or fail during the test and 4) the assembly does not seize before the final rotation in Step 7 is reached. Elongation of the bolt in the threaded region between the bearing face of the nut and the underside of the bolt head will not be considered a failure. Both fastener assemblies tested from one rotational capacity lot shall pass for the rotational capacity lot to be acceptable.

Installation Tension Testing and Rotational Capacity Testing After Arrival on Job Site.—Installation tension tests and rotational capacity tests on high-strength fastener assemblies shall be performed by the Contractor prior to acceptance or installation, and after arrival of the fastener assemblies on the job-site. The installation tension tests and rotational capacity tests shall be performed at the job-site, in the presence of the Engineer, on each rotational capacity lot of fastener assemblies.

Installation tension tests shall be performed on 3 representative fastener assemblies in conformance with Section 8, "Installation and Tightening," of the RCSC Specification. For short bolts, Section 8(d), "Joint Assembly and Tightening of Slip-Critical and Direct Tension Connections," of the RCSC Specification shall be replaced by the "Pre-Installation Testing Procedures," of the "Structural Bolting Handbook," published by the Steel Structures Technology Center, Incorporated.

The rotational capacity tests shall be performed in conformance with the requirements for rotational capacity tests in "Rotational Capacity Testing Prior to Shipment to Job Site" of these specifications.

At the Contractor’s expense, additional installation tension tests, tests required to determine job inspecting torque and rotational capacity tests shall be performed by the Contractor on each rotational capacity lot, in the presence of the Engineer, if 1) any fastener is not used within 3 months after arrival on the jobsite, 2) fasteners are improperly handled, stored, or subjected to inclement weather prior to final tightening, 3) significant changes are noted in original surface condition of threads, washers or nut lubricant or 4) the Contractor's required inspection is not performed within 48 hours after all fasteners in a joint have been tensioned.

Failure of a job-site installation tension test or a rotational capacity test will be cause for rejection of unused fasteners which are part of the rotational capacity lot.

Steel fasteners designated as on the plans as A 449 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 ASTM Designation: A 449 in accordance with Section 55-1.02, "Drawings," of the Standard Specifications. Direct tension indicators shall not be used. The plans 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 conforming to Supplementary Requirement S1 and S2 in ASTM Designation: A 563 and hardened washer.

Steel fasteners, including bolts and studs, designated on the plans as A 354, Grade BC, shall conform to the requirements of ASTM Designation: A 354, Grade BC. Steel fastener components for steel fasteners designated as A 354, Grade BC shall include a bolt or stud, as shown on the plans, nut and hardened washer. Nuts for steel fasteners designated as A 354, Grade BC 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 BC 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 BC in accordance with Section 55-1.02, "Drawings," of the Standard Specifications. Direct tension indicators shall not be used. The plans 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.

Surface Preparation.—For all bolted connections, the 1) contact surfaces, 2) surfaces of outside members within the grip under bolt heads, nuts and washers and 3) 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.

When zinc-coated fasteners are used, the sheared end of each tension control bolt shall be completely sealed with non-silicone type sealing compound conforming to the provisions in Federal Specification TT-S-230, Type II. The sealant

shall be gray in color and shall have a minimum thickness of 50 mils. The sealant shall be applied to a clean sheared surface on the same day that the splined end is sheared off.

Welding.—The third paragraph of Section 55-3.17, "Welding," of the Standard Specifications is amended to read:

The extent of radiographic testing on groove welds shall be in accordance with the requirements in ANSI/AASHTO/AWS D1.5, Subsection 6.7.1.2. In addition, twenty-five percent of all main member tension groove welds, in material in excess of 1/2 inch thickness, shall be ultrasonically tested.

Table 2.2 of ANSI/ AASHTO/AWS D1.5 is superseded by the following table:

Base Metal Thickness of the Thicker Part Joined, in.	Minimum Partial Joint Penetration Groove Weld Size, in.*
Over 1/4 to 1/2 inclusive	3/16
Over 1/2 to 3/4 inclusive	1/4
Over 3/4 to 1 1/2 inclusive	5/16
Over 1 1/2 to 2 1/4 inclusive	3/8
Over 2 1/4 to 6 inclusive	1/2
Over 6	5/8
*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 shall be a single length. Backing shall be of the same material as the structural steel being welded. Single lengths of backing shall be obtained by using a continuous strip, or may consist of lengths of backing joined by full penetration butt welds. Butt welds in the backing material shall be subject to the same kind and frequency of testing as specified for the type of joint in the material being joined. 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.

The last three paragraphs in Section 55-3.19, "Bearings and Anchorages," of the Standard Specifications are amended to read:

Mortar to be placed below masonry plates or bearing plates of the bearing assemblies and in anchor bolt sleeves or canisters shall conform to the requirements in Section 51-1.135, "Mortar," of the Standard Specifications except that the proportion of cement to sand shall be one to 3.

The embedded end of anchor bolts shall be either headed or with a nut and washer, and anchor bolts shall be installed with or without either pipe sleeves or corrugated metal canisters, as detailed on the plans. The anchor bolts shall be carefully installed to permit true positioning of the bearing assemblies.

When anchor bolts are installed in pipe sleeves or metal canisters, the pipes or canisters shall be completely filled with mortar. Such mortaring and the construction of mortar pads under masonry plates, if required, shall be done after erection of girders and before placing deck concrete.

MEASUREMENT AND PAYMENT

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

> If a portion or all of the welded structural steel is fabricated more than 300 air line miles 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 structural steel from each fabrication site located more than 300 air line miles from both Sacramento and Los Angeles will be reduced $5,000 or by an amount computed at $0.020 per pound of structural steel fabricated, whichever is greater, or in the case of each fabrication site located more than 3,000 air line miles from both Sacramento and Los Angeles, payment will be reduced $8,000 or by $0.036 per pound of structural steel fabricated, whichever is greater.

Pay quantities for structural steel will be measured and paid with deductions for perforations in structural steel plates.

If a portion of 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.

Full compensation for plate washers, erection bolts, drilling and coring existing steel, coring existing concrete, carbon equivalency testing repair methods and remedial work as required, shall be considered as included in the contract prices paid per pound for erect structural steel, bridge and no separate payment will be allowed therefor.

10-1.41 CLEAN AND PAINT STRUCTURAL STEEL

Exposed new metal surfaces and connections to existing steel shall be cleaned and painted in conformance with the provisions in Sections 59-2, "Painting Structural Steel," and 91, "Paint," of the Standard Specifications and these special provisions.

Additional cleaning and painting outside of the limits designated herein, shall be done as directed by the Engineer and will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

All debris produced when the existing paint system is disturbed shall be contained as specified in "Existing Highway Facilities" elsewhere in these special provisions.

The Contractor shall provide suitable enclosures to permit cleaning and painting during inclement weather. Provisions shall be made to artificially control atmospheric conditions inside the enclosures within 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 as a result of temperature or humidity which exceeds the limits for cleaning or painting designated herein, except as approved by the Engineer.

The fifth paragraph in Section 59-1.03, "Application," of the Standard Specifications is amended to read:

> Unless otherwise specified, should 7 days elapse between paint applications, the painted surface shall be water rinsed prior to the next paint application. Water rinsing is defined as a pressurized water rinse with a minimum nozzle pressure of 1200 psi . During rinsing, the tip of the pressure nozzle shall be placed between 12 inches and 18 inches from the surface to be rinsed. The nozzle shall have a maximum fan tip angle of 30°.

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.

The ninth paragraph in Section 59-1.03, "Application," of the Standard Specifications is amended to read:

> Runs, sags, thin and excessively thick areas in the paint film, skips and holidays, or areas of non-uniform appearance shall be considered as evidence that the work is unsatisfactory, and the Contractor may be required to blast clean the areas and reapply the paint.

The second paragraph in Section 59-2.01, "General," of the Standard Specifications is amended to read:

All exposed surfaces of structural steel and other metals, including inside surfaces of bolt holes when required, except galvanized or metalized surfaces, shall be cleaned and painted.

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

Structures, other than sign structures, shall be blast cleaned and painted with the total thickness of undercoats before erection. Finish coats and final coats shall be applied after erection. If concrete deck is to be placed on a steel member to be painted, finish coats and final coats shall be applied after concrete deck placement. After erection and deck placement, but before applying subsequent paint, areas where paint has been damaged or has deteriorated and exposed unpainted surfaces shall be thoroughly cleaned, foreign substances shall be removed, and surfaces shall be spot painted with undercoats to the specified thickness. Damaged areas of undercoat paint shall be blast cleaned and painted as specified in the special provisions.

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

Contact surfaces of stiffeners, railings, built up members, or any open seam exceeding 6 mils in width that would retain moisture, shall be caulked with non-silicone, chemically-curing type sealing compound conforming to the provisions in Federal Specification TT-S-230, Type II, or other approved material. The sealing compound shall be applied no sooner than 72 hours after the last application of undercoat. The sealing compound shall be allowed to cure as recommended by the manufacturer prior to water rinsing and application of the first finish coat. When no finish coats are applied, the sealing compound shall be gray in color.

The fourth paragraph in 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 gauge in conformance with the requirements of Steel Structure Painting Council Specification SSPC-PA2.

The existing paint systems consist of materials listed in "Existing Highway Facilities" of these special provisions.

CLEANING

New metal surfaces except where galvanized, shall be dry blast cleaned in conformance with the provisions of Surface Preparation Specification No. 10, "Near White Blast Cleaning," of the Steel Structures Painting Council. Blast cleaning shall leave surfaces with a dense, uniform, angular anchor pattern of no less than 1 1/2 mils as measured in conformance with the requirements of ASTM Designation: D 4417.

Areas of existing steel to the limits specified herein, except where galvanized, shall be water rinsed in conformance with the provisions in Section 59-1.03, "Application," of the Standard Specifications and dry spot blast cleaned in conformance with the provisions of Surface Preparation Specification No. 6, "Commercial Blast Cleaning," of the Steel Structures Painting Council. Blast cleaning shall leave surfaces with a dense, uniform, angular anchor pattern of no less than 1 mil as measured in conformance with the requirements of ASTM Designation: D 4417.

The areas of existing steel to be dry spot blast cleaned shall consist of, as a minimum: (1) contact surfaces of structural steel connections, (2) member surfaces under bolt heads, nuts or washers of all new high-strength bolted connections (3) exposed bare surfaces of existing steel remaining after trimming, cutting, drilling or reaming, (4) all areas of existing steel within a 4-inch radius measured in any direction from the of point of application of heat for welding or flame cutting and (5) all areas within 4 inches square of the centerline of rivets or bolts to be removed.

Dry spot blast cleaning of the inside of holes remaining after rivet removal and enclosed cells will not be required.

Enclosed cells shall be defined as chords, as designated on the plans, enclosed on 4 sides with solid steel plate from panel point to panel point.

A report titled "Survey of Existing Paint Thickness," is included in the "Materials Information" available to the Contractor as provided for in Section 2-1.03, "Examination of Plans, Specifications, Contract, and Site of Work," of the Standard Specifications.

Abrasives used for blast cleaning existing steel shall conform to the requirements of Abrasive Specification No. 1, "Mineral and Slag Abrasives," of the Steel Structures Painting Council and shall not contain hazardous material. Silica sand abrasives, if used, shall be Class A as defined therein.

A Certificate of Compliance conforming to the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications and a Material Safety Data Sheet shall be furnished prior to use for each shipment of blast cleaning material except silica sand to be used for existing steel.

The inside surfaces of bolt holes shall be cleaned in conformance with the provisions of Surface Preparation Specification No. 1, "Solvent Cleaning," of the Steel Structures Painting Council, and visible rust shall be removed.

All exposed galvanized surfaces shall be prepared and painted in accordance with Section 59-3, "Painting Galvanized Surfaces," of the Standard Specifications and these special provisions, except that the abrasive blast and pre-treatment of vinyl wash primer will not be required. Exposed galvanized surfaces shall be roughened by sanding with 120-grit sandpaper or equivalent. Surface roughening shall not remove galvanizing.

PAINTING

Blast cleaned new metal surfaces shall receive a single undercoat consisting of a waterborne inorganic zinc coating conforming to the provisions of AASHTO Designation M 300, Type II, except that: 1) the first 3 sentences of Section 4.7, "Primer Field Performance Requirements," and the entire Section 4.7.1 shall not apply, and 2) zinc dust shall be Type II in conformance with ASTM Designation: D 520. The inorganic zinc coating shall be listed on the qualified products list which may be obtained from the Transportation Laboratory.

Inorganic zinc coating shall be used within 12 hours of initial mixing.

Application of inorganic zinc coating shall conform to 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 45° F nor more than 85° F, 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 single undercoat of inorganic zinc coating shall be not less than 4 mils nor more than 8 mils, except that the total dry film thickness on each contact surface of high strength bolted connections, including the surfaces of outside existing members within the grip under bolt heads, nuts and washers, shall be between 1 mil and 4 mils and may be applied in one application.

Areas where mudcracking occurs in the inorganic zinc coating shall be blast cleaned and repainted with inorganic zinc coating to the specified thickness.

The inorganic zinc coating shall be tested for adhesion and cure. The locations of the tests will be determined by the Engineer. The sequence of the testing operations shall be determined by the Contractor. The testing for adhesion and cure will be performed no sooner than 72 hours after application of the single undercoat of inorganic zinc coating. At the Contractor's expense, satisfactory access shall be provided to allow the Engineer to determine the location of the tests and to test the inorganic zinc coating cure. The inorganic zinc coating shall pass both of the following tests:

The inorganic zinc coating shall have a minimum adhesion to steel of 600 psi when measured at no more than 6 locations per connection or member 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.

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.

Except as approved by the Engineer, a minimum curing time of 72 hours shall be allowed between application of inorganic zinc coating and water rinsing.

Exposed areas of inorganic zinc coating shall be thoroughly water rinsed in conformance with the provisions in Section 59-1.03, "Application," of the Standard Specifications.

Blast cleaned existing metal surfaces and areas exposed by rivet, bolt or bridge removal not blast cleaned shall receive the following undercoat paint system. The phenolic type undercoats shall be listed on the qualified products list which may be obtained from the Transportation Laboratory, (916) 227-7000.

The first undercoat, conforming to the requirements for Red Primer, High Solids Phenolic Type, Formula PB-201B, shall be applied in one or more applications to a dry film thickness of not less than 2 mils.

The second undercoat, conforming to the requirements for Pink Primer High Solids Phenolic Type Formula PB-202B, shall be applied in one or more applications to a dry film thickness of not less than 2 mils.

Application of phenolic type undercoats will not be permitted when the relative humidity exceeds 90 percent.

Phenolic type undercoats shall be applied by brush, daubers or rollers.

The first undercoat shall be applied to the required dry film thickness within 4 hours after blast cleaning.

Except as approved by the Engineer, a minimum drying time of 12 hours shall be allowed between the application of the first and second undercoats.

The second undercoat is not required for existing steel contact surfaces of structural steel connections and existing contact surfaces under bolt heads, nuts or washers of all high-strength bolted connections. Except as approved by the Engineer or otherwise specified, a minimum drying time of 1 hour shall be allowed between the application of the first phenolic type undercoat and the erection of structural steel to the structural steel connection. High strength bolts may be installed immediately after the application of the first phenolic type undercoat.

The total dry film thickness of undercoats, except those surfaces with only the first undercoat, shall be not less than 4 mils nor more than 8 mils.

Exposed areas of phenolic type undercoating shall be thoroughly water rinsed in conformance with the provisions in Section 59-1.03, "Application," of the Standard Specifications. Except as approved by the Engineer, a minimum drying time of 72 hours shall be allowed between application of second undercoat and water rinsing.

The first finish coat shall be applied within 48 hours following the water rinsing.

All exposed areas of inorganic zinc coating, phenolic undercoating and galvanized surfaces shall receive the following finish coats:

The first finish coat, conforming to the requirements for Non-Leafing Aluminum Finish Paint-Waterborne Acrylic Latex, Formula PWB-159D, shall be applied in one or more applications to a dry film thickness of not less than 2 mils.

The second finish coat, conforming to the requirements for Leafing Aluminum Finish Paint-Waterborne Acrylic Latex, Formula PWB-160D, shall be applied in one or more applications to a dry film thickness of not less than 2 mils.

Application of finish coats will not be permitted when the relative humidity exceeds 80 percent.

Except as approved by the Engineer, a minimum drying time of 12 hours shall be allowed between finish coats.

The total dry film thickness of all applications of inorganic zinc coating and finish coat paint shall be not less than 8 mils nor more than 16 mils .

MEASUREMENT AND PAYMENT

Dry spot blast cleaning and undercoat painting areas of existing surfaces will be measured in accordance with the limits specified herein and will be paid for as spot blast clean and paint undercoat.

The contract price paid per square meter for spot blast clean and paint undercoat shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in dry spot blast cleaning and painting undercoat on the existing surfaces complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract lump sum price paid for clean and paint structural steel shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in cleaning and painting the surfaces of the new structural steel galvanized surfaces and finish coats on undercoated areas of existing metal, complete in place, including water rinsing, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.42 VITRIFIED CLAY PIPE SEWER

This work shall consist of furnishing and constructing vitrified clay pipe culvert including excavating, backfilling, and other incidental work, necessary or required for a complete installation as shown on the plans, as directed by the Engineer, and as provided in these special provisions.

Excavation and backfill shall conform to the provisions in Section 19-3, "Structure Excavation and Backfill," of the Standard Specifications.

Vitrified clay pipe (VCP) shall conform to the ASTM “Standard Specifications for Extra Strength Clay Pipe,” Designation C700, except as modified by the plans and these special provisions. The minimum thickness of the pipe barrel shall conform to the Regional Western Standard of the Clay Pipe Institute.

Joints shall be made up in the field in accordance with the manufacturer's recommendations. All joints shall be tight fitting, watertight, and without imperfections. Only factory recommended lubricants shall be used. Joints connecting pipes to manhole structures shall be made with a short stub. The straight segment of stub barrel may not exceed 6 inches

maximum from face of structure. Joints for VCP plain-end pipe may be rubber compression couplings with stainless steel bands and shall be in accordance with the requirements of ASTM Designation: C425.

The Contractor shall furnish to the Engineer for approval six copies of the certified report of actual test results meeting ASTM C700. The pipes shall be handled and stored so as to prevent damage thereto, or to existing improvements. Pipe, when stored, shall be secured to prevent rolling.

VCP shall be so constructed and the sections so installed that the sections of pipe laid together from a continuous uniform line of pipe with a smooth regular interior surface. Pipe shall be laid uphill from structure to structure with the bell end upgrade. Each pipe shall be laid in the proper position, on a firm 4 inch deep sand bed, and shall have uniform support and bearing for its entire length. Bells shall be cleaned before the spigot of the succeeding pipe is inserted. A bell hole shall be dug at the end of each pipe to accommodate the bell and facilitate the making of joint.

Pipe shall be laid in conformity to the prescribed lines and grades, which shall be obtained for each pipe by measuring from a tightly stretched line running parallel with the grade and supported over the center line of the pipe by bars placed across the trench. The pipe sections shall be tightly fitted together. All adjustments of pipe to line and grade shall be made by scraping away of filling in and tamping the earth under the body of the pipe, not by blocking or wedging up. Supporting blocks shall not be under the pipe. Pipe shall not be laid within 4 inches of any rock or other rigid object.

The Contractor shall not lay pipe in water and shall use permeable material, subdrains, or some other method approved by the Engineer to maintain an appropriately dry trench. Permeable material bedding shall be Class 3 and shall conform to the following grading:

Sieve Sizes	Percentage Passing
1 1/2 "	100
1 "	90 - 100
3/4 "	40 - 100
3/8 "	0 - 50
No. 4	0 - 15
No. 8	0 - 5

Class 3 permeable material shall have a durability index of not less than 40. Compaction shall be obtained by shovel slicing, using care not to disturb pipe. Jetting will not be allowed to get proper compaction of the permeable material bedding.

The length of VCP will be the slope length designated by the Engineer.

Vitrified clay pipe will be measured and paid for as clay sewer pipe by the linear foot of the size shown in the Engineer's Estimate.

The contract price paid per linear foot for clay sewer pipe of the size designated in the Engineer's Estimate, shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in constructing the vitrified clay pipe, complete in place, including structure excavation, structure backfill, sand bedding, permeable material, subdrains and connecting the pipe to existing or new facilities, including concrete collars as shown on the plans, as specified in the Standard Specifications and these special provisions and as directed by the Engineer.

10-1.43 CAST IRON SEWER PIPE

This work shall consist of furnishing and constructing cast iron pipe culvert including any necessary excavating, backfilling, and other incidental work, necessary or required for a complete installation as shown on the plans, as directed by the Engineer, and as provided in these special provisions.

Excavation and backfill if required shall conform to the provisions in Section 19-3, "Structure Excavation and Backfill," of the Standard Specifications.

Cast iron pipe (CIP) and fittings shall conform to the ASTM "Standard Specifications Designation A74, or of Cast Iron Soil Pipe Institute Standard No. 301.

Joints shall be made up in the field in accordance with the manufacturer's recommendations. All joints shall be tight fitting, watertight, and without imperfections. Only factory recommended lubricants shall be used.

The Contractor shall furnish to the Engineer for approval six copies of the certified report of actual test results meeting ASTM A74. The pipes shall be handled and stored so as to prevent damage thereto, or to existing improvements. Pipe, when stored, shall be secured to prevent rolling.

CIP shall be so constructed and the sections so installed that the sections of pipe laid together from a continuous uniform line of pipe with a smooth regular interior surface. Pipe shall be laid uphill from structure to structure with the bell

end upgrade. Each pipe shall be laid in the proper position, on a firm 4 inch deep sand bed, and shall have uniform support and bearing for its entire length.

The length of CIP will be the slope length designated by the Engineer.

Cast iron pipe will be measured and paid for as cast iron sewer pipe by the linear foot of the size shown in the Engineer's Estimate.

The contract price paid per linear foot for cast iron sewer pipe of the size designated in the Engineer's Estimate, shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in constructing the cast iron pipe, complete in place, including structure excavation, structure backfill, including sand bedding, and connecting the pipe to existing or new facilities as shown on the plans, as specified in the Standard Specifications and these special provisions and as directed by the Engineer.

10-1.44 MISCELLANEOUS CONCRETE CONSTRUCTION

Curbs, curb and gutter, sidewalks and driveways shall conform to the provisions in Section 73, "Concrete Curbs and Sidewalks," of the Standard Specifications.

10-1.45 MISCELLANEOUS IRON AND STEEL

Miscellaneous iron and steel shall conform to the provisions in Section 75, "Miscellaneous Metal," of the Standard Specifications and these special provisions.

The second paragraph in Section 75-1.06, "Measurement," of the Standards Specifications is amended to read:

> Scale weights will not be required when miscellaneous iron and steel, miscellaneous bridge metal, miscellaneous metal (restrainer), or pumping plant metal work are designated as final pay items in the Engineer's Estimate.

10-1.46 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 Quality Control” elsewhere in 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:

> high strength threaded rods
> drainage pipe assemblies

Steel fasteners using high-strength rods and studs shall conform to the provisions for steel fasteners and for bolted connections in Section 55, "Steel Structures," of the Standard Specifications and in "Steel Structures" elsewhere in these special provisions.

Casing insulators for the drainage piping, as shown on the plans, shall be designed for the size of casing and drain pipe shown on the plans. casing insulators shall be 14-gage thick, painted or galvanized, steel band and a minimum of four 2-inch wide glass reinforced runners. The casing insulators shall have a non-conductive inner liner. Insulators 6-inch in diameter or larger shall also be coated with 0.010 inch thick coating of heat fused polyvinyl chloride. Casing insulators shall be factory constructed to ensure the drain pipe is centered to avoid any pipe to pipe contact and shall have at least 2 runners seated on the bottom of the casing.

An approved thread locking system, consisting of a cleaner, primer and anaerobic adhesive, shall be applied where shown on the plans. Lubricants and foreign materials shall be removed from the threaded areas of both parts using the cleaner and small wire brush. The primer shall be applied to cover the threaded areas of both parts. The anaerobic adhesive shall be applied to fill the male threads in the area of the final position of the nut. The nut shall be installed at the location or to the torque shown on the plans, and an additional fillet of anaerobic adhesive shall be applied completely around the exposed junctions of the nut and male part. Full compensation for furnishing and applying the thread locking system shall be considered as included in the contract price paid for the item of work requiring the system and no separate payment will be made therefor.

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

> 3. Manhole frames and covers, frames and grates, ladder rungs, guard posts, and access door assemblies.

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

Cast-in-place inserts shall be ferrule loop or cast iron type.

All metal parts of anchorage devices shall be fabricated from steel, except iron castings for cast-in-place inserts shall be malleable iron or ductile iron.

All metal parts of anchorage devices, except mechanical expansion anchors and iron castings for cast-in-place inserts, shall be hot-dip or mechanically galvanized. Mechanical expansion anchors may be hot-dip or mechanically galvanized, made from stainless steel, or coated with electrodeposited zinc conforming to the requirements of ASTM Designation: B 633. Iron castings shall be mechanically galvanized.

The second paragraph in Section 75-1.06, "Measurement," of the Standards Specifications is amended to read:

Scale weights will not be required when miscellaneous iron and steel, miscellaneous bridge metal, miscellaneous metal (restrainer), or pumping plant metal work are designated as final pay items in the Engineer's Estimate.

Full compensation for casing insulators shall be considered as included in the contract price paid per pound for miscellaneous metal (bridge) and no separate payment will be allowed therefor.

10-1.47 PAINT TRAFFIC STRIPES AND PAVEMENT MARKINGS

Painting traffic stripes (traffic lines) and pavement markings shall conform to the provisions in Sections 84-1, "General," and 84-3, "Painted Traffic Stripes and Pavement Markings," of the Standard Specifications and these special provisions.

The subparagraphs of the first paragraph in Section 84-3.02, "Materials," of the Standard Specifications are amended to read:

	State Specification No.
Solvent Borne, Acrylic Copolymer Traffic Line - White, Yellow and Black	PT-170-A
Water Borne, Traffic Line - White, Yellow and Black	8010-20A

The State Specification No. for glass beads in Section 84-3.02, "Materials," of the Standard Specifications is amended to read "8010-004 (Type II)."

At the option of the Contractor, permanent striping tape as specified in "Prequalified and Tested Signing and Delineation Materials" elsewhere in these special provisions, may be placed instead of the painted traffic stripes and pavement markings specified herein, except that "Stamark" Series A320 Bisymetric Grade pavement tape, manufactured by the 3M Company, shall not be used. Pavement tape, if used, shall be installed in accordance with the manufacturer's specifications. If pavement tape is placed instead of painted traffic stripes and pavement markings, the pavement tape will be measured and paid for as paint traffic stripe and paint pavement marking of the number of coats designated in the Engineer's Estimate.

SECTION 10-2. HIGHWAY PLANTING AND IRRIGATION SYSTEMS

10-2.01 GENERAL

The work performed in connection with highway planting and irrigation systems shall conform to the provisions in Section 20, "Erosion Control and Highway Planting," of the Standard Specifications and these special provisions.

The Contractor shall notify the Engineer not less than 72 hours prior to requiring initial access to the existing irrigation controllers. When the Engineer determines that access to the controllers is required at other times, arrangements will be made to provide this access.

10-2.01A COST BREAK-DOWN

The Contractor shall furnish to the Engineer a cost break-down for the contract lump sum items of highway planting and irrigation system.

Cost break-downs shall be completed and furnished in the format shown in the samples of the cost break-downs included in this section. Unit descriptions of work shown in the samples are the minimum to be submitted. Additional unit descriptions of work may be designated by the Contractor. If the Contractor elects to designate additional unit descriptions of work, the quantity, value and amount for those units shall be completed in the same manner as for the unit descriptions shown in the samples. The units and quantities given in the samples are to show the manner of preparing the cost break-downs to be furnished by the Contractor.

The Contractor shall determine the quantities required to complete the work shown on the plans. The quantities and their values shall be included in the cost break-downs submitted to the Engineer for approval. The Contractor shall be responsible for the accuracy of the quantities and values used in the cost break-downs submitted for approval.

No adjustment in compensation will be made in the contract lump sum prices paid for highway planting and irrigation system due to any differences between the quantities shown in the cost break-downs furnished by the Contractor and the quantities required to complete the work as shown on the plans and as specified in these special provisions.

The sum of the amounts for the units of work listed in each cost break-down for highway planting and irrigation system work shall be equal to the contract lump sum price bid for the work. Overhead and profit shall be included in each individual unit listed in each cost break-down. Cost break-downs shall be submitted to the Engineer for approval within 30 working days after the contract has been approved. Cost break-downs shall be approved, in writing, by the Engineer before any partial payment for the items of highway planting and irrigation system will be made.

Approved cost break-downs will be used to determine partial payments during the progress of the work and as the basis of calculating the adjustment in compensation for the items of highway planting and irrigation system due to changes ordered by the Engineer. When an ordered change increases or decreases the quantities of an approved cost break-down, 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 accordance with Section 4-1.03B, "Increased or Decreased Quantities," of the Standard Specifications.

HIGHWAY PLANTING COST BREAK-DOWN

Contract No. 04-043554

UNIT DESCRIPTION	UNIT	APPROXIMATE QUANTITY	VALUE	AMOUNT
PREPARE HOLE (SOIL AMENDMENT)	EA	73		
CULTIVATE (SOIL AMENDMENT)	SQYD	367		
MULCH	CY	30		
COMMERCIAL FERTILIZER (TABLET)	TAB	235		
PLANT (GROUP B)	EA	48		
PLANT (GROUP U)	EA	7		
PLANT (GROUP K)	EA	18		
PLANT (GROUP F)	EA	3,300		
ROOT PROTECTOR	EA	8		
TREE GRATE & FRAME	EA	1		
REMOVE AND RESET TREE GRATES	EA	14		
ROADSIDE CLEARING	LS	LUMP SUM		

TOTAL_____

IRRIGATION SYSTEM COST BREAK-DOWN

Contract No. 04-043554

UNIT DESCRIPTION	UNIT	APPROXIMATE QUANTITY	VALUE	AMOUNT
CAP AND REMOVE EXISTING IRRIGATION FACILITIES	LS	LUMP SUM		

TOTAL_____

10-2.02 EXISTING HIGHWAY PLANTING

In addition to the provisions in Section 20 of the Standard Specifications, work performed in connection with existing highway planting shall be in accordance with the provisions in Section 15, "Existing Highway Facilities," of the Standard Specifications and these special provisions.

Prior to beginning work at Location 3, the Engineer will designate the limits of disturbance allowed. Existing planting that is damaged or removed by the Contractor's operation outside the limits established by the Engineer shall be replaced at the Contractor's expense.

Replacement planting shall conform to the requirements specified under "Preservation of Property" elsewhere in these special provisions.

Replacement of existing planting within the limits of Location 3 will be paid for as extra work as provided in Section 4-1.030 of the Standard Specifications.

RESET TREE GRATES:- Reset tree grates shall consist of removing and resetting tree grates as shown on the plans.

10-2.02A MAINTAIN EXISTING PLANTS

Existing plants shall be maintained as directed by the Engineer. Maintain existing plants will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

10-2.03 EXISTING HIGHWAY IRRIGATION FACILITIES

In addition to the provisions in Section 20, "Erosion Control and Highway Planting," of the Standard Specifications, the work performed in connection with the various existing highway irrigation system facilities shall conform to the provisions in Section 15, "Existing Highway Facilities," of the Standard Specifications and these special provisions.

Existing irrigation facilities shown on the plans to be capped and removed, shall remain in place until their use, as determined by the Engineer, is no longer required.

Prior to beginning any work, the Engineer will designate the limits of disturbance allowed for each work location. Existing irrigation facilities that are to remain, as part of this contract, shall be protected from damage. If the Contractor's operations damage the existing irrigation facilities, the Contractor shall, at the Contractor's expense, repair or replace the damaged facilities as follows:

Repair or replacement of damaged facilities shall be completed within 10 working days of the damage.

Replaced irrigation facilities shall be new, and of equal or better quality than the damaged facility. Replacement irrigation facilities shall be compatible with the irrigation systems to remain.

After repair or replacement of the facilities is complete, the Contractor shall demonstrate to the Engineer that the repaired or replaced facilities operate properly. When remote control valves are repaired or replaced, the valves shall be tested with the irrigation controller in the automatic mode.

Replacement and checking of existing irrigation facilities within the limits of each work location will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

Existing irrigation facilities repaired or replaced by the Contractor shall be checked for satisfactory operation not more than 5 working days prior to the acceptance of the contract.

Unsatisfactory performance of irrigation facilities repaired or replaced by the Contractor shall be repaired or replaced and rechecked at the Contractor’s expense until satisfactory performance is obtained.

10-2.04 HIGHWAY PLANTING

The work performed in connection with highway planting shall conform to the provisions in Section 20-4, "Highway Planting," of the Standard Specifications and these special provisions.

10-2.04A HIGHWAY PLANTING MATERIALS

PLANTS.--Plants that are found to be in a root bound condition or have an underdeveloped root ball as determined by the Engineer will not be accepted.

MULCH.--Mulch shall be tree bark.

COMMERCIAL FERTILIZER.--Commercial fertilizer (granular) shall be a pelleted or granular form and shall have the following guaranteed chemical analysis:

Ingredient	Percentage
Nitrogen	16
Phosphoric Acid	8
Water Soluble Potash	4

Commercial fertilizer (slow release) shall be a pelleted or granular form, shall be a slow release type and shall have the following guaranteed chemical analysis:

Ingredient	Percentage
Nitrogen	6
Phosphoric Acid	20
Water Soluble Potash	20

Commercial fertilizer (tablet) shall be a slow release type and shall be in tablet form. Each tablet, as shown on the Plant List on the plans, shall have a mass of 21 ± 1 grams, and shall have the following guaranteed chemical analysis:

Ingredient	Percentage
Nitrogen	20
Phosphoric Acid	10
Water Soluble Potash	5

10-2.04B ROADSIDE CLEARING

Prior to preparing planting areas or commencing irrigation trenching operations for planting areas, trash and debris shall be removed from proposed planting areas and within the areas extending beyond the outer limits of the proposed planting areas to the adjacent edges of existing planting to remain or to be maintained, shoulders, dikes, curbs, sidewalks, fences and walls.

In addition to removing trash and debris, the project area shall be cleared as specified herein:

Existing trees, shrubs, and ground cover within the limits of planting as shown on the plans and trees designated on the plans shall be removed.

Weeds shall be killed and removed within proposed ground cover, and weeds shall be killed and within the area extending beyond the outer limits of the proposed ground cover areas to the adjacent edges of shoulders, dikes, curbs, sidewalks, walls, existing planting and fences.

Weeds shall be killed and removed within an area 6 feet in diameter centered at each proposed plant location where the plants are to be planted more than 15 feet apart and are located outside of proposed ground cover areas.

Disposal of weeds killed during the initial roadside clearing will be required.

After the initial roadside clearing is complete, additional roadside clearing work shall be performed as often as necessary to maintain the areas, as specified above, in a neat appearance until the start of the plant establishment period. This work shall include the following:

Trash and debris shall be removed.

Rodents shall be controlled.

Weed growth shall be killed before the weeds reach the seed stage of growth or exceed 6 inches in length.

Weeds in plant basins, including basin walls, shall be removed by hand pulling, after the plants have been planted.

WEED CONTROL.--Weed control shall also conform to the following:

Stolon type weeds shall be killed with glyphosate.

Removed weeds and ground cover shall be disposed of outside the highway right of way in accordance with the provisions in Section 7-1.13 of the Standard Specifications.

10-2.04C PESTICIDES

Pesticides used to control weeds shall conform to the provisions in Section 20-4.026, "Pesticides," of the Standard Specifications. Except as otherwise provided in these special provisions, pesticide use shall be limited to the following materials:

Glyphosate

If the Contractor elects to request the use of other pesticides on this project, the request shall be submitted in writing to the Engineer not less than 10 working days prior to the intended use of the other pesticides. Except for the pesticides listed in the preceding paragraph, no pesticides shall be used or applied without prior written approval from the Engineer.

Glyphosate shall be used to kill stolon type weeds.

No pesticides, except glyphosate shall be applied within the limits of plant basins. Pesticides shall not be applied in such a manner as to allow the pesticides to come in contact with the foliage and woody parts of proposed plants.

PREPARE HOLES.—Holes for plants shall be excavated to the minimum dimensions shown on the plans.

Plant holes excavated by drilling shall have the sides of the holes scarified to encourage plant root penetration.

Root protectors shall be installed in plant holes in accordance with the details shown on the plans and the requirements specified under "Root Protectors" elsewhere in these special provisions.

Backfill material for plant holes shall be a mixture of soil and soil amendment as shown on the plans. Backfill material shall be thoroughly mixed and uniformly distributed throughout the entire depth of the plant hole without clods and lumps.

CULTIVATE.--Areas to be planted with Hedera helix shall be cultivated.

Immediately prior to cultivation, soil amendment and commercial fertilizer shall be added to the areas to be cultivated. Soil amendment shall be added at the rate shown on the plans and commercial fertilizer shall be applied at the rate of 15 pounds per 1,000 square feet. Soil amendment and fertilizer shall be thoroughly mixed with the soil.

10-2.04D PLANTING

Commercial fertilizer shall be applied or placed at the time of planting and at the rates shown on the plans.

Commercial fertilizer (granular) shall be applied to ground cover plants immediately after planting and watered into the soil.

Commercial fertilizer (tablet) shall be placed evenly around and approximately half the depth of the root ball for Plant (Group B, K and U) plants.

Mulch for plant basins shall be placed so that the mulch does not come in contact with the plant stem.

Planting shall not be performed in an area until a functional test has been completed on the irrigation system serving that area.

TREE GRATE:- The tree grate shall be install with a steel support frame as shown on the plans and per manufacturer's recommendations and conform to the following:

1. Cast iron (Class 35 gray iron per ASTM A 48)
2. Design pattern as shown on plans,
3. Installed as 2 halves with a total dimension of 48-inch square.
4. Black enamel finish applied by the manufacturer.

The one piece steel angle support frame with concrete anchor bolts shall conform to the following:

1. Manufactured and supplied by the same company supplying the tree grate.
2. One continuous piece measuring 49 inches by 49 inches square.
3. Black enamel finish applied by the manufacturer.
4. Eight concrete anchors welded 1-foot from each corner of the support frame.

ROOT PROTECTORS.--Root protectors shall be installed at the time the plant holes are prepared in accordance with the details shown on the plans and these special provisions.

Root protectors shall be black, injection molded panels, with a minimum thickness of 0.085 inch, in modules 24 inch long by 24 inch deep; manufactured with a minimum 50 percent post consumer recycled polypropylene or polyethylene plastic with added ultraviolet inhibitors. The panel shall have a minimum of 4 raised vertical ribs spaced at 6 inches, protruding at 90 degrees from the interior of barrier panel, running from the top of the panel to the bottom. ROOT BARRIER PANELS SHALL BE CONNECTED BY MEANS OF SELF-LOCKING, RIGID CONNECTOR STRIP OR AN INTEGRAL MALE/FEMALE SLIDING LOCK, EACH PANEL HAVING A MALE CONNECTOR AT ONE END AND FEMALE AT THE OPPOSITE END. THE EDGE AT THE TOP OF THE CYLINDER SHALL BE UNCUT (MANUFACTURED FINISHED EDGE) AND SHALL BE FREE OF SHARP POINTS.

10-2.04E PLANT ESTABLISHMENT WORK

The plant establishment period shall be Type 2 and shall be not less than 125 working days.

Attention is directed to "Relief From Maintenance and Responsibility" elsewhere in these special provisions regarding relief of maintenance and protection.

One applications of commercial fertilizer (granular) shall be applied to ground cover areas when directed by the Engineer. Commercial fertilizer shall be applied at the rates shown on the plans and shall be spread with a mechanical spreader wherever possible.

One application of commercial fertilizer (slow release) shall be applied to trees, shrubs, vines and ground cover areas when directed by the Engineer. Commercial fertilizer shall be applied at the rates shown on the plans and shall be spread with a mechanical spreader wherever possible.

Weeds within plant basins, including basin walls and ground cover, shall be controlled by hand pulling.

Weeds within mulched areas and ground cover, but outside of plant basins, shall be controlled by killing.

At the option of the Contractor, plants of a larger container size than those originally specified may be used for replacement plants during the first 100 working days of the plant establishment period. The use of plants of a larger container size than those originally specified for replacement plants shall be at the Contractor's expense.

After 100 working days of the plant establishment period have been completed, replacement of plants, except for ground cover plants, shall be 15-gallon size for 5-gallon size plants; and 24-inch box size for 15-gallon size plants.

When the Engineer determines that the plant stakes are inadequate to support the plants during the plant establishment period, the Contractor, at his cost, shall replace the plant stakes with a larger diameter stake adequate to support the plant. Plant stakes shall be removed at any time during the plant establishment period when ordered by the Engineer. The final inspection, as specified in Section 5-1.13 of the Standard Specifications, shall be completed a minimum of 20 working days before the estimated completion of the contract.

10-2.04F PAYMENT

Highway planting work will be paid for as a single contract lump sum price for highway planting, except plant establishment work will be paid for separately as provided elsewhere in these special provisions.

SECTION 10-3. ELECTRICAL FACILITIES (SEISMIC RETROFIT)

10-3.01 DESCRIPTION

Electrical facilities (seismic retrofit) shall conform to the provisions in Section 86, "Signals, Lighting and Electrical Systems," of the Standard Specifications and these special provisions.

Electrical work on the San Francisco-Oakland Bay Bridge (SFOBB) seismic retrofit project shall consist of:

Stage 1- Before structure retrofitting:

1. Remove existing lighting system, communication cable and traffic operations system.
2. Install temporary traffic operations system as shown on the plans.

Stage 2- After structure retrofitting:

1. Reinstall the lighting system, communication cable and traffic operations system.

10-3.02 EXCAVATING AND BACKFILLING

The third paragraph in Section 86-2.01, "Excavating and Backfilling," of the Standard Specifications is amended to read:

> The excavations shall be backfilled in conformance with the provisions in Section 19-3, "Structure Excavation and Backfill." Backfill placed in conduit trenches to be outside of slope lines and not under pavement shall be compacted to a relative compaction of not less than 90 percent.

10-3.03 FOUNDATIONS

The first paragraph of Section 86-2.03, "Foundations," of the Standard Specifications is amended by the addition of the following sentence:

> Placement of concrete shall conform to the provisions of Section 51, "Concrete Structures."

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

> Anchor bars or studs and nuts, except for Type 30 and Type 31 lighting standards, shall conform to ASTM Designation: A 307. Headed anchor bolts for foundations shall conform to the specifications of ASTM Designation: A 307, Grade B with S1 supplementary requirements. At the option of the contractor, nonheaded anchor bolts for foundations shall conform either to the specifications of ASTM Designation: A 307, Grade C or to the provisions in AASHTO Designation: M 314, Grade 36 or 55 with S1 supplementary requirements. When nonheaded anchor bolts conforming to the specifications of ASTM Designation: A 307, Grade C are furnished, the end of each fabricated anchor bolt shall be either coded by end stamping as required in ASTM Designation: A 307 or the end that projects from the concrete shall be permanently coded with a green color by the manufacturer.

Sleeve nuts shall be used on Type 1-B standard. Foundations for Type 1-B standards shall conform to the details on Standard Plan ES-6A, "Anchor Bolts With Sleeve Nuts", except that the bottom of the base plate shall be flush with the finished grade.

10-3.04 CONDUIT

Conduit to be installed underground shall be the rigid steel or rigid non-metallic type unless otherwise specified.

The conduit in a foundation and between a foundation and the nearest pull box shall be the rigid steel type.

When a standard coupling cannot be used for coupling metal type conduit, a UL listed threaded union coupling, as specified in the third paragraph 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.

When rigid non-metallic conduit is installed in a trench (not in pavement or under portland cement concrete sidewalk), after the bedding material is placed and conduit installed, the trench shall be backfilled with commercial quality concrete, containing not less than 376 pounds of portland cement per cubic yard, to not less than 4 inches above the conduit before additional backfill material is placed.

Conduit runs shown on the plans to be located behind curbs may be installed in the street, within 3 feet of and parallel to the face of the curb, by the "Trenching in Pavement Method" described in Section 86-2.05C, "Installation," of the Standard Specifications. Pull boxes shall be located behind the curb or at the locations shown on the plans.

After conductors have been installed, the ends of conduits terminating in pull boxes, and in service and controller cabinets shall be sealed with an approved type of sealing compound.

At locations where conduit is required to be installed under pavement and existing underground facilities require special precautions, as described in "Obstructions" of these special provisions, conduit shall be placed by the "Trenching in Pavement Method" as specified in Section 86-2.05C, "Installation," of the Standard Specifications.

At other locations where conduit is required to be installed under pavement and if delay to any vehicle will not exceed 5 minutes, conduit may be installed by the "Trenching in Pavement Method."

Pull ropes for use when installing cables in rigid non-metallic conduit shall consist of a flat, woven, lubricated, soft-fiber polyester tape with a minimum tensile strength of 1,800 pounds and shall have printed sequential measurement markings at least every 3 feet.

For single conduit run on wall, single-hole malleable iron clamps shall be used.

Conduit supports shall be installed in locations where required by the NEC code and shall be suitable for the installation.

10-3.05 PULL BOXES

Grout shall not be placed in bottom of new or existing pull boxes.

10-3.06 TRAFFIC PULL BOXES

Traffic pull boxes and covers shall have a vertical proof-load strength of 25,000 pounds. The 25,000 pound load shall be distributed through a 9" x 9" x 2" steel plate according to Federal Specification RR-F-621e. This load shall be placed anywhere on the box and cover for a period of one minute without causing any cracks or permanent deformations.

The No. 5(T) pull boxes shall be reinforced with a galvanized Z-bar welded frame and cover similar to that shown on the plans for No. 6(T) pull boxes. Frames shall be anchored to the boxes by means of 1/4 inch x 2 1/4-inch long concrete anchors. Six concrete anchors shall be provided for each No. 5(T) and No. 6(T) pull box, one placed in each corner and one placed near the middle of each of the longer sides.

Hold down screws shall be 3/8 inch hex flange cap screws of Type 316 stainless steel. The nut shall be zinc plated carbon steel and shall be made vibration resistant with a wedge ramp at the root of the thread. The nut shall be spot welded to the underside of, or fabricated with, the galvanized Z-bar pull box frame.

Steel covers shall be countersunk approximately 1/4 inch to accommodate the bolt head. The bolt head shall not extend more than 1/8 inch above the top of the cover when tightened down. A 1/4 inch tapped hole and brass bonding screw shall be provided.

The opening of traffic pull boxes shall have the following dimensions.

Pull Box Type	Width (±1 inch)	Length (±1 inch)
No. 5(T)	13"	24"
No. 6(T)	17"	30"

Concrete placed around and under traffic pull boxes as shown on the plans shall contain a minimum of 564 pounds of cement per cubic yard.

After the installation of traffic pull boxes, the steel covers shall be installed and kept bolted down during periods when work is not actively in progress at the pull box. When placing the steel cover for the final time, the cover and the Z-bar frame shall be cleaned of all debris and securely tightened down.

10-3.07 CONDUCTORS AND WIRING

Splices shall be insulated by "Method B".

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

Section 86-2.09D, "Splicing," of the Standard Specifications is amended by retitling as "Splicing and Terminations," and the last paragraph is amended to read:

> All splices and terminal lugs for conductor sizes No. 8 and smaller shall be soldered by the hot iron, pouring or dipping method. Open flame soldering will not be permitted.

All single conductor of No. 10 AWG and larger sizes shall be stranded copper wire.

10-3.08 CHANGEABLE MESSAGE SIGN CONTROL CABLE

Changeable Message Sign Control (CMSC) cable shall consist of 77 No. 22 twisted pairs stranded, tinned copper conductors, insulated with 10 mils of color coded PVC (see color code below). The cable shall be provided with a gray polyurethane outer jacket with a nominal thickness of 83 mils. The cable shall pass the UL VW-1 flame test and shall be UL cable style: 20233. The outside diameter of the cable shall be 0.98 inch, maximum.

COLOR CODE FOR CMSC CABLE:

1. White paired with Black
2. White paired with Brown
3. White paired with Red
4. White paired with Orange
5. White paired with Yellow
6. White paired with Green
7. White paired with Blue
8. White paired with Violet
9. White paired with Gray
10. Black paired with Brown
11. Black paired with Red
12. Black paired with Orange
13. Black paired with Yellow
14. Black paired with Green
15. Black paired with Blue
16. Black paired with Violet
17. Black paired with Gray
18. Brown paired with Red
19. Brown paired with Orange
20. Brown paired with Yellow
21. Brown paired with Green
22. Brown paired with Blue
23. Brown paired with Violet
24. Brown paired with Gray
25. Red paired with Orange
26. Red paired with Yellow
27. Red paired with Green
28. Red paired with Blue
29. Red paired with Violet
30. Red paired with Gray
31. Orange paired with Yellow
32. Orange paired with Green
33. Orange paired with Blue
34. Orange paired with Violet
35. Orange paired with Gray
36. Yellow paired with Green
37. Yellow paired with Blue
38. Yellow paired with Violet
39. Yellow paired with Gray
40. Green paired with Blue
41. Green paired with Violet
42. Green paired with Gray
43. Blue paired with Violet
44. Blue paired with Gray
45. Violet paired with Gray
46. White/Black paired with Black
47. White/Black paired with Brown
48. White/Black paired with Red
49. White/Black paired with Orange
50. White/Black paired with Yellow
51. White/Black paired with Green
52. White/Black paired with Blue
53. White/Black paired with Violet
54. White/Black paired with Gray

55. White/Brown paired with Black
56. White/Brown paired with Brown
57. White/Brown paired with Red
58. White/Brown paired with Orange
59. White/Brown paired with Yellow
60. White/Brown paired with Green
61. White/Brown paired with Blue
62. White/Brown paired with Violet
63. White/Brown paired with Gray
64. White/Red paired with Black
65. White/Red paired with Brown
66. White/Red paired with Red
67. White/Red paired with Orange
68. White/Red paired with Yellow
69. White/Red paired with Green
70. White/Red paired with Blue
71. White/Red paired with Violet
72. White/Red paired with Gray
73. White/Orange paired with Black
74. White/Orange paired with Brown
75. White/Orange paired with Red
76. White/Orange paired with Orange
77. White/Orange paired with Yellow

Termination of CMS cable into the controller cabinet and CMS panel shall be as directed by the Engineer.

10-3.09 TELEPHONE CABLE

The telephone cable (TC) shall consist of 6 pairs of No. 19 solid copper conductors. Conductors shall be twisted in pairs. Each conductor shall be insulated with a high molecular weight, heat stabilized, color coded polyethylene material. The insulation shall be 18-mils nominal.

Color code for TC cable shall be as follows:

1. White/Blue
2. White/Orange
3. White/Green
4. White/Brown
5. White/Gray
6. Red/Blue

The core shall be protected by a non-hygroscopic polyester film with a single longitudinally applied 5-mil thick corrugated copper shield (or 8-mil thick plastic coated aluminum shield). A moisture barrier of petrolatum-polyethylene compound shall be applied over the core tape and over and under the cable shield to fill all cable interstices.

The cable shall be provided with an outer jacket of extruded, black, high molecular weight, heat stabilized polyethylene material. The outer jacket shall have a thickness of 60 mils nominal. The outer diameter of the cable shall be 0.60-inch maximum.

Splices will not be allowed, except where shown on the plans.

10-3.10 ANTENNA FEED COAXIAL CABLE

Antenna Feed Coaxial cable shall be Type RG-8/U coaxial cable, Belden No.9914 or equal. Splices shall be as directed by the Engineer.

10-3.11 COMMUNICATION CABLE

The communication cable shall consist of 25 pairs of No. 19 solid copper conductors. Conductors shall be twisted in pairs. Each conductor shall be insulated with a high molecular weight, heat stabilized, color coded polyethylene material. The insulation shall be 18 mils nominal.

The core shall be protected by a non-hygroscopic polyester film with a single longitudinally applied 5-mil thick corrugated copper shield (or 8-mil thick plastic coated aluminum shield). A moisture barrier of petrolatum-polyethylene compound shall be applied over the core tape and over and under the cable shield to fill all cable interstices.

The cable shall be provided with an outer jacket of extruded, black, high molecular weight, heat stabilized polyethylene material. The outer jacket shall have a thickness of 60 mils nominal. The outer diameter of the cable shall be 0.60-inch maximum.

Splices will not be allowed, except where shown on the plans.

10-3.12 COMMUNICATION CABLE SPLICES

Splices for No.19 twisted pair, shielded cables shall be as recommended by the cable manufacturer and suitable for the environment that it is situated in. The Contractor shall submit the splicing method to the Engineer for approval.

10-3.13 MISCELLANEOUS ELECTRICAL DEVICE

All power switches and outlets shall meet the latest NEMA Standards for Industrial System or be specification grade. Specification grade is defined as a product that meets or exceeds heavy duty NEMA test requirements. Specification grade device shall equal or exceed UL requirements. The size and type shall be as indicated on the plans and specified in these special provisions.

10-3.14 MISCELLANEOUS METAL

Miscellaneous metal shall consist of conduit fittings, adapters, elbows, connectors, clamps, clamp fasteners and metal plates. Miscellaneous metal shall be galvanized in accordance with Section 75 in the Standard Specifications.

10-3.15 LIGHTING FIXTURE

Lighting fixture is outdoor type and designed to exclude dirt, moisture and corrosive vapors from the interior of the fixture and the conduit system. All lighting fixtures are rugged, corrosion and heat resistance.

Installing lighting fixture shall include the following:

1. Body with 3/4" hub for 3/4" conduit or conduit adapter connection.
2. Head resisting clear straight globe with metal guard and gaskets.
3. Install 150 Watt Incandescent lamp for the fixture mounting on the metal plate and 200 Watt incandescent lamp for the fixture mounting on the type 1B standard.
4. The lighting fixture mounting on the type 1B standard shall include a fiber glass reinforced polyester reflectors.

10-3.16 FASTENERS

Conduit and cable clamps which are to be attached to the steel structure by means of fasteners such as screws or bolts may use drill-and-tap, drill and nut-and-bolt, power actuated fasteners, and self-drilling screws.

Attachment using drilling or drilling and tapping shall be in accordance with trade practices using equipment specifically designed for the purpose intended, and sized accordingly. All hardware used in attachment shall be for 1/4-20 stainless steel bolts unless otherwise specified or required by equipment being installed.

Power actuated fasteners used on this contract shall be manufactured specifically for attaching clamps to structure members. The fasteners shall be sized incorporating the structural member and clamp load.

Power actuated fasteners shall be installed by properly trained and licensed operators as described in ANSI Standard A10.3. Training and licensing shall be provided by the manufacturer or by the manufacturer’s designated representative. Job site performance tests as recommended by the manufacturer shall be conducted. Installation shall be according to the manufacturer's specifications in all applications.

All power actuated fasteners shall manufactured from AISI 1062 steel, and have a typical minimum from tensile strength of 280,000 psi and a typical minimum shear strength of 160,000 psi. They shall be the 1/4"-20 treaded stud type, with the shank sized according to the structural member thickness.

Self-drilling screws used on this contract shall be manufactured specifically for attaching clamps to structural members. The self-drilling screws shall be No.14 or larger, and be at least 3/4 inches long.

Self-drilling screws shall be installed by properly trained operators using equipment specifically designed for the installation of self-drilling screws. The screw drive shall have an adjustable torque screw depth, or variable drive clutch which results in a depth adjustment feature installation shall be according to the manufacturer's specification in all applications.

10-3.17 PAYMENT

The contract lump sum price paid for electrical facilities (seismic retrofit) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in installing electrical facilities (seismic retrofit), complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

SECTION 10-4. WATERLINE REPLACEMENT

10-4.01 GENERAL

The waterline, located on the San Francisco-Oakland Bay Bridge, is owned by the City of San Francisco and operated by the San Francisco Water Department (SFWD). The work on this pipeline will be administered by Caltrans as a part of the San Francisco-Oakland Bay Bridge Seismic Retrofit Project.

The work covered by this section includes the installation of a new waterline and two electrical conduits on Pier W1.

COORDINATION.--Attention is directed to Section "Cooperation" elsewhere in these special provisions regarding coordination with other State contracts within the limits of work under this contract.

MAINTAINING TRAFFIC.--The work on the waterline replacement will require lane closures. The Contractor's attention is directed to Section "Maintaining Traffic" of these special provisions regarding lane closures.

APPROVALS.--Approval by the Engineer of the work on the waterline replacement will be contingent upon the work and materials furnished and installed being satisfactory to the San Francisco Water Department.

SHUTDOWNS.--Continued operation of the waterline which supplies water to Yerba Buena and Treasure Island is necessary. In order to maintain service to the Island, a shutdown to make the connection to the existing waterline will be limited to 24 hours.

SUBMITTALS.--Working drawings for the waterline replacement work shall be submitted to the Engineer in accordance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications and these special provisions.

The Contractor shall submit to the Engineer for approval 12 copies of catalog cuts , working drawings and work procedures including, but not limited to, the following items:

1. Pipe and fittings.
2. Gate valve
3. Fabricated steel supports and braces
4. Electrical conduits and conduit supports
5. Pull boxes

The Contractor shall allow 3 weeks for the Engineer to review the submittals. If revisions are required, as determined by the Engineer, the Contractor shall submit revisions within 7 days. No work shall be performed on the waterline replacement work until all submittals are approved by the Engineer. Upon approval, 8 additional copies shall be submitted to the Engineer with the required changes.

SALVAGE.--All pipe and fittings which must be removed to accomplish the replacement work shall become the property of the Contractor. No salvage of materials will be required.

FUNCTIONAL TESTING.--The replacement waterline shall be pressure tested. The test pressure shall be 235 psi as measured at the connection to the existing pipeline at Elevation 167.00±.

DISINFECTION.--Disinfection of the new pipe will be done by SFWD after the pipeline has been successfully tested for leakage. A 3/4-inch threadolet shall be welded to the top of the pipe near the connection to the existing pipeline to facilitate testing and disinfection. The threadolet shall have a removable brass plug.

10-4.02 PIPE, FITTINGS AND VALVES

GENERAL.--All pipe, fittings, and valves shall be rated for a test pressure of 235 psi.

PRODUCTS.--

PIPE.--Pipe shall be welded steel conforming to AWWA C200 and AWWA M11, and shall be fabricated from ASTM A570, Grade 45 or A572, Grade 42. Pipe shall have an outside diameter of 10.75 inches, and shall have a minimum wall thickness of 0.307 inches (Schedule 30).

FITTINGS.--Fittings shall be forged, conforming to ASTM A234, Grade WPB. Fitting wall thickness to match pipe. Bends shall be short radius unless otherwise shown on the Drawings.

LINING.--Pipe and fittings shall be cement-mortar lined in conformance with AWWA C205.

COATINGS.--Pipe, supports, valves, and fittings shall be primed and painted in accordance with the provisions of Section 59, "Painting," of the Standard Specifications.

JOINTS.--All joints shall be single-butt welded except where flanged joints are shown on the Drawings or otherwise specified herein.

FLANGED JOINTS.-- Flanged joints shall be Class 150 slip-on welding type rated for 250 psi working pressure with raised faces conforming to ANSI B16.5. Gaskets shall be non-asbestos conforming to the requirements of AWWA Designation: C207, suitable for use with raised face flanges.

Bolts and nuts shall conform to the requirements in Section 55, "Steel Structures," of the Standard Specifications. Bolt length and diameter shall be in accordance with ANSI B16.5.

GATE VALVES.--Valves shall be New York Metropolitan style with cast iron body, bronze-mounted double disc with parallel seats, bottom wedges, and non-rising stem. Valve shall be equipped with a hand wheel operator and flanged ends as specified herein. Gate valve shall open when turning the handle in a clockwise direction. The valves shall be rated for a test pressure of 300 psi and a maximum working pressure of 250 psi.

Lining shall be fusion bonded epoxy in accordance with AWWA C550, minimum 7-mil dry film thickness except where limited by valve operating tolerances.

FABRICATED STEEL SUPPORTS AND FASTENERS.--Fabricated steel supports and welds shall be in conformance with the details shown on the plans, the provisions in Section 75, “Miscellaneous Metal," of the Standard Specifications, and these special provisions.

Concrete anchors shall be of the resin capsule type installed in drilled holes in accordance with the provisions of Section 75, "Miscellaneous Metal," of the Standard Specifications.

Bolts and nuts shall be in accordance with Section 55, "Steel Structures," of the Standard Specifications.

10-4.03 ELECTRIC CONDUIT AND APPURTENANCES

PRODUCTS.—

CONDUIT.--Provide rigid hot-dipped galvanized steel conduits with smooth walls. Conduit shall meet the requirements of ANSI C80.1 and UL6. A polypropylene cord pull line shall be provided in each conduit.

FITTINGS.--Fittings shall meet the requirements of UL 514B and shall be of the threaded galvanized type. Set screw types will not be permitted. Bushing and conduit hubs shall be malleable iron with integral insulated throat. Conduit bodies shall be cast ferrous, sized as required by NFPA 70. Couplings shall be as supplied by the conduit manufacturer. Expansion fittings shall be factory fabricated, lateral movement type only.

SUPPORT AND FRAMING CHANNELS.--Support and framing channels shall be Type 316 stainless steel conforming to the requirements in ASTM Designation: A 167 and shall conform to the details and dimensions shown on the plans.

PULL BOXES.--Electrical pull boxes shall be NEMA 250, Type 4X, 14-gauge conforming to ASTM Designation: A240 and shall be furnished with an interior barrier. Pull box covers shall be hinged and provided with clamps. Hardware and machine screws shall be Type 316 stainless steel conforming to the requirements in ASTM Designation: A 167.

10-4.04 EXECUTION

GENERAL.-- All waterline replacement work shall be coordinated with the work required for the bridge structure retrofit.

Contractor shall schedule required shutdown with SFWD a minimum of 3 working days before a planned shutdown.

Bolts, nuts and gaskets salvaged from the existing installation shall not be reused. Reconnection to existing flanges shall be made with new materials.

The Contractor shall provide temporary plugs which are to be inserted into the open end of any pipe during any period when no work is being done on the open end. Care shall be taken to insure that no debris is allowed to enter open ends of existing pipe at any time.

FIELD WELDING.--Verify proper grade and type of welding electrode, and visually verify that electrode is free of moisture and that coating is undamaged.

Field welding shall be in accordance with AWWA Designation: C206. Butt welds shall have complete penetration and fusion. Repair defective welds by chipping, grinding, flame gouging, or air-arc gouging.

WELDING OF FLANGES.--Shop or field welding of flanges shall be in accordance with the requirements of AWWA C207.

CONNECTIONS TO EXISTING PIPELINE.--The connection to the existing pipeline shall be made by removing the existing long radius bend at Pier W1 and installing a new flanged tee to the existing flange at the top of the long radius bend as shown on the Drawings. The long radius bend shall be replaced or modified to connect the existing piping to the new tee.

After the new pipeline and pump station have been completed, accepted and ready to be placed in service, the piping below the tee shall be removed and a blind flange with a 2-inch threaded and plugged outlet shall be installed.

ELECTRICAL CONDUIT INSTALLATION.--Install electrical conduits and appurtenances in accordance with the details shown on the plans and the provisions in Section 86-2.05C, "Installation," of the Standard Specifications.

ELECTRICAL CONDUIT EXPANSION JOINTS.--Place expansion joint midway between pull boxes, but not less than every 200 feet.

PULL BOXES.--Install pull boxes at the locations shown on the plans. Drill as necessary to connect conduits. Installation shall be plumb and level. The pull boxes are to be supported independently of the conduit. Connection to conduits shall be made in conformance with the conduit manufacturer's recommendation.

COATINGS FOR CONDUIT AND PULL BOXES.--Conduits and pull boxes shall be primed and painted in accordance with the provisions in Section 59, "Painting," of the Standard Specifications.

10-4.05 PAYMENT

The work performed under this Section "Waterline Replacement" will be paid for as follows:

Replacement Waterline on Pier W1 .....lump sum
Electrical Conduit Installation on Pier W1.....lump sum

The contract lump sum price paid for replacement waterline on Pier W1 shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals for doing all the work involved in replacement waterline on Pier W1, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract lump sum price paid for electrical conduit installation on Pier W1 shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals for doing all the work involved in electrical conduit installation on Pier W1, 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 miscellaneous metal used for steel supports, anchors and fasteners shall be considered as included in the contract lump sum prices paid for replacement waterline on Pier W1 or electrical conduit installation on Pier W1 and no separate payment will be made therefor.

SECTION 11. (BLANK)

SECTION 12. PUMP PLANT STATION EXISTING CONDITIONS: HAZARDOUS MATERIALS

SECTION 12-1. GENERAL REQUIREMENTS

1.1 SUMMARY

A. This Document describes Reference Documents covering investigations of existing hazardous materials, including data identified in survey reports prepared for the City and State, and the use of data resulting from the various investigations.

1.2 HAZARDOUS MATERIALS REPORTS

A. The Bidder's attention is directed to the fact that following survey reports were prepared which was utilized by the City and State in preparing the Contract Documents:

1. for the new Bay Bridge Pump Station site by the City's environmental consultant Tetra Tech, Inc., 180 Howard Street, Suite 250, San Francisco, California entitled "Site History and Subsurface Investigation Report, New Bay Bridge Pump Station, 434 Main Street, San Francisco, CA," TC# 1928 dated September 1998;
2. for the existing Bay Bridge Pump Station site by the City's environmental consultant SCA Environmental,. Inc., Four Embarcadero Center, Suite 480, San Francisco, California entitled "Final Report: Hazardous Material Survey, Bay Bridge Pump Station, 475 Spear Street, San Francisco, CA," SCA Project Number F-2277 dated September 1997;

B. Copies of the above referenced reports are available for inspection by prospective Bidders at the Department of Transportation, Toll Bridge Duty Senior's Desk, 111 Grand Avenue, Oakland, California, (510) 286-5549.

1.3 USE OF DATA

A. Environmental consultation was obtained only for the use of the City and State during the planning and design stages of the Project. The above mentioned reports are not, as a whole, part of the Contract Documents but the survey data contained therein can be relied upon by the Contractor to characterize general site conditions. Laboratory data is available to the bidders not as representation of fact, but for guidance only. The City and State is not responsible for any interpretation or conclusions drawn by the bidders or by the Contractor from the data.

B. All statements, findings, and interpretations in said report are those of the Consultants, the City and State makes no representations, either express or implied, as to the completeness or adequacy of said report.

C. Bidders shall visit Site and acquaint themselves with the existing conditions.

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:

Four (4) horizontal splitcase pumps.
12-inch ductile iron push-on joint pipes, fittings and gate valves.

The following material will be available to the Contractor at the San Francisco Water Department Yard at 1990 Newcomb Avenue in San Francisco:

1. Horizontal splitcase pumps
2. 12-inch Tyton Joint Pipes and Fittings with Field Lok restraining gaskets.
3. 12-inch TR Flex Restrained Joint Pipe and Fitting with TR Flex Gripper Ring and TR Flex pipe field weldments.
4. 12-inch “S.F.W.D.” gate valve.
5. Pipe joint lubricant

The Contractor shall notify the Engineer, not less than 48 hours before any recycled material is to be picked up, giving the Engineer a requisition itemizing such materials, the time it will be picked up, and the Contract No. of this project. No materials will be issued to the Contractor without the requisition signed by the Engineer.

12-1.01 SCOPE

Pump Station work described herein and as shown on the Plans shall conform to the requirements of these special provisions and Sections 1 through 9 of the Standard Specifications. Sections 10 through 95 of the Standard Specifications shall not apply to the work in this Section 12 except when specific reference is made thereto.

The pump station work to be done consists, in general, of constructing an above-ground Pump Station; furnishing and installing all mechanical and electrical equipment, underground fuel storage tank; installing State-furnished materials traffic routing, excavation, trenching, shoring, backfilling, restoring of pavement and sidewalk; handling, hauling and disposing of hazardous materials; testing and start-up; demolition of existing pump station; electrical work at Lake Merced Pump Station and Yerba Buena Island; all appurtenant work, and such other items or details, not mentioned above, that are required by the Plans, Standard Specifications, or these special provisions shall be performed, placed, constructed or installed.

Contractor shall obtain and pay for all City of San Francisco permits (excluding Building Permit) as required by the City and County of San Francisco Department of Building Inspection and by the Department of Public Works, Bureau Of Street Use and Mapping, San Francisco Fire Department and San Francisco Health Department. Permits are required for opening of City streets (see Section 12-1.31 Excavation Code Requirements) and discharge of groundwater into the sewer system.

The Bay Bridge Pump Station Relocation Work may be performed in any sequence preferred by the Contractor, subject to the following constraints:

1. Demolition of the existing Pump Station at Spear Street may not be performed until the new Bay Bridge Pump Station is fully operational for seven days.
2. Construction of the 12-inch buried ductile iron force main on Bryant Street from Main Street to The Embarcadero shall be completed by October 14th, 1999.
3. Construction of the 12-inch buried ductile iron force main from the new Pump Station may not proceed beyond a point closer than 50 feet from the North face of Pier W-1 until the seismic retrofit work at the North face of Pier W-1 is completed.

12-1.02 ABBREVIATIONS

Section 1-1.02, "Abbreviations," of the Standard Specifications is amended by adding the following:

AAMA	American Architectural Manufacturers' Association
ACI	American Concrete Institute
AGA	American Gas Association
AITC	American Institute of Timber Construction
AMCA	Air Movement and Control Association
APA	American Plywood Association
ARI	American Refrigeration Institute
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
CCSF/BCM	City & County of San Francisco Department of Public Works, Bureau of Construction Management
CCSF	City & County of San Francisco
City	State of California
CS	Commercial Standards (US Department of Commerce)
DPW/BOE	City & County of San Francisco Department of Public Works, Bureau Of Engineering
ESO	Electrical Safety Orders
FGMA	Flat Glass Marketing Association
FM	Factory Mutual
FS	Federal Specification
ICBO	International Conference of Building Officials
NAAMM	National Association of Architectural Metal Manufacturers
NBFU	National Board Fire Underwriters
NEC	National Electrical Code
NFPA	National Fire Protection Association
PEI	Porcelain Enamel Institute
PS	Product Standard (US Department of Commerce)
PUC	San Francisco Public Utilities Commission
RIS	Redwood Inspection Service
SCPI	Structural Clay Products Institute
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SSPC	Steel Structures Paint Council
TCA	Tile Council of America
TPI	Truss Plate Institute
UBC	Uniform Building Code
UL	Underwriters Laboratories, Inc.
WCLIB	West Coast Lumber Inspection Bureau (stamped WCLB)
WCLB	Grade stamp for WCLIB
WIC	Woodwork Institute of California
WWPA	Western Wood Products' Association

When reference is made to the Uniform Building Code (UBC) on the Plans or in the special provisions, it shall be the 1994 Uniform Building Code as amended by the 1995 Title 24 California Building Standards Code.

12-1.03 GUARANTEE

The Contractor hereby unconditionally guarantees that the pump station work, mechanical and electrical equipment and related components in the pump station work will be done in accordance with the requirements of the Contract, and further guarantees the same to be and remain free of defects in workmanship and materials for a period of twenty four (24) months from the date of Substantial Completion of the pump station work as determined by the Engineer. The Contractor hereby agrees to repair or replace any and all mechanical and electrical equipment and related components in

the pump station work that may prove to be not in accordance with the requirements of the contract or that may be defective in its workmanship or material within the guarantee period specified, without any expense whatsoever to the Department, ordinary wear and tear and unusual abuse or neglect excepted.

A portion of the performance bond for the Contract in a sum equal to one-half the value of the mechanical and electrical equipment and related components in the pump station work, shall remain in full force and effect during the guarantee period. The value of said mechanical and electrical equipment and related components shall be the value determined in accordance with the requirements specified under "Schedule of Values" in Section 12-1, "General Requirements," of these Special Provisions.

The Contractor further agrees, that within ~~10~~ 2 calendar days after being notified in writing by the Department of any mechanical and electrical equipment and related components in the Pump Station work not in accordance with the requirements of the Contract or any defects in the mechanical and electrical equipment and related components in the Pump Station work, he/she shall commence and prosecute with due diligence all work necessary to fulfill the terms of this guarantee, and shall complete the Pump Station work within a reasonable period of time, and, in the event the Contractor fails to comply, he/she does hereby authorize the Department to proceed to have such work done at the Contractor's expense and he/she shall honor and pay the cost and charges therefor upon demand. The Department shall be entitled to all costs and expenses, including reasonable attorney's fees, necessarily incurred upon the Contractor's refusal to honor and pay the above costs and charges.

Substantial Completion is defined as the Pump Station Work has progressed to the point where, as evidenced by the definitive Certificate of Substantial Completion issued by the City, it is sufficiently complete, in accordance with the Contract Documents as deemed by the City and State. The certificate will not be issued until the pump station work can be continuously utilized for the purposes for which it is intended. Said Certificate shall not be considered as final acceptance of any portion of the work or relieve the Contractor from completing the remedial items of Work within the specified time and in full compliance with the Contract Documents.

12-1.04 AREAS FOR CONTRACTOR'S USE

No area is available within the Contract limits for the exclusive use of the Contractor. The Contractor shall arrange with the Engineer for areas to store equipment and materials within the work area.

12-1.05 COOPERATION

Attention is directed to Sections 7-1.14, "Cooperation," and 8-1.10, "Utility and Non-Highway Facilities," of the Standard Specifications and these special provisions.

Work by State forces will be in progress within the Contract limits during the working period for this Contract.

The Contractor shall comply with all security policies and normal working hours of the State of California.

The Contractor shall plan his/her work to minimize interference with State forces and the public. Interruptions to any services for the purpose of making or breaking a connection shall be made only after consultation with and for such time periods as directed by the Engineer.

12-1.06 SUBMITTALS

Working drawings, material lists, descriptive data, samples and other submittals specified in these special provisions shall be submitted for approval in accordance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications and these special provisions.

Unless otherwise permitted in writing by the Engineer, all submittals required by these special provisions shall be submitted within 35 days after the contract has been approved.

Attention is directed to the provisions in Section 5-1.01, "Authority of 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 specified submittals, as necessary to determine the quality or acceptability of such materials or products.

Attention is directed to Section 6-1.05, "Trade Names and Alternatives," of the Standard Specifications. The second indented paragraph of the first paragraph of said Section 6-1.05 is amended to read:

> Whenever the Specifications permit the substitution of a similar or equivalent material or article, no test or action relating to the approval of such substituted material will be made until the request for substitution is made in writing by the Contractor accompanied by complete data as to the equality of the material or article proposed. Such request shall be made within 35 days after the date the Contract has been approved and in ample time to permit approval without delaying the work, but need not be made in less than 35 days after award of the Contract.

Work requiring the submittal of working drawings, material lists, descriptive data, samples, or other submittals shall not begin prior to approval of said submittal by the Engineer. Twenty working days shall be allowed for approval or return for correction of each submittal or resubmittal. Should the Engineer fail to complete his review 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 review, an extension of time commensurate with the delay in completion of the work thus caused will be granted as provided in Section 8-1.07, "Liquidated Damages," of the Standard Specifications.

Submittals shall be delivered to the locations indicated in these special provisions. If a specific location is not indicated, the submittal shall be delivered to the Office of Structures Design, Documents Unit, Fourth Floor, 1801 30th Street, Sacramento, California 95816, or mailed to the Office of Structures Design, Documents Unit, P. O. Box 942874, Sacramento, California 94274-0001.

Each submission of drawings, material lists and descriptive data shall consist of at least six (6) copies. Two copies will be returned to the Contractor either approved for use or returned for correction and resubmittal. The City will retain 2 copies of each approved or disapproved Submittal. One copy of each approved or disapproved Submittal will be forwarded to Caltrans.

No portion of the Work requiring submission of a shop drawing, product data, or sample shall commence until the submittal has been reviewed and accepted by the City. All such portions of the Work shall be executed in accordance with accepted submittals.

No change shall be made by Contractor in any submittal after it has been accepted by the City.

Submit shop drawings in form of one reproducible and 6 copies.

Submit six (6) copies of product data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturer’s data to provide information unique to this project.

Submit samples to illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work. Submit samples of finishes in custom colors selected, textures, and patterns for the City's selection. Include identification on each sample, with full project information.

Furnish three (3) samples in the following sizes, unless otherwise specified; after review, one (1) sample will be returned to Contractor.

Flat or Sheet Products: Minimum 6 inches square, maximum 12 inches square.

Linear Products:

Minimum 6 inches long, maximum 12 inches long.

Bulk Products:

Minimum one pint, maximum one gallon for liquids; minimum one pound, maximum three pounds or minimum one cubic foot, maximum one cubic yard, as applicable for solids.

Each separate item submitted shall bear a descriptive title, the name of the Contract, district, county, and Contract number. Plans and detailed drawings shall be not larger than 22" x36".

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.

Parts lists and service instructions packaged with or accompanying the equipment installed in the work shall be delivered to the Engineer at the jobsite. Required operating and maintenance instructions shall be submitted in triplicate.

Manufacturer's warranties for products installed in the work shall be delivered to the Engineer at the jobsite.

Unapproved samples and samples not incorporated in the work shall be removed from State property as the Contractor's property, when directed by the Engineer.

12-1.07 PROGRESS SCHEDULE

A progress schedule shall be submitted in duplicate for the building work in accordance with the requirements in Section 8-1.04, "Progress Schedule," of the Standard Specifications.

12-1.08 SCHEDULE OF VALUES

The Contractor shall prepare and submit to the Engineer 2 copies of a Schedule of Values covering each lump sum item for hazardous material, site, building, mechanical, electrical, demolition, control and telemetry work. The Schedule of

Values, showing the value of each kind of work, shall be acceptable to the Engineer before any partial payment estimate is prepared.

The schedule of values shall consist of a detailed cost breakdown of Contractor's Bid covering the lump sum items of Work by classification, in accordance with the Construction Specifications Institute 16 Division format (1988 Edition) as represented by the Specifications Table of Contents.

The sum of the items listed in the Schedule of Values shall equal the contract lump sum prices paid for each contract item involved in constructing the pump station work. Overhead and profit shall not be listed. Bond premium, temporary construction facilities, plant, and other such items will not be paid for under the various work items and shall be included in the site work bid item for the entire Contract.

12-1.09 INSPECTION

All items covered or all stages of work that are not to remain observable must be inspected and approved before progress of work conceals portions to be inspected. The Contractor shall notify the Engineer not less than 72 hours in advance of when such inspection is needed.

12-1.10 OBSTRUCTIONS

Attention is directed to Sections 7-1.11, "Preservation of Property," 7-1.12, "Responsibility for Damage," 7-1.16, "Contractor's Responsibility for the Work and Materials," and 8-1.10, "Utility and Non-Highway Facilities," of the Standard Specifications.

The Contractor shall notify the Engineer and the appropriate regional notification center for operators of subsurface installations at least 5 working 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:

Underground Service Alert
Northern California (USA)
Telephone: 1(800)642-2444

Underground Service Alert
Southern California (USA)
Telephone: 1(800)422-4133

South Shore Utility
Coordinating Council (DIGS)
Telephone: 1(800)541-3447

Western Utilities
Underground Alert, Inc.
Telephone: 1(800)424-3447

12-1.11 PRESERVATION OF PROPERTY

Attention is directed to Sections 7-1.11, "Preservation of Property," 7-1.12, "Responsibility for Damage," 7-1.16, "Contractor's Responsibility for the Work and Materials," and 8-1.10, "Utility and Non-Highway Facilities," of the Standard Specifications.

Operations shall be conducted in such a manner that existing facilities, surfacing, installations, and utilities which are to remain in place will not be damaged. Temporary surfacing, facilities, utilities and installations shall also be protected until they are no longer required. The Contractor, at his/her expense shall furnish and install piling, sheet piling, cribbing, bulkheads, shores, or whatever means may be necessary to adequately support material carrying such facilities, or to support the facilities themselves and shall maintain such support until they are no longer needed.

12-1.12 UTILITY CONNECTION

The Contractor shall make all arrangements, and perform all utility connection required for the extension of and connection to each utility service applicable to this project, shall furnish all labor and materials necessary for such

extensions which are not performed or provided by the utility, and shall furnish and install any intermediate equipment required by the serving utilities.

Upon written request by the Contractor, the City will pay all connection charges and excess length charges directly to the utility. Such request shall be submitted not less than 15 days before service connections are required.

The costs incurred by the Contractor for the extensions of utilities beyond the limits shown on the Plans, and in furnishing and installing any intermediate equipment required by the serving utilities, will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

Full compensation for any costs incurred by the Contractor to obtain utility connection permission shall be considered as included in the contract lump sum price paid for building work and no additional compensation will be allowed therefor.

12-1.13 TEMPORARY UTILITIES

The Contractor may obtain electrical power and water from existing State electrical power and water outlets within the contract limits free of charge for contract operations where such utilities exist, provided that such utility services are in service and are not required by the State for other purposes and subject to the provisions in the section "Cooperation" of these special provisions.

Temporary Electricity

Provide and pay for electrical service and weatherproof, grounded distribution system of sufficient size, capacity, and power characteristics during the construction period.

At certain times during the course of construction, the Contractor may be required to provide portable generator(s) for construction purposes. It shall be the responsibility of the Contractor to determine which, if any, Bay Area Air Quality Management District (BAAQMD) regulations apply to the operation of such generators. If the Contractor should exceed BAAQMD limits for the maximum amount of run time for such generators, then the Contractor shall be liable for any monetary penalties imposed by BAAQMD.

Temporary Lighting

Provide and maintain lighting for construction operations, including power to distribution boxes. Required illumination may be provided by approved cord sets with lamp guards.

Telephone Service

Provide and pay for telephone service to Contractor's field office from the time of Contract mobilization.

Temporary Water Service

Potable Water:

Arrange with the San Francisco Water Department to provide potable water obtained by connecting to City water systems.

1. Contact the Water Department at 923-2400 for arranging such water service.
2. Water is available from fire hydrants located in the streets. Obtain permission from the San Francisco Fire Department to use hydrants.
3. Pay the costs of connection fees, meters, and all water furnished by the San Francisco Water Department.
4. Contractor shall comply with Ordinance #175-91, Article 21, Sections 1100 to 1107 of the San Francisco Municipal Code (Public Works Code), restricting the use of potable water for soil compaction and dust control activities, to the extent not directly in conflict with any applicable federal, state, and local law.
5. Secondary effluent is available at no cost to Contractor from the Southeast Water Pollution Control Plant at 750 Phelps Street, San Francisco, from 8:00 a.m. to 5:00 p.m. on weekdays and Saturdays.
6. Contractor shall be responsible for handling and trucking of secondary effluent at no cost to the City.

Should Contractor seek to use potable water for soil compaction or dust control activities, Contractor shall apply for and obtain an exemption pursuant to Ordinance #175-91, Article 21, prior to its use.

Applications shall be sent to:

Department of Public Health
Bureau of Environmental Health Services
101 Grove Street, Room 217
San Francisco, CA 94102
Telephone (415) 554-2795.

Pursuant to Ordinance #175-91 permission for said use of potable water may be granted by the General Manager of the San Francisco Water Department.

Reclaimed Water:

Arrange with the South East Water Pollution Control Plant (SEWPCP) to provide reclaimed water for soil compaction and dust control which is available at no cost to Contractor at the SEWPCP from 8:00 a.m. to 5:00 p.m. on weekdays and Saturdays.

1. Arrangements can be made for access to reclaimed water at other times.
2. A permit is required to obtain reclaimed water from the City.

Provide and maintain distribution piping, water tankers, hoses, and all appurtenances necessary to supply water at the job site.

1. Bury pipe crossing traveled roadways beneath the roadway. Use hose or ramp over temporary piping on roadway surfaces.

Remove all temporary lines and related appurtenances upon completion of the work, restore all facilities to their condition prior to construction to the satisfaction of the Engineer.

12-1.14 SANITARY FACILITIES

When operational, State sanitary facilities will be available for use by the Contractor's employees, during normal State working hours. Tools shall not be cleaned nor shall cleaning liquids be disposed of in State sanitary facilities or sewers.

The Contractor shall provide adequate separate toilet facilities for Contractor's and City personnel. Facilities shall include the periodic flushing, waste removal and cleaning of such facilities. Units shall to be maintained in a clean and sanitary condition, including a supply of toilet tissue, toilet seat covers, paper towels and paper cups. Waste material shall be disposed of off site in a lawful manner. Temporary toilet units shall be single occupant units of the chemical, aerated recirculation or combustion type, properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar nonabsorbent material.

12-1.15 MEASUREMENT AND PAYMENT

Pump station work shall consist of the following contract items:

HANDLING, HAULING AND DISPOSAL OF HAZARDOUS NON-RCRA MATERIALS TO CLASS I DISPOSAL FACILITIES (Pump Station)

Handling, hauling and disposal of hazardous non-RCRA materials at a Class I disposal facility, satisfactorily completed, will be paid at the unit price per ton bid therefor. Includes all incidental and related work as described in the Seismic Retrofit Project 16 Specifications Section "HAZARDOUS MATERIAL EXCAVATION" in Section 10 of these special provisions.

SITE WORK (Pump Station)

Site Work, satisfactorily completed, will be paid at the lump sum price bid therefor. Includes City Resident Engineer field office, temporary construction utilities, bonds, insurance, all required Department of Building Inspection and

Department of Public Works permits and fees, construction signs; demolition and removal of existing pavement, base or other materials; excavation for building foundation; shoring; hauling and disposal of normal/non-hazardous materials to Class III disposal site; construction of 3-1/2 inch thick concrete sidewalk; construction of 6-inch thick concrete sidewalk; construction of 10-inch thick concrete sidewalk, driveway and pavement; ground water control; sampling and testing of ground water and soils; construction of 6-inch wide concrete curb; construction of concrete curb ramps; construction of 2-inch thick asphalt concrete wearing surface over 8-inch thick concrete base; resetting existing City-owned catch basins to new grades; furnishing and installing 8-foot high chain link fence, gates and accessories; temporary fencing; force main pipeline and conduits trenching, shoring, backfilling, compaction, pavement restoration and traffic control; underground fuel tank excavation and shoring; manholes; and all incidental and related work as shown on the Drawings and described in the Specifications.

BUILDING WORK (Pump Station)

Building Work, satisfactorily completed, will be paid at the lump sum price bid therefor. Includes all architectural and structural components including but not limited to: backfilling and compaction; structural steel; reinforcing steel, miscellaneous steel; metal decking; fireproofing; concrete work; embeds; anchorages; concrete protective coating; removable FRP covers and gratings; carpentry; roofing; hatches; flashings; sheet metal; sealants; doors; door hardware; acoustical materials; flooring materials; painting; signage; louvers; miscellaneous metal work; and all incidental and related work.

MECHANICAL WORK (Pump Station)

Mechanical Work, satisfactorily completed, will be paid at the lump sum price bid therefor. Includes all mechanical components including but not limited to: installing force main, all piping systems and associated testing and disinfection as required; piping accessories including thrust blocks, bracing and supports; install State-furnished equipment, equipment and piping identification; painting of mechanical equipment; valves; plumbing; sump pump; bridge crane; magnetic flowmeter; fire protection systems; diesel fuel supply and engine exhaust systems; ventilation equipment; complete start-up system testing including staffing, test equipment, meeting attendance, field support, and submittals; and all incidental and related work.

ELECTRICAL WORK (Pump Station)

Electrical Work, satisfactorily completed, will be paid at the lump sum price bid therefor. Includes all electrical and control components as shown on "E" series Drawings (except E-16 and E-26); motor control center; main switchboard; panelboards; wiring; conduit; electrical and control devices; transformer; grounding system; lighting; diesel generator; transfer switch; uninterruptible power system; connections to mechanical equipment; RTU/PLC including programming, testing and documentation; control systems; instrumentation; telemetry devices at Lake Merced and Bay Bridge Pump Station and connection of the same; conduits with pull rope to Bay Bridge connection point; intrusion alarm system; water quality analyzer station; and all incidental and related work. Furnish and install power and control wiring to all Division 11, 13, 14, 15 and 16 equipment items.

LAKE MERCED CONTROL WORK (Pump Station)

Lake Merced control work, satisfactorily completed, will be paid at the lump sum price bid therefor Includes all control work as specified in Section 13400, Article 2.14, and all incidental and related work.

YERBA BUENA ISLAND ELECTRICAL AND TELEMETRY WORK (Pump Station)

Yerba Buena Island electrical and telemetry work, satisfactorily completed, will be paid at the Lump Sum price bid therefor. Includes all electrical and control work as shown on Drawings E-16 and E-26, and specified in Section 13400, Article 2.15.

PUMP STATION DEMOLITION WORK

Pump Station Demolition Work, satisfactorily completed, will be paid at the lump sum price bid therefor. Includes hazardous material abatement; removal, disposal and salvage of existing equipment; structural demolition and disposal; and all incidental and related work as shown on Drawings D-0 thru D-6 and as specified in Sections 02060 and 02090.

The contract lump sum prices paid for each contract item involved in constructing the pump station work shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the pump station work, 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 any incidental materials and labor, not shown on the Plans or specified, which are necessary to complete the buildings and appurtenances shall be considered as included in the Contract lump sum prices paid for each contract item involved in constructing the pump station work and no additional compensation will be allowed therefor.

Each month the Contractor shall submit an itemized Application for Payment to the Engineer based on the approved Schedule of Values. This Application shall cover the Work completed as of the date of the Application for Payment.

1. Submit under transmittal letter three copies of each Application for Payment filled out and signed by Contractor.
2. List each authorized Change Order executed prior to date of submission by Change Order Number and description.
3. When the Engineer requires substantiating data, Contractor shall submit suitable information with cover letter identifying Application of Payment number and date, line item by number and description.

Except as otherwise expressly stipulated in the Contract Documents, no payment shall be made for materials stored on or off site, and for materials not yet incorporated into the Work on site.

12-1.16 PROJECT RECORD DRAWINGS

One set of the Contract Drawings 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 such as main filters, controls, isolating valves, and similar items shall be highlighted on this set of project record drawings.

All corrections shall be made in red ink or red pencil. Superseded data 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 drawings shall be submitted when as-built information cannot be clearly shown on existing drawings. Supplemental drawings for as-built information shall be not less than 11" x 17" in size and shall have the Contract number on each drawing.

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.

12-1.17 REGULATORY REQUIREMENTS

All work of Section 12 shall conform to or exceed the applicable requirements the 1995 editions of the San Francisco Building Code and the California Building Standards Code (CCR Title 24).

In addition, comply with the applicable laws, ordinances, rules and regulations, including but not limited to the following:

1. CCR Title 8, Industrial Relations.
2. CCR Title 17, Public Health.
3. CCR Title 19, Fire Marshal.
4. California Health and Safety Code.
5. San Francisco Electrical Code.
6. San Francisco Plumbing Code.
7. San Francisco Fire Code.
8. San Francisco Health Code, Article 21, Underground Tank Regulations.
9. San Francisco Police Code, Article 29, Regulation of Noise.

Other Applicable Laws and Regulations: All applicable Federal, State, and local laws, and the latest rules and regulations of governing utility districts and the various other authorities having jurisdiction over construction and completion of the Work, including but not limited to the State Fire Marshal, Cal-OSHA and the State Construction Safety

Orders, and the California Labor Code, shall apply to the Contract throughout, and they shall be deemed to be included in the Contract Documents as though printed herein.

Obtain copies of codes and reference standards when required by the Contract Documents.

The codes referred to shall have full force and effect as though printed in these Specifications. Nothing in the Contract Documents shall be construed to permit work not conforming to the governing code requirements.

TRENCH SUPPORT DESIGN PROVISIONS:

Shoring of excavations during construction shall include adequate sheeting, shoring, and bracing, or equivalent method for the protection of life and limb; and shall conform to the applicable Safety Orders of OSHA and Cal/OSHA.

As required by Section 6705 of the California Labor Code, whenever the work involves trench excavation 5 feet or more in depth, plans and calculations for the shoring system shall be submitted for review and approval prior to trench excavation. If such plans vary from the shoring standards established by the State Construction Safety Orders, the plans shall be prepared by a civil or structural engineer registered in the State of California. Approval shall not relieve Contractor of its responsibility to provide a satisfactory and safe shoring system.

Payment of all costs for the design, preparation of drawings, specifications and calculations, construction, and inspection in compliance with the applicable construction safety standards and regulations will be made at the lump sum price bid therefor in the Schedule of Bid which price shall constitute full compensation for completion of all such work.

SEISMIC LOADING DESIGN PROVISIONS:

Contractor shall be responsible for the design of all supports and anchorages for all nonstructural components including mechanical and electrical equipment, machinery, and piping to be constructed or installed by Contractor, and which are necessary for life safety or are necessary for the continued and satisfactory operation of the Bay Bridge Pump Station. Such items include, but are not limited to: tanks, pumps, rotating mechanical equipment, ductwork, piping, electrical control centers, and transformers.

Provide the services of a civil or structural engineer registered in the State of California for preparing the design of nonstructural attachments which shall be in accordance with the seismic loading provisions of the current edition of the San Francisco Building Code, Zone 4. Design all attachments using an importance factor of 1.0.

Submit shop drawings and supporting calculations of all Contractor's support and anchorage designs bearing the seal of Contractor's responsible design engineer with signature and license expiration date.

NOISE CONTROL ORDINANCE

Police Code Section 2907(b) - It shall be unlawful for any person to operate any powered construction equipment, regardless of age or date of acquisition, if such equipment emits noise at a level in excess of 80 dBA when measured at a distance of one hundred feet from such equipment, or and equivalent sound level at some other convenient distance.

Police Code Section 2907(c) - Requirements of Section 2907(b) need not be applied to impact tools and equipment, provided that such impact tools and equipment shall have intake and exhaust mufflers recommended by the manufacturers thereof and approved by the Director of Public Works as best accomplishing maximum noise attenuation, and that pavement breakers and jackhammers shall also be equipped with acoustically attenuating shields or shrouds recommended by the manufacturers thereof and approved by the Director of Public Works as best accomplishing maximum noise attenuation. In the absence of manufacturer's recommendation, the Director of Public Works may prescribe such means of accomplishing maximum noise attenuation as he deems to be in the public interest.

Police Code Section 2901.12 - Powered construction equipment includes any tools, machinery, or equipment used in connection with construction operations which can be driven by energy in any form other than manpower, including all types of motor vehicles when used in the construction process on any construction site, regardless of whether such construction site be located on-highway or off-highway, and further including all helicopters or other aircraft when used in the construction process except as may be pre-empted for regulation by state or federal law.

Police Code Section 2908 - It shall be unlawful for any person, including employees and agents of the City and County of San Francisco, between the hours of 8:00 p.m. any day and 7:00 a.m.. of the following day to erect, construct, demolish, excavate, alter or repair any building or structure, if the noise level created thereby is in excess of the ambient background noise level by 5 dBA at the nearest property line, unless a special permit therefor has been

applied for and granted by the Director of Public Works. In granting such special permit the Director of Public Works shall consider if construction noise in the vicinity of the proposed work site would be less objectionable at night than during daytime because of different population levels or different neighboring activities, if obstruction and interferences with traffic particularly on streets of major importance, would be less objectionable at night than during daytime, if the kind of work to be performed emits noises at such a low level as to not cause significant disturbance in the vicinity of the work site, if the neighborhood of the proposed work site is primarily residential in character wherein sleep could be disturbed, if great economic hardship would occur if the work were spread over a longer time, if the work will abate or prevent hazard to life or property, if the proposed night work is in the general public interest; and he shall prescribe such conditions, working times, types of construction equipment to be used, and permissible noise emissions, as he deems to be required in the public interest.

INDUSTRIAL WASTE ORDINANCE #19-92

(Refer to Amended Article 4.1, San Francisco Municipal Code Sections 118-124)

Sec. 123. Limitations and Prohibitions.

(a) Any grab sample of the Discharger's Wastewater shall not at any time exceed any of the following numerical limitations:

Pollutant Parameter	Limits
pH	6.0 min.; 9.5 max.
Dissolved Sulfides	0.5 mg/l
Temperature (except where higher temperatures are required by law)	125 degrees F (52 degrees C)
Hydrocarbon Oil and Grease	100 mg/l

(b) Any composite sample representative of the total Discharge of the Wastewater Discharge generated over a production week shall not exceed the following numerical limitation:

Pollutant Parameter	Limits
Total Recoverable Oil and Grease	300 mg/l

Representative composite Total Recoverable Oil and Grease samples shall be composited by grab sampling, as required in federal regulations at 40 CFR Part 403 (1990), which are incorporated by reference in this Article.

(c) In addition to the provisions of this Article, all Dischargers must comply with all requirements set forth in Federal Categorical Pretreatment Standards and other applicable Federal regulatory standards, applicable State orders and water quality control regulations, sewage discharge permits and orders issued to the City by Federal and State agencies, Federal and State pretreatment program approval conditions, local discharge limitations and regulations promulgated by the Director and the City, and any other applicable requirement regulating the Discharge of Wastewater into the Sewerage System. The Director is authorized to develop and enforce such local limitations as he or she deems necessary for the City's compliance with State and Federal laws and requirements and the enforcement of this Article.

(d) Discharge of Wastewater containing radioactive materials is permitted only if the following conditions are satisfied:

(1) The Discharger obtains a Permit from the Director for the discharge of radioactive materials.
(2) The Discharger is authorized to use radioactive materials by the Nuclear Regulatory Commission or other governmental agency empowered to regulate the use of radioactive materials; and
(3) The radioactive material is Discharged in strict conformity with all Nuclear Regulatory Commission or other governmental agency requirements.

(e) No person shall discharge, deposit, or throw, or cause, allow or permit to be discharged, deposited or thrown into the City's sewage system any substance of any kind whatever, including oxygen demanding Pollutants, that may or will in any manner cause Interference or Pass Through, obstruct or damage the Sewerage System, cause a nuisance, interfere with the proper operation, repair or maintenance of the sewerage system, interfere with the proper operation, repair or maintenance of a reclaimed water production or distribution facility, create difficulty for any workers to repair or maintain any part of the Sewerage System, or directly or indirectly cause a violation of the City's Federal or State sewage discharge permits or any other requirement applicable to the City. Such substances include but are not limited to the following:

(1) Ashes, cinders, sand, gravel, dirt, bark, leaves, grass cuttings and straw, metals, glass, ceramics and plastics, or any other solid or viscous substance capable of causing obstruction to the flow in sewers, or that will not be carried freely under the flow conditions normally prevailing in the City's Sewerage System;
(2) Any flammable or explosive substances;
(3) Garbage, excepting properly ground garbage discharged in accordance with this Article, from dwellings and restaurants or other establishments engaged in the preparation of foods and beverages;
(4) Any toxic or noxious or malodorous substance which either singly or by interaction with other wastes may or will prevent maintenance of Sewerage System or create a nuisance or hazard to the safety of the public or City employees.
(5) Any Bioaccumulative Toxic Substance that exceeds the Soluble Threshold Limit Concentration (STLC).
(6) Any Wastewater, in temperature or quantity, which will cause the temperature of influent to exceed 104° (40°C) at the point of introduction to any City wastewater treatment plant.
(7) Any liquids, solids or gases or any Discharge that may cause damage or harm to any reclaimed water facility, or that may limit or prevent any use of reclaimed water authorized by Title 22 of the CCR.

(f) No person shall discharge, without a Permit, any Pollutants, except stormwater, directly or indirectly into a manhole, catch basin, or other opening in the sewerage system other than through an approved side sewer.
(g) No discharger shall increase the use of process water, in any other way, attempt to dilute a discharge as a partial or complete substitute for adequate treatment to achieve compliance with the requirements of this Article.
(h) No person shall discharge groundwater or water from sumps or dewatering facilities into the sewerage system without a permit. An application for a permit pursuant to this subsection shall be submitted to the Director no later than 45 days prior to the proposed commencement of the discharge. Each permit for groundwater discharge shall contain appropriate discharge standards and any other appropriate requirements that must be achieved before discharge into the sewerage system may commence. Such discharges shall be subject to payment of sewer service charges in accordance with the provisions of applicable City laws. The Director may require the discharger to install and maintain meters at the discharger's expense to measure the volume of the discharge.
(i) No person shall discharge wastewater associated with groundwater cleanup or remediation plans without first obtaining a permit. An application for a permit pursuant to this subsection shall be submitted to the Director no later than 45 days prior to the proposed commencement of the discharge. A permit may be issued only if an effective pretreatment system on the process stream is maintained and operated. Each permit for such discharge shall contain appropriate discharge standards based on this Article and reports or data provided by the discharger, as well as any other appropriate requirements that must be achieved at the time the discharge commences. Such discharges shall be subject to payment of sewer service charges in accordance with the provisions of applicable City laws. The Director may require the discharger to install and maintain meters at the discharger's expense to measure the volume of the discharge. The Director may require that such dischargers shall indemnify and hold harmless the City from any and all costs, claims, damages, fines, remediation costs, losses and other expenses arising from the discharge into the sewerage system.
(j) The discharge of wastewater associated with asbestos abatement operations is authorized without a permit, provided that the wastewater has been pretreated through a system that provides for removal of waterborne asbestos. (Added by Ord. 19-92, App. ,1/23/92.)

SAN FRANCISCO DEPARTMENT OF PUBLIC WORKS ORDER NO. 158170

This order is being adopted in compliance with the requirements of the Federal Clean Water Act, as amended, and attendant Environmental Protection Agency regulations. Industrial waste discharge limits on wastewater discharges into the City's sewerage system have been proposed for adoption pursuant on this Order.

Pursuant to Chapter X (Public Works Code) of Part II of the San Francisco Municipal Code, Article 4.1, the Director of Public Works hereby adopts the following provisions:

1. The characteristics of any 24 hour composite sample representative of a wastewater discharge generated over that period of time shall not exceed the following concentration-based numerical limits:

Pollutant/Pollutant Parameter	Limit (mg/l)
Arsenic (As) (as Total)	4.0
Cadmium (Cd) (as Total)	0.5
Chromium (Cr) (as Total)	5.0
Copper (Cu) (as Total)	4.0
Lead (Pb) (as Total)	1.5
Mercury (Hg) (as Total)	0.05
Nickel (Ni) (as Total)	2.0
Silver (Ag) (as Total)	0.6
Zinc (Zn) (as Total)	7.0
Phenol	23.0
Cyanide (CN) (as Total)	1.0

2. These numerical limits shall apply at the point of wastewater discharge into the sewerage system of the City and County of San Francisco with the proviso that no discharger shall increase the use of process water or, in any other way attempt to dilute a discharge as a partial or complete substitute for adequate wastewater management to achieve compliance with the requirements of this Order.
3. On an individual discharger basis, the Director of Public Works may consider inclusion of local limits greater than those specified in this Order provided that the two following conditions are met:

   a. The discharger's inability to meet concentration-based limits specified in this Order is caused solely by implementation of a significant water reclamation or water reuse program at the discharger facility, and
   b. The amended concentration-based limit does not result in an increase in the mass emission of that pollutant from the discharger facility.

4. In addition to any other provision of this Order, all dischargers must comply with all the requirements of Chapter X (Public Works Code) of Part II of the San Francisco Municipal Code, Article 4.1 ("Industrial Waste Ordinance #19-92").
5. All of the pollutants/pollutant parameters specified above are defined in the Federal regulations at 40 CFR Part 136 (1991).
6. This Order rescinds City and County of San Francisco Department of Public Works Order No. 104,407, adopted March 3, 1976.
7. The provisions of this Order are effective immediately.

12-1.18 OPERATION AND MAINTENANCE DATA

Requirements

Furnish four (4) draft copies of a complete operation and maintenance.

(O & M) manual for installation, operation, maintenance, and lubrication requirements for each component of mechanical, electrical or instrumentation equipment item or system. Submit for review within 30 calendar days after receiving the City's approval of all required submittals for, and before delivering to the site, any mechanical, electrical or instrumentation equipment or systems.

Inform all equipment manufacturers of the O & M manual requirements and ensure that all associated costs are included in the costs for furnishing the equipment or system.

The City will return one marked-up review copy of the draft O&M manual to the Contractor for corrections.

The Contractor shall return one (1) corrected copy for checking of conformance to City comments.

After receiving final approval from the City, the Contractor shall prepare the transmittal sets. Final approval of the O & M manuals will be made by the Engineer.

Contractor shall furnish six (6) final transmittal copies of the approved O & M manuals and two (2) disks of text material before the equipment is delivered to the job site. If O&M Manuals are not provided by the Contractor as required by this Section, payment for Bid Items requiring submittal of O&M Manuals will be modified as follows:

PERCENT OF PAYMENT (exclusive of retention)		
	With Final O & M	Without Final O & M
Delivery of Equipment to Site	85%	75%
Installed-Not Tested	90%	80%
Final Testing	100%	90%

Computer File Backup

a. All O & M manual text material which has been created for the O&M Manual shall be written in the latest version of Microsoft Word. Two copies of computer disks with the final approved text written for the equipment O & M manuals shall be transmitted to the City.
b. Drawings which have been generated by the Contractor for a particular job's O & M manual shall be in the latest version of AUTOCAD. Two copies of computer disks with the final approved AUTOCAD Drawings shall be transmitted to the City.

Format

Prepare data for each O & M Manual in the form of an instructional manual.

Binders:

Commercial quality, 8-1/2 x 11 inch three-ring binders with hardback, cleanable, plastic covers; one inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

Cover:

Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; list title of Contract; identify subject matter of contents.

Arrange content by systems under section numbers and sequence of Table of Contents of these Specifications.

Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

Text:

Manufacturer's printed data, or typewritten data on white bond paper.

Drawings:

Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

Contents

Title Sheet/Table of Contents:

Provide for each O & M Manual a title sheet/table of contents indicating title of Contract; names, addresses, and telephone numbers of the Engineer, subconsultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

Contact Representative For Each Product or System:

List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

Product Data:

Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information. List the following design data in the Table Of Contents:

1. System design criteria.
2. System design description.
3. System schematic indicating system components.
4. Detailed functional description of each component of the system.
5. Control schematic indicating location of system controls.

Drawings:

Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

Type Text:

As required to supplement product data.

Warranties and Bonds - Bind in a copy of each.

Each O & M manual shall include, but not be limited to, the following:

1. Provide a listing in table of contents for design data, with tabbed fly sheet and space for insertion of data. Include a Bill Of Materials for all equipment furnished.
2. Name, address and telephone numbers of corporate and local vendor contacts.
3. Detailed description of the function of each principal component of the system.
4. Performance and nameplate data. Include purpose and intent of each system.
5. Installation instructions.
6. Procedure for start-up, shut-down, and break-in
7. Proper adjustment.
8. Test procedures and trouble shooting guide.
9. Procedure for operating.
10. Shutdown instructions.
11. Emergency operating instructions and troubleshooting guide.
12. Safety precautions including manufacturer’s code of safe practice.
13. Complete nomenclature and part number of replaceable parts.
14. Panelboard Circuit Directories: Provide electrical service characteristics, controls and communications diagrams.
15. Maintenance Requirements: Include routine preventive maintenance procedures and guide for disassembly, repair, list of special tools required, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
16. Provide complete preventive maintenance program with maintenance schedule in tabular form, servicing and lubrication schedule, and list of lubricants required.
17. Provide original manufacturer's spare parts list for specific equipment, exploded diagrams of specific equipment, electrical schematics for specific equipment, and diagrams required for maintenance. Provide current price list for spare parts.
18. Provide list of special tools required for maintenance tasks.
19. List special training requirements.
20. Additional Requirements: As specified in individual product Specification sections.

Training schedules and procedure

Designate and provide one or more persons to be responsible for coordinating and expediting Contractor's training duties. The person or persons shall be present at all training coordination meetings with the City.

Submit to the Engineer a schedule for training of City operating personnel by equipment manufacturers. This schedule shall list the estimated completion dates for the installation of all equipment and systems requiring the services of manufacturers' representatives, as stated in the individual Technical Specification sections.

Coordinate the pre-startup training periods with City operating personnel and manufacturers' representatives. Complete all pre-startup training 14 days prior to actual startup of the Work. Schedule training services at times requested by the City.

Divide the time specified for training in each Section among five different sessions as follows:

1. One session shall be for video recording as specified below.
2. The remaining four sessions shall be divided between the morning and afternoon shifts and separated by either 2 weeks or 4 weeks as directed by the Engineer.
3. The sessions shall take place sometime within the above time limits.
4. Training requiring multiple sessions per shift for large or complex equipment shall take place on consecutive days within the above time limits.

The City reserves the right to make video recordings of any of the manufacturer's training sessions for use in ongoing training programs.

Where post-startup training is called for in the Technical Specification sections, supply and coordinate the specified manufacturers' services and other Contractor personnel for post-startup training of the City's operating personnel.

12-1.19 MANUFACTURER'S AND CONTRACTOR'S SERVICES

Manufacturer's Certificate Of Proper Installation

Where a manufacturer's certificate is required in the Technical Specifications, the manufacturer's representative shall provide a certificate stating that the equipment or system has been installed in accordance with the manufacturer's recommendations and has been inspected by a manufacturer's authorized representative, that it has been serviced with the proper initial lubricants, that applicable safety equipment has been properly installed, that the proper electrical and mechanical connections have been made, and that the equipment is ready for startup.

The Manufacturer's Certificate of Proper Installation shall include the statement that proper adjustments have been made and that the equipment or system is ready for plant startup and operation.

Testing

The Contractor shall provide the following services:

Functional Testing

1. Pre-Operational Check-out Procedures.
2. Electrical system testing.
3. Piping system pressure testing and cleaning.
4. Process instrumentation and controls acceptance testing.
5. Equipment check-out for proper rotation, alignment, speed, excessive vibration, noisy operation.
6. Pre-operational lubrication.
7. Additional requirements are listed in the individual Technical Specification sections.

System Start-Up

1. All safety equipment required by OSHA and the City to be installed in place prior to start-up.
2. All temporary piping, bulkheads or other equipment shall be removed prior to system start-up.
3. Individual systems shall be started under simulated operating conditions.

4. Test media to be used shall be water, air or a compatible substitute furnished by the Contractor.
5. Failure of any system during testing shall require a repetition of that test at the Contractor's expense.
6. Any deficiencies noted during testing procedures shall be corrected to the satisfaction of the Engineer.
7. Test results shall be within the tolerances set forth in the Technical Specification sections.

Performance Testing

Contractor shall complete performance tests on all equipment and systems to demonstrate that they meet the performance requirements as described in the Technical Specification Sections.

Training Of City Personnel

Before final inspection, provide detailed instructions to the City's designated personnel in operation, adjustment, and maintenance of products, equipment, and systems, at agreed upon times.

Sales representatives shall not conduct the training sessions. Submit a brief description of the qualifications of the manufacturer's representative designated to conduct this training. The manufacturer's representative shall be a factory trained or manufacturer's certified individual with substantial experience in the repair and servicing of the equipment to be covered during the training session.

The City shall receive a six hundred ($600.00) dollar per day credit from the Contractor for any training that is not conducted as required above or as required in the individual Technical Specification sections. The Contractor and the Engineer will jointly verify that the required training is conducted.

For equipment requiring seasonal operation, perform instructions for other seasons within six months.

Use operation and maintenance manuals as basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.

The training shall cover a thorough discussion of the O&M manual. The training shall include but not be limited to, operation and maintenance of the specific equipment and systems installed, telltale signs of equipment malfunctioning and their solutions, other pertinent topics that relate to optimum system operation and energy conservation.

Prepare and insert additional data in Operation and Maintenance manual when need for such data becomes apparent during instruction.

System Familiarization Training shall follow the outline below:

1. Show location of catalogs, parts lists, drawings and other pertinent material in the plant files and O&M manuals.
2. Check out the installation of the specific equipment items.
3. Demonstrate the unit and show that all parts of the Specifications are met.
4. Answer questions.

Safety Training shall cover the following:

1. Point out safety references.
2. Discuss proper precautions around equipment.

Operational Training shall cover the following:

1. Point out reference literature.
2. Explain all modes of operation, including emergency.
3. Check out operators in proper use of the equipment.

Preventive Maintenance (PM)Training shall cover the following items:

1. Pass out PM list including:

a. Reference material.
b. Daily, weekly, monthly, quarterly, semi-annual and annual maintenance and inspection procedures.

2. Show how to perform PM jobs.
3. Show operators what to look for as indicators of equipment problems.

Corrective Maintenance Training shall cover the following items:

1. List possible problems.
2. Discuss repairs--point out special problems.
3. Open up equipment and demonstrate procedures, where practical.

Availability of Parts, Outside Service and Manufacturer's Representative

1. Show how to use parts list and order parts.
2. Where to order parts: Name, address, telephone.
3. Check over spare parts on hand. Make recommendations for additional spare parts needed. Sign off their acceptance of the spare parts in the presence of the City's representative.
4. How to get emergency service help.

Training Schedules And Procedure

The Contractor shall designate and provide one or more persons to be responsible for coordinating and expediting Contractor's training duties. The person or persons shall be present at all training coordination meetings with the City.

The Contractor shall submit to the City a Training Schedule, to be used by the City for scheduling the training of City operating personnel by equipment manufacturers. This schedule shall list the estimated completion dates for the installation of all equipment and systems requiring the services of manufacturers' representatives, as stated in the Technical Specifications.

The Contractor shall coordinate the pre-startup training periods with City operating personnel and manufacturers' representatives. All pre-startup training shall be completed 14 days prior to actual Plant Startup. Training services shall be at such times as requested by the City.

The time specified for training in each Specification section shall be divided among five different sessions. One session shall be for video recording as specified below. The remaining four sessions shall be divided as shown below between the morning and afternoon shifts and separated by either 2 weeks or 4 weeks as directed by the Engineer. The sessions shall take place sometime within the time limits shown. Training requiring multiple sessions per shift for large or complex equipment shall take place on consecutive days within the time limits shown for each shift.

The City reserves the right to make video recordings of any of the manufacturer's training sessions for use in ongoing training programs.

Where post-startup training is called for in the Technical Specifications, the Contractor shall supply and coordinate the specified manufacturers' services and Contractor personnel for post-startup training of the City's operating personnel.

12-1.20 FIELD ENGINEERING

Quality Control

Retain and pay expenses for a civil engineer or land surveyor registered in the State of California and acceptable to the City to perform site surveying under the Contract Documents.

Contractor shall submit evidence of surveyor's errors and omissions insurance coverage in the form of an insurance certificate.

Submittals

Submit name, address, and telephone number and state registration number of Contractor’s surveyor before starting survey work.

Submit a copy of site drawing, and a certificate that the elevations and locations of the Work are in conformance with Contract Documents, all prepared, stamped and signed by the surveyor.

Project Record Documents

Maintain a complete and accurate log of control and survey work as it progresses.

On completion of foundation walls and major site improvements, prepare a certified survey illustrating dimensions, locations, angles, and elevations of construction and site work.

Submit Record Documents under applicable provisions of Cal-Trans Standard Specifications.

Examination

Verify locations of survey control points prior to starting work.

Promptly notify the Engineer of all discrepancies discovered in Contract Documents.

Survey Reference Points

Control datum for survey is that established by City survey. All other lines and grades required for the completion of the Work shall be Contractor's responsibility.

Contractor to locate and protect survey control points prior to starting site work; preserve permanent reference points during construction.

Promptly report to Engineer the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Engineer.

Survey Requirements

Provide field engineering services, using recognized engineering survey practices.

Establish a minimum of one permanent bench mark on site, referenced to established control points. Record locations, with horizontal and vertical data, on Project Record Documents.

Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:

1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
2. Grid or axis for structures.
3. Building foundation, column locations, ground floor elevations.
4. Location of new underground water main from new pump station to Bent "A". Periodically verify layouts by same means.

Survey Control

Where roadway pavement reconstruction occurs adjacent to or at the pump station, the Contractor shall be responsible for providing primary control, with control line and grade, from existing off-site monument markers and lines. The Contractor shall maintain and preserve all line, grades, and benchmarks and provide for all other survey control work. The Contractor shall establish construction control line with hubs every 20 feet prior to construction work.

The Contractor shall replace or re-establish hubs missing or displaced during construction at no cost to the City.

The Contractor shall retain the services of a State of California registered land surveyor with a minimum of one (1) year experience in engineering surveying and control procedure for public works construction, who shall establish horizontal and vertical controls as needed by the Contractor.

The survey control work shall be considered Incidental Work and no separate payment will be made therefor..

12-1.21 CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

Operation Hours For Temporary Controls

Provide and maintain temporary construction facilities and controls as described herein on a 24-hour basis as required by the Engineer.

Barriers

Contractor shall comply with the requirements of San Francisco Department of Public Works Guidelines for the Placement of Barricades at Construction Sites (DPW Order No. 167,840), appended to this Section.

Contractor shall be responsible for providing and maintaining at least one accessible path-of-travel for pedestrians around the construction site consistent with applicable federal, state, and local laws, including the Americans with Disabilities Act and the California Building Code (Title 24, Part 2, Accessibility Standards).

Contractor will be assessed liquidated damages in the amount of one thousand dollars ($1,000) per calendar day for each day Contractor fails to comply with the requirements for placement of barricades.

Provide protection for plant life designated to remain. Replace damaged plant life.

Bridging Over Trenches And Excavations

The Contractor shall construct temporary bridges across excavations to provide, at all times, safe and adequate passage for vehicular and pedestrian traffic. In addition, the Contractor shall provide and maintain sufficient number of lighted barricades to be used as determined by the Engineer in the field.

The Contractor is referred to Document 00813: Placement Of Barricades and Section 01570 - “Traffic Routing Work” of these Specifications for more specific requirements.

Public Thoroughfare

Except as indicated or otherwise approved, construction operations shall not occupy public sidewalks except where pedestrian protection is provided in accordance with the requirements of Chapter 44 of the San Francisco Building Code and the regulations of public authorities having jurisdiction.

When Work is to be performed over an active public thoroughfare such as a sidewalk, close thoroughfare if possible, or take other precautions such as installing screens or barricades.

1. When the exposure to heavy falling objects may exist, such as during the demolition of building walls, provide special protection of the type detailed in 29 CFR 1910/1926 and as required by Cal-OSHA.
2. Provide solid continuous bottom rail such as 2' x 4's or other material of high contrast attached to the base of barricade and fencing systems to direct blind pedestrians through a temporary travel path.
3. Provide proper barricades and temporary curb ramps at all closed crosswalks and curb ramps.
4. Provide 45-degree beveled smooth, non-tripping transitions at all path-of-travel height changes over 1/4-inch.

Maintain at least one accessible travel path to and from the on-site facilities for persons with disabilities that conforms with the requirements of the State of California Title 24, Part 2 Accessibility Standards. Remove debris and other construction material from pedestrian walkways.

Do not allow storage, stockpiling, or placement of any equipment, materials or supplies in public streets and sidewalks outside construction phase area without obtaining prior written approval.

Temporary Fencing

Do not make openings in the existing property-line security fence or wall without providing and maintaining temporary, eight (8) foot high, commercial grade, chain link construction fencing or other approved means of security.

Construction Personnel Identification

All Contractor's vehicles and subcontractors' vehicles shall display the company name, logo, phone number, and State contractor's license number.

All employees of the Contractor and its subcontractors shall be provided with hard hats; each firm will be assigned a unique hard hat color by the Engineer.

Maintenance Of The Work Area

Maintain the work areas in a safe condition, remove all accumulations of rubbish and surplus materials at the end of each working day, restore them to a condition equal to that which existed prior to the start of work, and leave them at completion of the Contract in a clean, orderly fashion.

Cleaning During Construction: Control accumulation of waste materials and rubbish; collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly.

1. Maintain the site and all adjacent public areas including crosswalks and sidewalks in a clean and orderly condition. Maintain the site, equipment, fences and signs free of graffiti. Remove all graffiti daily using methods which cause no damage to the work or existing facilities.

Dust Control

Observe all of the following specific dust control measures:

1. Wash the tires of excavation and spoils trucks before they re-enter city streets to minimize deposition of dust-causing materials.
2. Minimize the amount of excavated material or demolition wastes stored at the site. All dust-generating stockpiled construction materials shall be covered to prevent dust generation.
3. Mist all exposed soil surfaces twice daily during dry weather and additionally if dust is blowing or if required by the Engineer.
4. Cover all trucks containing dust-generating excavated material or demolition waste prior to their leaving the construction sites.
5. Use reclaimed water for dust control as described in Article “Temporary Water Service” above.

Hazardous Excavated Material

Excavated material may be contaminated (DPW Order No. 171,378) with hazardous or toxic materials that may be dangerous if air borne. Minimize dust generation to reduce health risks to workers and to the public.

Adhere strictly to the following requirements to achieve a goal of "NO VISIBLE DUST EMISSIONS."

1. Treat water for dust control with a biodegradable, non-polluting, non-toxic dust control chemical. (Water so treated becomes "amended" water.)
2. Provide continuous water misting using as fine a spray or mist as possible in any area of excavation, drillings and other dust generating activity.
3. Wet down areas around the immediate excavation at least three times daily.
4. During all excavation and dirt moving activities, wet sweep/vacuum the above mentioned streets at least three times a day once at the end of the shift and two other times approved or as directed by the Engineer.
5. For wet sweeping use a vacuum sweeper vehicle with sufficient suction to ensure that the vehicle does not blow dust towards neighboring businesses or residences. Provide a more powerful and effective vehicle if required by the City.
6. Load haul trucks carrying excavated material so that the material does not extend above the walls or back of the truck bed. Tightly cover the surface of all loads before the haul trucks leave the loading area. Wet prior to covering if required by the City.
7. Limit vehicle travel speeds to no more than 15 mph for vehicles operating within the job site.

8. Do not allow the idling of motors from Contractor's and subcontractors' equipment and vehicles for more than 15 minutes to reduce pollutant emissions.

Perform and pay for cleanup of all spillage (including clean soils) on City streets, directly or indirectly caused by actions of employees of Contractor or its subcontractors.

If Contractor fails to provide adequate dust control as determined by the Engineer, the Engineer reserves the right to have the necessary work performed by others and to deduct or withhold all monies required therefor.

Air Pollution Control

The Contractor shall comply with all air pollution control rules, regulations, ordinances and statutes which apply to any work performed pursuant to the Contract, including any air pollution control rules, regulations, ordinances and statutes specified in Section 11017 of the California Government Code.

In the absence of any applicable air pollution control rules, regulations, ordinance, or statutes governing solvents, all solvents, including but not limited to the solvent portion of paints, thinners, curing compounds, and liquid asphalt used on the Contract shall comply with the applicable material requirements of the Bay Area Air Quality Management District. All containers of paint, thinner, curing compound or liquid asphalt shall be labeled to indicate that the contents fully comply with said requirements.

Materials to be disposed of shall not be burned.

Drainage Control

Grade site to drain. Maintain excavations free of standing water.

Protect site from erosion caused by flowing water.

Maintain catchbasins and storm water inlets throughout the entire Contract site, both inside and outside the phased construction work area for the duration of the project. Check and remove all debris from the catchbasins and storm water inlets prior to the rainy season and clear all clogged inlets and catchbasins during the rainy season. Perform final cleaning of the catchbasins and inlets prior to final inspection and acceptance of the work.

Project Signs

The Contractor shall provide two (2) project signs to be fabricated and installed as incidental work, where directed by the Engineer. Each sign panel shall be 4-feet by 6-feet in size, and shall be 1/2-inch thick exterior grade plywood, good one side. All exposed wood shall be painted bright yellow. Lettering shall be black. Lettering identifying the project title shall be 4-inches high. All other lettering shall be 3-inches high.

The signs shall read:

BAY BRIDGE PUMP STATION RELOCATION

Name of Contractor
Contractor Phone No.

The Contractor shall also provide two (2) warning signs for perimeter posting to be installed where directed by the Engineer. The warning signs shall be twenty four (24) inches by twelve (12) inches in size with black lettering on a white background and shall contain the following message:

HAZARDOUS MATERIALS NOTIFICATION

CONSTRUCTION ACTIVITY MAY INVOLVE EXCAVATION AND HANDLING OF FILL MATERIALS CONTAINING PETROLEUM DISTILLATES, LEAD, AND OTHER METALS. THESE CONTAMINANTS ARE KNOWN BY THE STATE OF CALIFORNIA TO CAUSE CANCER AND BIRTH DEFECTS.

DURING CONSTRUCTION, EVERY EFFORT WILL BE MADE TO HANDLE EXCAVATED MATERIALS SAFELY TO PROTECT CONSTRUCTION PERSONNEL AND THE PUBLIC.

WE REQUEST YOUR COOPERATION DURING THE CONSTRUCTION PERIOD BY OBSERVING POSTED WARNING SIGNS AND STAYING OUT OF THE CONSTRUCTION AREA.

Obtain the Engineer's approval of his proposed location of the project and warning signs. Maintain the signs in good condition for the duration of the Contract, and at the completion thereof shall remove them from the site as his/her property.

Place the project and warning signs at the job site prior to the start of any work.

Obtain the Resident Engineer's approval of locations and mounting details of the project signs.

Maintain the signs in good condition for the duration of the contract. Promptly clean graffiti and other marks from the project signs.

Remove project signs from the site as Contractor’s property at the completion of the Work.

Removal Of Utilities, Facilities, And Controls

Remove temporary above grade or buried utilities, construction equipment, temporary structures and facilities, unused materials, rubbish and debris prior to Final Inspection. Restore facilities to conditions prior to construction, to the satisfaction of the Engineer.

Clean and repair damage caused by installation or use of temporary work.

Restore existing facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

12-1.22 CITY RESIDENT ENGINEER’S FIELD OFFICE

The Contractor shall provide, maintain, and subsequently remove as his property, a field office as herein specified, for the free and exclusive use of the City Resident Engineer and his representatives.

The field office, equipped as specified, shall be available at the site for the City Resident Engineer's use prior to the start of any work in the field under the contract. The field office shall be located where directed during the Pre-Construction meeting, and relocated when necessary within one mile of construction site. The field office shall be secured with keyed cylinder-type locks. The Contractor shall maintain the field office and its appurtenances in good repair and acceptable appearance and shall provide daily cleaning service and constant maintenance and replenishment of paper towels, paper cups, soap, toilet paper, bottled water service with hot and cold water faucets, telephone service, electric lighting and electric heating.

The Contractor shall be responsible for the safety of engineering instruments and equipment belonging to the City and stored in the field office, and shall provide steel locker space for such storage.

Field offices shall be trailer type mobile structures with the following features:

All metal frame
All metal exterior, sides and roof
Security guard screens on all windows
Cylinder lock on door, with 5 keys in each door
Toilet and wash basin in separate compartment in office
Insulated double walls, floor and roof
Self contained, built-in, thermostatically controlled electric heater and air conditioner
Florescent ceiling lights
110-volt electric wall plugs

Minimum interior height 7 feet
Minimum interior width 10 feet
Minimum trailer size 500 sq. ft.
Railed stairway to entrance door
Steel locker attached to wall
Sign on office reading:

City Resident Engineer
SF DPW/Bureau of Construction Management
Bay Bridge Pump Station Relocation
PUC Contract WD-2259

The Contractor shall provide sewer and water connections as approved by the Engineer. Contractor shall arrange and pay for all necessary electricity, heat, water, telephone, sewer and daily janitorial services in connection with the City Resident Engineer's Field Office specified herein, for the duration of the work.

Field Offices shall contain the equipment and facilities hereinafter indicated:

Minimum Interior Length	45 feet
Doors	2
Windows	4
Bottled water service with hot and cold faucets	1
Toilet and Wash basin	1
Paper towel dispenser with towels	1
Paper cup dispenser with cups	1
Desks - 30"x60"	4
Swivel Chairs upholstered, fully adjustable with five casters	4
Straight Chairs	3
Drafting table 3'x6'	1
Drafting stool	1
Clamp-on incandescent desk lamps with bulb	3
4-drawer steel file case with lock (w/pendaflex suspension racks.)	2
Plan rack and plan hangers	1
Bookcase (4 shelf, 12 in. deep)	2
Waste paper basket (13 gal. with 500 plastic liners)	3
Clothes hangers	1
First Air Kit	1
Telephone	3
10-cup new coffee maker	1
Fax machine	1
Refrigerator (9.5 cu. Ft. minimum), with freezer compartment, with full warranty.	1
Microwave Oven (1.2 cu. Ft. minimum) with full warranty.	1
PCS Wireless Phone – with high capacity batteries, carry	3
Case, extra high capacity battery and rapid charger Photocopy Machine	1

Auto paper select and sort, staple, enlarge and reduce have 8 1/2x11, 8 1/2x14 and 11"x17" paper trays, and 60 copies/minute speed. MTS 2000 Motorola portable radio with same frequency as other Bureau of Construction Management (BCM) radios. These radios shall be the property of the City & County of San Francisco, Department of Public Works.	2

Seven Thousand ($7,000) allowance for the purchase of computers, printers, softwares, diskettes and other supplies for the use in the field office.

Telephone Service, Facsimile Machine, Photo Copy, Radio, Cellular phone and service contract:

The Contractor shall provide in the field office for the use of the Engineer, two incoming telephone lines and one additional telephone line dedicated for FAX machine. Contractor shall also pay telephone service for use by City employees during construction.

Contractor shall provide one telephone, in good order, at each desk. Telephones shall be touch-tone with speaker phone, hold, call transfer and conference features. A separate wall-mounted receptacle shall be provided for each desk telephone connection near each desk. Two incoming lines shall be connected to all the telephones. All telephones shall have the capability of answering any incoming call. Any transfer shall ring the appropriate phone and flash a button to show which line is being transferred. All telephones shall have capability of transferring a call to another phone in the trailer by dialing a 1 or 2-digit number. All telephones shall have conference capability within the trailer on all the lines and shall have "hold" and "last number redial" capability.

The Contractor shall provide for the exclusive use of the Engineer for the duration of the Contract, one FAX machine and constant supply of paper in the Field Office. Contractor shall obtain and pay for a service contract for on-site service and repair of the FAX machine. The FAX machine shall be equipped with the following features: Automatic document feeder, 16-digit dot matric display, alphabetical dialing, delayed transmission, automatic redial, uses plain paper.

The Contractor shall obtain and pay for a service contract from the local representative of the dealer or manufacturer for daily, on-site availability of a service engineer for service and repair of all telephone equipment, FAX machines and photo copy machine and cellular phone. Radios must also include an additional battery, a battery charger and warranty for one year. The Contractor shall also provide phone service for the cellular telephone including initiation fee, monthly membership fee and usage based on an average of 90 call minutes per calendar day. Service contract shall include toner for the FAX and photocopy machine.

All required field offices, equipped as specified herein, shall be provided and ready for use by the Engineer by the date of the Notice to Proceed and shall be maintained in full operation until Contractor's Application for Final Payment has been approved by the City.

Contractor shall remove field offices and construction facilities from the site as its property, including associated equipment and utilities, within 14 calendar days after Contractor's Application for Final Payment has been approved by the City, or when its use is no longer required, as determined by the Engineer. Restore the site occupied by said field offices to the original condition or as specified hereinafter.

Payment for the City Resident Engineer Field Office shall be paid under the Site Work Bid Item.

12-1.23 PROJECT MEETINGS

Pre-Construction Conference

Prior to commencement of Work, the Engineer will schedule and conduct a pre-construction conference.

Contractor shall be prepared to review and discuss the construction schedule and sequence of operations. The conference will be held by the Engineer at a time and location selected and arranged with Contractor after award of the Contract.

The conference shall be attended by:

Contractor and its general superintendent.

All authorized representatives of subcontractors or suppliers whom Contractor may desire to invite or whom the Engineer may request.

Representatives from the following agencies may also be invited to attend:

The City.
The City's Environmental Consultants.
Utility Companies.

Agenda:

1. Distribution of Contract Documents.
2. Submission of Contractor's proposed submittal schedule and progress schedule.
3. Designation of personnel representing the parties in Contract, and the Engineer.
4. Procedures and processing of field decisions, progress payments submittals, substitutions, applications for payments, proposal request, Change Orders and Contract close-out procedures.
5. Scheduling.
6. Inspection and observation responsibilities.
7. MBE/WBE requirements and Certified Payrolls

Weekly Progress Meetings:

The Engineer will schedule, prepare agenda, and administer meetings throughout progress of the Work at weekly intervals or more frequently, if required by the Engineer.

Attendance Required:

Job superintendent, major subcontractors and suppliers, as appropriate to agenda topics for each meeting.

Location:

Project field office, unless otherwise notified.

Typical Agenda:

1. Review and approval of minutes of previous meeting.
2. Review of work progress since previous meeting.
3. Field observations, problems, and conflicts.
4. Problems which impede Contractor's construction schedule.
5. Review of off-site fabrication and delivery schedules.
6. Corrective measures and procedures to regain projected schedule (if necessary).
7. Revisions to Contractor's construction schedule and "Look Ahead" schedules.
8. Coordination of schedules.
9. Review submittal schedules; expedite as required.
10. Maintenance of quality standards and field corrections.
11. Housekeeping and cleaning of site.
12. Review proposed changes for the following:

    a. Effect on Contractor's construction schedule and completion date.
    b. General status of proposed change.

13. Other business.

Once a month, or as otherwise required by the Contract Documents, include on the agenda of the progress meeting a review of the monthly billing.

1. Contractor shall prepare an itemized draft of the month's proposed billing for review with the Engineer at this meeting.
2. Following review of proposed billings, Contractor shall make revisions as may be required, prepare application for payment, and submit to Engineer.

Submit site photographs each month, if required by the Contract Documents at weekly progress meeting.

12-1.24 TESTS AND INSPECTIONS

All testing and inspection of the work required by the Contract Documents shall be arranged and paid for by the Contractor through an independent testing laboratory, unless specifically noted to the responsibility of the City.

Special inspections required in accordance with the Code or other agency having jurisdiction shall be performed at the City's expense. Contractor shall give the City, independent testing laboratory and special inspectors a minimum of 2 working days notice, excluding weekends and City holidays, of when and where tests and inspections are required so the City may be present to perform the necessary inspections or tests.

Tests to be performed by the City's Materials Testing Laboratory are:

1. Concrete slump test
2. Re-bar tensile strength testing
3. Asphalt gradation testing
4. Mortar and grout compressive strength testing
5. Soil compaction and soil classification testing

If such testing or inspection reveal failure of the portion of the work to comply with requirements of the Contract Documents, Contractor shall bear all costs made necessary by such failure including those of repeated testing and inspection and compensation for the City's testing and inspection services and expenses.

Neither observation by the City nor inspections, tests, or approvals by the City's inspectors or testing agencies and consultants shall relieve the Contractor from its obligation to ensure that the work conforms to the requirements of the Contract Documents.

Contractor shall promptly provide all facilities, labor, and material reasonably needed for performing such safe and convenient inspections and tests as may be required by the City. Tests or inspections shall be conducted promptly to avoid unreasonable delay in the work.

The Engineer reserves the right to charge Contractor any additional cost for inspection or testing when material or workmanship is not ready at the time specified.

12-1.25 SYSTEM START-UP TESTING

In addition to individual component testing described in the Technical Specifications, the Contractor shall conduct an overall System Start-Up Test for the entire Pump Station and all peripheral systems.

The overall System Start-Up Test shall be performed prior to final acceptance of the work of this Contract. Satisfactory completion of the test shall be required in order to achieve Substantial Completion of this Contract. The overall System Start-Up Test shall be satisfactorily completed prior to the demolition of the existing Pump Station.

Scope Of Test

It is the intent of this Section that the performance of the main pumps, the control system and all related components and equipment including the UPS and generator back-up system be tested as a complete and operational system. The entire pumping system shall be tested with respect to its ability to deliver City water to the Yerba Buena Island reservoir.

The Start-Up Test will be structured such that the Contractor shall be responsible for assuring that his/her work is fully operational for the duration of the Start-up test procedure.

The overall coordination of the Start-up test procedure will be jointly conducted by City personnel and their duly authorized representative.

The basic requirement of the Start-Up test is that all new work of this Contract shall be required to operate and function in a trouble-free manner with no mechanical or electrical failures for 4 continuous hours through two sets of pump start/stop cycle with a minimum of 2 hours pump run time for each pump. After this test is complete, the

standby power system shall be tested for actual (not simulated) operation according to the sequence of operation specified in Section 16620.

For Start-Up test purposes, the Contractor shall be responsible for providing necessary technical and crafts personnel to operate the new work and to correct any malfunction of the system components during the Start-up test procedure.

If, under test, any portion of the work should fail to fulfill the Contract requirements and should require adjustment, alteration, renewal or replacement, tests on that portion when so adjusted, altered, renewed or replaced, together with all other portions of the work as are thereby affected, shall, if required by the Engineer, be repeated within a reasonable time. Any failure of any part or component of the system during the Start-Up testing shall require a re-start of the test.

If a failure of any component should occur during the Start-up test, the Contractor shall be responsible for the actual cost of any idle time due to such failure. Such costs of idle time shall include personnel costs of City personnel who are assigned to coordinate, assist and witness the Start-up test, personnel costs of the City's duly authorized representatives, rental of equipment and any other incidental costs of the delay.

The test medium to be pumped during the Start-Up test shall be City water.

TEST PROCEDURE

Various activities shall be included in the Start-Up test to demonstrate proper functioning of all facilities and systems. Such activities shall include, but not be limited to:

All gate valves 3 inches and larger shall be operated through full travel.

Test two (2) pumps (#1 & #2) running simultaneously (in parallel) on demand through signal from level controller at YBI reservoir. Check and record flow, head and reservoir level every 15 minutes for two hours. Repeat with pumps #3 and #4.

A standby generator power test shall be conducted on a separate day from the main pump start-up testing. The pump reservoir must be low enough to provide a “low water” pump start signal during an induced normal power outage. The generator system shall power a complete pump start/stop run cycle and successfully transfer to “load shed” hold position. Refer to Section 16620.

The Contractor shall be responsible for providing diesel fuel for operation of the diesel generator.

CITY PARTICIPATION DURING START-UP TESTING

The Start-Up test shall be conducted at a time and date to be mutually agreed upon by the Contractor, City personnel and authorized representatives of the City.

S.F. Water Department shall provide 72 hours advance notice of the Start-up test to the Contractor so that the Contractor can mobilize his/her testing crew.

The City will be responsible for all normal operational costs incurred during the Start-up test. These costs shall include electrical power, providing water and other incidental utility costs. The Contractor shall bear the costs of all necessary repairs or replacements, including labor and materials as required to keep the portion of his/her new work operational during Start-Up testing.

CONTRACTOR'S PERSONNEL REQUIRED FOR SYSTEM TESTING

The Contractor shall provide the services of all technical and crafts personnel required to support the work covered under his/her Contract during the entire Start-Up test.

The Contractor, at his/her own expense, shall arrange to have all major equipment manufacturer's representatives present for the Start-up test.

EQUIPMENT REQUIRED FOR SYSTEM TESTING

It shall be the Contractor's responsibility to ensure that all required testing and repair equipment is on hand during the Start-up test procedure.

MEETINGS

Approximately 90 days prior to the Start-Up test, a regular weekly meeting will be held to discuss overall test procedures, strategy and preparations for the forthcoming test. The time and place of such meeting will be announced by the Engineer.

At the first meeting, the Contractor shall be required to submit his/her Start-up test procedure and strategy for review and discussion.

These weekly planning meetings shall continue until the final test plan is completed and has been approved by the Engineer.

At least one representative of the Contractor will be required to attend each meeting.

COMPONENT TESTING

Prior to commencement of the Start-Up test run procedure, all component testing described in the individual Specification Sections shall have been satisfactorily completed.

12-1.26 TRAFFIC ROUTING WORK

This Section is supplementing Traffic Routing Work for the Seismic Retrofit Project No. 16 and sets forth the minimum requirements in Traffic Routing Work for the installation of the 12-inch force main from Bryant and Main Streets to Spear Street and the Embarcadero. The Contractor shall conduct his operations with due regard to applicable Caltrans and City Standards by providing necessary traffic control devices and manpower as specified herein and as directed by the Engineer.

SUBMITTALS

The Contractor shall submit the following and gain approval from the City Traffic Engineer, before starting any work in the streets:

Traffic Control Plans

The Traffic Control Plan shall be prepared, signed and stamped by a Registered Civil or Traffic Engineer in the State of California. A separate set of traffic control plans shall be required for working and non-working hours.

Complete traffic control and detour plans shall be submitted within 20 working days of the award of Contract. A submittal shall consist of one (l) reproducible vellum, plus three (3) Xerox copies on white paper of each drawing. Drawing size shall be 36" X 24". The Contractor shall use the existing striping plan, T-1 as a base to prepare Traffic Control plans.

The traffic control plans shall be drawn to a scale of 1 inch = 50 feet. The Contractor shall submit the plans to the City Traffic Engineer, through the Engineer for approval. The City Traffic Engineer shall have 5 working days to review the submittal. No work shall be allowed on the streets prior to approval of traffic control plans.

Each traffic control plan shall show the following minimum information, unless required otherwise by the Engineer:

1. Street and traffic lane layout (width of sidewalk, street and traffic lanes etc.); outline of the work under construction, (i.e. limits of excavation).
2. Traffic lane transitions for various alignment of Water Mains.
3. Crosswalk and sidewalk closures (typical) if required.
4. Existing striping, pavement markings and traffic signs, and description of what is to be removed prior to installation of temporary striping and signage, and what will be restored after the construction is completed.
5. Location and spacing of "Tow-Away No Stopping" signs.
6. Location and description of traffic control devices proposed for the protection of the work area, excavation, etc.
7. Locations and details of plating/bridging over trenches and excavations, and structural calculations for spans over 4 feet wide.
8. Location and details of temporary paving over trench.
9. Trench protection plan, if any excavated trench is left open during non-working hours.

10. Other proposed changes and provisions for removal, relocation, or temporary installation of:

a. Traffic signs.
b. Transit stops.
c. Barricades, chain link and/or plywood fence, temporary K-Rail, crash cushions (sand barrels), etc.
d. Solar operated flashing arrow signs.

PROHIBITION OF STOPPING

The Contractor may prohibit stopping in parking lanes where and when necessary to gain access to the work or to provide the required lanes, unless specified otherwise in this section.

The Contractor shall obtain the approval of the San Francisco Department of Parking & Parking for the required prohibition of stopping from the Traffic Bureau (415) 554-9928, at least 72 hours in advance of the effective date and time. The Contractor shall post the signs at least 72 hours in advance of the effective date and time.

The Contractor shall furnish and place, spaced every 100 feet, where approved by the San Francisco Police Department and the Engineer, "Tow-Away - No Stopping" signs in accordance with DPW Standard Plan 32,400 Ch. 2, on wood posts at least 7 ft. above the sidewalk. The signs shall be metal. Signs shall be placed and attached to posts in so they are easily readable by motorists. If "Tow-Away - No Stopping" signs are to remain in place for less than 5 days, signs may be attached to Type II barricades and placed at 25 ft. centers. The Contractor shall post the signs only in the area where he will actually be working. Parking shall not be prohibited in any area where there is no construction activity. The name and contact telephone number of the Contractor shall be shown on all signs.

The Contractor shall maintain the signs on a continual basis and shall replace damaged or missing signs daily, and shall remove the signs immediately after they are no longer needed.

When a vehicle is removed from a street at the request of the Contractor and a post-storage hearing determines that as a result of the Contractor's improper posting of the required signs, reasonable grounds did not exist for removal, the Contractor shall reimburse the City and County of San Francisco for the cost incurred in storage and towing. The failure of the Contractor to provide reimbursement or to agree to assume all liability for any improper posting shall result in the Parking and Traffic Department's denial of any future requests by that Contractor for removal of vehicles in violation.

MASS TRANSIT VEHICLES

The Contractor shall not prevent or delay the operation of mass transit vehicles at any time.

The Contractor shall familiarize himself with the routes of the coach lines that operate within the limits of the work. The lanes made available for traffic shall be located so as to include an adequate and allowable travel path for the coach lines. The extreme touring range of the center line of a trolley coach is 10 feet from the center line of the trolley wires. A 45 foot turning radius for Municipal Railway vehicles shall be provided by the Contractor.

The Contractor shall notify the Chief Transit Control Inspector of the Municipal Railway at (415) 554-9286, thru the Engineer, at least TEN DAYS in advance of doing any work in existing passenger loading zones for buses on each street, where such work would interfere with passenger loading and unloading operations. The Municipal Railway, during this time, at no cost to the Contractor, will temporarily relocate these zones as necessary.

The Contractor shall provide flag personnel as required to assist MUNI lines operating around the construction area.

SPECIAL INSTRUCTIONS

The Contractor shall coordinate the water main installation work with other construction works that are under construction or scheduled to begin work, within the project site's vicinity.

No street closure shall interfere with the access of emergency vehicles including those of the Police and the Fire Departments and ambulances. At locations where the lane requirements allow the Contractor to close a street, local access shall generally be maintained at all times by providing a 14 ft. wide traffic lane.

The Contractor shall maintain the required travelway for vehicles in any public street and a minimum width of 6 ft. (or up to the existing width of the sidewalk, if less than 6 feet wide) of clear sidewalk for the pedestrians at all times. All crosswalks and sidewalks shall be kept fully open, unless full or partial closures are approved by the Traffic Engineer, in writing.

All existing traffic movements at any intersection shall be maintained by bridging and or phasing.

The Contractor shall plate over all trenches after working hours.

Whenever the grade difference between the new concrete base, manholes etc., and the existing AC pavement exceeds 0.75 inches, the Contractor shall use temporary paving (hot asphalt concrete) conforming to Section 211 of DPW Standard Specifications, to provide longitudinal and/or transverse transition from the new concrete base, manholes etc., to AC pavement, at the end of the work shift, before opening the lanes to traffic. The transitions shall have a slope of not more than 1:18.

The ends of any trench excavation shall be protected with Type III barricades, with flashers - minimum two (2) each.

TRAFFIC LANE AND PARKING REQUIREMENTS

The Contractor shall provide the tabulated lanes (as stated below) during the water main installation work,, to satisfactorily accommodate vehicular traffic. Vehicular/pedestrian access to properties along the project site shall be maintained at all times, to the satisfaction of the Engineer.

Traffic Lane Requirements
Number and Width of Lanes for Through Traffic

Street	Time	Northbound	Southbound	Eastbound	Westbound
Main St	7am-3pm (M-F) All Other Times			1@11' Full Rdwy	1@11' Full Rdwy
Spears St.	7am-3pm (M-F) All Other Times			1@12' * Full Rdwy	 Full Rdwy
Bryant St.	7am-3pm (M-F) All Other Times	1@12' Full Rdwy	1@12' Full Rdwy		
Embarcadero St.	9am-3pm (M-F) All Other Times	Full Rdwy Full Rdwy	2@11' Full Rdwy		

* During water main construction, Spears street shall be operated with one 12' wide traffic lane for both directions of traffic with two flag persons (one in each direction) to control the traffic movements at these intersections. The 90 degree parking on the West-side of Spear street shall be converted into parallel parking.

NOTES:

1. No street closure shall interfere with the access of emergency vehicles including those of Police and Fire Departments and ambulances. Local access shall be maintained at all times, including access to driveways.
2. The Contractor shall maintain the required travel ways for vehicles in any public street or way and a minimum width of 6 feet of clear sidewalk(or full sidewalk at locations where the sidewalk is less than 6 feet wide) for the pedestrians, at all times.
3. All existing traffic movements at the intersections shall be maintained by bridging and or phasing.

12-1.27 COORDINATION

Coordinate and schedule the Work with other concurrent projects on or near the site including the following:

"Waterfront Transportation Projects
Surface Streets and Transit Improvements – Phase 1"

Note that the work of the Surface Streets and Transit Improvements Contract includes the installation of four (4) new traffic signals at the intersection of Bryant and Main Streets and widening of Bryant Street between Main Street and The Embarcadero. See Reference Drawings R-4 and ET-13.

12-1.28 TIME ALLOWED FOR COMPLETION

The time allowed for the installation of the 12-inch buried force main on Bryant Street between Main Street and The Embarcadero shall be completed by October 14th, 1999. Installation work shall conform to all the requirements specified in

Section 15003 and shall include installation of electrical conduits, pull boxes, thrust blocks, field testing, backfilling and resurfacing.

12-1.29 LIQUIDATED DAMAGES

Contractor shall pay liquidated damages in the amount of Two Thousand Five Hundred dollars ($2,500) per calendar day for each day which the pipeline installation work on Bryant Street is not completed after October 14th, 1999.

12-1.30 CONTRACTOR'S FIELD SUPERVISION

The Contractor shall provide the services of a full-time Assistant to the Field Superintendent. The Assistant shall provide full-time construction supervision of the Bay Bridge Pump Station Relocation Work.

12-1.31 EXCAVATION CODE REQUIREMENTS

Contractor shall comply with the requirements of Article 2.4 of the San Francisco Public Works Code. Except for excavations specifically exempt, no excavation shall be performed in the public right of way under the jurisdiction of the Department of Public Works without a valid excavation permit issued by the San Francisco Department of Public Works, Bureau of Street-Use and Mapping, Street Construction Coordination Center.

Contractor shall refer to the manual "Regulations for Excavating and Restoring Streets in San Francisco," January, 1999, for complete information regarding Excavation Code requirements. Copies of the manual may be purchased from the Department of Public Works, Bureau of Street-use and Mapping, at 875 Stevenson Street, Room 460, San Francisco, CA 94103, telephone (415) 554-5800.

The excavation permit shall be obtained and paid for by the Contractor under the Site Work Bid Item.

The City will send written notice of the excavation to be performed via U.S. mail to each property owner affected by the excavation at least 30 days prior to starting the excavation. Contractor shall provide on-site public notices prior to commencing excavations. Such notices shall include the name, address, and 24-hour telephone number of Contractor's representative who will provide information to, and receive complaints from, the public concerning the excavation. Additionally, Contractor shall post and maintain notices every 100-feet and deliver written notices to each dwelling unit along any block of the excavation at least 10 days but not more than 15 days prior to starting excavation on that block.

No excavation shall be performed outside the boundaries, times, descriptions or methods set forth on the approved permit; no excavation shall be longer than 1,200-ft in length at any time without prior written approval of the City.

Contractor shall cover open excavations with steel plates ramped to street grade or provide other means of protection acceptable to the Department of Public Works. Restore trenches and pavement to a constant width equal to the widest section of the excavation, which shall not exceed 13 feet.

SECTION 02060 PUMP STATION DEMOLITION

PART 1 GENERAL

1.1 WORK INCLUDED

A. Provide all labor, tools, equipment, permits and materials as required for the demolition, removal, and proper disposal of structures, equipment, piping, concrete, and debris from the Bay Bridge Pump Station located at 475 Spear Street between Bryant and Harrison Streets in San Francisco. Work shall include, but not be limited to the following:

1. Disconnecting and capping of all utilities to the station.
2. Removal and disposal as Contractor's property of mechanical and electrical equipment and other features inside and adjacent to the building as indicated.
4. Removal and salvage as City property of mechanical and electrical equipment as indicated and transport to the San Francisco Water Department.
5. Demolition and removal as Contractor's property of all structures within the pump station, including but not limited to the roof, walls, floor, foundation and piles.

1.2 RELATED SECTIONS AND DOCUMENTS

A. Section 02080 - Pump Station Demolition: Hazardous Materials Procedures
B. Section 02090 - Pump Station Demolition: Hazardous Materials Abatement and Control
C. Document 00235 - Existing Hazardous Materials Conditions

1.3 DEMOLITION PLANS

D-0 - Demolition Site Plan
D-1 - Structural Demolition Plan and General Notes
D-2 - Structural Demolition Sections
D-3 - Existing Plans, Sections & Schedules
D-4 - Existing Sections and Details
D-5 - Mechanical Equipment Removal Work
D-6 - Electrical Equipment Removal Work

1.4 DEMOLITION COORDINATION

A. The Contractor shall coordinate all stages of demolition work with the Engineer.

1.5 SUBMITTALS

Submit the following:

A. Shop Drawings: Indicate the locations and construction of barricades and fences.
B. Submit Contractor's proposed sequence of operations including, but not limited to the following stages:

a. Notifying and coordinating with affected owners of adjoining buildings and utilities.
b. Securing of required permits and approvals from governing agencies.
c. Erecting temporary protection.
d. Shutting-off and capping of existing utilities.
e. Securing the site and providing fire safety measures.
f. Hazardous materials abatement
g. Sequencing of procedures for actual demolition and removal operations for pump station.
h. Cleaning and restoring the site and adjoining properties.

Submittals and resubmittals will be acted upon by the Engineer and transmitted to the Contractor within 21 working days after receipt by the Engineer unless otherwise specified herein.

1.6 SPECIAL INSPECTION FOR DEMOLITION WORK

A. Pursuant to the provisions of the San Francisco Building Code Ruling Number BC-5802-1 dated October 20, 1993 the demolition work shall be subject to continuous Special Inspection by a registered civil engineer licensed in the State of California.
B. The City will select and pay for Special Inspection services. The Contractor or permit applicant shall identify the Special Inspector for demolition work before a demolition permit is issued. The Contractor, the Engineer and Special Inspector shall meet with the District Inspector to review the demolition work and arrive at a clear understanding of what is expected of all parties as well as the proper sequence of demolition work prior to the start of work.
C. The Special Inspector will prepare a report certifying that he/she has checked the demolition work and that in his/her judgment it has/has not been performed in accordance with approved plans and sequences. Contractor shall cooperate and coordinate his operations with City's Special Inspector.

1.7 BLASTING

A. The use of blasting at the project site for the disposal of refuse, debris, and waste materials resulting from demolition and site clearing shall not be permitted.

1.8 ELECTRICAL DEMOLITION

A. The Contractor shall make all arrangements with PG&E for temporary power for the demolition work. The Contractor shall furnish and install all conduits, conductors, meter socket and other necessary equipment for the temporary service. At the end of the contract, the Contractor shall remove this equipment as his property. Payment for all temporary power work shall be incidental to the demolition work.

B. All electrical demolition work shall at all times be conducted by the Contractor in a safe and proper manner to avoid injury from electrical shock to the State's, City's and Contractor's personnel. Contractor shall coordinate work with the Resident Engineer. At no time shall live electrical wiring or connections, which can be energized; be accessible to Contractor, State and City employees, or other personnel without suitable protection or warning signs.

1.9 SALVAGED EQUIPMENT

A. All salvaged equipment shall be hauled to and unloaded at the San Francisco Water Department (SFWD) yard. The Contractor shall notify the Resident Engineer and the SFWD at least 48 hours in advance (two full business days) the delivery date and time. Address of yard shall be provided at that time. The contact person at the SFWD is Mr. Jeff Murray, Superintendent CDD, 1990 Newcomb Avenue, telephone no. (415) 550-4934.

B. Hauling and unloading of salvaged equipment shall be done as incidental work and payment shall be included in the removal, disposal and salvage of existing equipment bid item.

1.10 QUALITY ASSURANCE

A. Comply with all applicable State and local code requirements including, but not limited to:

1. American National Standard Institute "Safety Requirements for Demolition" ANSI AID.G, latest edition.
2. CAL and Federal OSHA regulations.

1.11 TIME ALLOWED FOR COMPLETION OF WORK

A. Time allowed for completion of demolition of pump station shall be 120 consecutive days from the start of the new Bay Bridge Pump Station in fully operational condition.

PART 2 PRODUCTS

2.1 GENERAL

A. The Contractor shall provide all materials and equipment in suitable and adequate quantity as required to accomplish the work specified herein and shown on drawings, and as required to complete the project.

2.2 SHORING AND BRACING MATERIALS

A. Shoring of excavation during demolition shall be in accordance with the requirements specified in the Caltrans Specifications for Seismic Retrofit Project No. 16 and shall include adequate bracing for the protection of life and limb and conforming to the applicable safety orders of OSHA and the State of California Division of Industrial Safety.

PART 3 EXECUTION

3.1 UTILITIES DISCONNECTION

A. The Contractor shall refer to "Obstruction" Section elsewhere in the Standard Specifications provisions on utilities disconnection.

B. At the Contractor's request, the City shall provide a letter from the Water Department requesting P G & E to disconnect the existing electrical service to the Bay Bridge Pump Station and to remove three (3) existing transformers. The Contractor shall then contact:

Ralph Leong
Hetch Hetchy Power, Public Utilities Commission
(415) 554-3210

Mr. Leong will contact P. G. & E. to have the service disconnected and the account closed. P. G. & E. will require two months advance notice to disconnect service and to schedule P. G. & E. crew to remove transformers.

3.2 HAZARDOUS MATERIALS ABATEMENT

A. Prior to demolish of pump station, Contractor shall perform hazardous materials abatement work in accordance to Specifications Section 02080: Pump Station Demolition Hazardous Materials Procedures and Section 02090: Pump Station Demolition Hazardous Materials Abatement and Control.

3.3 DEMOLITION

A. Contractor's access to property during demolition work shall be limited to within the Bay Bridge Pump Station and public streets as described in Caltrans Specification Section on Traffic Routing.
B. Contractor shall be responsible for the methods of demolition and all necessary safety precautions during the operation.
C. Remove, salvage and dispose of all mechanical and electrical equipment, instrumentation, piping, conduit and other features inside and adjacent to the pump station.
D. Remove and dispose of all structures including but not limited to the roof, floors, walls, foundation, piles, doors, signs, and interior partitions inside or adjacent to the building.
E. Sprinkle work with reclaimed water, provide temporary enclosures or other suitable methods to minimize dust and dirt, rising and scattering in the air, to the lowest level of air pollution. Comply with governing regulations pertaining to environmental controls during demolition.
F. The following work shall also be performed at no additional cost to the State:

1. All electrical control panels, junction boxes and motor control center, shall be removed. Dispose and salvage as indicated in drawings.
2. All pumps, motors and shafts shall be removed. Bridge crane and pressure tanks shall be removed. Dispose and salvage as indicated in drawings.
3. All pipings, fittings, valves, plumbing fixtures shall be removed.
4. All equipment supports, including concrete pads, base plates, mounting bolts, and support hangers shall be removed.
5. All concrete cutting required to remove foundation from piles.

G. Prepare project record drawings showing all capped utilities, shoring, bracing, and underpinning, if required, left permanently in place.
H. Remove demolished materials and equipment and debris from site during the course of work. Remove debris from the work site daily, unless otherwise directed.
I. All items removed, demolished and abandoned shall become the property of the Contractor unless otherwise noted. Disposal of all materials from the site shall be performed in compliance with all applicable local, state and federal codes, and requirements.
J. All items removed and salvaged shall be returned and transported to the City Water Department facility as directed by the Resident Engineer.

SECTION 02080 PUMP STATION DEMOLITION

HAZARDOUS MATERIALS PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes - General requirements and procedures for hazardous materials related work activities, as applicable, to the Pump Station Demolition Work and the existing conditions at the pump station site.
B. Related Documents:

1. Document 00235 - Existing Conditions: Hazardous Materials.

C. Related Sections:

1. Section 02060 - Pump Station Demolition.
2. Section 02090 - Pump Station Demolition: Hazardous Materials Abatement and Control.

1.2 DEFINITIONS

A. Abatement - Primary work involving the removal, containment, control or treatment of hazardous materials.
B. Hazardous Materials Control - Incidental work procedures for control of releases of project-related hazardous materials, including containment, enclosure, wetting, controlled renovation and demolition procedures, and removal and disposal.
C. Asbestos - A generic name given to a number of naturally occurring hydrated mineral silicates that possess a unique crystalline structure, are incombustible in air, and are separate into fibers. Asbestos includes any material that contains greater than 0.1 percent by weight the asbestiform varieties of chrysotile (serpentine); crocidolite (riebecklite); amosite (cummingtonite-grunerite); anthophyllite; tremolite; and actinolite. For the purposes of determining respiratory protection and worker protection both the asbestiform and non-asbestiform varieties of the above materials and any of these materials that have been chemically treated or altered shall be considered asbestos.
D. Asbestos-Containing Material (ACM) - Any material which contains more than one-tenth of one percent asbestos by weight.
E. Hazardous Waste:

1. Waste material, including asbestos, loose and peeling lead-based paints, PCB ballasts, and any other material which requires management, handling transport, treatment, storage or disposal according to the requirements of the Federal Resource, Conservation and Recovery Act (RCRA) and associated regulation 42 U.S.C. 6901 et seq. and 40 CFR Part 260 et seq.) or the California Hazardous Waste Control Law and associated regulations (Health and Safety Code 25000 et seq. and 22 CCR 66260 et seq.).
2. References to hazardous material or contaminated material incorporate definitions of hazardous pollutants, hazardous contaminants, hazardous material, hazardous substance, hazardous waste, toxic pollutants and toxic substance applicable in accordance with Federal, State, regional and local statutes, laws, regulations and policies.

F. Lead - Metallic lead, all inorganic lead compounds and organic lead soaps, and excluding all other organic lead compounds.
G. Lead-Containing - Any material, coating, substrate or product which contains metallic lead, all inorganic lead compounds and organic lead soaps, and excluding all other organic lead compounds.
H. Mercury - A silvery-white liquid metallic element commonly used in thermometers, barometers, and fluorescent light tubes.
I. Any regulated metallic compound including cadmium, chromium, zinc; includes all metals commonly referred to as California Assessment Metals (CAM 17).
J. Polychlorinated Biphenyls (PCBs) - Chemical compound commonly found in lighting ballasts, wet transformers, and in electrical equipment which uses dielectric fluids.

1.3 SUBMITTALS

A. Submit the following in accordance with "Submittals" section.

1. SITE-SPECIFIC MITIGATION PLAN (SSMP)

a. The Contractor shall submit to the Engineer a site-specific Mitigation Plan (SSMP) not less than 21 calendar days prior to the commencement of any excavation. The State reserves the right to modify or reject the Contractor's SSMP.

b. No shoring, excavation, or other site work shall begin until the SSMP has been reviewed and approved by the State.

c. The SSMP shall conform to all the requirements of this Section and shall include, but not be limited to:

1) Means and methods for suppressing and controlling asbestos-containing serpentine fibers, dust and other contaminants/ nuisances in order to satisfy the requirements of Assembly Bill 3180, Mitigation Measures under CEQA (California Environmental Quality Act), Article 21 (Hazardous Materials) of the San Francisco Health Code, and Bay Area Air Quality Management District (BAAQMD) regulations and Article 20 of the S.F. Public Works Code.
2) Means and methods of excavating, staging, handling, loading, treating, hauling and disposing of all excavated material, including soil and groundwater, in accordance with all federal, state and local requirements. Descriptions shall include planned order of excavation (including shoring installation and other critical path work) and methods of moving excavated material from the excavation to the haul trucks.
3) Proposed details of the treatment and/or disposal process of excavated materials, whether landfill disposal, incineration, bio-remediation or other process.
4) A list of the names and locations of all proposed legal disposal sites, regulatory approvals, and details of soil acceptance criteria granted to all proposed disposal sites.
5) Description of means used to prohibit public access to the construction site.
6) A description of the procedure which the Contractor proposes to use for on-site weighing of the excavated material as well as the means by which Contractor proposes to document the weight of each truckload or container load of excavated material removed from the project site and to relate the weight of that load to its appropriate hazardous waste manifest form.
7) Description of traffic routing and handling of excavated material.
8) Description of groundwater dewatering and disposal using settling tanks or any other feasible method approved by the Engineer.
9) Sewer discharge shall meet the requirements of the PUC/BERM, Industrial Waste Ordinance #19-92, SFDPW Order #158,170 and the Batch Discharge Requirements for sewer discharge.
10) Noise Control Ordinance per Article 29 of the S.F. Police Code.
11) Dust Control per specifications and the SFDPW Dust Control Ordinance.
12) Traffic Control per S.F. Department of Traffic & Parking.
13) Drainage/Erosion Control.

2. Site-Specific Hazardous Materials Management Plan (HMMP) - Submit Contractor's HMMP for the State's approval within 10 days after the fully functional start of the new Bay Bridge Pump Station operation, including the following items.

c. The Site-Specific HMMP shall be included as a section within the Site–Specific Mitigation Plan.

1.4 PROJECT CONDITIONS

A. Contractor shall pay all costs associated with the compliance with applicable hazardous materials regulations or requirements incurred by Contractor or its subcontractors for this Project.

B. Take precautions necessary to protect the health and safety of construction workers, site visitors, State and City personnel, outside consultants, public and others from exposure to hazardous materials.
C. Take precautions necessary to insure all surrounding properties or adjacent occupied areas are protected from any contamination from all hazardous materials from the Work site.
D. Review the information in the environmental and hazardous material investigation reports and make such information available to appropriate subcontractors and building occupants.
E. Obtain and pay for all sampling and profiling analyses required for waste disposal. Analyses shall be performed by California DOHS-accredited laboratories.
F. Minimize generation and migration of hazardous and contaminated materials, waste, dust, fumes and debris.
G. Prevent contamination or further contamination of any material or area by hazardous or contaminated material, waste, dust, fumes or debris.
H. Avoid mixing or concentrating removed, or demolished materials so as to increase the cost of disposing of such materials required to be disposed as hazardous or contaminated wastes.
I. Contractor shall retain, and the State will not indemnify against, any liability of Contractor resulting from the activities or duties which are the responsibility of Contractor under the terms of the Contract, including but not limited to present or future liability arising from the arrangement of transportation or disposal of any hazardous or contaminated material, whether on or off-site.
J. Pursuant to 29 CFR 1926.1101, Contractor shall be deemed to exercise general supervisory authority over the work covered by said standard, even though Contractor is not qualified to serve as the asbestos "Competent Person," as defined by the standard. As supervisor of the entire Project, Contractor shall ascertain whether its subcontractors are in compliance with the standard and shall require its subcontractors to come into compliance with said standard when necessary.

1.5 QUALIFICATIONS

A. Hazardous Materials Supervisor - Assign a qualified person directly responsible under Contractor's Superintendent having the necessary training to be knowledgeable in the identification, control, and management of the hazardous materials on-site. The Hazardous Materials Supervisor shall be responsible for the following:

1. Enforcing safe work and hygiene practices in compliance with the Mitigation Plan and HMMP approved by the State.
2. Advising subcontractors of potential hazards and minimum general requirements of the Mitigation Plan and HMMP.
3. Coordination of subcontractors regarding hazardous material procedures and controls.
4. Establishing and maintaining restricted work areas.
5. Requiring proper use of personal protective equipment.
6. Communicating approved modified safety requirements to site personnel.
7. Notification and coordinating signing of waste manifests with the State.

B. Hazardous Materials Handlers - Only qualified persons shall engage in hazardous material-related work. Contractor and subcontractor personnel who come into contact with, are exposed to, disturb, operate equipment or otherwise handle hazardous or contaminated material, or debris shall have appropriate hazard communication and required training, personal and medical monitoring, and shall be certified to wear appropriate personal protective equipment as required by the applicable laws and regulations. Special qualifications which may be required depending on Contractor's means and methods include, but are not limited to, the following:

1. Asbestos-Related Work Involving Asbestos-containing Materials:

   a. Valid asbestos handling license issued by the California State Contractors Licensing Board (SCLB) and a valid current Certificate of Registration for Asbestos-Related Work as issued by the California Department of Industrial Relations - Division of Occupational Safety and Health (Cal/OSHA).
   b. Work shall be completed under the on-site supervision of a Competent Person as defined by OSHA Regulation 29 CFR Part 1926.1101 (8 CCR 1529 in California).

c. All abatement workers shall have AHERA training with annual 8-hour refresher training, annual medical exams for the use of respiratory protection, and 6-month fit test of appropriate respirators.

2. Lead-Hazard Work - Lead awareness training, annual medical examinations and approval for the use of respiratory protection, and semi-annual fit testing of respirators complying with Cal/OSHA regulation 8 CCR 1532.1 affecting lead-based paints and lead construction hazards including, but not limited to:

   a. Demolishing or salvaging structural items where lead or material containing lead are present.
   b. Removing or encapsulating materials containing lead.
   c. Constructing, altering, repairing or renovating structures, substrates, or portions thereof, that contain lead or materials containing lead.
   d. Installing of products containing lead.
   e. Cleaning-up of lead contamination.
   f. Transporting, disposing, storing, or containing lead or lead-containing materials on the site or other locations where construction and renovation activities are performed.

3. Lead Abatement Work - California Department of Health Services (DOHS) approved Lead Workers training, annual medical examinations and approval for the use of respiratory protection, and semi-annual fit testing of respirators under the direct supervision of a DOHS approved Lead Abatement Supervisor complying with Cal/OSHA regulation 8 CCR 1532.1 affecting lead-based paints and lead construction hazards, including, but not limited to:

   a. Working in an environment where lead exposures exceed 30 g/m^3.
   b. Abating lead-based paints including, but not limited to, abatement of loose and peeling lead-based paints, demolition and disposal of concrete-encased primed structural steel, and stripping of lead coatings from structural steel prior to torching or welding.

4. PCB Ballast-Related Work - Removal of leaking or damaged PCB ballasts from lighting fixtures shall be completed by a trained worker, wearing protective gloves and following safety procedures as outlined in the Mitigation Plan and HMMP. Hazardous waste shall be handled according to the U.S. Environmental Protection Agency's Standards 40 CFR 761.60 and 761.65 (22 CCR Section 66699(b) in California).

5. For all types of Hazardous Materials: 40 hours Hazwoper Training.

C. Hazardous Materials Haulers:

1. Possess during the hauling of hazardous material, applicable federal, state, and local vehicle insurance requirements, valid driver's license, vehicle registration and licenses, and a current Class 1 Certification of Compliance from the California Highway Patrol affixed to each vehicle or container.
2. Possess a Hazardous Substance Removal Certification granted by the State of California Contractor's Licensing Board and other required certifications and insurance.
3. Contractor shall be responsible for informing drivers of hauling vehicles about:

   a. The nature of the material hauled.
   b. Recommended or required routes to and from the site.
   c. Applicable City street use regulations and requirements, and State of California Department of Transportation (CalTrans) codes, regulations and requirements.
   d. The City's requirements for proper handling and transportation of hazardous waste.
   e. The legal maximum loads for each vehicle.
   f. The Traffic Control Plan

1.6 REGULATORY REQUIREMENTS

A. Hazardous and contaminated materials and hazardous waste shall be handled according to applicable laws and regulations in effect at the time of disturbance, transport or disposal of said hazardous materials or waste and requirements of the Contract Documents.
B. Contractor is alerted to and shall familiarize itself to the following laws and regulations regarding the generation, management, characterization and disposal of hazardous waste:

1. Resources Conservation and Recovery Act, 42 U.S.C. Section 6901 et seq. and regulations 40 CFR Part 260 et seq.
2. California Health and Safety Code, Division 20 and regulations, and 22 CCR Section 66000 et seq.
3. For asbestos hazards - Comply with the applicable requirements of the Cal/OSHA Construction Asbestos Standard, 8 CCR Section 1529, and BAAQMD Regulation 11, Rule 2.
4. For lead hazards - Comply with the applicable requirements of the Cal/OSHA Lead in Construction Standard, 88 CCR Section 1532.1, and Cal/EPA Regulation 22 CCR Section 66000, et seq.

1.7 HAZARDOUS MATERIALS USED TO PERFORM THE WORK

A. General - Minimize the use of hazardous materials to perform the work. Where materials which contain hazardous substances or mixtures are used to perform the work, material usage shall be in strict adherence to Cal/OSHA's safety requirements and the manufacturer's warnings and application instructions listed on the Material Safety Data Sheet (MSDS) provided by the product manufacturer and on the product container label.

1. Contractor will be responsible for coordinating the exchange of MSDS or other hazard communication information between subcontractors at the site.
2. Notify the State when a specific product or equipment, or their intended usage, may be unsafe prior to ordering the product or equipment or prior to the product or equipment being incorporated in the Work.

B. Prohibited Material - The following materials and chemicals are specifically prohibited from use on this project unless otherwise accepted in writing by the State.

1. Material with a stated ACGIH threshold limit value of less then 25 parts per million.
2. Ethylene glycol monomethyl ether.
3. Dipropylene glycol methyl ether.
4. Ethylene glycol.
5. Formaldehyde.
6. Methylene chloride.
7. Isocyanates.
8. Chemicals with a flash point of less than 140 degrees Fahrenheit.

PART 2 PRODUCTS

2.1 MATERIALS

A. Waste Receptacles - Conform to federal and State regulations, with 6-mil minimum thickness waste bags.
B. Polyethylene Sheeting and Dust Barriers - Polyethylene sheeting shall be flame-retardant and approved and listed by the State Fire Marshal in accordance with Section 13121 and/or 13144.1 of the California Health and Safety Code.

1. Thickness and Size - 6-mil thick minimum, unless otherwise specified, sized to minimize the frequency of joints.
2. Flammability: Comply with NFPA Standard 701 with a flame spread rating of no greater than 5 and a smoke development rating of no more than 70 when tested in accordance with ASTM procedures.

C. HEPA Vacuums and Negative Pressure Units (NPUs) used for clean-up of asbestos and lead contaminated materials and detail cleaning shall be HEPA-filtered.

PART 3 EXECUTION

3.1 EXAMINATION

A. Notify Engineer of suspect conditions for testing by the Engineer. Do not remove or disturb suspect materials until tested and approved.
B. Promptly notify the Engineer of differing conditions in accordance with the provisions of "Unforeseen Conditions" section.

3.2 ASBESTOS HAZARD CONTROL PROCEDURES

A. Activities Not Specified in this Section - Asbestos-containing materials shall not be disturbed by cutting, sawing, grinding, pulverizing, crumbling, breaking, or otherwise rendered friable or airborne unless these activities are conducted under the requirements of all applicable regulations and guidelines.

   1. Work of asbestos-containing materials shall be completed by a qualified Asbestos Abatement Contractor. Refer to Section 02090 - Hazardous Materials Abatement and Control.

B. Demolition of non-ACM obstructing known intact ACM:

   1. Remove non-contaminated and non-asbestos materials for access using standard dust control procedures as required for painted assemblies, etc.
   2. Minimize disturbances to substrates concealing friable or damaged asbestos-containing materials, such as laid-in ceiling tiles concealing asbestos-containing fireproofing, demolition of non-ACM partitions which may destabilize sprayed-on asbestos-containing acoustical finishes, etc. Work impacting asbestos-containing materials shall be completed by qualified workers only.
   3. Remove and dispose of non-contaminated waste, where feasible. Alert the Contractor’s Hazardous Material Supervisor of contaminated conditions for proper removal and disposal and cordon off the affected areas where contamination is encountered. Do not dry sweep affected wastes and debris.

C. Unexpected Exposure to Known or Suspect Intact ACM:

   1. Where asbestos materials are intact, such as intact pipe lagging, proceed to remove the affected substrate and immediately label the asbestos material with a “caution” sign to prevent unintentional disturbances.
   2. Where asbestos materials uncovered are damaged or unknown asbestos contaminated conditions are encountered, discontinue work in the immediate contaminated area, shutdown the areas HVAC system, if not already disengaged, and alert the Contractor's Hazardous Materials Supervisor of the conditions for proper removal and disposal.

D. Unexpected Release of Asbestos into the Environment:

   1. Cordon off the immediate area (10 to 20 ft. radius average minimum), and shutdown the area’s HVAC system (if applicable).
   2. Notify the Contractor’s Hazardous Materials Supervisor for proper removal and disposal using wet methods and HEPA-filtered vacuums. Clean-up affected area under the direction of a competent person with 16-hour minimum EPA Operations and Maintenance asbestos training and by workers with 2-hours asbestos awareness training minimum unless exposures exceed the permissible exposure limit of 0.1 fibers/cc.
   3. Decontaminate or dispose of friable waste in double 6-mil thick goosenecked labeled waste bags for manifesting and disposal.

3.3 LEAD HAZARD CONTROL PROCEDURES

A. Activities Not Specified in this Section:

   1. Dry sweeping of debris and removal of surface coatings by torch or flame.

2. Disturbance of lead-painted or lead-coated surfaces scheduled to remain within the structure(s) by cutting, sawing, grinding, or other construction operations without adequate dust controls.
3. Eating, smoking and drinking in or in the proximity of lead hazard operations.
4. Removal of lead-containing coatings with a torch or flame, except as a result of unavoidable welding or torching of back-to-back structural elements that cannot be adequately previously abated without affecting the integrity of the structure.
5. The use of steam cleaning and compressed air removal methods.
6. Use of abrasive removal equipment without local HEPA exhausts or dust collectors.

B. Handling:

1. For existing lead-painted or lead-coated surfaces which are indicated to remain, advise workers of the potential hazard.
2. For areas where handling or disturbance of loose or peeling paints only are required, verify that the paint that remains on interior walls, ceilings and other surfaces in areas of active work, as applicable, is adhered to the substrate sufficiently to support eventual repainting. Paints that peel or loosen during wetting shall be handled and removed as specified in this Section.
3. Clean debris and surfaces with HEPA-filtered vacuums or wet methods. Dry sweeping is not permitted.
4. Shoveling, wet seeping, and brushing may be used only where vacuuming or other equally effective methods have been tried and are found to be ineffective.
5. Loose debris and scraped materials shall be treated as hazardous waste, unless otherwise approved by the State. Construction waste coated with intact lead based paint may be disposed of as construction debris in accordance with the Cal/EPA requirements.
6. Workers shall decontaminate themselves and appropriate equipment prior to eating, drinking and smoking.

C. Cleaning: Perform daily "housekeeping" on project site including, but not limited to:

1. Clean-up of loose debris and contamination daily prior to leaving the job site, or covering with tarpaulins to prevent disturbances.
2. Daily clean-up of traffic areas using a HEPA vacuum or wet methods.
3. Repair of torn or damaged protective barriers.

D. Field Quality Control:

1. Maintain airborne lead dust levels within the construction zone and throughout the site below Cal/OSHA's Project Action Level of 30 micrograms per cubic meter (?g/m^3). Levels above the Project Action Level may require an upgrade in respiratory protection for all affected workers, as well as amended work practices and clean-up of affected areas at no additional cost to the State.
2. Maintain airborne lead dust levels at the site's property line or at adjoining occupied non-construction areas below the EPA's National Ambient Air Quality Standard (NAAQS) of 1.5 micrograms per cubic meter. Exceeding this level may require further isolation of work areas, amended work practices and clean-up of affected areas at no additional cost to the State.

3.4 PCB BALLAST HANDLING PROCEDURES

A. Identification of PCB ballasts - All ballasts not specifically labeled "non-PCB" or "PCB free" shall be considered PCB-containing.
B. Activities Not Specified in this Section - Removal of ballast from the fixtures without hazard awareness training as indicated by Contractor's Hazardous Materials Supervisor.
C. Procedure for Handling Leaking PCB Ballasts:

1. Workers removing ballasts from fixtures shall wear protective clothing and nitrile or neoprene gloves.
2. Leaking ballasts pose a health and safety hazard and shall be removed by a trained worker only.
3. Wipe down the fixture showing signs of overheated or leaking ballasts with paper towels after the unit has been cooled to room temperature.
4. Follow with additional wiping with an organic solvent, e.g., mineral spirits or isopropyl alcohol.

5. Place leaking ballasts and rags into a plastic bag, which is tied-off and secured.
6. Pack the ballasts in steel drums for hazardous waste disposal.

D. Procedure for Disposal of PCB Ballasts:

1. Pack PCB ballasts and bagged leaking ballasts and rags into a steel drum, sealed, labeled, and transport to an approved incinerator following manifest procedures as specified in this Section.
2. Absorbent material, such as kitty litter, shall be used as a cushion and absorbent within the drums.
3. Do not exceed the incinerator's drum loading requirements, typically 350 to 500 pounds per drum.
4. Transport hazardous waste for disposal per the requirements under 22 CCR Section 66268.110.
5. Dispose of as a hazardous waste per EPA Regulation 40 CFR 761.60 and 761.65 and Cal/EPA Regulation 22 CCR Section 66508.

3.5 FLUORESCENT LAMP HANDLING PROCEDURES

A. Activities Not Specified in this Section - Disposal of quantities over 25 lamps per day as non-hazardous waste.
B. Handling and Disposal of Florescent Lamps:

1. Spent fluorescent and mercury vapor lamps contain mercury shall be considered a hazardous waste in accordance with the California Department of Health Services (DOHS; 22 CCR Section 66699(b)).
2. Ship lamps exceeding 25 units per site to a commercial recycler for crushing and mercury reclaiming.
3. Comply with the DOT requirements for manifests, with evidence of proper disposal provided to the State, including a log of shipping dates and quantities. Load into secured cardboard boxes for shipment to prevent unnecessary breakage.
4. In the event of florescent lamp breakage, clean-up broken glass and debris immediately, using a HEPA-filtered vacuum for final clean-up.

3.6 WASTE DISPOSAL AND MANIFESTING PROCEDURES

A. Hazardous Waste Disposal:

1. Packing, labeling, transporting, and disposing of hazardous waste shall comply with Cal/EPA regulations under 22 CCR, including completion of the Uniform Hazardous Waste Manifest Form (DTSC 8022A, 7/92, and EPA 8700-22).
2. A "Waste Manifest" shall be completed for disposal of hazardous waste. The transporter shall possess a valid EPA Generator I.D. number. The Contractor's Hazardous Materials Supervisor shall notify the State Representative at least 48 hours prior to the time that the Manifest is required to be signed by the State.
3. Applicable information to be included in the "Waste Manifest" includes the following:

   a. EPA Generator ID Number - Verify with State Representative.
   b. Generator's Name and Address - Verify with State Representative.

   c. Generator Tax ID Number - Verify with the State Representative.

B. Disposal of Contaminated and Other Materials:

1. Disposal of intact lead-coated architectural or structural elements may occur as non-hazardous waste if in accordance with the requirements of California EPA and Department of Toxics Substance Control.
2. Loose and peeling lead-based paints and miscellaneous lead debris shall be treated as hazardous waste, unless otherwise indicated. Lead wastes shall be profiled by Contractor by means of standard digestion and extraction tests (TCLP, WET and SW846), as appropriate, and shall be manifested and properly disposed.

3.7 FINAL CLEANING AND INSPECTION CLEARANCE CRITERIA

A. Asbestos - Asbestos-containing materials will be abated with clearance by visual inspection of phase contrast microscopy (PCM) or transmission electron microscopy (TEM) as specified in Section "Asbestos Abatement", as applicable.
B. Lead and Metals Hazards:

1. Final Cleaning - Final clean-up prior to Substantial Completion shall include wet wiping using a TSP solution and HEPA vacuuming all suspect dust and debris areas.
2. Final Reoccupancy Clearance:

a. Following the final clean-up, the State will visually inspect for any loose dust or debris. No clearance wipe testing will be conducted as the building is scheduled for immediate demolition.

SECTION 02090 PUMP STATION DEMOLITION: HAZARDOUS AND MATERIALS ABATEMENT AND CONTROL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Minimum requirements for hazardous materials handling, control, and abatement activities, as applicable, including, but not necessarily limited to:

1. Hazardous materials control.
2. Handling and disposal of asbestos-containing building materials (ACBM).
3. Handling and disposal of lead-based paints and lead-containing materials.
4. Removal and disposal of paints containing zinc, chromium, cadmium, and other heavy metals in regulated concentrations.
5. Removal and disposal of existing ballasts containing PCB.
6. Disposal of mercury-containing lamps and control switches ("Mercoid Controls").
7. Removal and disposal of surfaces containing lead and mercury residues in measurable concentrations.
8. Removal and disposal of other hazardous materials.
9. Demolition associated with access to hazardous materials.
10. Criteria for abatement zone clearance testing.
11. Criteria for reoccupancy clearance.

B. Related Documents:

1. Document 00235 - Existing Hazardous Materials Conditions.

C. Related Sections:

1. Section 01110 - Pump Station Demolition: Hazardous Materials Procedures.
2. Section 02060 - Pump Station Demolition.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. E84 - "Test Method for Surface Burning Characteristics of Building Materials."
2. E849 - "Safety and Health Requirements Relating to Occupational Exposure to Asbestos."
3. E119 - "Standard Method for Fire Tests of Building Construction and Materials"

B. American National Standards Institute (ANSI):

1. Z41.1 - "Men’s Safety Toe Footwear."
2. Z86.1 - "Commodity Specification for Air."

3. Z87.1 - "Practice for Occupational and Educational Eye and Face Protection."
4. Z89.1 - "Requirements for Industrial Head Protection."
5. Z9.2 - "Fundamentals Governing the Design and Operation of Local Exhaust Systems"
6. Z88.2 - "Practices for Respiratory Protection."
7. Z88.6 - "Respiratory Protection - Respiratory Use Physical Qualifications for Personnel."

C. National Fire Protection Association (NFPA):

1. Standard 701 - "Small Scale Fire Test for Flame Resistant Textiles and Films."
2. Standard 10 - "Fire Extinguishers."
3. Standard 70 - "National Electric Code."
4. Standard 90A - "Fire Rating of Sprayed-On Fireproofing."

1.3 DEFINITIONS

A. Activity Class/Category - Lead hazard designations assigned to work activities which involve lead-containing materials. Activities which fall into Classes I through III, including as examples the operations defined below, are required to assume the following personal airborne exposure levels, unless otherwise demonstrated.

Activity Class I exposure less than 500 ?g/m^3	Surface clean-up of lead-containing dust or debris less than 15,000 ?g/ft^2 Spray painting with lead-based paints Manual demolition of structures (e.g. drywall, plaster, etc.) Manual sanding, grinding, needle gunning, chiseling, hammering, wire brushing, milling or scraping of lead-based coatings Head gun removal of surface coating Power tool cleaning with dust collection systems
Activity Class II exposure 500 ?g/m^3 or greater, but less than 2,500 ?g/m^3	Using lead mortar Lead burning Rivet busting Power tool cleaning without dust collection systems Clean-up of dry abrasive Abrasive blasting enclosure movement and removal
Activity Class III exposure 2,500?g/m^3 or greater	Abrasive blasting of coated surfaces Welding on coated surfaces Torching or cutting of coated surfaces Torch burning of coated surfaces

B. Asbestos Work Class - Activities for removing asbestos materials by categories as follows:

Work Class I	Activity involving removal of Thermal System Insulation (TSI) and surfacing asbestos-containing materials (ACM) or friable presumed asbestos-containing materials (PACM).
Work Class II	Activity involving removal of ACM which is not TSI or surfacing material, including, but not limited to, wallboard, floor tiles and sheeting, roofing and siding shingles, and construction mastics.
Work Class III	Repair and maintenance operations where TSI or surfacing is likely to be disturbed, which fits within one standard glovebag or waste container under 60 inches.
Work Class IV	Maintenance and custodial activities during which employees contact but do not disturb PACM or ACM and activities to clean-up dust, waste and debris resulting from Work Class I, II, and III activities.

1.4 SUBMITTALS

A. Asbestos:

1. Submit the following, in accordance with section "Submittals", prior to commencement of the asbestos abatement Work:

   a. Proof of current asbestos contractor's license issued by the California Contractors' State License Board.
   b. Proof of current California Department of Health Services (DOHS) Asbestos Contractor's registration certification.
   c. Valid and current Bay Area Air Quality Management District (BAAQMD) notification for the Project (as applicable).
   d. Cal/OSHA 24-hour notice per 8 CCR 1529.
   e. Worker documentation, including:

   1) Current AHERA training certifications - supervisor/competent persons.
   2) Current AHERA training certifications - workers.
   3) Respiratory fit test records within past 6 months.

   f. Annual medical examination approvals.
   g. Written asbestos abatement work plan and schedule as part of Contractor's Hazardous Materials Management Plan (HMMP) to be submitted in accordance with Section 01110 - Hazardous Materials Procedures.
   h. Material Safety Data Sheets (MSDS) for chemicals used.
   i. Emergency phone number and pager listing.
   j. DOP testing of negative pressure units and vacuums.
   k. Rotameter calibration data within past 6 months.

2. Submit the following, in accordance with section "Submittals", within 5 calendar days of request by the State or within 5 calendar days of completion of abatement Work.

   a. Contractor's daily personal air-monitoring data.
   b. Updated worker documentation, as needed.
   c. Daily boundary access logs.
   d. Daily negative pressure records, as applicable.
   e. Copies of updated schedules and notices to regulatory agencies, as needed.
   f. Receipt and weight tickets from landfill operator or incinerator, as applicable.
   g. Copies of completed uniform waste manifests.

B. Lead-Related and Metals-Related Work:

1. Submit the following, in accordance with section "Submittals", prior to commencement of lead-related Work:

   a. Worker documentation, including:

   1) Current DOHS lead contractor/supervisor training certificate.
   2) Current lead awareness training certificates - workers or DOHS Certified Lead Workers Certificate, as appropriate.
   3) Respiratory fit test records within past 6 months.
   4) Annual Medical Examination approvals.
   5) Blood lead test within past 90 days.

   b. Material safety data sheets for chemicals used.
   c. Lead Hazard Control Plan - Procedures for minimizing and controlling the migration of lead from disturbance of lead-containing materials incidental to the Work, including a written lead hazard or lead abatement work plan and schedule as part of Contractor's HMMP to be submitted in accordance with Section 01110 - Hazardous Materials Procedures.

2. Submit the following, in accordance with section "Submittals", within 5 calendar days of request by the State or within 5 calendar days of completion of abatement work:

   a. Updated worker documentation.
   b. Contractor's periodic personal air-monitoring results.
   c. Receipt and weight tickets from landfill operator or recycler as applicable.
   d. Waste profiling data (TCLP, WET, and SW846, as applicable).

C. PCB Ballast Related Work:

1. Submit the following, in accordance with section "Submittals", within 5 calendar days of request by the State or within 5 calendar days of completion of PCB ballast related abatement Work:

   a. Hazard Control Plan - Procedures for clean-up of leaking ballasts and disposal and transportation for incineration of PCB ballasts as part of the Contractor's HMMP to be submitted in accordance with Section 01110 - Hazardous Materials Procedures.
   b. Evidence of hazard awareness training of workers removing and packing PCB ballasts.
   c. Identification of EPA approved incinerator and DOT approved transporter.
   d. Completed uniform waste manifest.

D. Fluorescent Light Tube Related Work:

1. Submit the following, in accordance with section "Submittals", within 5 calendar days of request by the State or within 5 calendar days of completion of fluorescent light tube related abatement Work:

   a. Identification of EPA approved recycle.
   b. Completed manifest or evidence of shipment date, recycle and quantities shipped.

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Asbestos Abatement Work - Only qualified persons shall engage in asbestos abatement activities. Work involving asbestos-containing materials shall be completed by a Contractor holding a valid asbestos handling license issued by the California State Contractors Licensing Board (SCLB) and a valid current Certificate of Registration for Asbestos-Related Work as issued by the California Department of Industrial Relations - Division of Occupational Safety and Health (Cal/OSHA). Work shall be completed under the on-site supervision of a Competent Person as defined by OSHA Regulation 29 CFR Part 1926.1101 (8 CCR 1529 in California). All abatement workers shall have AHERA training with annual 8-hour refresher training, annual medical exams for the use of respiratory protection, and 6-month fit test of appropriate respirators.
2. Lead Hazard/Abatement Work and Work with Metals-Containing Coatings - Only qualified persons with DOHS approved Lead Workers training, annual medical examinations and approval for the use of respiratory protection, and semi-annual fit testing of respirators under the direct supervision of a DOHS approved Lead Abatement Supervisor shall engage in the work defined under Cal/OSHA regulation 8 CCR 1532.1 affecting lead-based paints and lead construction hazards, including but not limited to:

   a. Working in an environment where lead exposures exceed 30 micrograms per cubic meter.
   b. Abating lead-based paints, including but not limited to abatement of loose and peeling lead-based paints.

3. PCB Hazard Work - Removal of leaking or damaged PCB ballasts from lighting fixtures shall be completed by a trained worker, wearing protective gloves and following safety procedures as outlined in the HMMP. Hazardous waste shall be handled according to the U.S. Environmental Protection Agency's Standards 40 CFR 761.60 and 761.65 (22 CCR Section 66699(b) in California).

B. Regulatory Requirements:

1. All labor, materials, facilities, equipment, services, employees and training, and testing necessary to perform the work required for asbestos abatement and disposal of waste shall be in accordance with these Specifications and the most current regulations including, but not limited to:

    a. Environmental Protection Agency (EPA).
    b. Occupational Safety and Health Administration (OSHA).
    c. California Department of Occupational Safety and Health (Cal/OSHA).
    d. California Environmental Protection agency (Cal/EPA).
    e. Bay Area Air Quality Management District (BAAQMD).

2. Contractor is alerted to and shall familiarize itself to the following laws and regulations regarding the generation, management, characterization and disposal of hazardous waste:

    a. Resources Conservation and Recovery Act, 42 U.S.C. Section 6901 et seq. and regulations 40 CFR Part 260 et seq.
    b. California Health and Safety Code, Division 20 and regulations, and 22 CCR Section 66000 et seq.
    c. For asbestos hazards - Comply with the applicable requirements of the Cal/OSHA Construction Asbestos Standard, 8 CCR Section 1529, and BAAQMD Regulation 11, Rule 2.
    d. For lead hazards - Comply with the applicable requirements of the Cal/OSHA Lead in Construction Standard, 88 CCR Section 1532.1, and Cal/EPA Regulation 22 CCR Section 66000, et seq.
    e. For PCB ballast work - Comply with Cal/EPA Regulation 22 CCR Sections 66268.110 and 66508.
    f. For fluorescent light tubes - Comply with Cal/EPA Regulation 22 CCR Section 66699(b).

C. Pre-Abatement Meetings

1. Prior to any hazardous materials abatement or hazardous materials control work Contractor shall schedule a pre-abatement meeting to be attended by representatives of the State, Contractor, hazardous materials abatement subcontractor, and other subcontractors whose work may be affected. The meeting agenda shall include the following considerations:

    a. Review in detail the Specifications and Drawings related to the abatement work. All conflicts and ambiguities, if any, shall be discussed at the meeting.
    b. Review in detail the project conditions, schedule, construction sequencing, abatement application requirements, and quality of the completed work.
    c. Review in detail the means of protecting adjoining areas, Contractor's, subcontractors' and the State's and City's workers, and completed work during the abatement activities.

1.6 TIME LIMITATION AND LIQUIDATED DAMAGES

A. Complete all asbestos, lead, PCB and mercury-containing element abatement requirements specified in this section in no more than 3 (three) calendar days.

B. In the event of failure to complete the Work of this Section within the specified time, Contractor shall pay liquidated damages in the amount of one thousand dollars ($1,000) per calendar day for each day of delay in completion of work beyond the number of days specified in Paragraph 1.6 A. The specified amount of liquidated damages represents the State's estimate of costs which include, but are not limited to, those of the State and the State's consultants for observations and inspections, daily air monitoring, equipment, transportation, and analysis charges which would be incurred by the State after the number of calendar days specified for completion of the Work of this Section.

PART 2 PRODUCTS

2.1 ASBESTOS WORK - MATERIALS AND EQUIPMENT

A. Protective Devices:

1. Temporary wash stations or showers, disposable clothing, respirators, gloves, hard hats, and other required items.
2. Respirators shall protect against asbestos and other appropriate dusts, fumes and mists as approved by:

    a. Mine Safety and Health Administration (MSHA).
    b. National Institute for Occupational Safety and Health (NIOSH) under provisions of 30 CRF Part 11.

B. Waste Receptacles to Conform to federal and State regulations, with 6-mil minimum thickness or glovebags or waste bags.

C. Sealants and Polyethylene Sheeting:

1. Polyethylene sheeting shall be flame-retardant and approved and listed by the State Fire Marshal in accordance with Section 13121 and/or 13144.1 of the California Health and Safety Code.

    a. Thickness and Size - 6-mil thick minimum, unless otherwise specified, sized to minimize the frequency of joints.
    b. Flammability - Comply with NFPA Standard 701 with a flame spread rating of no greater than 5 and a smoke development rating of no more than 70 when tested in accordance with ASTM E84 procedures.

2. Sealing Tape:

    a. 2-inches or wider capable of sealing joints of adjacent sheets of polyethylene and attaching polyethylene sheet to finished or unfinished surfaces or similar materials.
    b. Tape shall be capable of adhering under dry and wet conditions, including use of amended water.

3. Preservation Sealing Tape - Type specifically designed for adhering to critical or sensitive surfaces without damage to surface.
4. Spray adhesives shall not contain methylene chloride or methyl chloroform (1,1,1-trichloroethane) compounds.
5. Fire resistant sealants shall be compatible with concrete, metals, wood, cable jacketing and other materials capable of preventing fire, smoke, water and toxic fumes from penetrating through sealants.

    a. Sealants shall be asbestos free and shall have a flame spread, smoke and fuel contribution of zero
    b. Shall be ASTM and UL-rated for 3 hours for standard method of fire test for firestop systems.

6. Lagging sealer for enclosing and sealing raw exposed edges of piping, fitting, equipment and duct insulation (as applicable) shall meet the requirements of NFPA 90A.

D. Surfactants and Encapsulants:

1. Wetting agents or surfactants shall be effective and compatible with the ACM being wetted.
2. Bridging or penetrating type encapsulants shall have the following characteristics:

    a. Water based. Do not utilize an organic solvent in which the solid parts of the encapsulant are suspended.
    b. Non-flammable with no methylene chloride.
    c. U.L. listed encapsulants, in full-scale ASTM E119 fire test, compatible with W.R. Grace “Retroguard, RG-1” fireproofing with “Spatterkote” Type SKII” bonding treatment for structural and decking widths exceeding 24 inches.
    d. Compatible with replacement materials, especially mastics, fireproofing, and adhesives.

E. Mastic Removers to conform to the following:

1. Non-flammable solvent or gel, with a flash point above 140 degrees Fahrenheit.
2. Solvent waste shall not result in the generation of hazardous waste as described under 22 CCR, Division 4.

3. Removers shall not contain methylene chloride, halogenated hydrocarbons, or any of the following glycol ethers:

Common Name	Abbrev	CAS#	Chemical Name
ethylene glycol methyl ether	EGME	109-86-4	2 - methoxyethanol
ethylene glycol methyl ether acetate	EGMEA	110-49-6	2 - methoxyethyl acetate
ethylene glycol ethyl ether	EGEE	110-80-5	2 - ethoxyethanol
ethylene glycol ethyl ether acetate	EGEEA	111-15-9	2 - ethoxyethyl acetate
ethylene glycol dimethyl ether	EGDME	110-71-4	1,2 - dimethoxyethane
ethylene glycol diethyl ether	EGDEE	629-14-1	1,2 - diethoxyethane
diethylene glycol	DEG	111-46-6	2,2' - dihydroxyethyl ether
diethylene glycol methyl ether	DEGME	111-77-3	2 - (2-methoxyethoxy) ethanol
diethylene glycol ethyl ether	DEGEE	111-90-0	2 - (2-ethoxyethoxy) ethanol
diethylene glycol dimethyl ether	DEGDME	111-90-6	bis - (2-methoxyethoxy) ether
triethylene glycol dimethyl ether	TEGDME	112-49-2	2,5,8,11 - tetraoxadodecane
dipropylene glycol	DPG	110-98-5	2,2' - dihydroxyisopropyl ether

F. Vacuums and Negative Pressure Units (NPUs) used for clean-up of materials and detail shall be HEPA-filtered.

2.2 LEAD-RELATED WORK - MATERIALS AND EQUIPMENT

A. Protective Devices to conform to the following:

1. Polyethylene drop cloths and dust barriers, temporary wash stations or showers, disposable clothing, respirators, gloves, hard hats, and other required items.
2. Respirators shall protect against lead and other appropriate dusts, fumes and mists and be approved by:

   a. Mine Safety and Health Administration (MSHA).
   b. National Institute for Occupational Safety and Health (NIOSH) under provisions of 30 CRF Part 11.

B. Sealants and Polyethylene Sheeting:

1. Polyethylene sheeting shall be flame-retardant and approved and listed by the State Fire Marshal in accordance with Section 13121 and/or 13144.1 of the California Health and Safety Code.

   a. Thickness and Size: 6-mil thick minimum, unless otherwise specified, sized to minimize the frequency of joints.
   b. Flammability: Comply with NFPA Standard 701 with a flame spread rating of no greater than 5 and a smoke development rating of no more than 70 when tested in accordance with ASTM E84 procedures.

C. Sealing Tape to conform to the following:

1. 2-inches or wider capable of sealing joints of adjacent sheets of polyethylene and attaching polyethylene sheet to finished or unfinished surfaces or similar materials.

2. Tape shall be capable of adhering under dry and wet conditions, including use of amended water.
3. Preservation Sealing Tape: Type specifically designed for adhering to critical or sensitive surfaces without damage to surface.
4. Spray adhesives shall not contain methylene chloride or methyl chloroform (1,1,1-trichloroethane) compounds.
5. Fire resistant sealants:

    a. Be compatible with concrete, metals, wood, cable jacketing and other materials.
    b. Be capable of preventing fire, smoke, water and toxic fumes from penetrating through sealants.
    c. Be asbestos free.
    d. Have a flame spread, smoke and fuel contribution of zero, and shall be ASTM -and UL-rated for 3 hours for standard method of fire test for firestop systems.

D. Provide waste receptacles that meet federal and State regulations.
E. Paint Removers conform to the following:

1. Non-flammable removing solvents or gels, with a flash point above 140 degrees F.
2. Solvent waste shall not result in the generation of hazardous waste as described under 22 CCR, Division 4.
3. Removers shall not contain methylene chloride, halogenated hydrocarbons, or any of the following glycol ethers:

Common Name	Abbrev.	CAS#	Chemical Name
ethylene glycol methyl ether	EGME	109-86-4	2 - methoxyethanol
ethylene glycol methyl ether acetate	EGMEA	110-49-6	2 - methoxyethyl acetate
ethylene glycol ethyl ether	EGEE	110-80-5	2 - ethoxyethanol
ethylene glycol ethyl ether acetate	EGEEA	111-15-9	2 - ethoxyethyl acetate
ethylene glycol dimethyl ether	EGDME	110-71-4	1,2 - dimethoxyethane
ethylene glycol diethyl ether	EGDEE	629-14-1	1,2 - diethoxyethane
diethylene glycol	DEG	111-46-6	2,2' - dihydroxyethyl ether
diethylene glycol methyl ether	DEGME	111-77-3	2 - (2-methoxyethoxy) ethanol
diethylene glycol ethyl ether	DEGEE	111-90-0	2 - (2-ethoxyethoxy) ethanol
diethylene glycol dimethyl ether	DEGDME	111-90-6	bis - (2-methoxyethoxy) ether
triethylene glycol dimethyl ether	TEGDME	112-49-2	2,5,8,11 - tetraoxadodecane
dipropylene glycol	DPG	110-98-5	2,2' - dihydroxyisopropyl ether

F. Cleaning Agents to conform to the following:

1. Cleaning agents, equipment, and methods employed shall not in any way damage the substrate or adjoining surfaces and finishes.
2. Cleaning solvents shall be non-injurious to the surfaces upon which they are applied. The methods used shall cause no pitting, erosion or damages to the surfaces.
3. Do not use chemicals that may attach or leave deposits on the substrate material.
4. Modify the process or processes to suit the finish, hardness, and condition of the surface to be cleaned.

G. Vacuums and negative pressure units shall be HEPA-filtered for clean-up of loose debris and contaminants.

2.3 OTHER HAZARDOUS MATERIALS - MATERIAL AND EQUIPMENT

A. Waste Containers:

1. Provide sealable metal drums, 55-gallon capacity, with sealable lids. Label the drums in accordance with EPA and DTSC requirements, including the Generator I.D. or location identification and manifest number. Drums shall be air and water tight.

PART 3 EXECUTION

3.1 EXAMINATION

A. Review hazardous materials survey reports.
B. Review site conditions.

3.2 PREPARATION

A. Minimum protective procedure for Asbestos Work:

1. Protection of Visitors and Other Site Personnel: Cordon off the abatement area(s) with appropriate signs, and provide temporary tunneling or scaffolding, as applicable.
2. Respiratory Protection: Comply with Cal/OSHA Regulation 8 CCR Section 1529 and ANSI Standard Z88.2, "Practices for Respiratory Protection." Use respirators approved by the National Institute for Occupational Safety and Health (NIOSH).
3. Provide site security to assure that no member of the public is able to gain access to the asbestos work area at any time. Maintain access and egress routes at all times.
4. Provide worker training, respiratory protection, and medical examinations to meet applicable regulations.
5. Provide temporary lighting and power to work areas, including installation of ground fault interrupters.
6. Fully ground all equipment within the work zone and decontamination assemblies.
7. Establish negative pressure in work area(s) as required under 8 CCR Section 1529.
8. Construct enclosure system(s) for worker and equipment decontamination.
9. Provide workers with sufficient sets of protective full-body clothing to be worn in the designated work area and whenever a potential exposure to airborne asbestos or potential safety hazards exist. Such clothing shall include but not be limited to: full-body coveralls, headgear, eye protection, and gloves. Disposable-type protective clothing, headgear, and footwear may be provided.

   a. Full-Body Clothing - Assure that workers wear hoods covering their hair in the designated work areas at all times. Do not wear protective clothing in lieu of street clothing outside the work area. Leave non-disposable-type protective clothing and footwear in the wash room until the end of the asbestos abatement work. An acceptable alternative to disposal is proper storage in a sealed and labeled container so that containers would be opened and clothing reused only in an asbestos work area.
   b. Eye protection - Provide eye protection to be worn as required by applicable safety regulations. Wear eye protection at all times within the asbestos work areas during all phases of work: preparation, removal, clean-up, encapsulation, waste handling, and similar operations. When appropriate, based on regulatory mandates, a full facepiece respirator may be worn to satisfy this requirement. Equipment shall conform with ANSI Z87.1. Use of contact lenses with respiratory protection is prohibited.
   c. Head Protection - Provide hard hats or other head protection as required by applicable safety regulations, conforming with ANSI Z89.1, Class A or B.
   d. Foot Protection - Provide nonskid footwear to all abatement workers, conforming to ANSI Z41.1, Class 75.

B. Minimum Protective Procedures for Lead Related Work:

1. Follow, at the minimum, the protective procedures as outlined in Article 1.4 above, "Description of Work Activities".
2. Respiratory Protection - Comply with Cal/OSHA Regulations included in 8 CCR Section 1532.1 and ANSI Standard Z88.2, “Practices for Respiratory Protection.”
3. Use respirators approved by the National Institute for Occupational Safety and Health (NIOSH).
4. Provide respiratory protection to employees involved with lead-based paint demolition and/or abatement elements or as required for demolition work where employees may be occupationally exposed to lead at or exceeding the Action Level (AL) at no cost to the employees or State.
5. Workers shall wear appropriate respiratory protection during lead hazards work, unless initial testing verifies that employee exposures are below the Action Level.
6. Site security to assure that no member of the public is able to gain access to regulated work areas. Maintain access and egress routes at all times.
7. Worker training, respiratory protection, medical examinations, and blood lead monitoring to meet applicable regulations.
8. Activity Class I work areas, as a minimum, with a 2-stage decontamination assembly, including an equipment and contiguous clean room with bucket wash-up facilities positioned as follows:

9. Equipment Room shall have lockers or labeled bags and containers for storing contaminated protective clothing and equipment.
10. Clean Room shall have lockers or containers for storing employee's street clothes and personal items. Clean Room shall also contain a suitable supply of potable water to permit each employee to wash their hair, hands, forearms, face and neck.
11. Sufficient sets of protective full-body clothing for workers to be worn in designated work area and/or whenever a potential airborne lead hazard exists. Clothing shall include, but not be limited to, full-body coveralls, headgear, eye protection, and gloves. Disposable-type protective clothing, headgear and footwear is acceptable.
12. Full-Body Clothing - Workers shall wear hoods covering their hair in the designated lead hazard work areas at all times.
13. Wearing of protective clothing, in lieu of street cloths, outside the work area is not permitted.
14. Non-disposable-type protective clothing and footwear shall be left in the Wash Room decontamination assembly for disposal.
15. The use of cloth coveralls following the prescribed laundry procedures as identified in 8 CCR, 1532.1 is acceptable.
16. Eye Protection: Eye protection, conforming to ANSI Z87.1 shall be worn at all times within the lead hazard areas.
17. Head Protection - Hard hats or other head protection as required by applicable safety regulations and conforming to ANSI Z89.1, Class A or B.
18. Foot Protection - Construction workers shall use non-skid footwear conforming to ANSI Z41.1, Class 75.
19. Site Protective Controls

    a. Protect against disturbances or damages to sensitive finishes or furnishings which will remain within the facility.
    b. Locate temporary scaffolding and containment barriers, as required, and proceed with the construction or demolition, allowing for continued operation of any adjacent occupied areas, as applicable.
    c. Protect existing furnishings and building finishes from water, lead dusts, or chemical strippers.
    d. Erect temporary protective covers over pedestrian walkways and at points of passage for persons or vehicles which are to remain operational during the lead hazard work.
    e. Exterior lead hazard operations shall utilize mini-containments, drop cloths, wet methods, and HEPA vacuums as outlined in Cal/OSHA regulation 8 CCR Section 1532.1.
    f. The City may evaluate the lead dust concentrations outside the work area on adjoining finishes during the work progress by collecting wipe samples to evaluate the integrity of the containment and to detect dust contamination. Evaluation will review possible contamination resulting from:

        1) Failure to adequately cordon off or contain work area dusts, clean-up debris, and use approved work practices, such as wet wiping and HEPA vacuuming.
        2) Failure or breaches in the work area isolation containment.

3) Failure or rupture in the negative pressurization/HEPA filtration system.
4) Incomplete decontamination of personnel or equipment removed from the work area(s).

g. Perimeter wipe samples shall be collected by the Contractor adjacent to each work area prior to any hazardous material abatement. The wipe sample will be analyzed by the State by flame atomic absorption using NIST Standard 1578. The results of which will be reviewed and if acceptable will be considered by the State as acceptable background levels.

1) The Contractor shall reclean adjoining occupied areas with surface concentrations exceeding background level or 800 ?g/ft^2 during the construction activities. The Contractor shall bear the costs (including engineering, administrative, housekeeping, analytical and the labor and materials costs of the State's consultant(s)) to return surface lead concentrations in elevated areas to acceptable background levels.

3.3 ASBESTOS ABATEMENT

A. Notifications:

1. Notify, in writing, the BAAQMD 10 working days prior to commencement of any non-emergency asbestos project.
2. Notify Cal/OSHA 24 hours in advance of any disturbances of any amount of friable or non-friable asbestos-containing materials or prior to performing asbestos-related work.

B. Procedures:

1. Roofing:

a. Remove the roofing and flashing materials as indicated by the Contract Drawings.
b. Cordon off the work area, install critical barriers at the skylights, roof-level windows, and other penetrations, as applicable.
c. Remove all 3-dimensional materials using wet methods per Cal/OSHA’s Regulation 8 CCR 1529, Work Class II.
d. Set-up drop cloths on the ground and nearby objects to contain falling materials the ground or public access areas surrounding the work area.
e. HEPA vacuum the roof following abatement.
f. Provide a full decontamination system with shower.
g. Dispose of roofing as Category 1 non-friable waste.
h. Use of disposal chutes shall be approved by the State per the Contractor's Hazardous Materials Management Plan (HMMP) submittal.

2. Skylight Window Caulking:

a. Remove the caulking as indicated by the Contract Drawings.
b. Cordon off the work area, installing critical barriers at the windows, doors, and other penetrations, as applicable.
c. Remove ACM using wet methods per Cal/OSHA’s Regulation 8 CCR 1529, Work Class II.
d. Set-up drop cloths on the ground and nearby objects to contain falling materials on the ground or public access areas surrounding the work area.
e. HEPA vacuum the sills and frames following abatement.
f. Dispose of caulking as Category 2 non-friable waste.

3. Electrical Wiring and Bakelite Electrical Insulator Boards:

a. Obtain confirmation from a Licensed Electrician that the circuits are deactivated and locked out; and that no residual power sources remain in the circuit.

b. Remove wiring by cut-out of the conduit in manageable sections, where possible. Otherwise, pull the wire through the conduit, with a properly-sized sponge wetted with encapsulant tied to the distal end, misting the insulation continually and HEPA-vacuuming any residual debris.
c. Avoid any unnecessary cutting or peeling.
d. Unscrew or disconnect Bakelite boards from substrate. Avoid breaking boards, HEPA vacuum any residual debris.
e. Wrap wires and Bakelite boards in cardboard to avoid penetrating the waste bag.

C. Special Techniques

1. Ensure that all electrical power terminating in the work area, including but not limited to outlets and lights are disconnected and cannot be reenergized during the course of the work.

   a. Ensure that all power lines which transit the work area and are necessary for the continued operation of services in areas outside the work area are identified and protected adequately in order not to pose a hazard to workers during the course of work.
   b. Provide temporary power and lighting, and ensure safe installation of temporary sources and equipment per applicable electrical code requirements, and provide safety lighting and ground fault interrupter circuits as power source of electrical equipment.
   c. Secure systems and equipment using OSHA lock-out and tag-out procedures, as applicable.

2. Construct critical barriers and decontamination enclosure systems, as applicable. Erect polyethylene sheeting to protect walls, windows, flooring, and fixed equipment, as applicable.
3. Provide differential air pressure systems for each work area in accordance with Appendix J of the EPA's "Guidance for Controlling Asbestos-Containing Materials in Buildings," EPA 560/5-85-024.

   a. Establish negative pressurization within all Asbestos Work Class 1 areas, exhausting air to the exterior, unless otherwise approved by the Owner.
   b. Do not locate outlets near or adjacent to other building intake vents or louvers or at the entrances to the building.
   c. Do not exhaust air into the building's interior spaces or within 50 feet of the building's supply air intakes without DOP testing of all NPUs to show a filter efficiency of 99.97 percent minimum.
   d. Provide a minimum work area differential air pressure of -0.025 inch w.g. and 4 air changes per hour at all times for Asbestos Work Class 1 areas or as otherwise designated by the Contract Documents.

4. Remove ACM employing full isolation, glovebag, and glovebag with mini-containment procedures as designated by material quantities and work class under Cal/OSHA regulation 8 CCR Section 1529.

   a. Glovebag cut-out methods may be used for systems scheduled for demolition as outlined in the Demolition Plans.
   b. Use wet cleaning methods, HEPA vacuuming, and proper work practices.

5. Where encapsulation is required, encapsulate following the State's pre-encapsulation inspection.

6. After encapsulation:

   a. Remove the inner layer of polyethylene sheeting from the floor, walls, and other equipment.
   b. Dispose the inner layer of polyethylene as asbestos waste, as applicable. Leave all critical barriers with one layer of polyethylene sheeting.

7. After removing the final layer of polyethylene sheeting (as appropriate):

   a. Final-clean all surfaces, including the inner surface of the outer layer of polyethylene that serves as a critical barrier, any subfloor trenches, and similar locations.
   b. Allow adequate time for settlement of dust, then repeat final cleaning operation.

c. Clean and remove all materials and equipment within the work area using the equipment decontamination enclosure system.

8. Exterior Asbestos Work Class II abatement operations shall utilize critical barriers, drop cloths, wet methods, and HEPA vacuums as outlined under Cal/OSHA regulation 8 CCR Section 1529.

D. Field Quality Control

1. Site Tests - Clearance Criteria.

a. Clearance air samples using aggressive air sampling techniques shall be collected for all abatement zones, unless otherwise designated in the Contract Documents.
b. Phase Contrast Microscopy (PCM) Clearances: Areas cleared by PCM shall show an airborne concentration of total fibers for each sample at or below 0.01 fibers per cubic centimeter (f/cc) using the NIOSH 7400A counting rules. Any sample result exceeding 0.01 fibers/cc shall require recleaning of the work area and retesting. The minimum number of samples shall be determined by the State, based on the quantity and types of materials removed, configuration, and sequencing of the work areas, and similar considerations.
c. When transmission electron microscopy (TEM) clearances are require, as designated by the Contract Documents, analysis shall be by the method described in 40 CFR Part 763, Appendix A, Subpart E (AHERA), with an analysis turn-around time of 24 hours, unless otherwise designated by the State. Z-test requirements under the AHERA regulations will not apply to this Project.
d. The Contractor shall pay the costs of the final round of visual inspections, aggressive air sampling, and PCM and/or TEM analyses that will meet the Specifications. All rounds of visual inspections, aggressive air sampling, and PCM and/or TEM analyses that fail to meet the contract criteria shall be borne by the Contractor. For the purpose of this paragraph, visual inspection includes the area isolation inspection, pre-encapsulation inspection, and final area cleanup inspection.

E. Waste Disposal and Manifesting:

1. Packing, labeling, transporting, and disposing of asbestos materials shall comply with Cal/EPA regulations under 22 CCR, including completion of the Uniform Hazardous Waste Manifest Form (DTSC 8022A, 7/92, and EPA 8700-22), and the requirements of Article 3.10 - Waste Disposal and Manifesting, of this Section.

3.4 LEAD ABATEMENT AND HAZARD CONTROL

A. Notifications.

B. Procedures.

1. Loose and Peeling Paint:

a. Scrape loose and peeling paints using dust control procedures and procedures as outlined under Cal/OSHA Regulation 8 CCR 1532.1.
b. Characterize the waste for possible disposal as a hazardous waste.

2. Lead Paint Abatement:

a. Remove paints on metal components scheduled for welding or torching using a chemical stripper, needle gun or other approved methods as outlined in the approved Contractor's Hazardous Materials Management Plan (HMMP).
b. Use drop cloths, polyethylene barriers, Hudson and airless sprayers and other methods as required for dust control.
c. Characterize and dispose of paints, rags, etc, separately for possible disposal as a hazardous waste.

3. Lead Dust Clean-up:

a. Clean-up background or construction-related dusts from demolition of lead-coated elements or other contaminant sources using wet methods and HEPA-filtered vacuums.
b. Do not dry sweep.

4. Lead Hazard Control:

a. Scrape loose and peeling paints and use dust controls for demolition of lead-coated architectural and structural elements as indicated by the Demolition Plans, following minimum procedures as outlined under Cal/OSHA Regulation 8 CCR 1532.1.
b. Remove and dispose of intact lead-coated architectural and structural elements as non-hazardous waste.
c. HEPA vacuum residual debris and wet wipe affected substrates as required for clearance inspection or testing.

C. Special Techniques

1. Cordon off the proximity (with approximately 20 feet) of Activity Class I work areas using construction tape, polyethylene dust barriers, or other appropriate means.
2. Persons entering the regulated cordoned" work area shall wear appropriate respiratory protection and full body coveralls.
3. Affix appropriate warning signs at the entry and approaches to the regulated area(s).
4. Lockout electrical and HVAC equipment within the regulated area as necessary.
5. Protect floors and equipment with polyethylene drop cloths or other acceptable means to prevent contamination or damage to other building surfaces and finishes.
6. Apply chemical strippers and scrape following the manufacturer's recommended procedures. After scraping, remove remaining loose paint with a HEPA vacuum.
7. Maintain work area surfaces as free as practicable from accumulated dust or debris. Clean equipment, tools and containment structures within regulated areas, at a minimum, with HEPA vacuums or wet methods.
8. Conduct operations to prevent injury to adjoining facilities, persons, applicable.
9. Prevent chemical cleaning agents from coming into contact with pedestrians, and other surfaces which could be injured or damaged by such contact.
10. Do not spray or scrape outdoors during winds of sufficient force to spread cleaning agents to unprotected surfaces.
11. For areas where removal of loose and peeling paints only are required, the Contractor shall ensure that the paint that remains on walls, ceilings, eaves, and other surfaces in areas of active work, as applicable, shall be adhered to the substrate sufficiently to support eventual repainting. Paints that peel or loosen during wetting will become part of the scope of work scheduled for removal and disposal.
12. Where complete removal of lead coats is required, finished work shall not show signs of stains, scratches, streaks, or runs of discoloration from use of cleaners.

a. Leave substrate surfaces neat and clean, including removal of primers in addition to finish coats. Surfaces shall be uniformly cleaned.

13. Avoid direct welding or cutting on surfaces containing lead in concentrations greater than 0.64 ?g/cm^2 by mechanically or chemically removing the coating to a distance of at least six inches from the point at which heat is applied.

a. If surface coatings are not removed prior to welding or cutting, provide local exhaust ventilation to capture the aerosolized lead, using HEPA filters.

14. Where mechanical removal of surface coatings constitutes a Level II activity, provide power tools, to the extent feasible, with local HEPA exhaust or dust collector systems to capture the aerosolized lead.

5. Lead Dust Clean-up:

a. Clean-up background or construction-related dusts from demolition of lead-coated elements or other contaminant sources using wet methods and HEPA-filtered vacuums.
b. Do not dry sweep.

6. Lead Hazard Control:

a. Scrape loose and peeling paints and use dust controls for demolition of lead-coated architectural and structural elements as indicated by the Demolition Plans, following minimum procedures as outlined under Cal/OSHA Regulation 8 CCR 1532.1.
b. Remove and dispose of intact lead-coated architectural and structural elements as non-hazardous waste.
c. HEPA vacuum residual debris and wet wipe affected substrates as required for clearance inspection or testing.

C. Special Techniques

1. Cordon off the proximity (with approximately 20 feet) of Activity Class I work areas using construction tape, polyethylene dust barriers, or other appropriate means.
2. Persons entering the regulated "cordoned" work area shall wear appropriate respiratory protection and full body coveralls.
3. Affix appropriate warning signs at the entry and approaches to the regulated area(s).
4. Lockout electrical and HVAC equipment within the regulated area as necessary.
5. Protect floors and equipment with polyethylene drop cloths or other acceptable means to prevent contamination or damage to other building surfaces and finishes.
6. Apply chemical strippers and scrape following the manufacturer's recommended procedures. After scraping, remove remaining loose paint with a HEPA vacuum.
7. Maintain work area surfaces as free as practicable from accumulated dust or debris. Clean equipment, tools and containment structures within regulated areas, at a minimum, with HEPA vacuums or wet methods.
8. Conduct operations to prevent injury to adjoining facilities, persons, applicable.
9. Prevent chemical cleaning agents from coming into contact with pedestrians, and other surfaces which could be injured or damaged by such contact.
10. Do not spray or scrape outdoors during winds of sufficient force to spread cleaning agents to unprotected surfaces.
11. For areas where removal of loose and peeling paints only are required, the Contractor shall ensure that the paint that remains on walls, ceilings, eaves, and other surfaces in areas of active work, as applicable, shall be adhered to the substrate sufficiently to support eventual repainting. Paints that peel or loosen during wetting will become part of the scope of work scheduled for removal and disposal.
12. Where complete removal of lead coats is required, finished work shall not show signs of stains, scratches, streaks, or runs of discoloration from use of cleaners.

    a. Leave substrate surfaces neat and clean, including removal of primers in addition to finish coats. Surfaces shall be uniformly cleaned.

13. Avoid direct welding or cutting on surfaces containing lead in concentrations greater than 0.64 ?g/cm^2 by mechanically or chemically removing the coating to a distance of at least six inches from the point at which heat is applied.

    a. If surface coatings are not removed prior to welding or cutting, provide local exhaust ventilation to capture the aerosolized lead, using HEPA filters.

14. Where mechanical removal of surface coatings constitutes a Level II activity, provide power tools, to the extent feasible, with local HEPA exhaust or dust collector systems to capture the aerosolized lead.

D. Field Quality Control

1. Site Test: Monitoring and Clearance by the State.

a. During lead hazard-related work, such as demolition, refinishing, or torching and welding activities, the State may collect air samples for analysis by flame atomic absorption.
b. Air sampling results in excess of the Cal/OSHA “Project Action Level” of 30 micrograms per cubic meter (?g/m^3) within the construction zone may require isolation of the work area, upgrades in the required respiratory protection, amendment of work procedures, and/or clean-up of the affected area.
c. Air sampling results in excess of the EPA's National Ambient Air Quality Standard (NAAQS) of 1.5 ?g/m^3 at the site's property line or at adjoining occupied non-construction areas may require isolation of the work area, amendment of work procedures, and clean-up of the affected area.
d. Resampling of the contaminated areas and handling, shipping, and analysis charges (including the State's time and expenses) for additional sampling required to show background levels below these lead standards shall be borne by the Contractor.
e. Clearance Criteria -- Lead Abatement Zones:

1) The lead abatement zone shall remain secured until cleared by the State.
2) Visual Inspection: When the Contractor considers the work or a designated portion of the work to be complete, the Contractor shall notify the Resident Engineer that the work is ready for abatement zone clearance inspection. Within a reasonable time after receiving notification from the Contractor, the State will perform a visual inspection of the work area.
3) Evidence of lead contamination identified during the inspection will necessitate further cleaning as specified herein.

E. Waste Disposal and Manifesting:

1. Comply with current federal, State and local regulations concerning the waste handling, containerization, transportation, and disposal of lead-based paint or lead-contaminated materials, and Article 3.10 of this Section.
2. Loose debris and scraped materials shall be treated as hazardous waste, unless otherwise approved by the State. Construction waste coated with intact LBP may be disposed of as construction debris in accordance with the Cal/EPA requirements.
3. Laboratory costs associated with analyses required for disposal, if required, shall be at the Contractor's expense.
4. Segregate, containerize, and characterize construction debris including rags, protective coveralls, polyethylene sheeting, and other consumable items. Waste shall be packaged in accordance with the applicable U.S. Department of Transportation regulations included in 49 CFR Parts 173, 178 and 179.
5. Profile waste with an approved landfill or incinerator by means of standard digestion and extraction tests (TCLP, WET, and SW846), as appropriate. Use the facility's EPA Generator I.D. number on the “Waste Manifest.” See additional requirements specified below in Article titled "Manifesting".
6. If debris is to be recycled, provide a bill of lading and a memorandum from the recycle acknowledging that lead may be present and work activities and disposal will comply with applicable regulations. Submit in accordance with procedures of section "Submittals".

3.5 PCB BALLAST REMOVAL

A. Contractor shall ensure that PCB-containing lighting ballasts, are handled, containerized, secured, labeled, manifested, transported, and either reused, disposed, incinerated or recycled, as appropriate.
B. Generators of PCB ballasts who transport off-site no more than two 55-gallon drums per transportation vehicle shall be exempt from the standards set forth in Article 1, Article 2 and Article 4 of 22 CCR, Chapter 12 and 13 as follows:

1. Generators of PCB-containing light ballasts shall be except from filing an “Extremely Hazardous Waste Disposal Permit” as required by ? 67430.1.
2. A transporter of twelve or more non-leaking PCB-containing fluorescent light ballasts shall be exempt from provisions under 22 CCR, Chapter 13 provided the following conditions are met:

a) The transporter shall use a shipping paper which contains the information required pursuant to Title 49, Code of Federal Regulations, Part 172, Subpart C to document the transportation of the ballasts. The

shipping paper or manifest shall accompany the shipments, with a legible copy maintained by the transporter for a minimum period of three years.

b) The total number of PCB-containing light ballasts being transported shall not exceed two 55 gallon drums of non-leaking ballasts per load and shall not contain any other hazardous wastes.

c) The transporting container shall meet applicable federal and state regulations.

d) Any discharges or spills of hazardous waste consisting of PCB-containing fluorescent light ballasts shall be reported and cleaned up as required in 22 CCR, Chapter 13, Article 3.

3. Transfer of hazardous waste consisting of PCB-containing light ballasts from one container to another shall not be subject to the requirements of 22 CCR provided the containers hold no other hazardous wastes.

C. Waste Characterization: The U.S. Environmental Protection Agency (EPA; 40 CFR 761.60 & 761.65) and the California Department of Health Services (DOHS;22 CCR Section 66508) consider PCBs from ballasts as a hazardous waste. Disposal of the PCB-conta

D. Pack ballasts as “containing PCB” or ballasts not specifically marked as “non-PCB” or “PCB free” as hazardous waste. Workers removing ballasts from fixtures shall wear protective clothing and nitrile or neoprene gloves. Those ballasts showing signs of overheating or leakage will require wipe-down of the fixture with clean paper towels after the unit has cooled to room temperature. This step shall be followed with additional wiping with an organic solvent, such as mineral spirits or isopropyl alcohol. The leaking ballasts and rags shall be placed in a plastic bag, tied off, and secured. Remaining PCB ballasts and bagged waste shall be placed in steel drums, sealed, labeled, and transported to an approved incinerator following required manifest procedures. Absorbent material, such as kitty litter, shall be used as a cushion and absorbent within the drums. Drum loading shall not exceed the incinerator's requirements (typically 350 to 500 pound limit per drum).

3.6 MERCURY-CONTAINING LAMP REMOVAL

A. Spent fluorescent and mercury vapor lamps contain mercury, which is considered a hazardous waste by the California Department of Health Services (DOHS; 22 CCR Section 66699(b)). Ship lamps to a commercial recycle, (e.g., Mercury Technologies) where they are crushed and the mercury is reclaimed. The recycle shall comply with DOT requirements for manifests, etc., with evidence of proper disposal provided to the State, including a log of shipment dates and quantities. Quantities under 25 lamps per day may be disposed of as non-hazardous waste.

3.7 WASTE DISPOSAL AND MANIFESTING

A. Hazardous Waste Disposal:

1. Packing, labeling, transporting, and disposing of hazardous waste shall comply with Cal/EPA regulations under 22 CCR, including completion of the Uniform Hazardous Waste Manifest Form (DTSC 8022A, 7/92, and EPA 8700-22).
2. A "Waste Manifest" shall be completed for disposal of hazardous waste. The transporter shall posses a valid EPA Generator I.D. number. The Contractor shall notify the Resident Engineer a least 48 hours prior to the time that the Manifest is required to be signed by the State.
3. Applicable information to be included in the “Waste Manifest” includes the following:

   a. EPA Generator ID Number - Verify with the State Representative.
   b. Generator's Name and Address - Verify with the State Representative.
   c. Generator Tax ID Number - Verify with the State Representative.

SECTION 02200 EARTHWORK

PART 1 GENERAL

1.1 WORK INCLUDED

A. This Section covers the work necessary for earthwork, complete.

1.2 GEOTECHNICAL INFORMATION

A. Soil investigation report and boring information in the vicinity of the Contract are available for the Contractor to review and estimate. This report is not considered a part of the Contract Documents but is intended for the Contractor's information. The Contractor should make whatever investigations including laboratory tests he/she deems necessary to satisfy himself/herself as to the conditions he/she will encounter.

B. The Soil Report is titled:

Bay Bridge Pump Station Relocation Geotechnical Evaluation, San Francisco, California, Prepared by Olivia Chen Consultants, Inc., Dated October 2, 1997.

1.3 DEFINITIONS

A. Relative Compaction - "Relative compaction" is defined as the ratio, in percent, of the as-compacted field dry density to the laboratory maximum dry density as determined by ASTM D1557. Corrections for oversize material may be applied to either the as-compacted field dry density or the maximum dry density, as determined by the Engineer.

B. Optimum Moisture content - "Optimum moisture content" shall be determined by the ASTM standard specified to determine the maximum dry density for relative compaction. Field moisture content shall be determined on the basis of the fraction passing the 3/4 inch sieve.

C. Prepared Ground Surface - The "prepared ground surface" is defined as the ground surface after clearing, grubbing, stripping, excavation, and/or compaction.

D. Completed Course - "Completed course" is defined as a course or layer that is ready for the next layer or next phase of the work.

E. Well-Graded - "Well-graded" as used in this Section defines a mixture of particle sizes that has no specific concentration or lack thereof of one or more sizes. Well-graded does not define any numerical value that must be placed on the coefficient of uniformity, coefficient of curvature, or other specific grain size distribution parameters. Well-graded is used to define a material type that, when compacted, produces a strong and relatively incompressible soil mass free from detrimental voids.

F. Unclassified Excavation - Unclassified excavation shall mean that the nature of materials to be encountered has not been identified or described herein.

G. Borrow - Borrow material shall be material excavated on the site or taken from designated borrow areas on or near the site.

H. Imported Material - Imported materials shall be materials obtained by the Contractor from sources off the site.

I. Structural Fill - Structural fill shall be the fill materials as required under structures and paving.

1.4 SUBMITTALS

A. Certification, test results, source, and samples for all import material.

B. Certification and test results of on-site excavated backfill material.

C. Excavation shoring design by a California licensed civil engineer for review and approval. Plans shall bear the stamp, license expiration date and wet signature of the civil engineer.

1.5 EARTHWORK QUANTITIES

A. It shall be the Contractor's responsibility for estimating the quantity of excavation, fill, disposal, etc., that is necessary to accomplish the work. It shall be the Contractor's responsibility for estimating whether excavated material does not meet the requirements of fill material and therefore must be disposed of off site and imported materials be used as fill material.

B. When materials are specified as "excavated or imported", it shall be the Contractor's responsibility to decide on the source. Regardless of the source chosen, the material shall meet the applicable material requirements

regarding maximum size, grain-size distribution, plasticity, etc. If excavated material is used, material processing may be necessary to meet the applicable material type. Processing may consist of, for example, screening, washing, or changing the moisture content through aerating or wetting.

1.6 BACKFILL MATERIAL ACCEPTANCE

A. The Contractor shall maximize the use of excavated backfill material. Soils from the construction excavation (except for the Bay Mud deposits, contaminated, and/or hazardous excavated materials, and the clayey excavated materials) may be used for backfill material provided that it meets the requirements of Article 2.3 of this Section. Submit laboratory test results for approval of the Resident Engineer.

1.7 IMPORTED MATERIAL ACCEPTANCE

A. Imported material for backfill shall meet the requirements of Article 2,3 of this Section prior to hauling in. Cost for any imported backfill material shall be incidental to the work. No extra payment shall be made to the Contractor.
B. Prior to hauling in any import material, the Contractor shall provide environmental analytical data (a minimum of one four-point composite per 500 CY to be analyzed for RC, TRPH, CAM 17 metals), and additional test as required by the Resident Engineer. Analytical costs for any imported fill material incurred by the Contractor shall be Incidental Work.
C. Asphalt, crushed concrete aggregate, Bay Mud, clay bricks, cobblestones, rocks, and debris shall neither be accepted as imported fill material nor as backfill material.
D. The Contractor shall submit a final trucking log of all imported fill deposited at the project site. Log shall include information on origin of import (street address, city), location of deposit (coordinates and elevation) , quantity (cy), description of material, environmental analytical results, and trucking invoices.
E. Final progress payment will be withheld unless final trucking log of imported fill is submitted.

1.8 SHORING, SHEETING, BRACING, AND SLOPING

A. Install and maintain shoring, sheeting, bracing, and sloping as required by OSHA and other applicable governmental regulations and agencies.

1.9 EXCAVATION SAFETY

A. The Contractor shall be solely responsible for making all excavations in a safe manner. Provide appropriate measures to retain excavation sideslopes and ensure that persons working in or near the excavation are protected.

1.10 CODES, ORDINANCES, AND STATUTES

A. The Contractor shall familiarize himself with, and comply with, all applicable codes, ordinances, and statutes, and bear sole responsibility for the penalties imposed for noncompliance.

1.11 TOLERANCES

A. All material limits shall be constructed within a tolerance of 0.1 foot except where dimensions or grades are shown or specified as minimum. All grading shall be performed to maintain slopes and drainage as shown. No reverse slopes will be permitted.

PART 2 PRODUCTS

2.1 GENERAL

A. Provide all labor, materials, and equipment necessary to accomplish the work specified in this Section.

2.2 UNCLASSIFIED EXCAVATION

A. Excavation is unclassified. Complete all excavation regardless of the type, nature, or condition of the materials encountered. Make own estimate of the kind and extent of the various materials to be excavated in order to accomplish the work.

2.3 BACKFILL

A. Structural backfill materials - Structural backfill shall consist of approved material, free from debris, wood, and other organic, unsound or deleterious matter, and from all other materials that will prevent or adversely affect thorough and permanent compaction and stability.

B. Materials, including those excavated at the site, yielding a maximum dry density of less than 112 pounds per cubic foot, when tested in the laboratory in accordance with the compaction test described in Article 3.8 shall not be used as structural backfill or fill.

C. The material used for structural backfill behind or around structures and appurtenant facilities shall have a sand equivalent value of not less than 30. The percentage composition by weight shall conform to the following grading:

Sieve Size	Percentage Passing
3-inch	100
No. 4	35-100

D. Lumps, rocks and concrete pieces measuring 3 inches or less in greatest dimension may be incorporated into backfill; and, if contained in backfill more than 4 feet deep, and satisfactorily distributed in earth or other fine materials, pieces not greater than 6 inches in greatest dimension may be so incorporated, provided that such latter pieces not be placed within 3 feet of finished grade or subgrade, nor in areas where piles are to be driven or drilled.

E. Rocks, concrete, or hard lumps of earth larger than allowed shall be broken up before compacting.

2.4 STRUCTURAL FILL

A. Crushed gravel or crushed rock smaller than one-inch, free from dirt, clay balls, and organic material, well graded from coarse to fine, containing sufficient fine material for proper compaction, and less than 20 percent by weight passing the No. 200 sieve with a plasticity index not to exceed 12.

2.5 SELECTED FILL

A. On site natural sand or sand produced from crushed gravel or crushed rock, maximum size 1/4 inch, with at least 95 percent passing a No. 4 sieve, free from clay and organic material, with a maximum of 8 percent passing the No. 200 sieve, with a plasticity index not to exceed 6.

2.6 CRUSHED ROCK BEDDING

A. Crushed rock bedding under the building and force main pipes shall be uniformly graded crushed bedding with 100% passing maximum size of __ inch, with maximum 35% passing the No. 4 sieve, and with maximum 5% passing the No. 200 sieve (the fines passing the No. 200 sieve shall be non-plastic) free from clay and organic material.

2.7 WATER FOR COMPACTION

A The San Francisco Public Utilities Commission prohibits the use of potable water for soil compaction and dust control. Reclaimed water shall be used for these purposes. Reclaimed water is available at no cost to the

Contractor from the Southeast Water Pollution Control Plant (SEWPCP) 8:00 a.m. to 5:00 p.m. on weekdays and Saturdays. Arrangements can be made for access to reclaimed water at other times. A permit is required to obtain reclaimer water from the City. Contact Chief Stationary Engineer at 648-6882 three (3) days prior to the date that reclaimed water is required.

B. Due to potential health concerns, an exemption is allowed for the use of potable water when human contact and exposure exisits. The exemption will be granted by the RE on a case by case basis.

2.8 COMPACTION EQUIPMENT

A. Compaction equipment shall be of suitable type and size adequate to obtain the densities specified, and shall provide satisfactory breakdown of materials to form a dense fill,

B. Compaction equipment shall be operated in strict accordance with the manufacturer's instructions and recommendations. Equipment shall be maintained in such condition that it will deliver the manufacturer's rated compactive effort. If inadequate densities are obtained, larger and/or different types of additional equipment shall be provided by the Contractor. Hand-operated equipment shall be capable of achieving the specified densities.

2.9 MOISTURE CONTROL EQUIPMENT

A. Equipment for applying water shall be of a type and quality adequate for the work, shall not leak, and shall be equipped with a distributor bar or other approved device to assure uniform application. Equipment for mixing and drying out material shall consist of blades, discs, or other approved equipment.

PART 3 EXECUTION

3.1 EXCAVATION

A. Excavation is unclassified. Excavate for structures to the lines and grades shown or as required to accomplish the construction.

3.2 LIMITS OF EXCAVATION

A. Excavate to the depths and widths shown. Allow for forms, shoring, working space, working pad, and finish topsoil as shown or required. Excavation carried below the grade lines shown or established by the Engineer shall be replaced with the same fill material as specified for the overlying fill or backfill, and compacted as required for such overlying fill or backfill. Where the overlying area is not to receive fill or backfill, replace the over excavated material and compact to a density not less than 95 percent relative compaction at optimum moisture content, plus or minus 2 percent. Excavations under footings shall be filled with concrete of strength equal to that of the footing of structural fill compacted to 95 percent relative compaction. Cuts below grade shall be corrected by similarly cutting adjoining areas and creating a smooth transition. Correct all over excavated areas at the Contractor's sole expense.

3.3 REMOVAL OF WATER

A. Provide and operate equipment adequate to keep all excavations and trenches free of water. Remove all water during periods when concrete is being deposited, when pipe is being laid, during the placing of backfill, and at such other times as required for efficient and safe execution of the work. Avoid settlement or damage to adjacent property. When dewatering open excavation, dewater from outside the structural limits and from a point below the bottom of the excavation when possible. Submit dewatering, contingency, and disposal plans in accordance with Section 02530 - Groundwater Control.

3.4 BACKFILL

A. Backfill around concrete structures only after the concrete has attained the specified compressive strength indicated in Section 03300 - Concrete. Remove all form materials and trash from the excavation before placing any backfill. Obtain the Engineer's acceptance of concrete work and attained strength prior to backfilling.
B. Do not operate earth-moving equipment within 5 feet of walls of concrete structures for the purpose of depositing or compacting backfill material. Compact backfill adjacent to concrete walls with hand-operated tampers or similar equipment that will not damage the structure.
C. Backfilling on top of structures shall be limited to conveying the fill material onto the structure in a uniform manner as to not unbalance the loading on spans. Use of equipment to spread the backfill shall be limited to a unit weight of 300 psf.

3.5 FILLS NOT UNDER STRUCTURES OR FACILITIES

A Place hereinbefore defined earthfill to the lines and grades shown. Place fill material in maximum 8 inch lifts and compact each lift to not less than 90 percent relative compaction at optimum moisture content. Make proper allowance for topsoil or pavement where required.

3.6 EARTH BACKFILL AROUND STRUCTURES

A. Place hereinbefore defined earthfill in all areas not designated to be granular or selected fill.
B. Deposit material from the excavation in horizontal lifts of maximum 8 inch uncompacted depth and compact each lift to not less than 90 percent relative compaction. Maintain material at optimum moisture content, plus or minus 2 percentage points. Place backfill material free of roots, organic matter, trash, and rocks larger than 3 inch diameter. Stop backfill at specified grade. Make allowance for topsoil where required.

1. Structural Fill Under Structures: Place structural fill in all areas under structures including slabs and footings. Deposit structural fill in horizontal lifts of maximum 8 inch lift to not less than 95 percent relative compaction; maintain material at optimum moisture content plus or minus 2 percent.

3.7 COMPACTION

A. Compact all materials by mechanical means. Flooding or jetting will not be permitted. Compaction tests shall be conducted in accordance with the requirements below. If compaction tests indicate that compaction or moisture content is not as specified, material placement shall be terminated and corrective action shall be taken by the Contractor prior to continued placement.
B. Tests of relative compaction, including determination of optimum moisture content and maximum density of backfill, fill, and embankment materials, will be made in accordance with Method "C" of ASTM "Standard Methods of Test for Moisture-Density Relations of Soils, Using 10-lb. Rammer and 18-in. Drop," Designation D 1557, ASTM "Standard Method of Test for Density of Soil in Place by the Sand Cone Method," Designation D 1556, and Methods "A" and/or "B" of ASTM "Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth)," Designation D 2922.
C. As stated therein, the term "relative compaction," used hereinafter regarding compaction of backfill or embankment, means the percentage ratio of the field-compacted dry density to the maximum dry density obtainable by compaction at optimum moisture content.
D. Density and compaction tests of in place compacted backfill, fill, or embankment, as the case may be, and of the materials used, required by the Engineer as the work progresses, will be conducted and evaluated by the City at no cost to the Contractor.

3.8 MOISTURE CONTROL

A. During all compacting operations, maintain optimum practicable moisture content required for compaction purposes in each lift of fill. Maintain moisture content uniform throughout the lift. Insofar as practicable, water to the material at the site of excavation. Supplement, if required, by sprinkling the fill. At the time of compaction, the water content of the material shall be at optimum moisture content, plus or minus 2 percentage points.
B. Do not attempt to compact fill material that contains excessive moisture. Aerate material by blading, discing, harrowing, or other methods, to hasten the drying process.

3.9 FIELD DENSITY AND MOISTURE TESTS

A. The Engineer will determine in place density and moisture content by any one or combination of the following methods: ASTM D2922, D1556, D2216, D3017, or other methods selected by the Engineer. Cooperate with this testing work by leveling small test areas designated by the Engineer. Backfill test areas at Contractor's sole expense. The frequency and location of testing shall be determined solely by the Engineer. The Engineer may test any lift of fill at any time, location, or elevation.

3.10 DISPOSAL OF EXCESS EXCAVATION

A. Dispose of all excess excavated materials, not required for backfill or fills, outside of the areas of work.

3.11 SITE GRADING

A. Perform all earthwork to the lines and grades as shown and/or established by the Engineer, with proper allowance for topsoil where specified or shown. Shape, trim, and finish slopes of channels to conform with the existing lines, grades and cross sections. Neatly blend all new grading into surrounding, existing terrain.

3.12 DEMOLITION

A. The Contractor shall remove as part of the surface facilities all related subsurface foundations, footings, and encasements of removed or salvaged facilities as indicated on the Drawings and as necessary to accommodate the work including new foundations, footings, and encasements.
B. The Contractor shall remove demolished materials, equipment and debris from the site each day during the course of the work, and at completion of work.
C. All facilities to be removed as the Contractor’s property shall be removed from the site and disposed of in a legal manner.
D. The Contractor shall remove debris from the work site daily, unless otherwise directed. Refer to Section 12 for maintenance of the work area and dust control requirements.

3.13 PAVEMENT CUTTING AND STREET EXCAVATION

A. In accordance with the applicable requirements set forth in these Specifications, the Contractor shall use, but not be limited to, pavement concrete saw cutting or vibratory pavement breaker.
B. Use of Pavement Breaker Adjacent to Utility Facilities Limited - In accordance with the requirements of Section 373 of the Public Works Code of the City and County of San Francisco, the Contractor may use pavement breakers or other labor-saving devices; however, the use of any machine or device that breaks pavement by blows struck by a falling or driven hammer or weight is prohibited within a horizontal distance of 6 feet from any gas, sewer, water or Auxiliary Water Supply System pipe, communications duct or any other utility facility. Such prohibitions, however, shall not be construed as barring the use of hand tools or manually operated air tools such as jackhammers.
C. The Contractor shall not use any machine or device that breaks pavement by blows struck by a falling or driven hammer or weight. Hoe-ram and trenching machines shall not be used for concrete street at edge of pavement restoration. Such prohibitions, however, shall not be construed as barring the use of hand tools or manually operated air tools such as jack hammers.
D. The use of hand tools shall be required for demolition of surface facilities in areas of special sidewalk paving as noted on the Plans or as required by the Engineer to preserve and restore pavement to original condition.
E. Rock Cutter - The use of a rock wheel cutter for street excavation is prohibited unless permitted by special order of the City and County of San Francisco's Director of Public Works for specific locations. If permitted, rock wheel cutter shall only be used to remove the pavement (concrete base and asphalt wearing surface), and only after potholing has been done to determine the pavement thickness. Rock wheel cutter shall not be used on concrete streets, shall not be used as a trenching device, and shall not be used within ten (10) feet of a signalized intersection.

F. All areas of pavement to be cut shall be in neat and straight lines and overcutting of lateral trenches shall not be allowed. Dust control shall be provided by using non-potable water with rock cutting wheel. Protection from flying rocks, debris, etc., shall be provided.
G. Excavation and backfill shall be in accordance with the applicable requirements set forth in these Specifications.
H. The Contractor shall comply with all ordinances that regulate noise including the requirements of Article 29 of the San Francisco Police Code, Regulation of Noise.

EXISTING PAVEMENT EXCAVATION

A. The Contractor shall excavate and dispose of in a legal manner as Contractor's property the following:

Pavement, including but not limited to asphalt concrete pavement, concrete base, concrete sidewalk, concrete curb, concrete gutter, concrete parking strip, granite curb, and subgrade.

B. Excavated subgrade material shall be hauled and disposed of in a legal manner.

COBBLESTONES

A. The Contractor shall salvage all cobblestones as City property. Cobblestones shall be cleaned, neatly and securely placed on pallets, and delivered to 2323 Cesar Chavez Street lower lot yard or where directed by the Engineer within the City limits of San Francisco. Contact Mr. Mel Baker at (415) 695-2014 or Mr. Scott Shaw at (415) 695-2013 48-hours prior to delivery.
B. Removal and salvaging of cobblestones shall be considered Incidental Work.

SECTION 02221 TRENCH EXCAVATION AND BACKFILL

PART 1 GENERAL

1.1 WORK INCLUDED

A. The Contractor shall provide the following in complete accordance with the Contract Drawings and Specifications:

1. Trench Excavation
2. Trench Shoring Design
3. Backfill
4. Removal of Water
5. Disposal of Material

1.2 SUBMITTALS

A. Submittals shall be made in accordance with Section 12-1.06 - Submittals
B. Submit certification, test results, source, and samples of imported material
C. Excavation shoring design and drawings shall be reviewed and signed by a California registered civil engineer. The cost of such design services shall be borne by the Contractor.

1.3 RELATED SECTIONS

A. Section 02200 - Earthwork
B. Section 02530 - Ground Water Control

1.4 TRENCH EXCAVATION

A. Excavation is unclassified. Complete all excavation regardless of the type of materials encountered. The Contractor shall make his own estimate of the kind and extent of the various materials which will be encountered in the excavation.

1.5 TRENCH SUPPORT

A. The Contractor shall provide all engineering, installation and construction works related to the ground support systems in accordance with the requirements specified herein and in the Contract Drawings, as well as all pertinent safety orders of OSHA and the State of California Division of Industrial Safety. All trench work shall also comply with the applicable provisions of California Labor Code Section 6705.

PART 2 PRODUCTS

2.1 MATERIALS

A. Imported clean crushed rock shall be used for all pipe bedding and sand and gravel pipe zone backfill in locations shown on the Drawings.
B. Selected fill used shall be in accordance with Section 02200 - Earthwork.

2.2 WATER FOR TRENCH BACKFILL COMPACTION

A. Construction water shall be non-potable in accordance with the provisions of Section 02200 - Earthwork.
B. Condition trench backfill material to optimum moisture content plus or minus 2 percent prior to placement and compaction.

2.3 COMPACTION EQUIPMENT

A. Compaction equipment shall be of suitable type and size adequate to obtain the amount of compaction specified. Compaction equipment shall be operated in strict accordance with the manufacturer's instructions and recommendations and shall be maintained in such condition that it will deliver the manufacturer's rated compactive effort.

2.4 DENSITY REQUIREMENTS

A. Compact trench backfill to a density not less than 90 percent relative compaction at optimum moisture content, plus or minus 2 percent, per ASTM D1557.

PART 3 EXECUTION

3.1 PREPARATION OF RIGHT-OF-WAY

A. Where clearing or partial clearing of the right-of-way is necessary, complete prior to the start of trenching. Cut trees and brush as near to the surface of the ground as practicable, remove all stumps, and pile for disposal. Do not permit excavated materials to cover brush or trees.
B. Only trees and shrubs designated by the Engineer shall be removed. Protect all other trees and shrubs.
C. Protect from damage, unless otherwise marked by the Engineer, all trees, shrubs and plants within limits of the easement on private property.

3.2 DISPOSAL OF CLEARED MATERIAL

A. The Contractor shall bear all costs of disposing of trees, stumps, brush, roots, limbs, and other waste materials from the clearing operation. Material shall be disposed of in such a manner as to meet all requirements of state, county, and local regulations regarding health, safety, and public welfare.

B. In no case shall any material be left on the project, shoved onto abutting private properties, or buried in embankments or trenches on the Contract site.

3.3 OBSTRUCTIONS

A. This item refers to obstructions which may be removed and do not require replacement. Remove obstructions within the trench area or adjacent thereto such as tree roots, stumps, abandoned piling, buildings and concrete structures, logs, abandoned utility pipes and manholes, and debris of all types without additional compensation.
B. Dispose of obstructions removed from the excavation in accordance with Article 3.2 DISPOSAL OF CLEARED MATERIAL.

3.4 EXCAVATION

A. The trench length of all street openings shall not exceed the length of one block in any three block sections without special permission from the Department of Parking and Traffic, The amount of excavated trench in excess of pipe laid therein shall not exceed 200 linear feet at the end of each working day.
B. The trench shall be excavated so that the barrel of the pipe will have an even bearing along its entire length, and with sufficient clearance provided for any necessary operations in connection with the laying of the pipe. Bell holes shall be excavated for each pipe bell or joint.

SECTION 02231 AGGREGATE BASE

PART 1 GENERAL

1.1 DESCRIPTION

A. This Section includes specifications for materials and work necessary for constructing aggregate base under roadways, parking areas and at site locations that require aggregate base in accordance with these Special Provisions and as directed by the Engineer. All work in this section is considered Incidental Work.

1.2 REFERENCE STANDARDS

A. State of California Department of Transportation Standard Specifications (CTSS), dated July, 1992.

1.3 SPECIAL INSTRUCTIONS

A. Notifications:

1. Underground Service Alert:

a) Before commencing any excavation, obtain Underground Service Alert inquiry I.D. number by calling the following phone number:

Underground Service Alert: 1-800-642-2444

b) Allow four (4) calendar days after I.D. number is obtained and before excavation work is started so that utility owners can be notified.
c) I.D. numbers will not be given more than 10 calendar days prior to starting excavation work.

1.4 SUBMITTALS

A. Submittals - In accordance with State of California Department of Transportation Standard Specifications (CTSS), dated July, 1992.

PART 2 PRODUCTS

2.1 MATERIALS

A. Aggregate Base - All aggregate shall be in accordance with the requirements of Section 26-1.02A of CTSS, Class 2 Aggregate Base. The particle size distribution shall be in accordance with the grading specified for 3/4-inch maximum size aggregate.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

A. Subgrade: In accordance with the requirements of Section 26-1.03 of CTSS:

1. Preparation of subgrade to proper grade, including excavating, backfilling and compacting shall be considered as Incidental Work where excavation is required to perform the work.
2. Asphalt shavings or grindings shall not be used as fill material.

3.2 INSTALLATION

A. Adding Water - In accordance with the requirements of Section 26-1.035 of CTSS.
B. Spreading - In accordance with the requirements of Section 26-1.04 of CTSS.
C. Compacting - In accordance with the requirements of Section 26-1.05 of CTSS.

1. All water used for watering shall be applied as Incidental Work.

SECTION 02502 STREET AND SITE WORK NOT IN CONTRACT DAMAGED BY CONTRACTOR

PART 1 GENERAL

1.1 DESCRIPTION

A. This Section includes specifications for restoring any street work not in the Contract that has been damaged or removed by the Contractor's operations.
B. This work includes, but is not limited to, asphalt and concrete pavement and related improvements, such as sidewalk, curb, gutter, parking strip, side sewer vents and traps, City-owned frames and castings, and any other improvements not designated for removal or relocation.
C. The street and site restoration work shall be at the Contractor's expense.

1.2 REFERENCE STANDARDS

A. State of California Department of Transportation Standard Specifications (CTSS), dated July, 1992.

1.3 SUBMITTALS

A. The Contractor shall submit eight (8) copies of the manufacturer's literature, specifications, applications and installation instructions for Carbon Black (Grey or Charcoal color) for curb ramps for the Engineer's approval.

PART 2 PRODUCTS

2.1 MATERIALS

A. Asphalt concrete pavement shall be restored with 8-inch thick concrete base and 2-inch thick asphalt concrete wearing surface for roadway work and asphalt concrete pavement shall be restored to similar conditions in other areas.
B. Concrete pavement shall be restored with 8-inch thick concrete pavement.
C. Granite curb, armored curb or concrete curb shall be reconstructed with concrete curb.
D. Concrete sidewalk shall be restored with 3 1/2-inch thick concrete sidewalk to the nearest flagline.
E. Carbon Black (Grey or Charcoal Color) for Curb Ramps: Carbon Black shall be extra high strength, non-floating, dispersible, non-glare, and unaffected by sunlight. It shall be composed of extremely fine sub-micron particle size, and shall not create the loss of concrete strength.

PART 3 EXECUTION

3.1 SPECIAL INSTRUCTIONS

A. Any damage to work or property by the Contractor shall be repaired per State of California Department of Transportation Standard Specifications (CTSS), dated July, 1992.
B. Existing San Francisco Fire Department (SFFD) and existing San Francisco Water Department (SFWD) valves are to be accessible at all times.

3.2 INSTALLATION

A. Sidewalk shall be restored to match existing sidewalk in design, color, and material and to existing whole flag lines.
B. All street work restored by the Contractor shall be in accordance with the following conditions:

1. Planing Existing Asphalt Concrete Surfaces: In accordance with the requirements of Section 42-2.02 of CTSS.
2. Asphalt Concrete Wearing Surface: In accordance with the requirements of Section 39 of CTSS.
3. Portland Cement Concrete Paving:

a. Compaction of Subgrade - In accordance with the requirements of Section 73-1.02 of CTSS.
b. Concrete Curb - In accordance with the requirements of Sections 73, 90-2, and 90-10 of CTSS.
c. Concrete Sidewalk - In accordance with the requirements of Sections 73, 90-2, and 90-10 of CTSS. Concrete sidewalk shall be darkened with either:

1) Lampblack in dry form, in accordance with the requirements of ASTM "Standard Specifications for Lampblack," Designation D209, in the proportion of 1/2 to 3/4 pound per cubic yard of concrete; or
2) An approved liquid or semi-paste black colorant intended for use integrally in concrete mixes. The proportion required, generally from 10 to 40 ounces liquid measure per cubic yard of concrete, may be affected by the colorant used. Curing in this case shall be by the pigmented curing compound method.
3) The proportion of lampblack or other approved colorant, to a great extent dependent on the color of the cement used in the mix, shall be that required to properly darken the concrete to reduce glare, and shall be subject to the approval of the Engineer.

d. Concrete Base - In accordance with the requirements of Section 28 of CTSS. Except that the amount of cement per cubic yard for concrete base shall contain no less than 517 pounds of cement per cubic yard. Minimum compressive strength at 28 days shall be 3,000 pounds per square inch.
e. Concrete Curb Ramps:

1) Curb Work - In accordance with the requirements of Sections 73, 90-2, and 90-10 of CTSS.
2) Sidewalk Work - In accordance with the requirements of Sections 73, 90-2, and 90-10 of CTSS.
3) Curb ramps shall be constructed in accordance with the details shown on Reference Drawing Plan Numbers 62,171 and 62,172. These plans are included as part of the Contract Plans.

4) Carbon Black (Grey or Charcoal Color) at curb ramps - Add three (3) pounds of Carbon Black with a dispersing agent per cubic yard of concrete mix for a visual color contrast between the ramp and the adjacent sidewalk.
5) All curb ramps shall be poured separately from any adjacent construction; such as, curb, sidewalk, or gutter.
6) When any portion of a curb ramp is damaged, the Contractor shall replace the entire curb ramp.

f. Driveways - In accordance with the requirements of Sections 90-2 "Materials" and 90-10 "Minor Concrete" of CTSS.

1) Curb Portion of Work - In accordance with the requirements of Sections 90-2 and 90-10 of CTSS.
2) Sidewalk Portion of Work - In accordance with the requirements of Sections 90-2 and 90-10 of CTSS.

4. Side Sewer Vent and Trap - In accordance with the requirements of State of California Department of Transportation Standard Specifications (CTSS), dated July, 1992.

SECTION 02510 ASPHALT CONCRETE PAVING

PART 1 GENERAL

1.1 DESCRIPTION

A. This Section includes specifications for constructing new asphalt concrete wearing surface Type A, 1/2-inch maximum with medium grading, at the locations and to the dimensions indicated on the Plans in accordance with these special provisions and as directed by the Engineer.

1.2 REFERENCE STANDARDS

A. State of California Department of Transportation Standard Specifications (CTSS), dated July, 1992.

1.3 PERFORMANCE QUALITY CONTROL

A. Compaction - In accordance with the requirements of Section 39-6.03 of CTSS.
B. Pavement Finish Irregularity Requirement: In accordance with the requirements of Section 39-6.03 of CTSS.

1.4 SUBMITTALS

A. Prior to starting construction, the Contractor shall submit the following items to the Engineer for approval. No resurfacing work shall be done prior to the approval of the following:

1. The asphalt concrete mix design including the amount of asphalt binder to be mixed with the dry aggregate. Asphalt concrete mix design shall conform to Section 39 of CTSS.
2. A sample of the filler and/or sealer material to be used for the filling and/or sealing work.

PART 2 PRODUCTS AND EQUIPMENT

2.1 MATERIALS

A. Asphalt: - In accordance with the requirements of Section 39-2.01 of CTSS, except that asphalt shall be AR-4000.
B. Aggregate for asphalt concrete wearing surface: In accordance with the requirements of Section 39-2.02 of CTSS, except that aggregate grading shall be as follows:

Sieve Sizes	Limits of Proposed Gradation	Operating Range	Contract Compliance

_”	----------	100	100
_”	----------	95-100	89-100
3/8”	----------	80-95	75-100
No. 4	59-66	X±5	X±8
No. 8	43-49	X±5	X±8
No. 30	22-27	X±5	X±8
No. 200	----------	3-8	0-11

Minimum durability index, when tested in accordance with Caltrans Test Method No. California 229, shall be 50.

2.2 EQUIPMENT

A. Spreading Equipment - In accordance with the requirements of Section 39-5.01 of CTSS.
B. Compacting Equipment - In accordance with the requirements of Section 39-5.02 of CTSS.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

A. Immediately before resurfacing, the Contractor shall, as Incidental Work, clean and repair cracks, and apply paint binder in areas to be paved.
B. Cracks larger than one (1) inch shall be filled or sealed with hot asphalt concrete as directed by the Engineer.
C. All cracks equal to or smaller than one (1) inch shall be filled or sealed with ready mixed asphalt slurry mixture, fiberated asphalt emulsion or any bituminous materials of equal quality.
D. Subgrade: In accordance with the requirements of Section 39-4.01 of CTSS.
E. The Contractor shall not proceed with the paving work until given written approval from the Engineer.
F. The temporary asphalt concrete fill or wedges on the concrete base reconstruction areas shall be removed by the Contractor before placing the asphalt concrete wearing surface. Refer to Section 02520, Article 3.2, Protection.
G. Preparation of subgrade to proper grade, including excavating, backfilling, and compacting shall be considered as Incidental Work where excavation is required to perform the work.

1. Asphalt shavings or grindings shall not be used as fill material.

3.2 INSTALLATION

A. Paint Binder - In accordance with the requirements of Sections 39-4.02 and 94-1.06 of CTSS.
B. Spreading - In accordance with the requirements of Sections 39-5.01, 39-6.01, and 39-6.02 of CTSS.
C. Compaction - In accordance with the requirements of Sections 39-5.02, 39-6.01, and 39-6.03 of CTSS.

SECTION 02520 PORTLAND CEMENT CONCRETE PAVING

PART 1 GENERAL

1.1 DESCRIPTION

A. This Section includes specifications for constructing new curb, sidewalk, concrete pavement, concrete base, driveways and curb ramps at the locations and to the dimensions shown on the Plans, in accordance with these Special Provisions and as directed by the Engineer.
B. Preparation of subgrade to proper elevation, including excavating, backfilling and compacting as required, shall be done as Incidental Work.
C. Refer to Section 03251 for Expansion Joint requirements.

1.2 REFERENCE STANDARDS

A. State of California Department of Transportation Standard Specifications (CTSS), dated July, 1992.

1.3 SPECIAL INSTRUCTIONS

A. Notifications:

1. Underground Service Alert:

a) Before commencing any excavation, obtain Underground Service Alert inquiry I.D. number by calling the following phone number:

Underground Service Alert: 1-800-642-2444

b) Allow four (4) calendar days after I.D. number is obtained and before excavation work is started so that utility owners can be notified.
c) I.D. numbers will not be given more than 10 calendar days prior to starting excavation work.

B. Curb Ramps:

Curb ramps shall be constructed in accordance with the details shown on Reference Standard Plan Numbers 62,171 and 62,172.

C. Broken Water Meters:

Replace any broken San Francisco Water Department meter boxes before pouring new sidewalk. Call Mr. Bill Olinger at (415) 550-4949 to pick up the meter boxes free of charge.

D. Temporary Asphalt:

1. The temporary asphalt concrete on the concrete base repair areas shall be removed by the Contractor before placing the asphalt concrete wearing surface.
2. Installing and removing the temporary asphalt concrete on the concrete base repair areas before placing asphalt concrete wearing surface shall be considered as Incidental Work.

1.4 SUBMITTALS

A. The Contractor shall submit eight (8) copies of manufacturer's literature, specifications, applications and installation instructions for Carbon Black (Grey or Charcoal Color) for Curb Ramps for the Engineer's approval.

PART 2 PRODUCTS

2.1 MATERIALS

A. Portland Cement: In accordance with the requirements of Section 90-2.01 of CTSS.
B. Aggregate: In accordance with the requirements of Section 90-2.02 of CTSS.

1. Combined Aggregate Gradings: In accordance with the requirements of Section 90-3.04 of CTSS.

C. Water: In accordance with the requirements of Section 90-2.03 of CTSS.
D. Admixtures: In accordance with the requirements of Section 90-4 of CTSS.
E. Carbon Black (Grey or Charcoal Color) for Curb Ramps: Carbon Black shall be extra high strength, non-floating, dispersible, non-glare, and unaffected by sunlight. It shall be composed of extremely fine sub-micron particle size, and shall not create the loss of concrete strength.

2.2 MIXES

A. Concrete Base and Concrete Pavement - In accordance with the requirements of Section 28 "Lean Concrete Base" of CTSS, except that the cement content shall be no less than 517 pounds of cement per cubic yard.

B. Concrete Sidewalk - In accordance with the requirements of Sections 90-2, "Materials" and 90-10 "Minor Concrete" of CTSS.
Concrete sidewalk shall be darkened with either:

1) Lampblack in dry form, in accordance with the requirements of ASTM "Standard Specifications for Lampblack," Designation D209, in the proportion of 1/2 to 3/4 pound per cubic yard of concrete; or
2) An approved liquid or semi-paste black colorant intended for use integrally in concrete mixes. The proportion required, generally from 10 to 40 ounces liquid measure per cubic yard of concrete, may be affected by the colorant used. Curing in this case shall be by the pigmented curing compound method.

The proportion of lampblack or other approved colorant, to a great extent dependent on the color of the cement used in the mix, shall be that required to properly darken the concrete to reduce glare, and shall be subject to the approval of the Engineer.

C. Concrete Curb - In accordance with the requirements of Sections 90-2, "Materials" and 90-10 "Minor Concrete" of CTSS.

D. Curb - In accordance with the requirements of Sections 90-2, "Materials" and 90-10 "Minor Concrete" of CTSS.

1. Curb Portion of Work: In accordance with the requirements of Sections 90-2 and 90-10 of CTSS.
2. Sidewalk Portion of Work: In accordance with the requirements of Sections 90-2 and 90-10 of CTSS.
3. Carbon Black (Grey or Charcoal color): Add three (3) pounds of Carbon Black with a dispersing agent per cubic yard of concrete mix for a visual color contrast between the ramp and the adjacent sidewalk.

E. Driveways - In accordance with the requirements of Sections 90-2, “Materials” and 90-10, “Minor Concrete” of CTSS.

1. Curb Portion of Work: In accordance with the requirements of Sections 90-2 and 90-10 of CTSS.
2. Sidewalk Portion of Work: In accordance with the requirements of Sections 90-2 and 90-10 of CTSS.

F. Concrete and minor concrete shall have a minimum compressive strength of 3,000 psi at 28 days.

PART 3 EXECUTION

3.1 PREPARATION

A. Preparation and Compaction of Subgrade: In accordance with the requirements of the following Sections of CTSS:

1. Concrete Curb: In accordance with the requirements of Section 73 of CTSS.
2. Concrete Sidewalk: In accordance with the requirements of Section 73 of CTSS.
3. Concrete Base and Concrete Pavement: In accordance with the requirements of Section 28 of CTSS.
4. Concrete Curb Ramps and Driveways:

a. Curb Portion of Work: In accordance with the requirements of Section 73 of CTSS.
b. Sidewalk Portion of Work: In accordance with the requirements of Section 73 of CTSS.

B. Preparation of subgrade to proper grade, including excavating, backfilling and compacting shall be considered as Incidental Work to the applicable bid items where excavation is required to perform the work.

1. Asphalt shavings or grindings shall not be used as fill material.

3.2 PROTECTION

A. Concrete base repair areas less than or equal to forty (40) square feet are to be temporarily filled with hot asphalt concrete to the level of adjacent existing pavement or gutter surface before opening to traffic.

B. Concrete base reconstruction areas greater than forty (40) square feet shall be ramped with a temporary 1:18 slope of hot asphalt concrete wedge constructed along any longitudinal and/or transverse drop-off exceeding 3/4 of an inch.

3.3 INSTALLATION

A. CONCRETE CURBS

1. Concrete Curb: In accordance with the requirements of Section 73 of CTSS.
2. Placing Concrete: In accordance with the requirements of Section 73-1.05A of CTSS.
3. Construction Joints: In accordance with the requirements of Section 73-1.05 of CTSS.
4. Finishing: In accordance with the requirements of Section 73-1.05A of CTSS.
5. Curing and Protection: In accordance with the requirements of Sections 90-10.04 and 90-10.05 of CTSS.
6. Repair and Replacement: In accordance with the requirements of Section 73-1.03 of CTSS.
7. Painting: In accordance with the requirements of Section 59-6 of CTSS.

B. CONCRETE SIDEWALK

1. Concrete Sidewalk - In accordance with the requirements of Section 73 of CTSS.
2. Construction - In accordance with the requirements of Section 73-1.06 of CTSS.
3. Finishing - In accordance with the requirements of Section 73-1.06 of CTSS.
4. Scoring - The surface shall be marked into rectangles not less than 2.5 nor more than 4 feet on a side, and shall match adjacent sidewalk pattern.
5. Joints - In accordance with the requirements of Section 73-1.06 of CTSS.
6. Curing and Protection - In accordance with the requirements of Sections 90-10.04 and 90-10.05 of CTSS.
7. Sidewalk shall not be constructed monolithic with curb except for sidewalk repair within existing curb return areas or curb ramp installation within existing curb return areas. In such cases the concrete mix shall conform to that of concrete curb. At new curb returns, sidewalk shall not be constructed monolithic with curb.
8. Street Names - On all sidewalks constructed at street intersections the names of the intersecting streets shall be impressed, opposite the crosswalk or crosswalks, as approved by the Engineer, in letters and numerals 4 inches high and 1/2-inch deep.

C. CONCRETE BASE AND PAVEMENT

1. Concrete Base - In accordance with the requirements of Section 28 of CTSS.
2. Placing Concrete - In accordance with the requirements of Section 28-1.05 of CTSS.
3. Protection and Curing - In accordance with the requirements of Section 28-1.07 of CTSS.
4. Joints - In accordance with the requirement of Sections 28-1.05 and 40-1.08B of CTSS.

D. DRIVEWAYS

1. Curb Portion of Work - In accordance with the requirements of Section 73 of CTSS.
2. Sidewalk Portion of Work: In accordance with the requirements of Section 73 of CTSS.

E. CURB RAMPS

1. Curb Portion of Work: In accordance with the requirements of Section 73 of CTSS.
2. Sidewalk Portion of Work - In accordance with the requirements of Section 73 of CTSS.
3. All curb ramps shall be poured separately from any adjacent construction; such as, curb, sidewalk, or gutter.
4. Curb ramps shall be constructed in accordance with Standard Plan numbers 62,171 and 62,172.

3.4 FIELD QUALITY CONTROL

The City may test to satisfactorily demonstrate the proper drainage of the constructed curb and gutter work. The City will flush with water approximately 50 feet of the upstream end of each curb and gutter work for two minutes with a minimum flow rate of 0.02 cubic feet per second or approximately 20 gallons equivalence. After five minutes, the Engineer and Contractor shall make a visual inspection of the gutter for ponding.

SECTION 02530 GROUND WATER CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

This section covers all work necessary to control ground water and surface water for all excavations as required for performance of the work.

1.2 RELATED SECTIONS

A. Section 02200 - Earthwork
B. Section 02221 - Trench Excavation and Backfill

1.3 BLANK

1.4 DEFINITIONS

A. Deep Excavation - Deep excavation shall be defined as any excavation extending below 5 feet from ground elevation.
B. Ground Water Levels and Initial Ground Water Levels - Ground water levels shall be defined as the levels of the ground water in a specific area as measured at any time during construction by the Engineer through observations and records made within observation wells installed at the site. Initial ground water levels shall be defined as the levels measured prior to the start of construction.
C. Hydrostatic Pressure and Initial Hydrostatic Pressure - Hydrostatic pressure shall be defined as the hydrostatic level measured at any time during construction by the Engineer through observations and records made in piezometers. Initial hydrostatic pressure shall be defined as the levels measured prior to the start of construction.

1.5 HANDLING OF GROUND WATER

A. The Contractor shall be responsible for the continuous control of ground water at all times during the course of construction, including Saturdays, Sundays, holidays and during periods of labor strikes.
B. The Contractor shall not discharge any ground water to the bay, nor any sediment, debris, or pollutants into the sewerage system.
C. Dewatering Discharge Handling During Site Excavation:

    1. Once the dewatered ground water has met the pre-treatment standards of this Section, such water may be discharged into the near-by manhole/sewer system. Temporary piping and pumping or other means of transporting the ground water to near by manhole/sewer system shall be at Contractor's expense.

D. Ground Water Pumped From the Excavation:

    1. Prior to discharging ground water to the sewer system, the Contractor shall ensure that the ground water being disposed of is of quality equal to the pre-treatment standards of:

a. Amended Article 4.1, Chapter X, Part II, San Francisco Municipal Code, Section 123, "Industrial Waste Ordinance #19-92" (hereafter in this Section referred to as "Industrial Waste Ordinance";
b. DPW Order No. 158170
c. DPW "Requirements for Batch Wastewater Discharge," latest issue.

2. Copies of the documents listed above are included in Section 12 of these Specifications.
3. The ground water samples shall be collected and tested by the Contractor.
4. Should the existing ground water become contaminated due to the Contractor's operations, all costs of satisfactory remediation and disposal shall be at the expense of the Contractor. Such costs shall include, but not be limited to: all re-design, reconstruction and pre-treatment costs necessary to satisfy the requirements of the regulations listed in Paragraph 1.5,D,1 above.
5. Should the existing ground water be found contaminated, or should it be uncontaminated but subsequently become contaminated due to conditions other than the Contractor's operations, all additional costs to pre-treat the contaminated water before routing the flow into the nearby sewer system (or other approved disposal at the direction of the Engineer) will be paid for as Extra Work.

E. The Contractor shall be responsible for obtaining all water discharge permits and for all costs of cleaning and repairing the sewerage system damaged by Contractor's operations, plus for all related administrative costs, penalties and other incidental fees and expenses resulting from discharging any groundwater and construction water into the San Francisco sewerage system as necessary to perform the work under the Contract Documents and as specified hereinabove.

1. The application for such wastewater discharge permit and the dewatering plan shall be sent to:

Mr. Tommy Lee
Department of Public Works
Bureau of Environmental Regulation and Management
3801 3rd Street, Suite 600
San Francisco, CA 94124
Telephone: (415) 695-7310.

2. The City will pay PUC/Environmental Regulation and Management (“BERM”) directly for the sewer service charge (discharge fee), pursuant to Part III, Chapter X, Articles 4. 1 and 4.2 of the San Francisco Municipal Code (Public Works Code/Resolution 540-94). The fee is based on flow volumes and fee constituents. The Contractor shall, therefore, install and maintain a flow meter (with a deviation of less than 10%) approved by DPW/BERM. All costs for installing and maintaining the flow meter shall be considered Incidental Work. No mark-up or mobilization fee is to be paid to the Contractor on the sewer service charge.

F. The Contractor shall remove all temporary lines and related connections upon completion of the work and shall restore all facilities to conditions prior to construction, to the satisfaction of the Engineer.

1.6. (BLANK)

1.7 (BLANK)

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

The Contractor shall provide all materials and equipment, including but not limited to: pipe, fittings, valves, pumps, tools, fuel and all other appurtenances in suitable and adequate quantities as required to perform the ground water control work.

SECTION 02607 ADJUSTMENT OF CITY-OWNED FRAMES AND CASTINGS

PART 1 GENERAL

1.1 DESCRIPTION

A. This Section includes specifications for resetting existing manholes, catch basins, and other City-owned street castings to new grade after resurfacing and reconstruction work.
B. City-Owned street castings include but are not limited to:

1. Department of Public Works (DPW)
2. Department of Electricity and Telecommunications (DET)
3. San Francisco Police Department (SFPD)
4. San Francisco Fire Department (SFFD)

1.2 REFERENCE STANDARDS

A. State of California Department of Transportation Standard Specifications (CTSS), dated July, 1992.

PART 2 PRODUCTS

2.1 MATERIALS

A. The Contractor shall furnish adjusting rings for resetting the low pressure and high pressure hydrant valve castings.
B. Raising devices to adjust the castings to grade shall be in accordance with the requirements of Section 15-2.05A of CTSS.

PART 3 EXECUTION

3.1 SPECIAL INSTRUCTIONS

A. Existing San Francisco Fire Department (SFFD) valves are to be accessible at all times.

3.2 INSTALLATION

A. The final layer of asphalt concrete shall be placed around each City-owned casting no later than two (2) calendar days after said casting has been adjusted and concrete has been placed.
B. Adjustment of manhole frames shall be in accordance with the requirements below:

1. GENERAL:

In order to insure a true, smooth pavement wearing surface, all frames and castings of manholes, catchbasins, curb inlets, vaults, valves, handholes, monuments, and other installations in the street and sidewalk area, hereinafter referred to as "castings," shall be reset accurately to the final finished pavement surface. Resetting includes extending or shortening the cones, barrels or risers of such structures as required for the proper adjustment of the castings. The work to be done by the Contractor and the "Owner," respectively, in connection with the required removal and resetting of such castings and the paving work relative thereto, shall be in accordance with the requirements hereinafter specified. The term "Owner," as used in this Section, means any person, company, firm, corporation or agency, private or governmental, owning or controlling utility facilities in public streets.

In the case of castings owned by the Department of Public Works, Department of Electricity, Police Department, Fire Department, and of the Auxiliary Water Supply System, the Contractor shall perform all necessary work in connection therewith, including the work herein specified to be performed by the Owner. All such castings shall be reset to finished pavement grade, and the subsequent repaving adjacent to the

castings shall be completed, not later than 7 calendar days after the surrounding wearing surface has been constructed unless otherwise specified in the special provisions.

The Contractor shall restore pavement around each casting after such casting has been properly reset to new pavement grade. If the pavement around such castings is not restored by the Contractor within twenty-four hours, the Contractor shall provide temporary bridging over each of the casting cut-out areas with a steel plate, approved by the Engineer, ramped to the adjacent pavement and secured against any movement. The bridging, including material and work related to, shall be done at the Contractor's sole expense.

The Contractor may enter into a private agreement with the Owner to do work that is the responsibility of the Owner, provided that such work will be done at no cost to the City.

2. CONSTRUCTION OR RECONSTRUCTION OF PAVEMENT:

Where pavement, or pavement base and wearing surface, is to be constructed, or if existing, is to be removed and reconstructed, the Contractor shall construct a box around each casting. The box shall be 5 feet square around sewer and vault manholes and proportionately dimensioned for other castings. The construction of pavement shall be temporarily omitted within the confines of the boxes. The Owner of each casting will then remove his castings, after which the Contractor shall carefully cover the openings in the exposed structures with planks not less than 2 inches thick and shall fill the boxed-out areas with a temporary pavement consisting of at least 4 inches of graded rock and 1 inch of asphalt concrete wearing surface.

After the pavement surrounding the boxes has been constructed, the Owners of the castings will remove the boxes and the temporary pavement from within them and will reset the castings to conform accurately with the finished pavement surface. Resetting will be done in a workmanlike manner using concrete base conforming to Section 02520, bricks set in Class "B" mortar, or rings or other approved devices.

After each casting has been satisfactorily reset to the finished pavement surface, the Owner will place, and compact, asphalt concrete in the entire boxed-out area around the casting to within 1 inches of finished pavement grade, upon which he will construct asphalt concrete wearing surface to finished pavement grade.

3. Adjustment of castings shall be considered Incidental Work.
4. ALTERNATIVE METHODS:

The Owners and the Contractor may agree to any modification of, or alternative to, the herein before specified methods of resetting castings, provided that application for the use of such modification or alternative is made in writing to, and is approved by, the Engineer.

SECTION 02608 ADJUSTMENT OF SFWD-OWNED FRAMES AND CASTINGS

PART 1 GENERAL

1.1 DESCRIPTION

A. This Section includes specifications for resetting existing San Francisco Water Department (SFWD)-owned frames and covers or gratings to new grade in connection with resurfacing work. All work in this section is considered Incidental Work.

1.2 REFERENCE STANDARDS

A. State of California Department of Transportation Standard Specifications (CTSS), dated July, 1992.

PART 2 PRODUCTS

2.1 MATERIALS

A. The SFWD will supply the required adjusting rings for the 6-inch and 8-inch valve box castings at the City Distribution Division Corporation Yard, 1990 Newcomb Avenue, San Francisco, at no cost to the Contractor.

PART 3 EXECUTION

3.1 SPECIAL INSTRUCTIONS

A. Existing San Francisco Water Department (SFWD) valves are to be accessible at all times.

3.2 PREPARATION

A. The Contractor shall notify the San Francisco Water Department, City Distribution Division, Telephone (415) 550-4949, four (4) working days in advance of scheduled work that requires resetting of valve castings larger than 8-inches in diameter.

3.3 INSTALLATION

A. Adjustment of San Francisco Water Department (SFWD) frames larger than 8 inches in diameter will be done by the Water Department, at no cost to the Contractor.

B. SFWD-owned castings, which can not be adjusted by placement of steel rings, shall be adjusted in the following manner, or as determined by the Engineer:

When reconstruction or adjustment of Riser Box is required, the Contractor shall partially remove existing pavement and concrete, as necessary. All damage to existing concrete which is to remain in place shall be repaired to a condition equal to that which existed prior to the beginning of reconstruction, adjustment, or removal. The cost of repairing existing concrete damaged by the Contractor's operations shall be at the Contractor's expense.

The Contractor shall excavate down to the top of existing valve and expose Gate Box. When that has been completed, the Engineer will determine if replacement is required. If replacement of the Gate Box is required, the Contractor will receive a material issue slip from the Engineer. The material issue request will be based on information provided by the Contractor, giving the length and size of pipe and amount needed, and must be delivered to the Engineer 24 hours in advance of the desired pick-up date. The Contractor will pick-up the required materials from the San Francisco Water Department's Corporation Yard at 1990 Newcomb Avenue, San Francisco. The material will be provided at no cost to the Contractor.

Installation shall be done in accordance with State of California Department of Transportation Standard Specifications (CTSS), dated July, 1992.

C. The Contractor shall take necessary precautions to prevent grindings or new asphalt from filling SFWD valve boxes during operations.

D. Placement of 6-inch and/or 8-inch steel rings on SFWD-owned castings shall be performed during paving operation, except when it is necessary to reconstruct as described above in 3.02-B.

A maximum of two (2) steel rings may be used for adjustment of SFWD castings to grade during paving operation.

Any SFWD-owned casting which cannot be satisfactorily adjusted by using no more than two (2) steel rings will require reconstruction as described in 3.3-B above.

E. Adjustment of SFWD-owned castings shall be considered Incidental Work.

SECTION 02609 ADJUSTMENT OF NON-GOVERNMENTALLY OWNED FRAMES AND CASTINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This Section include specifications for resetting existing manholes, frames, and other Non-Governmentally-Owned street castings to new grade after resurfacing work. The Contractor shall be responsible for negotiating an agreement for payment with the Owner(s) of privately owned manholes, frames and castings to be adjusted to new grades.

B. Non-Governmentally-Owned Include but are not limited to the following companies:

1. Pacific Gas and Electric Company
2. Pacific Bell
3. TCI of San Francisco
4. MCI Telecommunications
5. GTE/Sprint Communications

1.2 REFERENCE STANDARDS

A. State of California Department of Transportation Standard Specifications (CTSS), dated July, 1992.

PART 2 (BLANK)

PART 3 EXECUTION

3.1 INSTALLATION

A. The final layer of asphalt concrete shall be placed around each Non-Governmentally-owned casting no later than two (2) calendar days after said casting has been adjusted and concrete has been placed.

B. Adjustment of manhole frames and other castings shall be in accordance with the requirements of Sections 15-2.05A and 70 of CTSS.

C. Adjustment of Pacific Gas and Electric Company, Pacific Bell, and Pacific Telephone and Telegraph Company owned manhole frames and covers to grade shall be done in accordance with the requirements of Sections 15-2.05A and 70 of CTSS.

SECTION 02830 CHAIN LINK FENCING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Work Included: Provide all material, labor, equipment and service necessary for the furnishing and installation of chain link fencing and gates, as shown on the Drawings and as specified herein. The work includes, but is not limited to:

1. Galvanized chain link fencing and lockable gates.
2. Finish hardware.
3. Replacement of unsatisfactory materials.
4. Temporary Construction Fencing.
5. Connecting existing fencing to new fencing

1.2 RELATED SECTIONS

A. Section 02520 - Portland Cement Concrete Paving
B. Section 02510 - Asphalt Concrete Pavement

1.3 REFERENCES

A. Section 80-4, State of California Department of Transportation Standard Specifications (CTSS), dated July, 1992.

1.4 QUALITY ASSURANCE

A. Provide chain link fence as complete units controlled by a single source including: necessary erection accessories, fittings, and fastenings. A single installer shall perform the work of this section, and the installer shall have not less than 5 years of successful experience in installation if chain link fences similar to those required for this Contract.
B. Fence shall be erected by skilled mechanics in accordance with the best practice of the trade in accordance with the recommendation of the Chain Link Fence Manufacturer's Institute.

1.5 SUBMITTALS

A. Submit the following to the Engineer for approval, in accordance with requirements of Section 12-1.06 of these Specifications.

1. Product Data: Manufacturer’s technical data and installation instruction for metal fencing, fabric and accessories.
2. Shop Drawings: Indicate thicknesses, dimensions, fastenings, hinges, and post anchoring method. Required shop drawings are to be prepared by a California State Licensed Civil Engineer. Provide separate drawings for each of the following:

   a. Post layout and fence material.
   b. Post anchoring system.
   c. Connection of new fencing to existing fencing

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

All material shall be delivered and unloaded at job site on pallets and bound in such a manner that no damage occurs to the product during hauling, handling, or unloading at the job site.

PART 2 PRODUCTS

2.1 MATERIALS

A. Section 80-4.01 of CTSS.
B. All fencing material including hardware shall be hot dipped galvanized.
C. All fencing shall have top and bottom rails.
D. Fence fabric shall be nine (9) gauge, core one inch (1") square mesh, with a minimum breaking strength of 1,290 pounds.

PART 3 EXECUTION

3.1 INSTALLATION

A. Section 80-4.02 of CTSS.
B. Fence and gate heights, widths and locations are shown on plans.

C. Footings shall be in accordance with Section 03300, Concrete, of these Specifications.

SECTION 03210 REINFORCING STEEL

PART 1 GENERAL

1.1 WORK INCLUDED

A. This Section covers the work necessary to furnish and install, complete, the reinforcing steel and welded wire fabric.

1.2 REFERENCE STANDARDS

A. American Concrete Institute - Building Code Requirements for Concrete Structures, ACI 318-95.
B. American Concrete Institute - Concrete Sanitary Engineering Structures, ACI 350R-89.
C. City and County of San Francisco Standard Specification Section 411-05.
D. City and County of San Francisco Building Code.

1.3 SUBMITTALS

A. Submit the following items per Section 12:
B. Bending Lists
C. Placing Drawings
D. Lab Test Reports Showing Stress-Strain Curves and Ultimate Strengths
E. Provide two samples of all sizes of reinforcing steel 4 feet long to the location designated by the Engineer for testing by the State.

1.4 RELATED SECTIONS

A. Section 02200 - Earthwork
B. Section 03251 - Expansion, Construction and Control Joints
C. Section 03300 - Concrete
D. Section 05500 - Fabricated Metalwork and Miscellaneous Items

1.5 QUALITY ASSURANCE

A. Tolerances for reinforcing steel and mechanical splice material and installation shall conform to the requirements specified herein.

1.6 DELIVERY, STORAGE AND HANDLING

A. Reinforcement shall be shipped and stored with bars of the same size and shape fastened in bundles with durable tags, marked in a legible manner with waterproof markings showing the same designations as shown on the submitted Drawings.
B. Reinforcement shall be stored off the ground and shall be protected from moisture and kept free from dirt, oil, or other injurious contaminants. All steel which cannot be properly identified will be rejected, and shall be immediately removed from the job site.

PART 2 PRODUCTS

2.1 DEFORMED REINFORCING BARS

A. Deformed billet-steel bars conforming to ASTM A615, Grade 60, including Supplemental Requirements S1 where welding is not required, or deformed bars conforming to ASTM A706, Grade 60, including the Supplement

Requirements for all reinforcing to be welded. Grade 60, unless otherwise shown on the Drawings, bars shall be furnished for all stirrups and column ties.

2.2 SPLICES CONNECTIONS

A. Splices other than lap splices shall not be used except where specifically indicated or permitted in writing by the Engineer.

PART 3 EXECUTION

3.1 GENERAL

A. Conform to "Placing Reinforcing Bars", Recommended Practices, Joint Effort of CRSI-WCRSI, prepared under the direction of the CRSI Committee on Engineering Practice. All bars shall be bent cold.
B. Notify the Engineer when reinforcing is ready for inspection and allow sufficient time for this inspection prior to casting concrete.

3.2 DELIVERY AND STORAGE

A. Deliver steel with suitable hauling and handling equipment. Tag steel for easy identification. Store to prevent contact with the ground. The unloading, storing, and handling bars on the job shall conform to CRSI publication "Placing Reinforcing Bars".

3.3 PLACING REINFORCING STEEL

A. Cleaning - Clean metal reinforcement of any loose mill scale, oil, earth, and other contaminants.
B. Straightening and Rebending - Do not straighten or rebend metal reinforcement. Where construction access through reinforcing is a problem, bundling or spacing of bars instead of bending shall be used. Submit details and obtain Engineer's review prior to placing.
C. Protection, Spacing, and Positioning - Conform to the current edition of the ACI Standard Building Code Requirements for Reinforced Concrete (ACI 318), reviewed placing drawings and design drawings.
D. Location Tolerances - Conform to the current edition of "Placing Reinforcing Bars" published by Concrete Reinforcing Steel Institute and to the Details and Notes on the Drawings.
E. Splicing: Conform to Drawings and current edition of ACI Code 318. Splices in adjacent bars shall be staggered by 4'-0" minimum.
F. Tying Deformed Reinforcing Bars - Conform to the current edition of "Placing Reinforcing Bars" published by Concrete Reinforcing Steel Institute and to the Details and Notes on the Drawings. Mats made up of #3 - #4 - #5 - #6 shall have every other intersection tied in such a manner to hold bars at required spacing.
G. Reinforcement Around Openings - Place an equivalent area of steel around the pipe or opening and extend on each side sufficiently to develop bond in each bar. See the Details on Drawings for bar extension length each side of opening. Where welded wire fabric is used, provide additional reinforcing using fabric or deformed bars.
H. Welding Reinforcement - Welding shall not be permitted unless the Contractor submits detailed shop drawings, qualifications, and radiographic nondestructive testing procedures for review by the Engineer. Reinforcing bars to be welded shall conform to ASTM A706; other bars shall not be welded. The Contractor shall obtain the results of this review prior to proceeding. The basis for the Contractor submittals shall be Structural Welding Code, Reinforcing Steel, AWS Dl.4-79, published by the American Welding Society and the applicable portions of ACI 318, current edition. The Contractor shall test 10 percent of all welds using radiographic, nondestructive testing procedures referenced in this code.

3.4 FIELD BENDING

A. Field bending of reinforcing steel bars is not permitted when rebending will later be required to straighten bars. Rebending of bars at the same place where strain hardening has taken place due to the original bend will damage the bar. Consult with the Engineer prior to any pour if the Contractor foresees a need to work out a solution to prevent field bending.

SECTION 03251 EXPANSION, CONSTRUCTION AND CONTROL JOINTS

PART 1 GENERAL

1.1 WORK INCLUDED

A. This Section covers the work necessary to furnish and install, complete, the expansion, construction, and control joints including all premolded, pourable, and gun grade fillers.

1.2 SUBMITTALS

A. Submittals shall be made in accordance with Section 12-1.06 - Submittals

1.3 RELATED WORK

Section 03300 - Concrete

PART 2 PRODUCTS

2.1 BOND BREAKER TAPE FOR EXPANSION JOINTS

A. Where shown, bond breaker tape shall be an adhesive-backed glazed butyl or polyethylene tape which will satisfactorily adhere to the premolded joint material or concrete surface as required. The tape shall be the same width as the joint.

2.2 PREMOLDED JOINT FILLER

A. Bituminous Type: Bituminous type conforming to ASTM D994 or D1751, unless otherwise shown or specified.
B. Sponge Rubber at Contractor's Option: Neoprene, closed-cell, expanded, conforming to ASTM D1056, Type RE-45-El with a compression deflection, 25 percent deflection (limits), 119 to 168 kPa (17 to 24 psi) minimum.

2.3 BOND BREAKER

A. Bond breaker, except where a tape is specifically called for, shall be either bond breaker tape as hereinbefore specified or a bond prevention material, nonstaining type, as specified in Section 03300 CONCRETE.

2.4 PREFORMED CONTROL JOINT

A. Preformed control joint for slabs on grade shall be a one-piece, flexible, polyvinyl chloride joint former such as Kold-Seal Zip-Per Strip KSF-150-50-50, manufactured by Vinylex Corp., Knoxville, TN; Heckman Building Products, Inc., Chicago, IL; or equal, or a one-piece steel strip with preformed groove, such as Keyed Kold Retained Kap, manufactured by Burke Concrete Accessories, Inc., San Mateo, CA; Heckman Building Products, Inc., Chicago, IL; or equal. The preformed control joint material shall be furnished and installed in full-length unspliced pieces, unless otherwise approved by the Engineer.

PART 3 EXECUTION

3.1 JOINT PREPARATION

A. General:

1. The joints shall be accurately located and constructed to produce straight joints; and shall be vertical or horizontal, except where walls intersect sloping floors.

2. The concrete pour shall not commence until after the joint preparation has been inspected and approved by the Engineer.

B. Construction Joints:

1. Prior to placing the abutting concrete for all construction joints, the contact surface shall be cleaned by sandblasting or other approved means to remove all laitance, expose the aggregate, and roughen surface to a minimum of 1/4-inch amplitude. The exposed portion of the reinforcing steel shall be cleaned of all concrete. The cleaning method shall be conducted so as not to damage the water stop, if one is present. Grout for horizontal construction joints shall be as specified in Section 03300 CONCRETE.
2. Roughen the surface of the hardened concrete by one of the following methods:

   a. Sandblasting the foundation and reinforcing dowels after the concrete has fully cured to remove all laitance and spillage, and to expose sound aggregate
   b. Water blasting the foundation and reinforcing dowels after the concrete has partially cured to remove all laitance and spillage, and to expose sound aggregate
   c. Green cutting fresh concrete with high pressure water and hand tools to remove all laitance spillage from the foundation and reinforcing dowels, and to expose sound aggregate

C. Location - Locate construction joints as shown on the Drawings, or as approved.
D. Time Between Pours - At least 2 hours must elapse after depositing concrete in long or high columns and/or heavy walls before depositing in beams, girders, or slabs supported thereon. For short columns and low height walls, 10 feet or less, wait at least 45 minutes prior to depositing concrete in beams, girders, brackets, column capitals, or slabs supported thereon. Beams, girders, brackets, column capitals, and haunches shall be considered as part of the floor or roof system and shall be placed monolithically therewith. Where cold joints will result and this joint will be below the finished water surface, provide and install a water stop in the joint.

3.2 EXPANSION JOINTS

A. General:

1. The premolded joint filler shall be of sufficient width to completely fill the joint space, unless shown otherwise on the Drawings. If a water stop is in the joint, the premolded joint filler shall be accurately cut to butt tightly against the water stop and the side forms.
2. At locations where joint sealant or filler is to be applied, the premolded joint filler shall be precut to the required depth, see details on Drawings.
3. Cavities for joint sealant or joint filler shall be formed with either precut, premolded joint filler; or smooth, accurately-shaped material that can be removed.
4. Concrete shall be thoroughly vibrated along the joint form to produce a dense, smooth surface. Surface irregularities along the joint sealant cavity, due to improper concrete consolidation or faulty form removal, shall be repaired with an approved compound compatible with the joint sealant or joint filler in a manner that is satisfactory to the manufacturer.

B. Installation of Bituminous or Closed Cell Types of Premolded Joint Filler: Drive nails at about 1 foot on centers through the filler to provide anchors into the concrete when it is placed. Place premolded joint filler in the forms in the proper position before concrete is poured.

SECTION 03300 CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This Section covers the requirements for furnishing and installing, complete, concrete as required under the Contract Documents.

B. The work of this Section includes coordinating, forming, mixing, placing, curing, finishing, patching, and doing all appurtenant work as required to produce finished concrete.
C. The following types of concrete are covered in this Section:

1. Cast-in-place structural concrete for chlorination facility structure.
2. Structural concrete for transformer foundation pad and miscellaneous concrete pads or footings.
3. Lean concrete for constructing concrete fill for over excavation.

D. Coordinate the work of this Section with interfacing and adjoining work for proper sequencing of installations such as waterstops, anchor bolts, conduit embedments, penetration sleeves, and electrical stub-ups.

1.2 RELATED SECTIONS

A. Section 03210 - Reinforcing Steel
B. Section 03251 - Expansion, Construction and Control Joints Section 05500 - Fabricated Metalwork and Miscellaneous Items Section 08111 - Standard Steel Doors and Frames
C. Section 15000 - General Mechanical Requirements Section 16050 - Basic Electrical Materials and Methods

1.3 REFERENCES

A. Codes - San Francisco Building Code.
B. Standard Specifications:

1. Section 411, "Concrete Structures."
2. Section 800, "Portland Cement Concrete and Related Material and Work."

C. American Concrete Institute (ACI):

1. ACI 301, Specifications for Structural Concrete for Buildings.
2. ACI 315, ACI Detailing Manual (SP-66).
3. ACI 318, Building Code Requirements for Reinforced Concrete.
4. ACI 350, Concrete Sanitary Engineering Structures.

1.4 SUBMITTALS

A. Prior to beginning the work, the Contractor shall submit the following in accordance with Section 12-1.06, "Submittals."

1. Shop Drawings: Submit the following shop drawings, schedules, mix designs, and reports prepared and sealed by a civil engineer registered in the State of California.

a. Schedule and sequence of placing concrete.
b. Shop drawings showing the location of all reinforcing steel, splices, construction joints, waterstops, anchorages, embedments, penetrations, and other items to be installed in cast-in-place concrete.
c. Certified copies of concrete mix design and trial mix laboratory test reports.

2. Records and Certifications

a. Special Inspection Reports of concrete compression, yields, air content, and slump by approved testing laboratory: Submit reports to the Engineer and Department of Building Inspection.
b. Certification for aggregate quality, including a statement from an independent laboratory that the aggregates to be used are not reactive.
c. Manufacturer's certifications and instructions for concrete admixtures, concrete coloring agents and admixtures, bonding agents, and bond breakers hereinafter specified. When a water reducing admixture is to be used, the Contractor shall furnish mix designs for both concrete with and without the admixture.

d. Certified Delivery Tickets: Where ready-mix concrete is used, the Contractor shall provide certified delivery tickets at the time of delivery of each load of concrete. Each certificate shall show the state certified equipment used for measurement and the total quantities, by weight of cement, sand, each class of aggregate, admixtures, and the amounts of water in the aggregate and added at the batch plant as well as the amount of water to be added at the site for the specific design mix. Each certificate shall also state the mix number, total yield in cubic yards, and the time of day, to the nearest minute, corresponding to when the batch was dispatched, when it left the plant, when it arrived at the job, the time that unloading began, and the time that unloading was completed.

1.5 QUALITY ASSURANCE

A. General: All materials testing required by Section 306, "Special Inspections" of the San Francisco Building Code shall be approved by the Department of Building Inspection. Tests on component materials and for compressive strength will be performed as specified herein. Test for determining slump will be in accordance with the requirements of ASTM C143.

B. Coordination: The Contractor shall be responsible for installation and provision of holes, sleeves, waterstops, anchor bolts, conduit embedments, electrical stub-ups, and other appurtenant accessories embedded in concrete. Patching or cutting made necessary by failure or delay in complying with this requirement shall be at no additional cost to the State.

C. Field Sampling and Testing: Sampling and testing will be performed by the City's testing agency at no charge to the Contractor to determine compliance with the Specifications. However, the Contractor will be charged for the cost of any additional tests and investigation on work performed which does not meet the Specifications.

D. Field Compression Tests:

1. Compression test specimens will be taken during construction from the first placement of each class of concrete specified herein and at intervals thereafter as specified by the Engineer to ensure continued compliance with these Specifications. Minimum number of tests shall be as called for in ASTM C94.
2. Plastic cylinder molds meeting ASTM C470 shall be provided by the Contractor in such quantities as necessary. Compression test specimens for concrete shall be made in accordance with ASTM C31.
3. The Contractor shall be responsible for supplying all facilities for protection and controlled temperature curing of concrete cylinders in the field in accordance with ASTM C31. Field curing facilities shall be located in close proximity to the concrete discharge area. The compressive strength determined for such purposes will be evaluated on the basis of individual tests made using the field cured specimens.
4. Compression tests shall be performed in accordance with ASTM C39.

PART 2 PRODUCTS

2.1 GENERAL

A. The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired only. Products of other manufacturers will be considered in accordance with Cal-Trans Standard Specifications.

2.2 CEMENT

A. Portland cement Type I or Type II conforming to ASTM C150, including the low alkali provisions of Table 1A of that specification. In addition, the tricalcium aluminate content of Type I cement shall not exceed 12 percent.

B. For all structures, use Type II cement or, at the Contractor's option, use the combination of Type I mixed with fly ash. At the Contractor's option, fly ash may be used in combination with any cement as long as all requirements of these Specifications are met. The fly ash may be combined at the batch plant or during the production of the cement (Type I cement). For the combination fly ash and cement, the cement and fly ash shall comply with these Specifications.

2.3 WATER

A. Clean and free from oil, acid, alkali, organic matter, or other deleterious substances.

2.4 CONCRETE AGGREGATES

A. Normal Weight Aggregates:

1. Natural aggregates:

   a. Free from deleterious coatings, conforming to ASTM C33, together with all referenced ASTM Standard Specifications, except as modified herein. Aggregates shall not be potentially reactive as defined in Appendix XI of ASTM C33. The Contractor's attention is directed also to paragraph XII of Appendix XI of ASTM C33. Reactive aggregates shall not be used. The Contractor shall be responsible for meeting these Specifications and shall import nonreactive aggregates if local aggregates are reactive. Aggregates shall be thoroughly and uniformly washed before use.
   b. Cleanness values and sand equivalent values shall conform to California Department of Transportation Standard Specifications, July 1992.

2. Fine Aggregates - Conform to ASTM C33. Materials finer than the 200 sieve shall not exceed 4 percent. Use only clean, sharp, natural sand.
3. Coarse Aggregate - Use only natural gravels, a combination of gravels and crushed gravels, crushed stone, or a combination of materials containing no more than 15 percent flat or elongated particles (long dimension more, than five times the short dimension). Materials finer than the 200 sieve shall not exceed 0.5 percent.

2.5 GROUTS

A. Non-shrink Grout - Use only grout from an approved manufacturer. Follow manufacturer's instruction relating to mixing, testing, placing and curing.

1. Nonshrink Grout, Category I:

   a. Non-shrink, nonmetallic, nongas-liberating grout for use in filling tie holes in concrete, and blockouts for gate guides shall be one of the following:

      1) Crystex, L & M Construction Chemicals, Inc., Omaha, NE;
      2) EUCO NS grout, Euclid Chemical Co., Cleveland, OH;
      3) Set grout, Master Builders Co., Cleveland, OH;
      4) Supreme grout, Gifford Hill & Co., Dallas, TX;
      5) UPCON "Super Flow", UPCON Co., Cleveland, OH;
      6) or equal.

   b. All grout shall be a fluid consistency in use, as determined by the flow cone, CRD-611-80, with a flow of 22-25 seconds, except that for formwork tie holes, the grout shall be dry pack consistency and shall fill the conical section with dense grout hammered in with steel tool and steel hammer.

2. Non-shrink Grout, Category II

   a. Use Category II grout for filling formwork through bolt openings and for patching defects in walls and slabs after removal. Non shrink grout with natural aggregate shall conform to the Corps of Engineers' Specification for Non-Shrink Grout, CRD-C621-83, and to these Specifications. Fluid grout as determined by the flow cone, CRD-C611-80, shall have a flow of 22 to 25 seconds, shall meet CRD-C62-81 at 40 degrees F to 80 degrees F. Grout must be fluid and be able to be placed for 15 plus or minus 5 minutes from mixing, and shall have a minimum strength of 4,500 psi at 7 days and 6,500 psi at 28 days when tested at a 22 to 25 seconds flow and at temperature range specified above.
   b. The grout shall be as:

      1) Conbextra High Flow, Fosroc, Twinsburg, OH;

2) EUCO NS Grout, Euclid Chemical Co., Cleveland, OH;
3) Master Flow 713, Master Builders, Cleveland, OH;
4) Supreme grout, Gifford Hill & Co., Dallas, TX;
5) UPCON "Super Flow", UPCON Division, Cleveland, OH;
6) Crystex, L & M Construction Chemicals, Inc., Omaha, NE;
7) or equal.

c. Follow manufacturer's instructions relating to mixing, testing, placing and curing.

B. Grout for Horizontal Construction Joints in Walls - Grout shall be flowable and shall consist of sand, water, and a minimum of 12 sacks of cement per cubic yard. Provide positive measuring device such as a bucket or other device that will contain only enough grout for depositing in one place in the wall to ensure that portion of the form does not receive too much grout. The depositing of grout from pump hoses or large concrete buckets will not be permitted, unless inspection windows close to the joint are available to allow visual measurement of grout thickness and means for grout removal are available for removal of excess grout.

C. Sand-Cement Dry Pack - Use sand-cement dry pack for patching and re-surface concrete edges, such as the removed concrete in wall/slab for new openings.

1. Sand shall be natural or manufactured, and free of organic impurities or deleterious substances in accordance with ASTM C404. Grading shall be: 100% passing through No. 4mesh sieve and no more than 10% passing through No. 100 mesh sieve. Cement shall be in accordance with ASTM C150 and shall be Type II.
2. Sand shall be used at two parts for every part of cement by weight, mixed with a minimum amount of water for placement. Water added shall not exceed 25% of the cement weight.

D. Concrete Topping - Use concrete topping to level or raise floor at new finish floor elevation. All concrete requirements in this section for concrete are applicable, except that the aggregates shall be pea gravels (3/8").

2.6 CONCRETE ADMIXTURES

A. Air-Entrainment Admixture - Provide air-entraining admixture in all concrete. Admixture shall conform to ASTM C260, except it shall be nontoxic after 30 days and shall contain no chlorides. Concrete with air-entrainment admixture added shall maintain the air percentage as batched, within 2 percent for a minimum of 1-1/2 hours after addition of admixture and through concrete pump-up. Furnish manufacturer's compliance statement for these requirements.

B. Water-Reducing and Superplasticizing Admixture - Water reducing admixture shall conform to ASTM C494, Type A or Type D. Superplasticizer admixture shall conform to ASTM C494, or Type F or Type G. Admixtures shall contain, no chlorides, shall be nontoxic after 30 days in concrete, and shall be compatible with the air-entraining admixtures. The amount of admixture added to the concrete shall be in accordance with the manufacturer's recommendations. Type F or Type G admixtures shall be a second or third generation superplasticizer and be added at the batch plant and be able to hold slump within 4 inches of that batch for up to 2 hours. No first generation superplasticizer requiring jobsite addition or addition of Type D retarders to meet this time-slump requirement will be allowed. Furnish a compliance statement that the admixture used satisfies all requirements of this Specification.

C. Pozzolan Admixture:

1. The pozzolan used in combination with cement, shall be Class C or Class F fly ash conforming to ASTM C618-84, including the requirements of Table 1 and 2, except as modified hereinafter:

Loss on Ignition, maximum	3%
Water Requirement, Maximum Percent of Control	100%
[CaO (%) - 5] /Fe_2O_3	1.5

a. OR, for fly ash not meeting the requirements of the chemical ratio listed above, the Contractor and/or supplier shall test the fly ash in accordance with ASTM C1012 and furnish test data confirming that the fly ash in combination with the cement to be used meets all strength requirements, is compatible with air-entraining agents and other additives, and provides increased sulfate resistance equivalent to or better than Type II cement. The tests shall be conducted using the proposed fly ash and cement samples together with control samples using Type II cement without fly ash.

D. Integral Color:

1. General:

All concrete above grade, unless otherwise noted, shall contain integral pure color concentrate as manufactured by Davis Colors, L. M. Scofield or equal. The color shall be Davis Colors "Miami Buff" color concentrate 5447 at an addition rate of one pound per ninety four pound sack of cement.

2. Mock-Up:

a. All construction materials for the mock-up must be those planned for use during the actual construction. Use the mock-up as a place to confirm any decisions about form release agents, forming details, mix design, etc., (Samples of the actual cement and aggregates used should be retained).
b. Pick a section or sections of the building which typify the most difficult area to build.
c. Include the full allocation of reinforcing steel that will appear in the Contract work.
d. Use a forming system that consists of all forming conditions in the Contract work.
e. The mock-up should include a repaired area to determine ahead of time an acceptable color and texture match for use in patching of honeycombing or tie holes is needed. See paragraph below entitled "Patching Colored Concrete."

3. Quality Control:

a. The concrete temperature should be kept consistent - concrete temperatures between 65 degrees and 85 degrees Fahrenheit will normally produce uniform color.
b. It is important that the scheduling of trucks is such that they arrive just before the concrete is required. This avoids excessive mixing of concrete while waiting.
c. Design of forms should be such to prevent pillowing and deflection of forms. When using a natural wood form, a cement slurry coal with the appropriate DAVIS COLORS should be applied to seal the surface of the forms prior to the first pour. Release agents must be nonstaining.
d. Methods of conveying and placing should conform with the requirements of ACI-304-89.
e. The concrete should normally be deposited in lifts 12" to 18" thick. The layers should be fairly level so that the vibrator does not need to move the concrete laterally.
f. Vibration - The distance between insertions should generally be about 18" depending on the concrete mix and vibrator used. The vibrator should penetrate at least 6" into the preceding layer. Do not over vibrate.

4. Patching Colored Concrete:

a. All repair work must be done within a few days after form removal so the repair and surrounding concrete age together, thereby minimizing the possibility of color variation. The same materials and techniques should be used that were approved on the mock-up.
b. White cement must be added to the patching mix to overcome the fact that a patch area will normally dry darker. Blend proportions must be done by trial and error; however, one part of white cement and one part of gray cement is a good starting place. Add 1-1/2 parts sand to 1 part of the mixture of white and gray cement. For best color matching, use the cement and sand used on the job.
c. IMPORTANT . . . the color added to the patch mix should be the same ratio as the original color/cement ratio on the job. The white cement used to lighten the patch should not be included when figuring the color/cement ratio for patching.

E. Liquid Water-repellent (LWR):

1. System 1 (LWR-1) - Opaque Concrete Stain - Interior Surfaces Below Grade:

   a. Apply liquid water-repellent (LWR) to all interior concrete walls and ceilings below grade excluding concrete protective coating areas unless otherwise noted on Architectural Finish Schedule.
   b. The Product shall be a pure acrylic, water-repellent penetrating stain that contains methyl methacrylate ethyl acryalite copolymer resins and inorganic oxide toning such as Canyon Tone Stain as manufactured by United Coating, or Concrete Waterproofing of California Inc., or approved equal. Color shall be "bright white." Selected concrete stain shall be test compatible with the integral colored concrete. Minimum coverage shall be 150 square feet per gallon in two applications. Surface preparation and application method shall be in accordance with manufacturer's instructions.

2. System 2 (LWR-2) - Clear Concrete Sealer - Exterior and Interior walls above grade:

   a. All exterior and interior walls above grade shall be integrally colored and shall receive a clear coat of liquid water-repellent (LWR).
   b. The product shall be a pure acrylic water-repellent penetrating sealer that contains pure, non-yellowing Methyl Methacrylate-Ethyl Acrylate copolymer resins such as Canyon Tone clear as manufactured by United Coatings, or Concrete Waterproofing of California Inc., or approved equal. Minimum coverage shall be 150 square feet per gallon in two applications. Surface preparation and application method shall be in accordance with manufacturer's instructions.

F. Clear Floor Hardener (Surface Applied):

All floor and base slab surfaces shall receive clear floor hardener. The floor hardener shall be a colorless, aqueous solution of zinc and/or magnesium floro-silicate, or of sodium silicate. Each gallon of the fluoro-silicate solution shall contain not less than 2 pounds of crystals. The sodium silicate solution shall be 32 percent by volume of 42-degree Baume sodium silicate. An approved proprietary hardener such as Saniseal, a product of master Builder Company; or Hornolith, a product of Grace Construction Materials, Los Angeles CA; or equal, may be used provided the solution is delivered ready for use in the manufacturer's original sealed containers.

G. Anti-graffiti coatings: Anti-graffiti coatings shall be applied on exterior finished concrete wall surfaces exposed to the public areas, such as streets, sidewalks and unfenced yards.

1. Samples - when applied over painted or stained surfaces, submit samples with coating applied over paint or stain for approval of color by Engineer.
2. Coating systems - permanent clear polyurethane water based which is compatible with stained concrete and painted metal surfaces.
3. Acceptable manufacturers - Genesis Coatings Corp., Carlsbad, CA, (800) 533-4273; Aquathane UA-210H-A/G; Edison Coatings, Inc, Waterbury CT, (203) 597-9727; or equal.
4. Preparation - Protect freshly placed concrete surfaces from vandalism until application. Remove all dirt, dust, graffiti, form coatings, bondbreaker, and other foreign materials which adversely affect proper application.
5. Application - apply 2 coats with a total dry fil thickness of not less than 2 mils each coat in accordance with manufacturer’s instructions.
6. Height - minimum 10 feet measured from the finished ground level.

2.7 FORM MATERIAL

A. Wall Forms:

1. General:

   a. Form surfaces shall be in "new and undamaged" condition and may be plywood, hard plastic finished plywood, overlaid waterproof particle board, fiberglass and steel of sufficient strength and surface smoothness to produce the specified finish.

b. All joints in forms shall be designed so that the joint will remain watertight and withstand placing pressures without bulging outward or creating surface patterns. Formwork that leaks mortar shall not be used. Form surfaces that have been damaged and are no longer in a smooth "new and undamaged" condition shall not be reused except in areas where finish is not required.
c. The Contractor shall comply with all form tie requirements included in the various sections of this Specification.

2. Double Wall Construction:

a. Formwork required for wall construction composed of concrete wall adjacent to the existing wall with polystyrene between the adjacent surfaces, as shown on the Drawings, shall meet all of the requirements specified herein.
b. The form for the new wall shall be rigid and strong enough to maintain the finish surface straightness within the tolerances hereinafter specified under paragraphs FORM TOLERANCES and WALL TOLERANCES. Do not use form ties that penetrate the wall. Forms shall be designed by the Contractor to be structurally sound, meeting all specification requirements, and be braced back to the base slab and in a manner that will not cause damage or overstress to any permanent construction, including the existing wall.
c. No form ties or other metallic objects shall be embedded into both walls so as to produce a tie between the walls. Attachments may be used to secure the premolded joint filler to one wall only, and this premolded joint filler shall be secured and be without gaps or separations so that concrete from the second wall pour does not penetrate the thickness or space to be occupied by the premolded joint filler.
d. The finished double wall construction shall provide a space between the walls occupied only by the premolded joint filler and/or sealant specified so as to minimize any resistance of movement from one structure to the other.
e. Show the details of the wall forming and premolded joint filler attachment on a submittal to the Engineer.
f. Alternate forming systems will be considered - The Contractor submits complete shop drawings including forming system to be used, bracing methods, concrete placement procedures, and calculations. The calculations shall be signed and sealed by a professional engineer registered in the State of California. No ties will be permitted to penetrate the second wall poured. Residual stresses, based upon a working stress analysis, included in the reinforcing on the liquid side of the first wall poured shall be zero. Residual stresses induced in the reinforcing on the dry side (side closest to second wall) of the first wall poured shall be 12 ksi.

B. Column Forms - For rectangular column forms see requirement for walls.
C. All Other Forms - All other formed concrete shall be formed with the materials specified for wall forms, unless otherwise approved by the Engineer.
D. Column Reinforcing Spacers and Rebar Supports - Provide a positive spacer between column reinforcing and column forms to required covers Unless otherwise approved, the spacer shall be removed as the concrete is placed, consolidated, and proper support and spacing is achieved. Any permanent spacers and rebar supports that are designed to be left in place shall be concrete blocks of the same strength and density of the concrete that they are being encased with.
E. Wall Spacers - Provide positive spacers for all wall forms.
F. Form Ties:

1. Form ties on exposed surfaces shall be located in a uniform pattern or as indicated on the Drawings. Form ties shall be constructed so that the tie remains embedded in the wall, except for a removable portion at each end. Form ties shall have conical or spherical type inserts. Inserts shall be fixed so that they remain in contact with forming material and shall be constructed so that no metal is within 1 inch of the concrete surface when the forms, inserts, and tie ends are removed. Wire ties will not be permitted. Ties shall withstand all pressures and limit deflection of forms to acceptable limits.
2. Ties shall have either an integral steel water stop 0.103 inch thick and 0.625 inch in diameter that is tightly and continuously welded to the tie, or a neoprene water stop 3/16-inch thick and 15/16 inch in diameter whose center hole is 1/2 the diameter of the snap tie, or a molded plastic water stop of comparable size. Flat snap ties complying to above requirements and other sections of this Specification may be used. The water stop shall be considerably larger in area than the tie cross sectional area, and shall be oriented perpendicular

to the tie and symmetrical about the center of the tie. The ties shall be constructed to provide a positive means of preventing rotation or disturbance of the center portion of the tie during removal of the ends.

G. Alternate Form Ties - Through-Bolts:

1. Alternate form ties consisting of tapered through-bolts at least 1 inch in diameter at smallest end, or through-bolts that utilize a removable tapered sleeve of the same minimum size may be used at the Contractor's option. Clean and roughen, fill, and seal form tie, or where not shown on the Drawings, the Contractor shall provide a shop drawing submittal of his proposed method of sealing the through-bolt hole. The Contractor shall be responsible for water tightness and any repair needed. Any leaks or dampness on the exterior of through-bolt patches during or after water testing shall require repair or replacement of the patch.
2. The elastic plug to be inserted into the form tie hole shall be a Dayton Sure Plug, as manufactured and supplied by the Dayton Sure-Grip and Shore Co., or equal.

2.8 BONDING AGENT

A. Bonding agent shall be as manufactured by Sika Chemical Corporation, Lyndhurst, NJ; or Adhesive Engineering Company, San Carlos, California; or equal. Product shall be recommended by manufacturer as suitable to meet job requirements with regard to surface, pot life, set time, vertical or horizontal application, forming restrictions, etc. Provide manufacturer's specific instructions for this job application, and have this information available on the project site for Contractor and/or Engineer use.

2.9 BOND BREAKER

A. Bond breaker shall be a nonstaining type, which will provide a positive bond prevention such as Williams Tilt-Up Compound, as-manufactured by Williams Distributors, Inc., Seattle, WA; Silcoseal 77, as manufactured by SCA Construction Supply Division, Superior Concrete Accessories, Franklin Park, IL; or approved equal. Submit review copies of manufacturer's data, recommendations, and instructions for specific use on this Contract.

2.10 CURING COMPOUND

A. The Contractor shall not use the curing compound where additional finishes such as hardeners, paintings, and other special coatings are required. Use water curing as hereinafter specified instead.
B. When curing compound is used, conform to the requirements of ASTM C309, with the additional requirement that permeability not exceed 0.039 gm/square cm/72 hours. Masterseal, manufactured by Master Builders Co., Cleveland, OH; Euco Floor Coat, manufactured by Euclid Chemical Co., Cleveland, OH; or equal. Manufacturer's certification shall state quantity or coverage required to meet or exceed tests and method of application. The manufacturer shall submit certification that the product meets ASTM C309 and the additional permeability requirement, and shall specifically state the coverage required to meet these requirements.

2.11 RUBBER PAD

A. Neoprene conforming to ASTM D2000-80, Type M2BC414.

2.12 SPONGE RUBBER

A. Neoprene, closed-cell, expanded, conforming to ASTM D1056-85, Type 2C5 with a compression deflection, 25 percent deflection (limits), 119 to 168 kPa (17 to 24 psi) minimum.

PART 3 EXECUTION

3.1 DESIGN OF CONCRETE MIX

A. General: Before beginning any concrete work, the Contractor shall have the concrete mix designed and the ingredients selected and proportioned by an approved independent testing laboratory meeting the requirements of ASTM E329 and signed by a registered California engineer. Certified copies of all laboratory trial mix reports shall be sent to the Engineer from the testing laboratory. Do not place concrete prior to the Engineer's review and acceptance in writing of the concrete mixes and the cylinder test results from these laboratory mixes. Trial mix reports, together with cylinder tests, shall be made for each design mix. Trial mix tests will also be run after the superplasticizer has been in the mix trial batch and held on agitation mixing for 1-1/2 hours, at the maximum slump to be used to show compliance with this time requirements. These mixes shall not exceed the water cement ratio specified. Any variation in slump or working time for these allowable mixes must be accomplished by the addition or conjunction of the superplasticizer dose at the ready-mix plant.

3.2 PROPORTIONS

A. The concrete mix shall be designed so that the proportions will produce results that will meet the structural concrete requirements of the Contract.
B. The concrete shall be proportioned in accordance with ACI 211 subject to the following specifications.
C. Design the mix and perform tests to meet the following requirements:

1. Design strength:

   a. Design strength shall be 4,000 psi at 28 days, unless otherwise shown on the Drawings or specifies herein. The combined aggregate grading shall be for 1 inch, except 1 inches for footing and 3/4 inch where required because of tight pouring conditions, unless otherwise shown on the Drawings or specified herein.
   b. Lean concrete where shown on the Drawings shall be designed for 2,000 psi at 28 days using 3/4-inch aggregate and a 4-inch maximum slump and 0.49 water-cement ratio. Use water reducers as hereinbefore specified.

2. The water-cement ratio or water-cement plus pozzolan ratio, if applicable, shall not exceed 0.40 by weight. A water reducing agent type A manufactured by the same company that manufactures the superplasticizer may be used in the initial batching if required by the admixture manufacturer.
3. Minimum cement content or combined cement plus fly ash content when fly ash is used for performance and longevity, regardless of design strength, shall be 517 pounds per cubic yard for concrete with 1-1/2 inch maximum size aggregate, 540 pounds per cubic yard for 1-inch maximum size aggregate, and 564 pounds per cubic yard for 3/4-inch maximum size aggregate. The Contractor shall increase cement content or the combined cement plus fly ash content, when fly ash is used, as required to meet strength requirements.

   a. The amount of fly ash used shall not exceed 25 percent or be less than 15 percent of the total weight of fly ash plus cement.

4. Air content (ASTM C173); range 3 to 6 percent. Add air to all concrete in treatment plants or water-holding areas.
5. Maximum Slump Range:

   a.

      1. Footings, piers, and walls: 3 inches to 4 inches.
      2. Beams and columns: 3 inches to 4 inches.
      3. Slabs: 2 inches to 4 inches.
      4. Fireproofing an underground duct envelope: 3 inches to 6 inches.
      5. Pours over 2.5 feet thick: 1 inch to 2-1/2 inches.

   b. Concrete with super-plasticizer and high range water reducer:

      Slab on Grade or Heavy Section Wider than 3 feet — 6 to 9 inches

Footings, Wall, Slabs, and Beams	6 to 9 inches
Columns (Less than 3 feet Wide) and Thin Sections (Less than 6 inches Thick)	6 to 9 inches

c. Verify that design mix test cylinders are taken from concrete slump equal to that to be used by the Contractor.

6. Combined Aggregate Gradings:

a. Aggregates for concrete shall be combined in proportions that will provide a mixture within the grading limits shown below, unless otherwise approved in writing by the Engineer:

Percentage Passing:

Sieve Sizes	1-1/2" Max	1" Max	3/4" Max
2"	100	-	-
1-1/2"	90-100	100	-
1"	50-86	90-100	100
3/4"	45-75	55-100	90-100
1/2"	-	-	-
3/8"	38-55	45-75	60-80
No. 4	30-45	35-60	40-60
No. 8	23-38	27-45	30-45
No.16	17-33	20-35	20-35
No.30	10-22	12-25	13-23
No.50	4-10	5-15	5-15
No. 100	1-6	1-8	1-5
No. 200	0-3	0-4	0-2

b. The combined aggregate grading used in concrete for structures and other concrete items, except when specified or shown otherwise, shall be the 1-inch maximum grading shown in table above unless otherwise specified hereinbefore or shown on the Drawings or approved in writing by the Engineer.

7. Use superplasticizer as specified in all concrete.
8. The lab-cured trial mix cylinders used for the purpose of verifying the mix designs shall break at or above a strength equal to the specified design strengths plus 1,200 psi.
9. Tremie concrete shall contain a minimum cement factor of 7 sacks per cubic yard. A superplasticizer conforming to ASTM C494, Type F or Type G second or third generation shall be used. Fine aggregate shall be in the range of 40 to 50 percent of total weight of aggregates. Use natural round gravel if available in project area and if it meets these Specifications. Proportion mix for design strength and a slump range of 6 to 11 inches with a maximum water-cement ratio of 0.40.
10. Drying shrinkage

a. Drying shrinkage tests shall be made for all concrete from the laboratory trial mixes and during construction, one test per 400 cubic yard concrete placement or as directed by the Engineer and as specified in the preceding Article to ensure continued compliance with these Specifications. A set of three specimens shall be taken for each shrinkage test.
b. Drying shrinkage specimens shall be 4-inch by 4-inch by approximately 11-inch prisms with an effective gauge length of 10 inches for all aggregate that passes a 2-inch sieve. A prism may be 3-inch by 3-inch by approximately 11 inches with an effective gauge length of 10 inches for all aggregate that passes a 1-inch sieve. All specimens shall be fabricated, cured, dried, and measured in the manner specified in

ASTM C157 modified as follows: specimens shall be removed from molds at an age of 23 plus or minus 1 hour after trial batching, shall be placed immediately in water at 73 degrees F plus or minus 3 degrees for at least 30 minutes, and shall be measured within 30 minutes thereafter to determine original length and then submerged in saturated limewater at 73 degrees F plus or minus 3 degrees. Measurement to determine expansion expressed as a percentage of original length shall be made at age 7 days. This length at age 7 days shall be the base length for drying shrinkage calculations (0 days drying age). Specimens then shall be stored immediately in a humidity control room maintained at 73 degrees F plus or minus 3 degrees and 50 percent plus or minus 4 percent relative humidity for the remainder of the test. Measurements to determine shrinkage expressed as percentage of base length shall be made and reported separately for 7, 14, 21, and 28 days of drying after 7 days of moist curing.

c. The drying shrinkage deformation of each specimen shall be computed as the difference between the base length (at 0 days drying age) and the length after drying at each test age. The average drying shrinkage deformation of the specimens shall be computed to the nearest 0.0001 inch at each test age. If the drying shrinkage of any specimen departs from the average of that test age by more than 0.0004 inch, the results obtained from that specimen shall be disregarded. Compression test specimens shall be taken in each case from the same concrete used for preparing drying shrinkage specimens, and shall be fabricated, cured, and tested in accordance with ASTM C192. Three specimens shall be tested at an age of 7 days and three at the age of 28 days. Shrinkage tests shall be considered a part of the normal compression tests for the project. Concrete shrinkage at 28-Contractday drying age shall be 0.048 percent maximum for laboratory trial mixes and 0.053 percent maximum for field specimens during construction.

d. If 7-day and/or 14-day shrinkage specimen tests for placed concrete exceed the shrinkage limits established from the acceptable test batch shrinkage tests, the Contractor shall provide an additional 14 days of water curing beyond that specified for all concrete surfaces of hydraulic structures containing drying shrinkage specimens that exceed Specifications.

3.3 USE OF SUPERPLASTICIZERS

A. Use in all concrete.

B. Superplasticizers shall conform to ASTM C494, Type F or G and of a second or third generation type.

C. All admixtures used including the superplasticizer shall be compatible and shall be manufactured, serviced, and warranted by an established admixture company with a successful record of field service to concrete suppliers, and the admixture manufacturer shall assist in the design of the mixes and supervision of their product uses at the concrete plant and at the project site. The admixture shall be as furnished by the Master Builders Company; Gifford Hill and Co., Inc., Chemical Division; the Euclid Chemical Company; or approved equal.

D. The superplasticizer shall be added at the concrete plant only through the equipment furnished and/or approved by the admixture manufacturer. The use of a water reducing agent in the mix water to facilitate mixing at a water cement ratio of 0.40 shall be approved by the admixture company furnishing the superplasticizer. The equipment shall provide for easy and quick visual verification of the amount of admixture used for each dose. The amount to be added to each load of concrete shall be discharged into a separate dispensing container and then added to the concrete.

E. Redosing of the concrete shall not be permitted.

F. The design strengths, slumps, water-cement ratio, and other requirements hereinbefore specified shall be met at the slump required at placement.

G. The slump of the concrete with the superplasticizers shall be 6-inch minimum and 9-inch maximum and the slump shall remain in this range throughout the time of placement and consolidation. Lack of performance by the superplasticizer to meet all of these requirements shall be adequate reason for rejection of its use.

3.4 CERTIFICATION

A. Furnish to the Engineer with each batch of concrete before unloading at the site, a delivery ticket with the information stated in Section 16 of ASTM C94. In addition to this information, indicate also the type, brand, test certification, and amount of fly ash, if used. Recording of revolution counter is required.

3.5 MEASUREMENT OF MATERIALS AND MIXING

A. Conform to ACI 304 current edition and to other requirements hereinbefore specified for mix design, testing, and quality control and to these Specifications.
B. Concrete shall be discharged at the job within 1-1/2 hours after the cement has been added to the water or the aggregates, except for high-early-strength concrete mixes which shall be 45 minutes.
C. If a water-reducing and retarding admixture is used in the mix, these times specified above may change. Coordinate the information related to set time with admixture manufacturer and Engineer prior to start of concreting.
D. Truck mixers shall be equipped with electrically actuated counters by which the number of revolutions of the drum or blades may be readily verified. The counter shall be of the resettable, recording type and shall be mounted in the driver's cab. The counters shall be actuated at the time of starting mixers at mixing speeds. Limit volume of concrete in trucks to ASTM C94 stipulations.
E. Each batch of concrete shall be mixed in a truck mixer for not less than 70 revolutions of the drum or blades at the rate of rotation designated by the manufacturer of the equipment. Additional mixing, if any, shall be at the speed designated by the manufacturer of the equipment as agitating speed. All materials, including mixing water, shall be in the mixer drum before actuating the revolution counter for determining the number of revolutions of mixing.
F. Truck mixers and their operation must be such that the concrete throughout the mixed batch as discharged is within acceptable limits of uniformity with respect to consistency, mix, and grading. If slump tests taken at approximately the 1/4 and 3/4 points of the load during discharge give slumps differing by more than 1 inch when the specified slump is 3 inches or less, or if they differ by more than 2 inches when the specified slump is more than 3 inches, the mixed batch shall not be used on the work unless the causing condition is corrected and satisfactory performance is verified by additional slump tests. All mechanical details of the mixer, such as water measuring and discharge apparatus, condition of the blades, speed of rotation, general mechanical condition of the unit, and clearance of the drum, shall be checked before a further attempt to use the unit will be permitted.
G. The use of nonagitating equipment for transporting ready-mixed concrete will not be permitted. Combination truck and trailer equipment for transporting ready-mixed concrete will not be permitted. The quality and quantity of materials used in ready-mixed concrete and in batch aggregates shall be subject to continuous inspection at the batching plant by the Engineer.

3.6 RETEMPERING

A. The retempering of concrete or mortar in which the cement has partially hydrated will not be permitted.

3.7 FORMS

A. The contractor is responsible for review of reinforcing steel, embedments, project access conditions and for coordination with the Engineer to provide placement methods and formwork designs that will facilitate quality construction.
B. Maximum Size of Concrete Placements shall be as follows:

1. The Contractor shall limit the size of each of his/her concrete pours regardless whether slabs or walls. Submit placement drawings for Engineer's review to obtain an agreed upon procedure, time between adjacent pours, and location of each type of joint to be used.
2. All construction joints where not otherwise shown on the Drawings shall be located and shown on Contractor's shop drawings. Obtain Engineer's approval in writing prior to start of this portion of the construction. Alternate pours with 10 days minimum curing time between pours to allow for strength gain and some shrinkage.

C. Form Design and Windows:

1. The Contractor shall design all formwork prior to fabrication, placing his order, or use on jobs. The design shall account for all the tolerances, form ties, finishes, rebar supports, construction joint locations, and other nonstructural formwork requirements specified. Forms shall contain pouring and observation windows to allow placement of concrete through windows or shall be staged to allow visual observation at all times of

the fresh concrete to ensure correct placement and vibration. Provide a formwork and placement design that will limit free fall of concrete in forms 8-inch or less in width up to 5 feet high; and for forms wider than 8 inches, limit this fall to 8 feet high, except as hereinafter specified. The Contractor shall review methods with Engineer prior to start of work. Placement devices, such as chutes, pouring spouts, and pumps, shall be used as required to prevent segregation of the aggregates. Superplasticized mixes may free fall up to 15 feet if the slump is over 6 inches. The Contractor is required to design the forms strong enough to hold high liquid heads without any form distortion as specified hereinafter if flowable or rheoplastic mixes are used in this manner. Coordinate form design with the admixture manufacturer's recommendations.

2. Reuse of forms will be permitted only if a "like new" condition, unless otherwise approved in writing, is maintained. The Engineer shall be notified one full working day prior to concrete placement so that the forms can be inspected. The Contractor shall correct any defective work, found in the Engineer's inspection, prior to delivery of concrete to the project. Formwork surfaces that were in good condition and accepted for use, but were damaged during removal and handling shall not be reused on additional pours. The Contractor shall take care in the handling of forms and obtain approval of form surfaces prior to each reuse.
3. All forms, falsework, shoring, and other structural formwork required shall be structurally designed by the Contractor and the design shall comply with all applicable safety regulations, current OSHA regulations, and other codes. Where federal or state agencies require a licensed engineer to prepare and/or seal all formwork, falsework or shoring designs, the Contractor shall hire this engineer and pay all costs. The designs shall be made available to the Engineer or any governing agency upon request. Comply with applicable portions of ACI 347, ACI 318 current edition, and these Specifications. All design, supervision, and construction for safety of property and personnel shall be the Contractor's full responsibility.

D. Form Tolerances:

1. Forms shall be surfaced, designed, and constructed to meet ACI 318 and the following minimum requirements for the specified finishes. Failure of the forms to produce the specified requirements will be grounds for rejection of the concrete work. Rejected work shall be repaired or replaced by the Contractor at no additional cost to the City. All repair or replacement shall be subject to these Specifications and the approval of the Engineer. Where the Contractor's work does not meet the tolerance specifications he shall submit his proposed method to upgrade the specified finish to compensate for the inferior appearance or to repair or provide an acceptable alternate solution. Obtain in writing the Engineer's approval of this repair or alternate solution before proceeding. All repair work or work on an alternate solution shall be the result of poor workmanship in not achieving the specified quality of finish, and the Contractor shall upgrade the work with no additional compensation.

E. Wall Tolerances:

1. General - Straight vertical or horizontal wall surface shall be flat planes within the tolerance specified hereinafter. Depression in a wall surface shall not be more than 1/8 inch when a 10-foot straightedge is placed upon high points in any direction or at any location. Wall thickness shall not be more than 1/4 inch minus nor 1/2 inch plus from dimension shown. Walls shall be plumb within 1/4 inch in any 10 feet or within 1/2 inch in its entire height from top to bottom for walls over 20 feet high. Refer to wall finishes hereinafter specified. Honeycomb areas and rock pockets shall be repaired to secure the structural adequacy of the walls. Other defects shall be finished as hereinafter specified under Article 3.15 CONCRETE WALL FINISHES.

F. Slab Tolerances:

1. General - Exposed slab surfaces shall be comprised of flat planes as shown or as required and these flat planes shall be within the tolerances hereinafter specified.
2. Slab Finish Tolerances and Shape Tolerances - Shall be as hereinbefore specified. Floor flatness measurements will be made the day after a concrete floor is finished and before the shoring is removed, in order to eliminate any effects of shrinkage, curling, and deflection. The 10-foot long straightedge shall be supported at each end with steel gauge blocks whose thickness are equal to specified tolerance. Floor surface shall not have crowns so high as to prevent 10-foot straightedge from resting on these two end blocks, nor low spots so low that a third block of twice the tolerance in thickness can easily pass under the

supported 10-foot straightedge. Compliance with the designated limits in four of five consecutive measurements should generally be satisfactory unless obvious faults are observed. A check for adequate slope and drainage will also be made to confirm compliance with these Specifications.

3. Finish slab elevation shall be within 1/2 inch of elevation specified except that slabs which are designed and detailed to drain to a floor drain or gutter shall in fact adequately drain regardless of tolerances and the Contractor shall be fully responsible to achieve this important function in the finished structure. Repair floor slopes in an approved manner if necessary to provide complete drainage. Slabs shall not be more than 1/4 inch minus nor 1/2 inch plus from the thickness shown on the plans and shall also satisfy the above requirements.

G. Beams and Columns:

1. General - Exposed straight horizontal and vertical beam and column surfaces shall be flat planes specified within the tolerances hereinafter.
2. Beam - Beams physical dimensions shall not be more than 1/4 inch minus nor 1/2 inch plus from dimension shown. Elevations shall be within 1/2 inch plus or minus except where the tops of beams become part of a finished slab and in this case refer to slab tolerances also.
3. Column - Column physical dimensions shall not be more than 1/4 inch minus nor 1/2 inch plus from dimension shown. Columns shall be plumb within 1/4 inch in any 10 feet with a maximum out-of-plumb of 1/2 inch at the top with respect to the bottom.

H. Forms for Sidewalks and Driveways - Standard steel forms or wood forms constructed and fastened to prevent movement. Set forms to true lines and grades, and securely stake in position.

I. Form Surface Preparation:

1. General - All form surfaces in contact with the concrete shall be thoroughly cleaned of all previous concrete, dirt, and other surface contaminants prior to preparing by the applicable method below. Do not reuse damaged form surfaces.
2. Exposed Wood Forms - All wood surfaces in contact with the concrete shall be coated with form sealer as hereinbefore specified.
3. Steel Forms - Mill scale and other ferrous deposits shall be sandblasted or otherwise removed from the contact surface of forms. All forms shall have the contact surfaces coated with a release agent. The release agent shall be effective in preventing discoloration of the concrete from rust, and shall be nontoxic after 30 days.

J. Beveled Edges (Chamfer) - Form 3/4-inch bevels at all concrete edges, unless otherwise shown. Where beveled edges on existing adjacent structures are other than 3/4 inch, obtain Engineer's approval of size prior to placement of bevel form strip.

K. Removal of Forms:

1. The Contractor shall be responsible for all damage resulting from improper and premature removal of forms. Satisfy all applicable OSHA requirements with regard to safety of personnel and property.
2. Forms and shoring for elevated structural slabs or beams shall remain in place in accordance with ACI 318, Chapter 6, and until the concrete has reached a compressive strength equal to the specified 28-day compressive strength as determined by test cylinders. Removal of all supports prior to obtaining adequate field cured cylinder results and reshoring shall not be permitted.

L. Backfill Against Walls:

1. Do not place earth backfill against walls until the concrete has obtained a compressive strength equal to the specified 28-day compressive strength. Where backfill is to be placed on both sides of the wall, the backfill shall be placed simultaneously on both sides to prevent differential pressures.
2. Since the walls are laterally restrained or supported by suspended slabs and/or slabs on grade, and are not designed as cantilever retaining walls, the Contractor a shall submit a schedule of wall shoring, bracing, and backfilling that is coordinated with the concrete curing, test cylinder reports, and the design assumptions, and obtain a review from the Engineer prior to proceeding.

3.8 BONDING TO NEW CONCRETE HORIZONTAL WALL CONSTRUCTION JOINTS

A. Roughen the surface of the hardened concrete. Thoroughly clean and saturate with water, and immediately place concrete. New concrete is defined as less than 60 days old. Provide inspection windows to allow close visual inspection of this work.

3.9 BONDING TO OLD CONCRETE

A. Mechanically roughen the existing concrete surfaces to a 1/4-inch amplitude using chipping guns or bushhammers, and then coat the contact surfaces with bonding agent specified hereinbefore. Apply the bonding agent in conformance with the manufacturer's instructions.

3.10 CONSTRUCTION JOINTS

A. Construction joints shall be as specified in Section 03251 EXPANSION, CONSTRUCTION, AND CONTROL JOINTS.

3.11 CONSOLIDATION

A. Concrete shall be placed as close to its final position as possible. The Contractor shall thoroughly consolidate concrete by vibration during and immediately after placing. The Contractor shall provide a sufficient number of approved mechanical vibrators of appropriate size for the batch size and access conditions. Forms shall be designed to provide sufficient access for proper consolidation by operating vibrators in a vertical position.

3.12 EVALUATION AND ACCEPTANCE OF CONCRETE

A. Conform to ACI Standard Building Code Requirements for Reinforced Concrete (ACI 318-95), Section 5.6, "Evaluation and Acceptance of Concrete," and to the following specifications:

1. The Engineer will make or have tests made to determine compliance with the Specifications. The Contractor shall cooperate in the making of such tests by furnishing necessary labor to assist testing agencies and/or the Engineer in obtaining, handling, and protecting and/or curing samples at the jobsite in accordance with Section 01036. The Contractor shall provide adequate facilities for safe storage and proper curing of concrete test cylinders on the project site for the first 24 hours, and for additional time as may be required before transporting to the test lab. Specimens will be made, cured, and tested in accordance with ASTM C31 and ASTM C39.
2. The frequency of testing may be increased at the discretion of the Engineer. Where admixtures are required, trial mixes will be tested with materials representative of those admixtures to be used and under environmental conditions expected on the Contract site. Where the term "building official" is used in Section 5.6 of ACI 318-95, the term shall be redefined to the Engineer.

3.13 PATCHING

A. General:

1. Prior to starting patching work, obtain quantities of color-matched grout and grout manufacturer's detailed instructions for use so as to provide an acceptable structural patch and a patch technique that has an acceptable finish.
2. The Contractor and the grout manufacturer shall jointly develop his patching techniques and mixes. Dress surface of patches that will remain exposed to view to match the color and texture of adjacent surfaces.
3. Patching of concrete shall provide an acceptable and structurally sound surface finish uniform in appearance or the Contractor shall upgrade the finish by other means at no additional cost.

B. Tie Holes - All tie holes, except where sealant is indicated, shall be filled with nonshrink, nonmetallic grout. Color of grout after curing shall match color of adjacent concrete. Through-bolt openings shall be filled with nonshrink grout as specified hereinbefore.

C. Defective Areas - Remove all defective concrete such as honeycombed areas and rock pockets out to sound concrete. Small shallow holes caused by air entrapment at the surface of the forms shall not be considered defects unless the amount is so great as to be considered not the standard of the industry and due primarily to poor workmanship. If chipping is required, the edges shall be perpendicular to the surface. Feather edges shall not be permitted. The defective area shall be filled with a nonshrink, nonmetallic grout. Use an approved bonding agent on horizontal patches prior to placing nonmetallic, nonshrink grout. Since some bonding agents may not be compatible for some vertical surface patching techniques, demonstrate all methods for repair of vertical surfaces using the actual materials, methods, and curing procedures required by the manufacturers of the materials on the project site as specified hereinbefore. The Contractor shall consult with representatives of the bonding agent manufacturer and the nonshrink grout manufacturer, and these representatives shall be onsite and assist in the demonstration.

D. Blockouts at Pipes or Other Penetrations - Conform to details shown or submit proposed blockouts for review. Use nonshrink, nonmetallic grout, Category I or II.

3.14 SCHEDULE OF CONCRETE FINISHES

Area	Type of Finish
Interior walls of buildings	W-3
Exterior walls below grade - not waterproofed from 6 inches below grade and down	W-1
Interior walls of water holding basins - not coated	W-2
Interior Slabs	S-1
Slabs of water-holding basins	S-1
Columns	C-1

3.15 CONCRETE WALL FINISHES

A. Type W-1 - All snap tie holes shall be filled with nonshrink, nonmetallic grout. All projections shall be KNOCKED OFF. Also all honeycomb areas and rock pockets shall be patched. Small air holes do not require patching.

B. Type W-2 - All snap-tie holes shall be plugged with nonshrink, nonmetallic color matched grout that has been reviewed by Engineer. GRIND OFF projections, fins, and rough spots. Repair all other defects such honeycomb areas, air packets, rock pockets, and rough spots which are a result of form release agent failure or other reasons with color matched nonshrink grout.

C. Type W-3 - All snap-tie holes shall be plugged with nonshrink, nonmetallic grout that has been reviewed by Engineer. GRIND OFF all projections, fins, and rough spots. Repair all defects as per Type W-2. Small shallow air holes do not require patching.

3.16 CONCRETE SLAB FINISHES

A. The excessive use of "jitterbugs" or other special tools designed for the purpose of forcing the coarse aggregate away from the surface and allowing a layer of mortar to accumulate will not be permitted on any slab finish. The dusting of surfaces with dry materials will not be permitted. Slabs and floors shall be thoroughly compacted by vibration. All edges of slabs and tops of walls shall be rounded off with a steel edging tool, except where a cove finish is indicated on the Drawings. Steel edging tool radius shall be 1/4 inch for all slabs subject to wheeled traffic.

B. Type S-1 (Concrete Slab Finish Steel Troweled Finish):

1. Finish by screening and floating with straightedges to bring the surfaces to the required finish elevation shown on the Drawings. While the concrete is still green, but sufficiently hardened to bear a person's weight without deep imprint, it shall be wood floated to a true, even plane with no coarse aggregate visible. Sufficient pressure shall be used on the wood floats to bring moisture to the surface. After surface moisture has disappeared, the concrete shall be hand troweled to produce a smooth, impervious surface, free from trowel marks. An additional troweling shall be given the surface for the purpose of burnishing. The final troweling shall produce a ringing sound from the trowel. Dry cement or additional water shall not be used in troweling, nor will excessive troweling be permitted.
2. In lieu of hand finishing, the Contractor may use an approved power machine for finishing concrete floors and slabs in accordance with the directions of the machine manufacturer and as approved by the Engineer. The use of a power machine will not be allowed when the concrete has not attained the necessary set to allow finishing without introducing high and low spots in the slab. The first steel troweling for slab S-1 finish should be done by hand.
3. Concrete Curb: Grade subgrade to proper elevation and compact. Securely stake and brace forms to a true line at the proper elevation. Place concrete as hereinbefore specified. Float the top surface of the curb smooth, and finish all discontinuous edges with a steel edgers After concrete has taken its initial set, remove the front form and give the exposed vertical surface an ordinary wall finish.

3.17 COLUMN FINISHES

A. Type C-1 - Column shall be ground to remove all form marks. Repair all rockpockets.

3.18 CURING OF CONCRETE

A. Cure concrete by keeping the surface continuously wet for 7 days where normal Portland cement is used. Subject to approval by the Engineer, one of the following methods shall be followed:

1. Walls - Concrete forms shall be left in place and kept sufficiently damp at all times to prevent opening of the joints and drying of the concrete; or a curing compound as hereinbefore specified, where allowed, shall be applied immediately after removal of forms, or exposed surfaces shall be continuously sprinkled.
2. Slabs and Curbs - Protect surface by ponding, cover with burlap or cotton mats kept continuously wet, or cover with 1-inch layer of wet sand, earth, or sawdust and keep continuously wet, or continuously sprinkle the exposed surface, or other agreed upon method that will provide that moisture is present and uniform at all times on the entire surface of the slab; the Contractor shall determine the best method for his/her operation to ensure a good water cure and submit this for review.

SECTION 05500 FABRICATED METALWORK AND MISCELLANEOUS ITEMS

PART 1 GENERAL

1.1 WORK INCLUDED

A. This Section includes the work necessary to furnish and install the following fabricated metalwork and miscellaneous items:

1. Miscellaneous steel trim.
2. Steel pipe railings.
3. Covers.
4. Anchors.
5. Structural Steel Supports and Framing.
6. Miscellaneous Framing and Supports.

B. Reference standards include but are not limited to:

1. The AISC Specification for Structural Steel Building 1989 Edition.
2. The AISC Manual of Steel Construction, 9th Edition.
3. San Francisco Building Code 1995 Edition.
4. American Welding Society Structural Welding Code.
5. Manufacturer's recommendation and specifications.

1.2 RELATED WORK

A. Section 03300 Concrete.

1.3 DEFINITIONS

A. Definitions in ASTM E985 for railing-related terms apply to this Section.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. Structural Performance - Design, engineer, fabricate, and install the following metal fabrications to withstand the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each respective component of each metal fabrication.

1. Handrails Not Serving as Top Rails - Capable of withstanding the following loads applied as indicated:

a. Concentrated load of 200 lbf applied at any point nonconcurrently, vertically downward or horizontally.
b. Uniform load of 50 lbf per linear foot applied nonconcurrently, vertically downward or horizontally.
c. Concentrated and uniform loads above need not be assumed to act concurrently.

1.5 GENERAL

A. Like items of materials provided hereunder shall be the end products of one manufacturer in order to achieve standardization for appearance, maintenance, and replacement.

1.6 SUBMITTALS

A. Product data for products used in miscellaneous metal fabrications, including paint products and grout.
B. Shop drawings detailing fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, wiring layout, power requirements, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other sections and all other detail necessary to evaluate the submittal.

1. Where installed metal fabrications are indicated to comply with certain design loadings, include structural computations, material properties, and other information needed for structural analysis that has been signed and sealed by the qualified professional engineer who was responsible for their preparation.

C. Test pieces and samples representative of materials and finished products as may be requested by Engineer.
D. Certificates and test reports including welder certificates signed by Contractor certifying that welders comply with requirements specified under "Quality Assurance" article, following.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications - Firms experienced in successfully producing metal fabrications similar to that indicated for this Contract, with sufficient production capacity to produce required units without causing delay in the Work.

B. Installer Qualifications - Arrange for installation of metal fabrications specified in this Section by same firm that fabricated them.
C. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel," D1.3 "Structural Welding Code - Sheet Steel".

1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone re-certification.

D. Engineer Qualifications - Professional engineer licensed to practice in jurisdiction where Contract is located and experienced in providing engineering services of the kind indicated that have resulted in the successful installation of metal fabrications similar in material, design, and extent to that indicated for this Contract.
E. Workmanship

1. Verify dimensions and conditions at job.
2. Weld by shielded electric arc method according to American Welding Society Code.
3. Grout all plates, bolts and similar items with non-shrink grout.
4. Set all work plumb, true, rigid and neatly trimmed out.
5. Protect dissimilar metals from galvanic corrosion with pressure tapes, coating or isolators as approved.

1.8 PROJECT CONDITIONS

A. Field Measurements - Check actual locations of walls and other construction to which metal fabrications must fit, by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work.

1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabrication of products without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

PART 2 PRODUCTS

2.1 FERROUS METALS

A. Metal Surfaces, General - For metal fabrications exposed to view upon completion of the Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and, for steel sheet, variations in flatness exceeding those permitted by reference standards for stretcher-leveled sheet.
B. Steel Plates, Shapes, and Bars - ASTM A36.
C. Uncoated Structural Steel Sheet - Product type (manufacturing method), quality, and grade, as follows:

1. Cold-Rolled Structural Steel Sheet: ASTM A611, grade as follows:

a. Grade A, unless otherwise indicated or required by design loading.

2. Hot-Rolled Structural Steel Sheet: ASTM A570, grade as follows:

a. Grade 30, unless otherwise indicated or required by design loading.

D. Galvanized Steel Sheet - Quality as follows:

1. Commercial Quality - ASTM A526, G90 coating designation unless otherwise indicated.

E. Steel Pipe - ASTM A53; finish, type, and weight class as follows:

1. Galvanized finish for exterior installations and where indicated.

2. Type F, standard weight (schedule 40), unless otherwise indicated, or another weight, type, and grade required by structural loads.

F. Brackets, Flanges and Anchors - Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.
G. Concrete Inserts - Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A47, or cast steel, ASTM A27. Provide bolts, washers, and shims as required, hot-dip galvanized per ASTM A153. E70XX low hydrogen, conforming to AWSD1.1 except different requirement.
H. Welding Rods and Bare Electrodes - In accordance with AWS specifications for the metal alloy to be welded.

2.2 STAINLESS STEEL

A. Bar Stock - ASTM A666, Type 316, unless otherwise shown on Drawings.
B. Plate or Shape - ASTM A666, Type 316, unless otherwise shown on Drawings.

2.3 FASTENERS

A. General - Provide stainless steel fasteners for exterior use or where built into exterior walls. Select fasteners for the type, grade, and class required.
B. Bolts and Nuts - Regular hexagon head type, ASTM A307, Grade A otherwise shown on Drawings.
C. Lag Bolts - Square head type, FS FF-B-561.
D. Machine Screws - Stainless steel, FS FF-S-92.
E. Plain Washers - Round, stainless steel, FS FF-W-92.
F. Drilled-In Expansion Anchors - Expansion anchors complying with FS FF-S-325, Group VIII (anchors, expansion, [nondrilling]), Type I (internally threaded tubular expansion anchor); and machine bolts complying with FS FF-B-575, Grade 5.
G. Toggle Bolts - Tumble-wing type, FS FF-B-588, type, class, and style as required.
H. Lock Washers - Helical spring type carbon steel, FS FF-W-84.

2.4 ANCHOR SYSTEMS FOR CONCRETE

A. Submerged use is defined as any connection to concrete from a point 1 foot 6 inches above the maximum water surface in a water-holding basin and any connection below that point.
B. Wedge Anchors

1. Wedge anchors shall not be used to anchor pumps or vibrating equipments.
2. Wedge anchors shall be 100 percent 316 stainless steel and shall not be used below a point 1 foot 6 inches above the peak (maximum) water surface in any water-holding structure. See adhesive anchors or coated anchor bolts specified elsewhere in this Specification.
3. Wedge anchors shall be 316 stainless steel, manufactured by ITT Phillips Drill Division, Michigan City, IN; Hilti Kwik-bolt, stud type manufactured by Hilti, Inc., Stamford, CT; Wej-It, stainless steel bolts, completely assembled, manufactured by Wej-It Corporation, Broomfield, CO; Parabolt Concrete Anchors, manufactured by Molly Division of Emhart Corp., Temple, PA; or approved equal. Furnish sizes shown on Drawings. Provide ICBO (International Conference of Building Officials) or other similar building code organization recommendations regarding safe allowable design loads.

C. Expansion Anchors

1. Expansion anchors shall not be used to anchor pumps or vibrating equipments.
2. Expansion anchors shall not be used in wet areas unless the expansion anchors are 316 stainless steel.
3. Self-drilling anchors, snap-off type or flush type. Provide anchors for use with hot-dipped galvanized bolts. Nondrilling anchors shall be flush type for use with a bolt or stud type with projecting threaded stud. Provide ICBO or other similar code organizations' recommendations regarding safe allowable design loads. ITT Phillips-Drill In anchors, Hilti, Inc., Stamford, CT; or approved equal.

D. Adhesive Anchors/Capsule Type Anchors

1. Adhesive or capsule type anchors shall be used for anchoring metal components below ground level pipe trenches or surface elevations in water-holding structures. For embedded anchors refer to coated steel anchor bolts as herein before specified.
2. Adhesive or capsule type anchors shall be Parabond capsule anchors with 316 stainless steel stud, nuts, and washers, as manufactured by Molly Division, 504 Mt. Laurel Avenue, Temple, PA 19560; heavy-duty adhesive anchor with HBP adhesive cartridge and has 316 stainless steel anchor rod assembly as manufactured by Hilti, Inc., P. O. Box 45400, Tulsa, OK 74145, or approved equal.

2.5 PAINT

A. Shop Primer for Ferrous Metal - Manufacturer's or fabricator's standard, fast-curing, lead-free, universal modified alkyd primer selected for good resistance to normal atmospheric corrosion, for compatibility with finish paint systems indicated, and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure complying with performance requirements of FS TT-P-645.
B. Galvanizing Repair Paint - High zinc dust content paint for regalvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint-20.
C. Bituminous Paint - Cold-applied asphalt mastic complying with SSPC-Paint 12 except containing no asbestos fibers.
D. Zinc Chromate Primer - FS TT-P-645.

2.6 CONCRETE FILL AND REINFORCING MATERIALS

A. Concrete Materials and Properties - Comply with requirements of Section 03300 "Concrete" for normal weight.
B. Nonslip Aggregate Finish - Factory-graded, packaged material containing fused aluminum oxide grits or crushed emery as abrasive aggregate; rust-proof and nonglazing; unaffected by freezing, moisture, or cleaning materials.

2.7 FABRICATION

A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.
B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
C. Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and over stressing of welds and fasteners. Base design calculations on actual surface temperature of metals due to both solar heat gain and nighttime sky heat loss.

1. Temperature Change (Range): 100 deg F (55.5 deg C).

D. Shear and punch metals cleanly and accurately. Remove burrs.
E. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
F. Remove sharp or rough areas on exposed traffic surfaces.
G. Weld corners and seams continuously to comply with AWS recommendations and the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

H. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.
I. Provide for anchorage of type indicated coordinate with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.
J. Shop Assembly: Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for re-assembly and coordinated installation.
K. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware, screws, and similar items.
L. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

2.8 ROUGH HARDWARE

A. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 6 sections.
B. Fabricate items to sizes, shapes, and dimensions required. Furnish malleable-iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

2.9 STRUCTURAL STEEL SUPPORTS AND FRAMING

A. All work shall comply with the latest editions of AISC Code of Standard Practice for Steel Buildings and Bridges, AISC Specification for Design Fabrication and Erection of Structural Steel for Buildings, and AWS Structural Welding Code AWS D1.1.
B. Qualifications for Welding Work: Qualify welding procedures and welding operators in accordance with AWS "Qualification" requirements.

1. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests.
2. If recertification of welders is required, retesting will be Contractor's responsibility.

C. Quality Assurance

1. Materials and fabrication procedures are subject to inspection and tests in shop, conducted by a qualified inspection agency. Such inspections and tests shall not relieve Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.
2. Connection details shown are typical; similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at site whenever possible. When connections are not indicated or detailed on the drawings, the minimum connection for a beam shall be the minimum number of bolts per Framed Beam Connections, Table II, or the equivalent weld per Table III of the AISC Manual of Steel Construction. Bolted connections shall contain at least 2 bolts in each structural member. Minimum size of bolts shall be 5/8" dia. Connections shall be shop welded, if possible, unless special condition requires use of bolt connections shown on the design drawings. If high strength bolting is used, the calibration shall be performed using an approved device capable of indicating actual bolt tension to assure that the minimum required bolt tensions are being obtained in accordance with the AISC Specification for Structural Joints Using ASTM A325 Bolts.
3. No substitutions shall be made in material or in size or weight of members unless authorized by the Engineer in writing.
4. Material specified to be galvanized shall be hot-dip galvanized after fabrication on the same day the surface is sandblasted or pickled. Galvanizing shall occur before assembly by bolting. Galvanizing procedures shall be in accordance with ASTM A123.

2.10 GRATING

A. Gratings shall be galvanized steel, serrated, unless specifically indicated otherwise.
B. Gratings shall be provided with all frames, seat angles, fasteners, and other appropriate accessories as required where shown on Plans, checkered plate shall be welded to the grating in shop.
C. Fasteners for anchoring grating to beam and channel flanges shall be Universal clip type with 1/4 inch bolts and nuts. Fasteners shall be furnished for a minimum of four, or as required, for proper support to each panel, unless otherwise noted on the Drawings.
D. Standard installation clearances and tolerances shall conform to the requirements of the current Metal Bar Grating Manual published by the National Association of Architectural Metal Manufacturers.
E. Width of any single grating section shall not exceed 3 feet 0 inch, unless otherwise shown on reviewed shop drawings.
F. Grating shall be of the minimum thickness indicated on the Drawings for the various spans and shall be designed for the minimum uniform loads specified herein and concentrated loads as shown in the specified manufacturer's catalogs, unless otherwise indicated, with a maximum deflection not exceeding 1/4 inch and maximum allowable stress of 20,000 psi.
G. Provide angle supports as indicated. Size support angles to provide a minimum of 1 inch support for all main bearing bars. Band all edges and cutouts. Galvanize all steel grating and angle supports which are not to be embedded in concrete after fabrication.
H. Main bearing bars shall be of depth designated as GRATING THICKNESS on the Drawings. Provide welded 3/16 inch banding for all openings and rating ends. Cross bar spacing shall be a maximum of 2 inches unless otherwise specified. Limit lateral deflection of grating to prevent pedestrian discomfort.

    1. Steel Grating (Vehicular Traffic): Heavy-duty grating for vehicular traffic use shall have main bars space at 1-3/16 inch center-to-center and shall be of the minimum thickness indicated on the Drawings and shall be suitable for AASHTO HS 20-44 loading where required for heavy traffic, and shall be edge-banded, hot-dip galvanized after fabrication, of the size and shape indicated on the Drawings; and shall be equal to heavy-weld grating, as manufactured by Irving Grating Department, IKG Industries, Division of Harsco Corporation, Nashville, TN; or Borden Mental Products Co., press locked, rectangular cross bar, Type PJ with cross bars flush with top of main bars, or approved equal. Swaged cross bars shall not be used.

2.11 MISCELLANEOUS FRAMING AND SUPPORTS

A. General - Provide steel framing and/or supports for Mechanical, Electrical and Architectural applications as required to complete work.
B. Fabricate units to sizes, shapes, and profiles indicated and required to receive adjacent other construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.

    1. Equip units with integrally welded anchors for casting into concrete. Furnish inserts if units must be installed after concrete is placed.

        a. Except as otherwise indicated, space anchors 24 inches o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches wide x 1/4 inch x 8 inches long.

C. Galvanize miscellaneous framing and supports, unless otherwise indicated.

2.12 MISCELLANEOUS STEEL TRIM

A. Provide shapes and sizes indicated for profiles shown. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and steel bars, with continuously welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cutouts, fittings, and anchorages as required for coordination of assembly and installation with other work.
B. Galvanize miscellaneous framing and supports in the following locations:

1. Exterior locations.
2. Interior locations where indicated.

2.13 STEEL PIPE RAILINGS AND HANDRAILS

General - Fabricate pipe railings and handrails to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of pipe, post spacings, and anchorage, but not less than that required to support structural loads.

B. Interconnect railing and handrail members by butt-welding or welding with internal connectors, at fabricator's option, unless otherwise indicated.

1. At tee and cross intersections, notch ends of intersecting members to fit contour of pipe to which end is joined and weld all around.

C. Form changes in direction of railing members as follows:

1. By insertion of prefabricated elbow fittings.
2. By radius bends of radius indicated.
3. By mitering at elbow bends.
4. By bending.
5. By any method indicated above, applicable to change of direction involved.

D. Form simple and compound curves by bending pipe in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross-section of pipe throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of pipe.

E. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated.

F. Close exposed ends of pipe by welding 3/16 inch thick steel plate in place or by use of prefabricated fittings, except where clearance of end of pipe and adjoining wall surface is 1/4 inch or less.

G. Toe Boards - Where indicated, provide toe boards at railings around openings and at the edge of open-sided floors and platforms. Fabricate to dimensions and details indicated, or if not indicated, use 4 inches high x 1/8 inch steel plate welded to, and centered between, each railing post.

H. Brackets, Flanges, Fittings, and Anchors - Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnections of pipe and attachment of railings and handrails to other work. Furnish inserts and other anchorage devices for connecting railings and handrails to concrete or masonry work.

1. For railing posts set in concrete fabricate sleeves from steel pipe not less than 6 inches long and with an inside diameter not less than 1/2 inch greater than the outside diameter of post, with steel plate closure welded to bottom of sleeve.
2. For removable railing posts, fabricate slip-fit sockets from steel pipe whose inside diameter is sized for a close fit with posts and to limit deflection of post without lateral load, measured at top, to not more than 1/12 of post height. Provide socket covers designed and fabricated to resist accidental dislodgment.

I. Fillers - Provide steel sheet or plate fillers of thickness and size indicated or required to support structural loads of handrails where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses. Size fillers to produce adequate bearing to prevent bracket rotation and over stressing of substrate.

J. For all interior and exterior steel railings and handrails formed from steel pipe with galvanized finish, galvanize fittings, brackets, fasteners, sleeves, and other ferrous components.

1. All handrails shall be galvanized at exterior locations and at interior locations.

K. For interior steel railings and handrails formed from steel pipe with galvanized finish, galvanize fittings, brackets, fasteners, sleeves, and other ferrous components.

L. For interior steel railings formed from steel pipe with black finish, provide nongalvanized ferrous metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.

2.14 FINISHES - GENERAL

A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.
B. Finish metal fabrications after assembly.
C. Interior and exterior steel items - All welds shall be ground smooth after fabrication and completed assembly shall be hot-dip galvanized. If items are too large, fabricate in smaller sections with proper connectors or sleeves in order that assemblies fit dipping tanks. Stainless steel items shall not be galvanized.

2.15 STEEL AND IRON FINISHES

A. Galvanizing - For those items indicated for galvanizing, apply zinc-coating by the hot-dip process compliance with the following requirements:

1. ASTM A53 for galvanizing iron and steel hardware.
2. ASTM A123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch thick and heavier.

B. Preparation for Shop Priming - Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B): SSPC-SP6 "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP3 "Power Tool Cleaning."

C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finish or to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with requirements of SSPC-PA1 "Paint Application Specification No. 1" for shop painting.

1. Stripe paint all edges, corners, crevices, bolts, welds, and sharp edges.

2.16 LIFTING LUGS

A. Individual equipment and/or each field disassemble part over 100 pounds in weight shall be provided in proper lifting lugs for easy handling.

2.17 CHECKERED PLATE

A. Steel: A36, tread plate, thickness as indicated, 1/4 inch minimum. Fasten all accessories by welding or stainless steel bolts or screws.

2.18 COVERS

A. Access Hatches - Exterior or interior type steel as listed herein, access hatches shall be single-leaf of size shown on the Drawings. Hatch leaf shall be 1/4-inch diamond pattern plate with reinforcing on the underside to withstand a live load of 150 pounds per square foot with maximum deflection of 1/240th of the span.
B. Nonsparking manhole covers - Cast iron manhole covers in traffic areas shall be 36-inch diameter, Fig. No. 220-82, Varec Division, Rosemount, Inc., Cypress, CA, Type YC, as manufactured by OCECO Division, Pettibone Corp., Chicago, IL., or equal.

2.19 NEOPRENE GASKET

A. Unless otherwise indicated, Rubatex No. R-411-N, (ASTM D1056-RE-41-E), soft, closed-cell, neoprene gasket material, as manufactured by Rubatex Division of Great American Industries, Bedford, VA; equivalent as manufactured by Garlock Manufacturing, San Francisco, CA; or approved equal. The material shall be suitable for exposure to sewage and sewage gases. Thickness shall be as indicated, but in no case less than 1/4 inch. Gaskets shall be furnished without skin coat on either side. Provide two spare gaskets for each location shown requiring neoprene gaskets. In addition, provide one roll of 4 inch wide by 50 foot long neoprene gasket material and 1 pint of manufacturer's recommended adhesive.

PART 3 EXECUTION

3.1 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Contract site.
B. Center nosings on tread widths with noses flush with riser faces and tread surfaces.
C. Set sleeves in concrete with tops flush with finish surface elevations; protect sleeves from water and concrete entry.

3.2 INSTALLATION, GENERAL

A. Workmanship and finish of all metalwork specified under this Section shall be the highest grade and equal to the best practice of modern shops for the respective work. Exposed surfaces shall have smooth finish, and sharp, well-defined lines. Provide all necessary rabbets, lugs, and brackets so that the work can be assembled in a neat, substantial manner. Conceal fastenings where practical. Drill metalwork and countersink holes as required for attaching hardware or other materials. Fabricate materials as specified. Weld connections, except where bolting is indicated on Drawings or directed. Items requiring special fabrication methods are mentioned herein. Fabrication of all other items shall be of equal quality.
B. Grind all exposed edges of welds smooth on walkways, guardrails, handrails, stairways, channel door frames, steel column bases, and where indicated on the Drawings. All sharp edges shall be rounded to a 1/8-inch minimum radius; all burrs, jagged edges, and surface defects shall be ground smooth.
C. Welds and adjacent areas shall be prepared such that there is (1) no undercutting or reverse ridges on the weld bead, (2) no weld spatter on or adjacent to the weld or any other area to be painted, and (3) no sharp peaks or ridges along the weld bead. All embedded pieces of electrode or wire shall be ground flush with the adjacent surface of the weld bead.
D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.
E. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
F. Provide temporary bracing or anchors in form work for items that are to be built into concrete masonry or similar construction.
G. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.
H. The technique of welding employed, appearance, quality of welds made, and the methods of correcting defective work shall conform to codes for Arc and Gas Welding in Building Construction of the AWS and AISC Surfaces to be welded shall be free from loose scale, rust, grease, paint, and other foreign material, except that mill scale which will withstand vigorous wire brushing may remain. A light film of linseed oil may likewise be disregarded.

No welding shall be done when the temperature of the base metal is lower than zero degrees F. Finished members shall be true to line and free from twists.

I. All welding operators shall be qualified in accordance with the requirements of current AWS Standard Qualification Procedure D1.1, and welders of structural and reinforcing steel shall be certified for all positions of welding in accordance with such procedure. Qualification tests-shall be run by a recognized testing laboratory at the Contractor's expense. Previous recent qualification (last 2 years) by the State of California Department of Transportation will be acceptable.

J. All welding operators shall be subject to examination for requalification using the equipment, materials, and electrodes employed in the execution of the Contract work. Such requalification, if ordered by the Engineer, shall be done at the expense of the Contractor.

3.3 INSTALLATION OF FABRICATED METALWORK

A. Fabricated metal work shall be installed in accordance with the shop drawings. Field welding and erection work shall be performed by skilled mechanics. Install fabricated metalwork plumb or level as applicable. The completed installations shall, in all cases, be rigid, substantial, and neat in appearance. Erect structural steel in accordance with the applicable portions of AISC Code of Standard Practice, except as modified. Install commercially manufactured products in accordance with manufacturer's recommendations as approved.

3.4 ANCHOR BOLTS

A. All anchor bolts shall be accurately located and held in place with templates at the time the concrete is poured.

3.5 CONCRETE ANCHORS

A. Installation shall not begin until the concrete receiving the anchors has attained its design strength. An anchor shall not be installed closer than six times its diameter to either an edge of the concrete or masonry, or to another anchor, unless specifically detailed otherwise on the Drawings. Install in strict conformance with manufacturer's written instructions. Use manufacturer's recommended drills and equipment.

3.6 ACCESS COVERS

A. Covers shall be accurately and substantially positioned prior to placing concrete, such that the covers are flush with the floor surface. The covers shall-be protected from damage resulting from concrete placement. Exposed surfaces shall be thoroughly cleaned of all concrete spillage such that a clean, uniform appearance is achieved.

3.7 INSTALLATION OF STEEL PIPE RAILINGS AND HANDRAILS

A. Adjust railings prior to anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated, or if not indicated, as required by design loadings. Plumb posts in each direction. Secure posts and railing ends to building construction as follows:

Anchor posts in concrete by means of pipe sleeves preset and anchored into concrete. After posts have been inserted into sleeves, fill annular space between post and sleeve solid with the following anchoring material, mixed and placed to comply with anchoring material manufacturer's directions.

2. Anchor posts in concrete by core drilling holes not less than 5 inches deep and 3/4 inch greater than outside diameter of post. Clean holes of all loose material, insert posts and fill annular space between post and concrete with the following anchoring material, mixed and placed to comply with anchoring material manufacturer's directions.

   a. Nonshrink, nonmetallic grout.
   b. Nonshrink, nonmetallic grout or anchoring cement.
   c. Cover anchorage joint with a round steel flange attached to post as follows:

      1) Welded to post after placement of anchoring material.

2) By set screws.

d. Leave anchorage joint exposed, wipe off surplus anchoring material, and leave 1/8 inch build-up, sloped away from post. For installations exposed on exterior, or to flow of water, seal anchoring material to comply with grout manufacturer's directions.

3. Anchor posts to steel with steel oval flanges, angle type or floor type as required by conditions, welded to posts and bolted to steel supporting members.
4. Anchor rail ends into concrete and masonry with steel round flanges welded to rail ends and anchored into wall construction with lead expansion shields and bolts.
5. Anchor rail ends to steel with steel oval or round flanges welded to rail ends and bolted to structural steel members, unless otherwise indicated.
6. Install removable railing sections where indicated in slip-fit metal sockets cast into concrete. Accurately locate sockets to match post spacing.

B. Secure handrails to wall with wall brackets and end fittings. Provide bracket with not less than 1-1/2 inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated, or if not indicated, at spacing required to support structural loads. Secure wall brackets and wall return fittings to building construction as follows:

1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
2. For concrete and solid masonry anchorage, use drilled-in expansion shield and either concealed hanger bolt or exposed lag bolt, as applicable.

C. Expansion Joints: Provide expansion joints at locations indicated, or if not indicated, at intervals not to exceed 40 feet. Provide slip joint with internal sleeve extending 2 inches beyond joint on either side; fasten internal sleeve securely to one side; locate joint within 6 inches of post.

3.8 GALVANIZING AND REPAIR

A. All steel items including framing embedded in concrete shall be galvanized after fabrication.
B. Galvanizing of steel plates, shapes, bars (and products fabricated from these items), and strip 1/8-inch thick or thicker, shall conform to ASTM A123. Pipe, welded or seamless steel, shall conform to ASTM A53. Material thinner than 1/8 inch shall either be galvanized before fabrication in conformance with the requirements of 525, Coating Designation G 210; after fabrication, in conformance with the requirements of ASTM A123, except that the weight of zinc coating shall average not less than 1.2 ounces per square foot of actual surface area with no individual specimen having a weight of less than 1.0 ounce. Unless otherwise provided, galvanizing shall be done before or after fabrication, for material which is thinner than 1/8 inch, at the option of the Contractor. Galvanizing will not be required for stainless steel, coated metal, and similar corrosion-resistant parts.
C. All welded areas shall be thoroughly cleaned prior to galvanizing to remove all slag or other material that would interfere with the adherence of the zinc. When it is necessary to straighten any sections after galvanizing, such work shall be performed without damage to the zinc coating.
D. In like manner, galvanizing of iron and steel hardware, and nuts and bolts, shall conform to ASTM A153. Galvanizing shall be performed after fabrication. Galvanizing of tapped holes will not be required.
E. Fabrication shall include all operations such as shearing, cutting, punching, forming, drilling, milling, bending, welding, and riveting.
F. Components of bolted assemblies shall be galvanized separately before assembly.
G. The minimum pitch diameter of the threaded portion of all bolts, anchor bars, or studs shall conform to ANSI Bl.1, having a Class 2A tolerance before galvanizing. After galvanizing, the pitch diameter of the nuts or other internally threaded parts may be tapped over ANSI B1.1, Class 2B tolerance, by the following maximum amounts:

3/8-inch through 9/16-inch	0.016-inch oversize
5/8-inch through 1-inch	0.023-inch oversize
1-1/8-inch and layer	0.033-inch oversize

H. All edges of tightly contacting surfaces, where galvanized is repaired, shall be completely sealed by welding before galvanizing.

I. Galvanized surfaces that are abraded or damaged at any time after the application of the zinc coating shall be repaired by solvent cleaning the areas (Steel Structures Painting Council SP 1) by hand or power tool (Steel Structures Painting Council SP 2 or SP 3); removing all loose and cracked coating; and subsequently painting the cleaned areas with one of the following coatings:

1. One coat of Inorganic Zinc Silicate (MIL-P-23236, Class 3)
2. Two coats of Galvanizing Repair Paint (MIL-P-21035)
3. Two coats of Zinc Dust Paint (MIL-E-15145, Formula 102)

J. Paint should be applied to a cleaned surface. Abrasive blasting is required for inorganic zinc silicate.

3.9 ADJUSTING AND CLEANING

A. Touch-Up Painting - Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touch-up of field painted surfaces.

1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touch-Up Painting - Cleaning and touch-up painting of field welds, bolted connections, and abraded areas of the shop paint on miscellaneous metal is specified in Division 9 Section "Painting" of these Specifications.

C. For galvanized surfaces clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

3.10 PREPARATION FOR SHIPMENT

A. Insofar as is practical, the items provided hereunder shall be factory assembled. The parts and assemblies that are of necessity shipped unassembled, shall be packaged and clearly tagged in a manner that will prevent the materials from damage, and facilitate the identification and final assembly in the field.

SECTION 05510 STRUCTURAL AND MISCELLANEOUS FIBERGLASS

PART 1 GENERAL

1.1 WORK INCLUDED

A. This Section covers the work necessary to furnish and install, complete, fiberglass reinforced plastic (FRP) structural shapes, grating, and FRP cover for trenches under the Contract Documents.

B. Work shall include but not be limited to:

1. All miscellaneous FRP items; including clip angles, base plates, and other appurtenant items.
2. Sealer and ultra-violet (UV) coating for field cuts.

1.2 SUBMITTALS

Submit the following in accordance with Section 12-1.06, "Submittals":

A. Product data including manufacturer's specifications and installation instructions for each type of FRP and accessories.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM A 167 - Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
2. ASTM D 570 - Test Method for Water Absorption of Plastics.
3. ASTM D 638 - Test Method for Tensile Properties of Plastics.
4. ASTM D 695 - Test Method for Compressive Properties of Rigid Plastics.

PART 2 PRODUCTS

2.1 MATERIALS

All materials shall be new stock. Materials shall be in accordance with the requirements specified herein and ASTM specifications listed in this Section, unless otherwise shown on the Drawings.

2.2 FIBERGLASS STRUCTURAL SHAPES

A. Fiberglass structural shapes shall have premium grade fire-retardant polyester resin with a UV inhibitor as manufactured by IKG Industries, or Morrison Molded Fiber Glass Company, or Fiberglass Reps, or approved equal. All shapes shall be pultrusion technique and shall have a synthetic surface veil 20 mils minimum thickness.

B. Minimum mechanical and physical properties of the fiberglass composites shall be as follows:

Mechanical Properties Mechanical Properties	Longitudinal Directional (psi)	Transverse Direction (psi)
Ultimate Tensile Strength	30,000	7,000
Ultimate Compressive Strength	30,000	15,000
Ultimate Flexural Strength	30,000	10,000
Ultimate Shear Strength	5,500	5,500
Ultimate Bearing Stress	30,000	30,000

Full Section in Bending	
Specific Gravity (ASTM D 792)	2.5×10^6 psi
Ultimate Tensile Strength	20,000 psi
Ultimate Compressive Strength	20,000 psi
Specific Gravity (ASTM D 792)	1.8 Minimum
Water Absorption (ASTM D 570)	0.60 max. % by wt.
Thermal Coeff. of Expansion (ASTMD 696)	5×10^{-6} inches/inch/° F

2.3 FIBERGLASS GRATING

A. Fiberglass grating shall be made from premium grade fire-retardant polyester resin as manufactured by IKG Industries, or Morrison Molded Fiber Glass Company, or Fiberglass Reps, or Chemgrate, or approved equal. All grating shall be made by pultrusion technique and shall have a synthetic surface VEIL 20 mils minimum thickness.
Molded gratings are not acceptable.

B. Fiberglass grating shall be CUSTOM GRATING T-3300-2" or having equal properties of A = 4.338 in.^{2}/ft. of width, I = 2.234 in.^{4}/ft. of width, S_T = 2.541 in.^{3}/ft. of width, and S_B =1.994 in.^{3}/ft. of width, unless otherwise noted on the Drawings, as manufactured by IKG Industries, or Morrison Molded Fiberglass Company, or Fiberglass Reps, or approved equal.

C. Maximum deflection of fiberglass grating at the center of unsupported span shall not exceed 1/240 the span with a maximum of 0.285" under either of the following loading conditions:

1. Concentrated live load of 300 lbs. per ft. of width of grating applied at the center of the span.
2. Uniform live load of 100 lbs./sq. ft. applied over the entire area of grating.

D. The top of fiberglass grating shall be covered with a permanently bonded quartz grit/baked epoxy anti-skid surface. Grit size shall be such that it shall pass 100% through sieve size 20 and shall retain 100% on sieve size 80.
E. Cross tie rods and spacers when used shall be totally sealed against the bearing bars. A minimum of three cross tie rods shall be provided for a given unsupported span. In any case, center to center of cross tie rods shall not exceed 12 in.
F. Grating shall be furnished complete with panel hold downs and connectors. There shall be a minimum of three hold downs along edge supports and a minimum of two hold downs along intermediate supports.
G. Bolts for the hold downs and connectors shall be 316 stainless steel having 3/16 minimum diameter.
H. Grating shall be furnished in OSHA "Safety Gray" *color*.

2.4 FIBERGLASS COVER FOR TRENCHES

A. Fiberglass cover for trenches shall be made from premium grade polyester resin suitable for sodium hypochlorite atmosphere at ambient temperature, as manufactured by IKG Industries, or Morrison Molded Fiberglass Company, or Fiberglass Reps, or Chemgrate, or approved equal. Minimum thickness shall be 1".
B. The top of fiberglass grating shall be covered with a permanently bonded quartz grit/baked epoxy anti-skid surface. Grit size shall be such that it shall pass 100% through sieve size 20 and shall retain 100% on sieve size 80.

2.5 EPOXY ADHESIVES

A. The epoxy adhesives recommended for structural connections are either Shell 828 Epoxy Resin or DOW D.E.R. 331 Epoxy Resin or MMFG Epoxy Adhesive, or approved equal. In general, epoxy adhesives provide stronger joints than vinyl ester adhesives.

PART 3 EXECUTION

3.1 DETAILING AND FABRICATION

A. All working points, as indicated on the Drawings shall be adhered to in the detailing of the work.
B. Fabrication shall be based on approved shop drawings.
C. All FRP members shall be prefabricated into subassemblies to facilitate field erection.
D. Substitution of FRP structural shapes or modification of design details shall be made only as approved by the Engineer.
E. At cutouts shown or indicated on the Drawings, grating bearing bar ends shall be supported either by adding adequate structural support or support bars with hold downs.
F. Field cuts shall be sealed per manufacturer's supplier's recommendations, and UV coating shall be provided where applicable.

SECTION 06100 ROUGH CARPENTRY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This Section covers the work necessary to furnish, and install, complete the following items required under the Contract Documents:

1. Wood grounds, nailers, and blocking.
2. Rooftop equipment bases and support curbs.

3. Preservative treatment of wood members.

1.2 RELATED DOCUMENTS:

A. Reference standards include but are not limited to:

1. San Francisco Building Code 1995 Edition, Chapter 25, "Wood".
2. National Forest Products Association (NFPA): National design specifications for stress grade lumber and its fastenings.

B. Related Sections - The following Sections contain requirements that relate to this Section:

1. Division 3 Section 03300 "Concrete."

1.3 DEFINITIONS

A. Rough carpentry includes but is not limited to carpentry work which is generally not exposed to view.

1.4 QUALITY ASSURANCE

A. Lumber: Provide visible grade stamp of an agency certified by NFPA.

B. Lumber Standard - Comply with U. S. Product Standard PS20 for each indicated use, including moisture content and actual sizes related to indicated nominal sizes.

PART 2 PRODUCTS

2.1 MATERIALS

A. Lumber:

1. Dimensions given are nominal surface, four sides (S4S), unless specified otherwise.
2. All lumber shall bear the grading mark of the WWPA.

B. Unless otherwise noted, lumber shall be as follows:

Use	Minimum Grade
General framing, studs, lates, blocking, furring, braces and nailers.	Standard and better or stud grade Douglas fir, Larch.

C. Nails, Spikes and Staples - Type 316 stainless steel for exterior locations, high humidity locations and treated wood; size and type to suit application.

D. Bolts, Nuts, Washers, Lags, Pins and Screws - Medium carbon steel; sized to suit application, Type 316 stainless steel for exterior locations, high humidity locations and treated wood, size and type to suit application as per reference standards.

E. Fasteners: Provide fasteners as required for complete, secure installation of miscellaneous rough carpentry.

1. Solid Masonry or Concrete: Expansion shield and lag bolt type.
2. Steel: Bolts.

2.2 WOOD PRESERVATIVE

A. Treat lumber to comply with applicable requirements of American Wood Preservers Association, available from AWPA.

B. Pressure treat the following items with water-borne preservatives for above ground use, with AWPA LP-2:

1. Wood members in connection with roofing, flashing, vapor barriers and waterproofing.
2. Wood members in contact with masonry, concrete, earth, water or weather.
3. Kiln-dry wood to a maximum moisture content of 15 percent after treatment with weather-borne preservatives.

C. Fire Retardant Treatment - Comply with AWPA standards for pressure impregnation with fire-retarding chemicals to achieve flame-spread rating of not more than 25 in accordance with ASTM E84 or UL Test 723.

1. Treat interior rough carpentry members.
2. Provide UL label on each piece of fire-retardant wood.
3. Kiln-dry treated items to maximum moist content of 19 percent.

D. Complete fabrication of treated items prior to treatment, wherever possible; if cut after treatment, coat cut surfaces with heavy brush coat of same chemical used for treatment.
E. Inspect each piece after drying and discard damaged or defective pieces.

PART 3 EXECUTION

3.1 INSTALLATION:

A. Place miscellaneous rough carpentry true to lines and levels.
B. Correlate location so that attached work complies with design requirements and is properly located.
C. Construct member of continuous pieces of longest possible lengths.
D. Fit carpentry work to other work; scribe and cope as required for accurate fit.
E. Shim with metal or slate for bearing on concrete and masonry.
F. Securely attach carpentry work to substrates by anchoring and fastening as required by recognized standards.

1. Provide washers under bolt heads and nuts in contact with wood.

G. Wood Blocking - Provide blocking of S4S lumber not less than 1-1/2 inch wide and of thickness required to provide adequate support or to properly locate attached material.

1. Provide attachment to other work; form to shapes shown.
2. Countersink bolts and nuts flush with surfaces.
3. Remove temporary blocking when no longer needed.
4. Anchor to form work before concrete placement.

SECTION 07527 SBS-MODIFIED BITUMINOUS SHEET ROOFING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Reference standards include but are not limited to:

1. San Francisco Building Code 1995 Edition.

1.2 SUMMARY

A. This Section includes the following:

1. Modified bituminous sheet with mineral granule surfacing.
2. Roofing asphalt.
3. Modified bituminous sheet with metal foil surfacing in all drains.

4. Three ply modified bituminous system over concrete deck.

B. Related Sections: The following sections contain requirements that relate to this Section:

1. Division 6 Section "Rough Carpentry" for treated wood nailers, curbs, and wood cants
2. Division 7 Section "Flashing and Sheet Metal" for metal counter flashings.

1.3 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 for definitions of terms related to roofing work not otherwise defined in this Section.
B. Thermal Resistivity (r-value) is the reciprocal of thermal conductivity (k-value) which is the rate of heat flow through a homogenous material exactly 1 inch thick. Thermal resistivity (r-value) is expressed by the temperature difference in degrees F between two parallel surfaces required to cause 1 Btu to flow through 1 sq. ft. of a homogenous material exactly 1 inch thick per hour at the mean temperature indicated.
C. Thermal Resistance (R-value) i\ the reciprocal of thermal conductance (C-value) which is the rate of heat flow through a material of the thickness indicated Thermal resistance (R-value) is expressed by the temperature difference in degrees F between the two exposed faces required to cause 1 Btu to flow through 1 sq. ft. per hour at the mean temperature indicated.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. General - Install modified bituminous sheet roofing to withstand wind loads, structural movement, thermally induced movement, and exposure to weather, without failure.
B. UL Listing - Provide modified bituminous sheet roofing system and component materials that have been tested for application and slopes indicated and are listed by Underwriters Laboratories, Inc.(UL) for Class A external fire exposure.

1. Provide roof-covering materials bearing UL Classification Marking on bundle, package, or container indicating that materials have been produced under UL's Classification and Follow-up Service.
2. Provide modified bitumen sheet roofing system that can be installed to comply with UL requirements for Fire Classified and FM Class 60 wind-uplift requirements
3. Provide roof-covering materials bearing FM approval marking on bundle, package, or container, indicating that material has been subjected to FM's examination and follow-up inspection service.

1.5 SUBMITTALS

A. General - Submit the following according to Section 12-1.06.

B. Product data for each type of product specified Include data substantiating that materials comply with requirements.

1. For asphalt bitumen, provide label on each container or certification with each load of bulk bitumen, indicating flash point (FP), finished blowing temperature (FBT), softening point (SP), and equiviscous temperature (EVT).

C. Manufacturer's certification indicating that bulk bituminous materials (if any) delivered to contract site comply with required standards Include quantity and statistical and descriptive data for each product. Submit certificate with each load before it is used.

1. Include continuous log showing time and temperature for each load of bulk bitumen, indicating date obtained from manufacturer, where held, and how transported prior to final heating and application on roof.

D. Field Test Reports: Submit daily softening point test reports on samples of asphalt used on project, taken at beginning of each day's work and at 2-hour intervals during course of the work Test by Ring and Ball Test,

ASTM D 36, or similar recognized test method. Submit samples to independent laboratory for testing or perform tests in field, at Contractor's option

E. Samples of the following:

1. 12-by-12-inch-square samples of each color modified, bituminous, mineral-surface cap sheets to be exposed as finished roof surface.
2. 12-by-12-inch-square samples of metal foil-covered, modified, bituminous cap sheets to be exposed as finished roof surface.

F. Installer Certification: Submit written certification from manufacturer of modified bituminous sheet roofing system certifying that installer is approved by manufacturer to install specified roofing system. Provide copy of certification to Engineer before award of roofing work.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications - Obtain primary products, including each type of roofing sheet, bitumen, membrane flashings, and vapor retarder (if any), from a single manufacturer. Manufacturer must have a minimum of Ten (10) years experience in production of the system components in the United States. Provide secondary products as recommended by manufacturer of primary products for use with roofing system specified.

B. Installer Qualifications - Engage an experienced installer (roofer) who is certified by modified bituminous sheet roofing system manufacturer as qualified to install manufacturer's roofing materials.

1. Installer's Field Supervision - Require installer to maintain a full time supervisor/foreman on job site during times that modified bituminous sheet roofing work is in progress and who is experienced in installation of roofing systems similar to type and scope required for this Project

C. Insurance Certification - Assist City in preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire and extended coverage insurance on roofing and associated work.

D. Preliminary Roofing Conference - As soon as possible after award of modified bitumen sheet roofing work, meet with installer (roofer), installers of substrate construction and other work adjoining roof system including penetrating work and roof accessories, Engineer, and representatives of other entities directly concerned with performance of roofing system.

1. Review requirements (Contract Documents), submittals, status of coordinating work, availability of materials, and installation facilities and establish preliminary installation schedule. Review requirements for inspections, testing, certifications, forecasted weather conditions, governing regulations, insurance requirements, and proposed installation procedures.
2. Discuss roofing system protection requirements for construction period extending beyond roofing installation Discuss possible need for temporary roofing.
3. Record discussion, including agreement or disagreement on matters of significance; furnish copy of recorded discussions to each participant. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store and handle roofing sheets in a dry, well-ventilated, weathertight place to ensure no possibility of significant moisture pickup. Store rolls of felt and other sheet materials on end on pallets or other raised surface.

B. Do not leave unused felts and other sheet materials on the roof overnight or when roofing work is not in progress unless protected from weather or other moisture sources.

C. Handle and store materials or equipment in a manner to avoid significant or permanent deflection of deck.

D. Roofing material shall be delivered to the job-site in new, dry, unopened containers clearly showing catalog number, product description, manufacturer's name and location. Delivered quantities should be sufficient to assure continuous work.

E. Assure that materials are kept clean, and away from excessive heat and cold; do not remove labels or tear off protective covering until ready for application; store in an enclosed area where temperature is above 50 degrees and below 90 degrees Fahrenheit. Material shall not be stored directly on the ground.

F. Do not double stack membrane. Maintain aisle space between stacks to facilitate fire suppression.

1.8 PROJECT CONDITIONS

A. Weather Condition Limitations - Proceed with roofing work only when existing and forecasted weather conditions will permit unit of Work to be installed in accordance with manufacturers' recommendations and warranty requirements.
B. Temporary Roofing - When adverse job or weather conditions prevent permanent roofing system from being installed according to requirements and Contractor determines that roofing cannot be delayed because of need for job progress or protection of other work, install temporary roofing. Engage roofing installer to provide temporary roofing and to remove it prior to proceeding with permanent roofing work.

1. Record by way of Change Order the City's agreement to proceed with temporary roofing, along with any additional costs and other changes to Contract Documents.

1.9 SEQUENCING AND SCHEDULING

A. Sequence installation of modified bituminous sheet roofing with related units of Work specified in other sections to ensure that roof assemblies, including roof accessories, flashing, trim, and joint sealers, are protected against damage from effects of weather, corrosion, and adjacent construction activity

1.10 WARRANTY

A. Special Project Warranty - Submit two executed copies of standard 2-year roofing warranty, covering work of this section including roofing membrane, membrane flashing, roof insulation, any vapor retarders, and roofing accessories, signed and countersigned by installer (roofer) and Contractor.
B. Manufacturer's Warranty - Submit executed copy of roofing manufacturer's standard limited service warranty agreement including flashing endorsement, signed by an authorized representative of modified bitumen sheet roofing system manufacturer, on form that was published with product literature as of date of Contract Documents, for the following period of time:

1. 20 years after date of substantial completion.

PART 2 PRODUCTS

2.1 TEMPORARY ROOFING

A. Temporary Roofing Membrane: Two plies of asphalt-impregnated glass-fiber felt complying with ASTM D 2178, Type IV, set in and glaze-coated with hot moppings of ASTM D 312, Type III asphalt.

2.2 ROOF INSULATION

A. Provide rigid tapered insulation perlite boards in manufacturer’s standard sizes; ASTM C 728, prior to application of modified bitumen roofing.

2.3 MODIFIED BITUMINOUS SHEET ROOFING SYSTEM

All materials must be manufactured in the USA. Materials not manufactured in the USA are only acceptable if similar materials are not available by United States manufacturers.

A. Modified Bituminous Sheet, General: Furnish modified bituminous sheet materials complying with the following:

1. Breaking Strength - ASTM D 412, Minimum 175 lb.
2. Ultimate Elongation (elongation at break) - ASTM D 412, 8.0 percent.

3. Water Resistance - ASTM D 570, will not absorb more than 1.0 gram of water and dimensional change will not exceed 1.0 percent (ASTM D 1204).
4. Water Vapor Transmission - ASTM E 96, maximum 1.0 gram in 24 hours.
5. Dynamic Impact (puncturing) - Pass water-tightness test after impact of 3.6 ft. lb.
6. Lap Joint Strength - ASTM D 412, 176 lbf., after immersion at 50 deg F for 5 days plus five freeze-thaw cycles.

B. Modified Bitumen Membrane/Fully Adhered.

1. Base Sheet - Styrene Butadiene Styrene (SBS)-modified bitumen base sheet, with polyester fiber reinforcing mat, dusted with fine mineral granules both sides. Minimum weight 90 lb. per square.
2. Interply Bitumen - Roofing asphalt, complying with ASTM D 312, Type III or Type IV.
3. Modified Bitumen Sheet Membrane/Mineral Surfaced Cap Sheet: Styrene Butadiene Styrene (SBS)-modified asphalt sheets with continuous layer of mineral granules factory applied to top exposed surface; manufacturer's standard thickness. Granule color: To be chosen by Engineer. Minimum weight 110 lb.

   a. Sheet Reinforcing - Dual reinforced polyester and glass fiber mat.

4. Modified Bitumen Sheet Membrane/Mineral Surfaced Flashing Sheet - Torch applied Styrene Butadiene Styrene (SBS)-modified asphalt sheets with continuous layer of mineral granules factory applied to top exposed surface; manufacturer’s standard thickness. Granule color: to be chosen by Engineer. Minimum Weight 100 lbs.

   a. Sheet reinforcing - Dual reinforced polyester and glass fiber material.

5. Modified Bitumen Sheet Membrane/Metallic Surfaced (for all Drains) - Styrene Butadiene Styrene (SBS)-modified asphalt sheets with embossed copper or aluminum foil surfacing; manufacturer’s standard thickness.
6. Manufacturers: Subject to compliance with requirements, provide products by:

   a. MBTechnology

      SBS Superflex SF 160 PSA - Base
      Fireguard SBS FG160CWH - Cap
      Fastorch SBS FTI6OCWH - Flashing
      Metalflex SBS MF160WAL - Drains

   or approved equal by:

   a. The Garland Company, Inc.
   b. Tremco Inc.
   c. Schuller Roofing Systems
   d. Siplast

C. Metal Securement System - L-shaped securement flashing and other required insulation strapping fabricated from stainless steel, minimum 0.031-inch thick (22 gage). Provide fasteners as recommended by insulation manufacturer.

2.5 MISCELLANEOUS MATERIALS

A. Wood Members: Comply with requirements of Division 6 Section "Rough Carpentry" for wood members indicated as roofing system work.
B. Cants: Perlite board, ASTM C 728
C. Cants: Wood fiberboard, ASTM C 208.
D. Tapered Edge Strips: Rigid perlite board, ASTM C 728

E. Tapered Edge Strips: Rigid wood fiberboard, ASTM C 208.
F. Tapered Edge Strips: Rigid fiberglass board, ASTM C 726.
G. Walkway Protection Boards: Mineral-surfaced bituminous composition boards, approximately 1/2 inch thick, manufactured specifically for hot bituminous application on modified bitumen sheet roofing as a protection course for foot traffic.
H. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
I. Products: Subject to compliance with requirements, provide one of the following:

1. Carey-Tread, Celotex Corp.
2. J-Walk, Manville Sales Corporation
3. White Walk
4. Meadows, Inc.

J. Substrate Joint Tape - 6-inch- or 8-inch-wide, coated, glass fiber joint tape.
K. Mastic Sealant: Polyisobutylene (plain or bituminous modified), nonhardening, nonmigrating, nonskinning, and nondrying.
L. Fasteners - Provide mechanical fasteners for modified bitumen sheet roofing system work, tested by manufacturer for required pull-out strength where applicable and compatible with deck type and roofing products used.
M. Fasteners - Galvanized steel, fluoropolymer-coated steel, or nonferrous metal screws. Size, length, and type recommended by manufacturer as suitable for material to be fastened, substrate, and that will comply with requirements of governing authorities and listing agencies.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrate surfaces to receive modified bitumen sheet roofing system and associated work and conditions under which roofing will be installed Do not proceed with roofing until unsatisfactory conditions have been corrected in a manner acceptable to installer.

1. Test concrete substrate for excessive moisture by pouring 1 pint of hot bitumen at 400 deg F (204 deg C) or EVT on deck at start of each day's work and at start of each roof area or plane. Do not proceed with roofing work if test sample foams or can be easily and cleanly stripped after cooling, indicating a wet substrate.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Limit use of the premises to construction activities in areas indicated. Allow for Owner occupancy and use by the public. Confine operations to areas within Contract limits indicated. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed.
B. Keep driveways and entrances serving the premises clear and available to the Owner and the Owner's employees at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site. Access by workmen and delivery of all materials and equipment to the roof of the building shall be from areas only designated. All ladders shall be taken down at the end of each work day.
C. Contractor shall verify that surfaces are smooth, dry, sound, and free from any conditions effecting proper roofing applications. Prior to starting work, owner shall be advised of conditions needing correction. Work will not be started until other trade work required ahead of membrane application is completed. Contractor is responsible for all carpentry work such as wood nailers, wood curbs, wood expansion or contracting members, wood cants and similar items necessary for the completion of the work according to these Specifications.
D. Cooperate with inspection and test agencies engaged or required to perform services in connection with installing modified bitumen sheet roofing system.

E. Protect other work from spillage of modified bitumen roofing materials, and prevent liquid materials from entering or clogging drains and conductors. Replace or restore other work damaged by installation of modified bituminous sheet roofing system work.
F. Insurance/Code Compliance: Where required, install and test modified bitumen sheet roofing system to comply with governing regulations and specified insurance requirements.
G. Coordinate installing roofing system components so that insulation and roofing plies are not exposed to precipitation or left exposed overnight. Provide cut offs at end of each day's work to cover exposed ply sheets and insulation with a course of coated felt with joints and edges sealed with roofing cement. Remove cut offs immediately before resuming work.
H. Asphalt Bitumen Heating: Heat and apply bitumen according to EVT Method as recommended by NRCA. Do not raise temperature above minimum normal fluid-holding temperature necessary to attain EVT (plus 5 deg F or 14 deg C, at point of application) more than 1 hour prior to time of application. Determine flash point, finished blowing temperature, EVT, and fire-safe handling temperature of bitumen either by information from manufacturer or by suitable tests. Do not exceed recommended temperature limits during bitumen heating. Do not heat bitumen to a temperature higher than 25 deg F (14 deg C) below flash point. Discard bitumen that has been held at temperature exceeding finished blowing temperature (FBT) for more than 3 hours. Keep kettle lid closed except when adding bitumen.
I. Bitumen Mopping Weights: For interply mopping, apply bitumen at the rate of 25 lb. of asphalt per roof square (plus or minus 25 percent on a total job average basis).
J. Substrate Joint Penetrations: Prevent bitumen from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction. Where mopping is applied directly to substrate, tape substrate joints or, where steep asphalt is used, hold asphalt back 2 inches from both sides of the joint.
K. Cutoffs: At end of each day's roofing installation, protect exposed edge of incomplete work, including ply sheets and any insulation. Provide temporary covering of two plies of No. 15 roofing felt set in full mappings of hot bitumen; remove at beginning of next day's work.

3.3 TEMPORARY ROOF INSTALLATION

A. Temporary Roofing on Non-nailable Decks: Prime deck with asphaltic primer at the rate of 0.75-1 gallons per square. Apply two plies of roofing felts, lapping each felt 19 inches (plus or minus 1/2 inch) over preceding one. Solid mop the felts to deck using Type III asphalt at a rate of 20 lb. per square (plus or minus 25 percent). Glaze coat completed surface with Type III asphalt at rate of 20 lb. per square (plus or minus 25 percent).

1. Comply with NRCA "Low-Slope Roofing Manual" Specification 10 TR and Diagram TRC.

B. Remove temporary roof completely prior to installing permanent roofing system.

3.4 INSTALLING INSULATION

A. General - Comply with insulation manufacturer's instructions and recommendations for the handling, installation, and bonding or anchorage of insulation to substrate.
B. Prime surface of concrete deck with asphalt primer at rate of 3/4 gallon of primer per 100 sq. ft. and allow primer to dry.
C. Set insulation in hot solid mopping of Type III or Type IV asphalt, applied within temperature range of EVT plus or minus 25 deg F (14 deg C) and at rate of 25 lb. per 100 sq. ft. (plus or minus 15 percent on total-job basis). Run long joints of insulation in continuous straight line, perpendicular to roof slope, with end joints staggered between rows, Maximum size of insulation to be 4' by 4'.
D. Trim surface of insulation where necessary at roof drains so that completed surface is flush with ring of drain.
E. Nailers - Where insulated substrates slope more than 1/2 inch per foot, install wood nailers of same thickness as insulation, spaced not more than 20 to 21 feet apart and between insulation boards, depending on board size. Anchor nailers to substrate. Run nailers perpendicular to slope of roof unless otherwise indicated.

3.5 ROOF MEMBRANE INSTALLATION

A. Shingling Plies - Install membrane with ply sheets shingled uniformly to achieve required number of membrane plies throughout. Shingle in proper direction to shed water on each large area of roofing, where slope is significant (over 1/2 inch per foot).
B. Where slope exceeds One (1)inch per foot, run sheets of modified bituminous roofing membrane parallel with slope, except run cap sheet surfacing near-parallel with a 1:12 incline for proper shed of water from exposed edges of cap sheets Nail top ends of sheets. For Slopes of 1" - 2 1/2" back nail head and side laps to stabilize membrane curing time.
C. Membrane length must be maximum 17' on 1" - 2" slope. Maximum 11' on 2" - 2 1/2" slope.
D. Cant Strips/Tapered Edge Strips - Install preformed 45 degree cant strips at junctures of modified bituminous sheet roofing system membrane with vertical surface. Provide preformed, tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.
E. Base Sheet - Install one lapped course of base sheet adhered in hot asphalt Type III or Type IV.
F. Top Sheet - Install top sheet using hot bitumen at the same rate as interply sheets to form a continuous bonded membrane

1. Extend modified bituminous sheet to 2 inches above top edge of cant strip and terminate.
2. Nail edges of membrane to wood blocking at perimeter edges of roof prior to installing metal gravel stops/ fascias Space nails at minimum 8 inches o.c.

G. Set - On Accessories - Where small roof accessories are set on modified bituminous sheet roofing, set metal flanges in a bed of roofing cement and seal penetration of membrane with bead of roofing cement to prevent flow of bitumen from membrane.

3.6 MEMBRANE FLASHING AND STRIPPING

A. Install modified bituminous flashing at cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof. Install one ply of flashing sheet material by mopping substrate and back of flashing sheet with Type IV asphalt and embedding flashing solidly against substrate. Extend flashing a minimum of 6 inches onto modified bituminous sheet roofing.
B. Install modified bituminous stripping where metal flanges are set on roofing. Install one ply of modified bituminous stripping in a continuous mopping of Type III asphalt and extend stripping a minimum of 6 inches out onto the roof membrane.
C. Allow for expansion of running metal flashing and edge trim that adjoins roofing. Do not seal or bond membrane or modified bituminous flashing or stripping to metal flanges over 3 feet in length.
D. Counter-Flashings: Counter-flashings, cap flashings, expansion joints, and similar work to be coordinated with modified bitumen roofing work are specified in other sections.
E. Roof Accessories: Miscellaneous sheet metal accessory items, including piping vents, insulation vents and other devices to be coordinated with modified bituminous roofing system work, are specified in other sections.

SECTION 07570 TRAFFIC COATINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pedestrian traffic coatings for interior applications.

1.2 EQUIPMENT NUMBERS

Not used.

1.3 RELATED SECTIONS

1. Section 12-1.06 - Submittals
2. Section 12-1.18 - Operating and Maintenance Instructions
3. Section 03300 - Concrete; for concrete placement, curing, and finishing.

4. Section 07900 - Joint Sealants; for joint sealant materials and installation.

1.4 REFERENCE STANDARDS

A. ASTM Standards cited herein.

1.5 SYSTEM DESCRIPTION

A. Traffic coatings are defined to include cold liquid-applied, elastomeric membranes with integral wearing surfaces for application to building decks not subject to hydrostatic pressure, in areas housing equipment or subject to pedestrian or vehicular traffic.

1.6 SYSTEM PERFORMANCE REQUIREMENTS

A. General - Provide traffic coatings that are watertight and that will not deteriorate upon exposure to normal ice- and snow-melting compounds, sun, weather, normal traffic, and manufacturer-recommended cleaning procedures.
B. Traffic coatings shall not deteriorate upon spillage of motor oil, transmission fluids, or other motor vehicle operating compounds.

1. Deterioration of traffic coatings includes but is not limited to:

a. Adhesive or cohesive failures.
b. Abrasion or tearing failure resulting from normal traffic.
c. Surface crazing or spalling.
d. Intrusion of water, oils, gasoline, grease, salt, deicer chemicals, or acids into deck substrate.

C. Provide traffic coatings that comply with ASTM C957 and that meet or exceed the following physical requirements:

1. Low-Temperature Flexibility and Crack Bridging (ASTM C957): No cracking.
2. Adhesion-in-Peel after Water Immersion (ASTM C957): 5 lbf/inch (875 N/m) on concrete; 3 lbf/inch (525 N/m) on plywood.
3. Chemical Resistance (ASTM C957): Tensile retention of base, intermediate, and top coats; minimum 70 percent in water, 70 percent in ethylene glycol, and 45 percent in mineral spirits.
4. Weathering Resistance and Recovery from Elongation (ASTM C957): Average recovery from elongation not less than 90 percent; average tensile retention not less than 80 percent; average elongation retention not less than 90 percent.
5. Abrasion Resistance (ASTM C957): Weight loss no greater than 50 mg.

1.7 SUBMITTALS

A. General - Submit the following according to the Conditions of the Contract and Section 12-1.06 - Submittals:

1. Product data consisting of manufacturer's printed instructions for evaluating, preparing, and treating the substrate, technical data, and tested physical and performance properties of traffic coatings.
2. Shop drawings showing extent of each duty category of traffic coating. Include details for substrate joints and cracks, flashings, deck penetration, and other termination conditions.

a. Include layout of traffic striping and markings.
b. Samples for initial selection purposes in the form of manufacturer's color charts showing a full range of colors and finishes available.
c. Material certificates, in lieu of independent testing agency test reports, signed by manufacturer certifying that each traffic coating material complies with requirements.

d. Maintenance data for traffic coatings to include in the "Operating and Maintenance Manual" specified in Section 01730. Identify substrate and type of traffic coatings applied. Include recommendations for periodic inspections, cleaning, care, maintenance, and repair of traffic coatings.

1.8 QUALITY ASSURANCE

A. Installer Qualifications - Installer experienced in applying traffic coatings of comparable scope to this Contract and who is acceptable to traffic coating manufacturer.
B. Single-Source Responsibility: Obtain primary traffic coating materials, including primers and aggregates, from a single manufacturer regularly engaged in manufacturing traffic coatings. Provide secondary materials; including sheet flashings, joint sealants, and substrate repair materials; of type and from source recommended by traffic coating manufacturer.
C. Field Samples - Apply traffic coating field sample to 20 sq. ft. of deck to demonstrate surface preparation, joint and crack treatment, thickness, texture, color, and standard of workmanship.

1. If the Engineer determines that a field sample does not meet requirements, reapply traffic coating until the field sample is accepted.
2. Keep the accepted field sample undisturbed during construction as a standard for judging completed traffic coating. An undamaged field sample may be incorporated into the Work.

D. Environmental Conditions - Apply traffic coatings within the range of ambient and substrate temperatures recommended by the manufacturer. Do not apply traffic coatings to a damp or wet substrate, when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F (3 deg C) above dew point.

1. Do not apply traffic coatings in snow, rain, fog or mist, or when such weather conditions are imminent during the application and curing period.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers with seals unbroken and bearing manufacturer's labels containing brand name and type of material, directions for storage and mixing with other components, and the following label information:

1. Date of manufacture and shelf life.
2. Lot or batch number.
3. Application instructions.
4. Color.

B. Store materials in a clean, dry, protected location and within the temperature range required by the manufacturer. Protect stored materials from exposure to direct sunlight.
C. Remove and replace material that cannot be applied within its stated shelf life.

1.10 WARRANTY

A. Warranty: Submit written warranty signed by traffic coatings manufacturer and installer agreeing to repair or replace traffic coatings that do not meet requirements or that deteriorate as defined in this Section within the warranty period indicated below. Warranty does not include deterioration or failure of traffic coating due to unusual weather phenomena, failure of prepared and treated substrate, formation of new joints and cracks in excess of 1/16 inch wide, fire, vandalism, or abuse by snowplows, truck traffic, or maintenance equipment.

1. Warranty Period: 2 years after date of substantial completion.

PART 2 PRODUCTS

2.1 TRAFFIC COATINGS, GENERAL

A. Material Compatibility - Provide primers, base, intermediate, and top coats, and miscellaneous materials that are compatible with one another and with substrate under conditions of service and application, as demonstrated by the manufacturer based on testing and field experience.
B. Colors - Provide color selections of traffic coatings made by the Engineer from the manufacturer's full range of standard colors.

2.2 EPOXY TRAFFIC COATINGS

A. Provide epoxy traffic coatings complying with system performance requirements and manufacturer's printed physical requirements for each coat as certified by a qualified independent testing agency.
B. Primer - Manufacturer's standard factory-formulated epoxy primer.
C. Epoxy Top Coat - Manufacturer's standard liquid epoxy top coat.
D. Available Products - Subject to compliance with requirements, traffic coatings that may be incorporated in the Work include, but are not limited to, the following:

1. Pedestrian Traffic Coatings:

a. Kelmar FWC II T.E. Exposure 6; Master Builders, Inc.
b. Kelmar T.E. Exposure 6; Master Builders, Inc.
c. Stoneshield HLT by Stonehard.
d. Conrad Sovig, Co. Inc.

2.3 MISCELLANEOUS MATERIALS

A. Aggregate: Uniformly graded washed silica sand of particle sizes and shape as recommended by traffic coating manufacturer, with minimum hardness of 6 on the Moh Scale.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrate and conditions under which traffic coating systems will be applied for compliance with requirements. Do not proceed with installation until unsatisfactory conditions have been corrected.

1. Do not proceed with installation until after the minimum concrete curing period recommended by traffic coating manufacturer.
2. Verify substrate is visibly dry and free of moisture. Test for capillary moisture by the plastic sheet method according to ASTM D4263.
3. Notify the Engineer in writing of anticipated problems using traffic coatings over substrate.

3.2 SURFACE PREPARATION

A. Clean and prepare substrate according to manufacturer's recommendations and as specified. Provide clean, dust-free, and dry substrate for traffic coating application.
B. Mask off adjoining surfaces not receiving traffic coatings and close off deck drains and other deck penetrations to prevent spillage and migration of liquid coatings.
C. Concrete Surfaces: Remove grease, oil, paints, or other penetrating contaminants from concrete. Remove concrete fins, ridges, or other projections. Abrasive-blast clean concrete surfaces to a uniform profile according to ASTM D4259 with a self-contained, recirculating blast-cleaning apparatus. Remove material to provide a sound surface free of laitance, glaze, efflorescence, curing compounds, concrete hardeners, or form release agents. Remove remaining loose material and clean surfaces according to ASTM D4258.

1. Surface Profile - Lightly blast the concrete surface to expose the top surface of the fine aggregate.

3.3 PREPARATION AT TERMINATIONS AND PENETRATIONS

A. Prepare vertical and horizontal surfaces at terminations and penetrations through traffic coatings and at expansion joints, drains, and sleeves according to ASTM C1127 and manufacturer's recommendations.
B. Provide sealant cants at penetrations and reinforced and nonreinforced deck-to-wall butt joints.
C. Prime substrates and apply preparatory base coat. Embed joint reinforcing strip in coating when recommended by traffic coating manufacturer.
D. Terminate edges of deck-to-deck expansion joints with preparatory base coat strip.

3.4 TRAFFIC COATINGS APPLICATION

A. General - Apply each traffic coating material according to ASTM C1127 and manufacturer's recommendations.

1. Start installation of traffic coatings in presence of manufacturer's technical representative.
2. Mix materials according to manufacturer's instructions.
3. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
4. Apply coatings by spray, roller, notched squeegee, or other applicators according to manufacturer's recommendations.
5. Apply total dry film thickness of traffic coating as indicated, but to not less than the minimum thickness recommended by the manufacturer. Apply each coating to the thickness recommended by the manufacturer.
6. Apply aggregate into wet coating according to manufacturer's recommendations.
7. Verify wet film thickness of each component coat every 100 sq. ft.

B. Pedestrian Traffic Coating - Apply base, intermediate, and top coats and aggregate according to manufacturer’s recommendations and as follows:

1. Normal Duty - Apply a minimum dry film thickness of 32 mils, excluding substrate primer and aggregate.

a. Aggregate - Apply silica aggregate at manufacturer's recommended rate.

C. Wall Terminations and Vertical Surfaces - Apply traffic coatings to prepared wall terminations and vertical surfaces to height indicated according to manufacturer's recommendations and details.

1. Omit aggregate on vertical surfaces.

3.5 CURING, PROTECTION, AND CLEANING

A. Cure traffic coatings according to manufacturer's recommendations taking care to prevent contamination and damage during application stages and curing.
B. Protect traffic coatings from damage and wear during remainder of construction period.
C. Cleaning - Remove temporary covering and clean traffic coatings just before final inspections. Use cleaning materials and procedures recommended by manufacturer.

SECTION 07600 FLASHING AND SHEET METAL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This Section includes the following flashing and sheet metal items required under the Contract Documents:

1. Metal counter flashing and base flashing (if any).
2. Metal wall flashing and expansion joints.
3. Built-in metal valleys, gutters, and scuppers.

4. Gutters and downspouts (rain drainage).
5. Exposed metal trim/fascia units.
6. Miscellaneous sheet metal accessories.
7. Elastic roof/wall expansion joint systems.

B. Roofing accessories installed integral with roofing membrane are specified in roofing system sections as roofing work.
C. Roof accessory units of premanufactured, set-on type are specified in Division 7.

1.2 RELATED DOCUMENTS

A. Reference standards include but are not limited to:

1. San Francisco Building Code, 1995 Edition.
2. SMACNA Standard Details or better.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Section 12-1.06.
B. Product data, Flashing, Sheet Metal, and Accessories: Manufacturer's technical product data, installation instructions and general recommendations for each specified sheet material and fabricated product.

1.4 PROJECT CONDITIONS

A. Coordinate work of this Section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of work and protection of materials and finishes.

PART 2 PRODUCTS

2.1 SHEET METAL FLASHING AND TRIM MATERIALS

A. Zinc-Coated Steel: Commercial quality with 0.20 percent copper, ASTM A 526 except ASTM A 527 for lock-forming, G90 hot-dip galvanized, mill phosphatized where indicated for painting; 0.0359-inch thick (20 gage) except as otherwise indicated.
B. Stainless Steel: AISI Type 302/304, complying with ASTM A 167, 2D annealed finish, soft, except where harder temper required for forming or performance; 0.0156-inch thick (28 gage) except as otherwise indicated.
C. Lead: ASTM B 749, Type L51121, copper-bearing sheet lead, minimum 4 lb/sq ft (0.0625-inch thick) except not less than 6 lb/sq ft (0.0937-inch thick) for burning (welding) unless otherwise indicated.
D. Extruded Aluminum: Manufacturer's standard extrusions of sizes and profiles indicated, 60063-T52, AA-C22A41 clear anodized finish; 0.080-inch minimum thickness for primary legs of extrusions.

2.2 MISCELLANEOUS MATERIALS AND ACCESSORIES

A. Solder - For use with steel or copper, provide 50 - 50 tin/lead solder (ASTM B 32), with rosin flux.
B. Solder - For use with stainless steel, provide 60 - 40 tin/lead solder (ASTM B 32), with acid-chloride type flux, except use rosin flux over tinned surfaces.
C. Fasteners - Same metal as flashing/sheet metal or other non-corrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.
D. Bituminous Coating - SSPC - Paint 12, solvent-type bituminous mastic, nominally free of sulfur, compounded for 15-mil dry film thickness per coat.
E. Mastic Sealant - Polyisobutylene; nonhardening, nonskinning, non-drying, nonmigrating sealant.
F. Elastomeric Sealant - Generic type recommended by manufacturer of metal and fabricator of components being sealed and complying with requirements for joint sealants as specified in Division 7 Section "Joint Sealers."
G. Epoxy Seam Sealer - 2-part noncorrosive metal seam cementing compound, recommended by metal manufacturer for exterior/interior nonmoving joints including riveted joints.

H. Adhesives - Type recommended by flashing sheet manufacturer for waterproof/weather-resistant seaming and adhesive application of flashing sheet.
I. Paper Slip Sheet - 5-lb. rosin-sized building paper.
J. Polyethylene Underlayment - Minimum 6-mil carbonated polyethylene film resistant to decay when tested in accordance with ASTM E 154.
K. Reglets - Metal or plastic units of type and profile indicated, compatible with flashing indicated, noncorrosive.
L. Metal Accessories - Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gage required for performance.
M. Cast-Iron Drainage Boots - Grey iron castings of size and pattern indicated, ASTM A 48, bituminous shop-coated.
N. Gutter and Conductor-Head Guards - 20-gage bronze or nonmagnetic stainless steel mesh or fabricated units, with selvaged edges and noncorrosive fasteners. Select materials for compatibility with gutters and downspouts.
O. Elastic Flashing Filler - Closed-cell polyethylene or other soft closed-cell material recommended by elastic flashing manufacturer as filler under flashing loops to ensure movement with minimum stress on flashing sheet.
P. Roofing Cement - ASTM D 2822, asphaltic.

2.3 FABRICATED UNITS

A. General Metal Fabrication - Shop-fabricate work to greatest extent possible. Comply with details shown and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices. Fabricate for waterproof and weather-resistant performance, with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed sheet metal work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.
B. Seams - Seams and joints shall be kept to a minimum. Fabricate nonmoving seams in sheet metal with flat-lock seams. For metal other than aluminum, tin edges to be seamed, form seams, and solder. Form aluminum seams with epoxy seam sealer; rivet joints for additional strength where required.
C. Expansion Provisions - Where lapped or bayonet-type expansion provisions in work cannot be used or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
D. Sealant Joints - Where movable, nonexpansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.
E. Separations - Provide for separation of metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.
F. Aluminum Extrusion Units - Fabricate extruded aluminum running units with formed or extruded aluminum joint covers for installation behind main members where possible. Fabricate mitered and welded corner units.

2.4 ELASTIC EXPANSION JOINTS

A. General - Provide factory-fabricated units of size and profile indicated, complete with prefabricated corner units, intersection units, and splicing materials. Provide complete with elastic sheet flashing forming the primary joint membrane, in a supported, "bellows" arrangement designed for securement to both sides of expansion joints. Underside of bellows insulated with adhesively applied, flexible, closed-cell rubber or plastic not less than 3/8-inch thick.
B. Type - Metal flanged edges, 3 to 4 inches wide, formed to profiles as indicated to fit curbs and designed for nailing to curb substrate. Provide metal flanges in the following minimum thicknesses:

1. Stainless Steel: 0.0187 inch (26 gage).

C. Looped Bellows Width - 5 to 6 inches, exclusive of flanges.

D. Available Manufacturers - Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
E. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:

1. Celotex Corporation
2. Schuller / Roofing Systems Division.

PART 3 EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. General - Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations and with SMACNA "Architectural Sheet Metal Manual." Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weatherproof.
B. Underlayment - Where stainless steel or aluminum is to be installed directly on cementitious or wood substrates, install a slip sheet of red rosin paper and a course of polyethylene underlayment.
C. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.
D. Install reglets to receive counterflashing in manner and by methods indicated. Where shown in concrete, furnish reglets to trades of concrete work for installation as work of Division 3 sections.
E. Install counterflashing in reglets, either by snap-in seal arrangement or by welding in place for anchorage and filling reglet with mastic or elastomeric sealant, as indicated and depending on degree of sealant exposure.
F. Install elastic flashing in accordance with manufacturer's recommendations. Where required, provide for movement at joints by forming loops or bellows in width of flashing. Locate cover or filler strips at joints to facilitate complete drainage of water from flashing. Seam adjacent flashing sheets with adhesive, seal and anchor edges in accordance with manufacturer's recommendations.
G. Nail flanges of expansion joint units to curb nailers, at maximum spacing of 6 inches o.c. Fabricate seams at joints between units with minimum 3-inch overlap, to form a continuous, waterproof system.
H. Install continuous gutter guards on gutters, arranged as hinged units to swing open for cleaning gutters. Install "beehive"-type strainer-guard at conductor heads, removable for cleaning downspouts.

3.2 CLEANING AND PROTECTION

A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.

B. Protection - Advise Contractor of required procedures for surveillance and protection of flashings and sheet metal work during construction to ensure that work will be without damage or deterioration other than natural weathering at time of substantial completion.

SECTION 07750 PROTECTIVE COATING FOR CONCRETE SURFACES

PART 1 GENERAL

1.1 WORK INCLUDED

A. This Section covers work necessary for furnishing and applying 100% solid elastomeric polyurethane as a coating system to the surfaces of the walls, floors, sump, and piers in the chemical feed room as shown on the Contract Drawings.

1.2 RELATED SECTIONS

A. Section 03300 - Concrete

1.3 SUBMITTALS

A. Submittals shall be made in accordance with the following provisions:

Section 12-1.06 - Submittals

B. Product Data

1. Submit manufacturer's literature including installation procedure and warranty for the coating system.
2. Submit test results of the product from an approved material testing laboratory certifying that the product meets or exceeds all the requirements in Article 2.1.
3. Submit certification by the Patent Holder of the expansion process that the product has been approved for ecosystem expansion.

C. Applicator Qualification

1. Submit approval of applicator and list of verifiable references for the applicator on a minimum of 5 wastewater projects for successful application of polyurethane systems (similar application) completed more than 5 years before bid date.
2. Submit certification by the Patent Holder of the ecosystem expansion process that the applicator has been licensed for expansion work.

D. Inspector Qualification

1. Submit NACE 3 certification of the inspector by the National Association of Corrosion Engineers.

1.4 WARRANTY

A. The Contractor shall furnish a two (2) year Warranty for all work covered by this Section.

PART 2 MATERIALS

2.1 PRODUCTS

A. The coating material shall be a 100% solids, aromatic, 100% Moca free, MDI (Methylene Diisocyanate) elastomeric polyurethane coating which contains no sand or silica fillers. The coating system shall be a two component 1A: 2B ratio (1 Activator to 2 Base). The product shall be certified by an approved material testing laboratory to be resistant to hydrogen sulfide and sodium hypochlorite and to meet the following requirements on physical properties:

Physical Properties	Test Method	Requirements
Durometer Hardness	Durometer Hardness	
@ 75°F, Shore D 30 minutes		85-90 shore A
	60 minutes	90-95 Shore A
	4 hours	45-50 Shore D
	24 hours	60-65 Shore D
	48 hours	65-70 Shore D
Tensile Strength, ASTM D638 PSI		2800-3000 psi
Percent Elongation, @ 60 mils:		<42%
Abrasion Resistance	ASTM D4060-84 <55mg	
1000 cycles;		
1000 gms; CS-17		
Impact Resistance	ASTM D2794	> or = 35 psi
80 mils		
Elcometer Adhesion:		
(Steel; no primer;		
SSPC SP-5		> 1500 psi
Tear Strength:	ASTM D624	> 200 psi
Heat Aged 180°F ASTM D573		Durameter D65
30 days 60 mil		Elongation
film		36%
Water Vapor	ASTM D1653A	<0.055 grams/
Permeability		24 hrs/SF
@ 75-80 mils		(144 in)
Pot Life @ 70°F		3-5 minutes

PART 3 EXECUTION

3.1 PREPARATION

A. Installation shall be in strict accordance with the manufacturer's latest published installation instructions and recommendations.
B. Prepare surfaces in accordance with manufacturer's recommendations. Repair surfaces as required by manufacturer's representative.

3.2 MANUFACTURER'S SERVICES

A. The Contractor shall obtain an inspection by the coating manufacturer's authorized representative and shall obtain the manufacturer's written approval of surfaces to receive the coating system. Beginning application will constitute acceptance of surfaces by manufacturer and applicator. Representative's services shall be supplied at no extra cost to the City.

3.3 APPLICATION

A. Concrete surfaces shall be coated with the materials described in Article 2.1, by applicator meeting the qualifications described in Paragraph 1.3,C, utilizing the licensed ecosystem expansion process.
B. Equipment for the coating application shall be high pressure proportioning spray system specially designed to mix components A and B in the exact proportion required and to deliver mixed materials to the spray tip at the temperature specified by the manufacturer's most current publicized data sheets.
C. Equipment utilized for the expansion process shall conform to the specifications set forth under the terms of the expansion license.

D. Environmental conditions shall be monitored and verified through NACE (National Association of Corrosion Engineers) procedures. Relative humidity and temperature shall be measured through the proper use of a sling psychrometer. Dew point and surface temperature shall be verified and surface temperature shall not be within 5° F of dew point.
E. Materials conditioning must be performed per manufacturer's latest publicized data sheet. Component B (base) must be agitated thoroughly prior to use. Materials shall be recirculated and heated such that upon exit at the spray tip, the catalyzed product is 100° F. Applicator shall control this temperature in order to produce a repeatable finished product on each application.
F. Polyurethane material shall be applied pursuant to the patented technology known as Ecosystem expansion.
G. Deposition of materials specified shall be within a minimum total thickness of 200 mils, or as required to be pinhole free. Total film thickness shall include a minimum of 50 mils solid film. The polyurethane coating shall be applied in such a way so as to be monolithic and cohesive in nature. Multiple passes shall be employed to build film thickness which shall be accomplished in a single coat. Expanded film applied shall be top coated solid film the same shift or within 24 hours, whichever is sooner. The recoat window for solid or expanded films shall not exceed 24 hours at 75° F. Coating operations shall be planned in such a way so as to maximize the spray process allowing for a monolithic application and to minimize hand work repair.
H. Coating termination shall be completed in such a way so as to protect the lining and to eliminate leading edges. Coating shall terminate into the "key" provided in concrete. There shall be no overspray beyond the embedded FRP curb angle.
I. Protrusions shall be verified by the manufacturers agent as compatible with the coating relative to adhesion. All protrusions shall be prepared so as to exhibit a roughened surface and shall be free of grease or dust or other contaminants. Protrusions shall be coated to the specified mil thickness as required.
J. Expansion joints where existing and filled with a joint sealant shall be isolated from the lining so as to ensure that the coating does not bond to the joint sealant. A polyethylene tape shall be applied so as to bridge the joint and cover the sealant. No more overlap than necessary should occur onto the concrete by the tape.
K. Repairs of holidays, pinholes, or damaged areas shall be accomplished through the hand mixing of the materials specified in small quantities and applied in a trowel on fashion. All areas to be required where the coating has exceed the recoat window shall undergo surface preparation. Surfaces to be repaired shall be roughened and cleaned free of contaminants prior to stop coating.

3.4 CLEAN UP

A. Clean spillage and overspray from adjacent surfaces as recommended by the coating system manufacturer.

3.5 CURING OF PROTECTIVE COATING SYSTEM

A. The finished coating shall be protected from damage during curing and shall protect the coated slab surface during the entire chemical feed room construction period.

3.6 FILED TESTING

A. Contractor shall provide inspection and field testing services from an independent inspector meeting the requirements of Paragraph 1.3,D.
B. Upon completion of the protective coating system installation, the surface of the coating shall be cleaned in order to permit inspection by the NACE 3 certified inspector.
C. Inspection shall follow NACE procedures.
D. Visual inspection of the entire coating shall verify that the color is a uniform cream color. Color variations can mean off ratio application or improper mixing. Coating shall be free of blisters and holidays. The coating shall be free of sags, runs, and drips.
E. Durometer readings shall be within those stated by the latest manufacturers published data sheets.
F. TDFT (Total Dry Film Thickness) readings shall measure as equal to or greater than the minimum specified in Paragraph 3.3,G. Concrete substrates shall have core samples taken and subsequently repaired per manufacturer's recommendations. Core samples shall verify the minimum thickness specified in Paragraph 3.3,G.
G. Location of holidays and pinholes in the coating shall be done by the inspector by means of spark testing of the coating surface with a High voltage Holiday Detector.

H. High voltage spark testing shall show a pinhole free (spark free) lining. Voltage shall be a minimum of 100 volts per mil. A known “void” shall serve to verify proper operation of the spark testing equipment. If necessary a void will be created for the purposes of ensuring proper adjustment of the equipment. Spark testing should take place as soon as the lining has achieved a Durometer reading of 50D. All pinholes and voids in the coating detected by the spark testing procedure shall be repaired per the manufacturers recommended procedure.

SECTION 07900 JOINT SEALANTS

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. The work includes, but is not limited to, the furnish and installing of all caulking, including interior caulking and sealing, as indicated on the Drawings and specified herein.

1.2 QUALITY ASSURANCE:

A. Comply with manufacturer's printed instruction, except where more stringent requirements are indicated.
B. Before purchase of each required material, confirm its compatibility with every other material it will be applied to in the joint system and certify that such material and conditions are in accordance with manufacturer's recommendation.

1.3 SUBMITTALS:

A. Procedures: In accordance with Section 12-1.06.
B. Product Data: Manufacturer's specifications, recommendations and installation instructions including cleaning of join surfaces, fore each type of material required.
C. Samples: Each color required for each type of exposed sealant. Standard colors.

1.4 ENVIRONMENTAL CONDITIONS:

A. Apply the sealants and caulking only when the temperature is between 40° and 90° F.

1.5 GUARANTEE:

A. Guarantee exterior caulking and sealing against leaks per 12-1.03.
B. Guarantee workmanship and materials against deterioration, or other failure to perform properly for two (2) years.

1.6 PRODUCT DELIVERY STORAGE AND HANDLING:

A. Deliver and store sealant materials which have been packed by the manufacturers in the original packing until ready for installation in the work.
B. Protect sealant materials from damage, and form accumulation of dirt and other foreign materials.

PART 2 PRODUCTS

2.1 MATERIALS:

A. Sealant Type 1:

1. Material: ASTM C-920, FS-S-0227E Type I, Class A, two-component, gun-grade, with primer, two-part polyurethane, sealant, capable of plus and minus of 25-percent movement. THC-901 by Tremco, Sikaflex, or equal.
2. Color: To match adjacent area color.

3. Use: Exterior, for horizontal joints at paving and building.

B. Sealant Type 2:

1. Material: ASTM C-920-79, FS TT-S-00227E Type II, Class A, Gun-grade, with primer as required, two component polyurethane sealant, capable of plus and minus of 50-percent movement Dymeric-Plus by Tremco, 2C by Sikaflex, or equal.

   a. Use for exterior wall systems must have approval from exterior wall system manufacturer.
   b. Primer for substrate shall be recommended by sealant manufacturer.

2. Color: As selected.
3. Use: General exterior building sealing, unless otherwise shown or specified.

C. Sealant Type 3:

1. Material: ASTM C834, Single Component, gun-grade, paintable acrylic-latex, water-base sealant. Acrylic Latex 834 by Tremco, or equal.
2. Color: As Selected.
3. Use: All interior building sealing, including for sound insulated partitions except as otherwise specified.

D. Sealant Type 4:

1. Material: FS TT-S-001543 A, single component, gun-grade, silicone rubber sealant, with movement capability plus or minus 25-percent, Dow-Corning 786, General Electric Sanitary 1700, Tremco Proglaze or equal.
2. Color: White.
3. Use: Interior wet areas and sanitary sealant.

E. Sealant Type 5:

1. Materials: USG Smoke Seal Compound Sealant in 30 ounce cartridge, or equal (no known equal), gun-grade, paintable, acrylic-latex, water base sealant.
2. Use: All fire-rated partitions.
3. Color: As selected.

F. Sealant Type 6: NOT USED
G. Joint Backing: Closed cell neoprene or polyethylene, compatible with sealant material of size and shades as recommended by the joint sealant manufacturer.
H. Primers, Solvents and Cleaning Materials: Non-staining and non-injury to exposed surfaces of types as recommended by the joint sealant manufacturer.

PART 3 EXECUTION

3.1 INSPECTION:

A. Verify that surfaces to receive joint sealant materials are satisfactory for their application by material manufacturer. If unsatisfactory conditions exists do not commence application until such conditions have been corrected.

3.2 APPLICATION:

A. Prepare surfaces and poly materials in accordance with the manufacturer's instructions and as specified herein.
B. Surface to receive materials shall be clean, dry and free from foreign material.

C. Joint width conditions: Do not proceed with installation of joint sealant where joint widths are less than allowed by joint sealant manufacturer for application indicated.
D. Mask areas adjacent to joints, as necessary to obtain a neat sealant line.
E. Place sealant backup rod so that sealant depth will not be greater than one-half (1/2) the joint width, nor less than 1/4-inch, unless otherwise shown.
F. Apply material with hand gun, power gun, or trowel to completely fill voids and joints, free of wrinkles and skips, uniformly smooth with full adhesion. Observe temperature control in accordance with sealant manufacturer's recommendation.

3.3 CLEANING:

A. Remove masking tape and excess and splattered sealant, while sealant is still uncured and rubbed clean with a solvent as recommended by the sealant manufacturer. Upon completion of application of compound, all smears, stains, and other soil shall be removed with solvent or other means recommended by manufacturer of compound and other work left in a clean and neat condition.

SECTION 08111 STANDARD STEEL DOORS AND FRAMES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This Section covers the following products manufactured in accordance with SDI Recommended Standards required under the Contract Documents:

1. Doors: Flush, hollow construction standard steel doors for interior and exterior locations.
2. Frames: Pressed steel frames for doors, transoms, sidelights, mullions, interior glazed panels, and other interior and exterior openings of following type:

   a. Welded unit type.
   b. Drywall slip-on type for drywall partition only.

3. Assemblies: Provide standard steel door and frame assemblies as required for the following:

   a. Labeled and fire rated.
   b. Thermal rated (insulated).
   c. Sound rated (acoustical).

4. Provide factory primed doors and frames to be field painted.

B. Painting primed doors and frames is specified in Division 9 Section 09900, "Painting."

1.2 RELATED DOCUMENTS

A Reference standards include but are not limited to:

1. San Francisco Building Code 1995 Edition.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Section 12-1.06.
B. Product data for each type of door and frame specified, including details of construction, materials, dimensions, hardware preparation, core, label compliance, sound ratings, profiles, and finishes.
C. Shop drawings showing fabrication and installation of standard steel doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and

installation requirements of door and frame hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.

1. Provide schedule of doors and frames using same reference numbers for details and openings as those on contract drawings.
2. Indicate coordinate of glazing frames and stops with glass and glazing requirements.

D. Samples for verification purposes of each type of exposed finish required, prepared on samples not less than 3 inches by 5 inches and of same thickness and material indicated for final unit of Work. Where finishes involve normal color and texture variations, include sample sets showing full range of variations expected.
E. Label Construction Certification: For door assemblies required to be fire-rated and exceeding limitations of labeled assemblies, submit manufacturer's certification that each door and frame assembly has been constructed to conform to design, materials and construction equivalent to requirements for labeled construction.

1.4 QUALITY ASSURANCE

A. Provide doors and frames complying with Steel Door Institute "Recommended Specifications Standard Steel Doors and Frames" ANSI/SDI-100 and as herein specified.
B. Fire-Rated Door Assemblies: Units that comply with NFPA 80, are identical to door and frame assemblies whose fire resistance characteristics have been determined per ASTM E 152 and which are labeled and listed by UL, Factory Mutual, Warnock Hersey, or other testing and inspecting organization acceptable to authorities having jurisdiction.

1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide manufacturer's certification that doors conform to all standard building code construction requirements of tested and labeled fire-rated door assemblies except for size.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.
B. Inspect doors and frames upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to Architect; otherwise, remove and replace damaged items as directed.
C. Store doors and frames at building site under cover. Place units on minimum 4-inches high wood blocking. Avoid use of non-vented plastic or canvas shelters which could create humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4-inches spaces between stacked doors to promote air circulation.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering standard steel doors and frames which may be incorporated in the work include; but are not limited to, the following:

1. Standard Steel Doors and Frames:

a. Forderer
b. Fenestra Corp.
c. Kewaneer Corp.

2.2 MATERIALS

A. Hot-Rolled Steel Sheets and Strip: Commercial quality carbon steel, pickled and oiled, complying with ASTM A 569 and ASTM A 568.
B. Cold-Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A 366 and ASTM A 568.
mplying with ASTM A 526, or drawing quality, ASTM A 642, hot-dipped galvanized in accordance with ASTM A 525, with A60 or G60 coating designation, mill phosphatized.
D. Supports and Anchors: Fabricate of not less than 18-gage sheet steel; galvanized where used with galvanized frames.
E. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where items are to be built into exterior walls, hot-dip galvanize in compliance with ASTM A 153, Class C or D as applicable.
F. Shop Applied Paint: Apply after fabrication.

1. Primer: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints complying with ANSI A224.1, "Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames."

2.3 DOORS

A. Provide metal doors of SDI grades and models specified below or as indicated on Drawings or schedules:

1. Interior Doors: ANSI/SDI-100, Grade II, heavy-duty, Model 3 or 4, minimum 18-gage cold-rolled sheet steel faces.
2. Exterior Doors: ANSI/SDI-100, Grade III, extra heavy-duty, Model 4, minimum 16-gage galvanized steel faces.

B. Door Louvers: Provide sightproof stationary louvers for interior doors where indicated, constructed of inverted V-shaped or Y-shaped blades formed of 24-gage cold-rolled steel set into minimum 16-gage steel frame.

2.4 FRAMES

A. Provide metal frames for doors, transoms, sidelights, borrowed lights, and other openings, of types and styles as shown on drawings and schedules. Conceal fastenings, unless otherwise indicated. Fabricate frames of minimum 16-gage cold-rolled steel.

1. Fabricate frames with mitered, coped, or welded corners.
2. Form exterior frames from 16-gage galvanized steel.

B. Door Silencers: Except on weatherstripped frames, drill stops to receive 3 silencers on strike jambs of single-door frames and 4 silencers on heads of double-door frames.
C. Plaster Guards: Provide minimum 26-gage steel plaster guards or mortar boxes at back of hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.

2.5 FABRICATION

A. Fabricate steel door and frame units to be rigid, neat in appearance and free from defects, warp or buckle. Wherever practicable, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory-assembled before shipment, to assure proper assembly at contract site. Comply with ANSI/SDI-100 requirements.

1. Internal Construction: Manufacturer's standard honeycomb, polyurethane, polystyrene, unitized steel grid, vertical steel stiffeners, or rigid mineral fiber core with internal sound deadener on inside of face sheets where appropriate in accordance with SDI standards.
2. Clearances: Not more than 1/8 inch at jambs and heads except between non-fire-rated pairs of doors not more than 1/4 inch. Not more than 3/4 inch at bottom.

B. Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from only cold-rolled steel.
C. Tolerances: Comply with SDI 117 "Manufacturing Tolerances Standard Steel Doors and Frames."
D. Fabricate frames, concealed stiffeners, reinforcement, edge channels, louvers and moldings from either cold-rolled or hot-rolled steel.
E. Fabricate exterior doors, panels, and frames from galvanized sheet steel in accordance with SDI-112. Close top and bottom edges of exterior doors as integral part of door construction or by addition of minimum 16-gage inverted steel channels.
F. Exposed Fasteners: Unless otherwise indicated, provide countersunk stainless steel flat or oval heads for exposed screws and bolts.
G. Thermal-Rated (Insulating) Assemblies: At locations as shown or scheduled, provide doors fabricated as thermal insulating door and frame assemblies and tested in accordance with ASTM C 236 or ASTM C 976 on fully operable door assemblies.

    1. Unless otherwise indicated, provide thermal-rated assemblies with U factor of 0.41 Btu/(hr x sq ft x deg F.) or better.

H. Sound-Rated (Acoustical) Assemblies: Where shown or scheduled, provide door and frame assemblies fabricated as sound-reducing type, tested in accordance with ASTM E 90, and classified in accordance with ASTM E 413.

    1. Unless otherwise indicated, provide acoustical assemblies with sound ratings of STC 33 or better.

I. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware in accordance with final Door Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A115 Series specifications for door and frame preparation for hardware.

    1. For concealed overhead door closers, provide space, cutouts, reinforcing and provisions for fastening in top rail of doors or head of frames, as applicable.

J. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at project site.
K. Locate hardware as indicated on final shop drawings or, if not indicated, in accordance with "Recommended Locations for Builder's Hardware on Standard Steel Doors and Frames," published by Door and Hardware Institute.
L. Shop Painting: Clean, treat, and paint exposed surfaces of steel door and frame units, including galvanized surfaces.

    1. Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before application of paint.
    2. Apply shop coat of prime paint of even consistency to provide a uniformly finished surface ready to receive finish paint.

M. Glazing Stops: Minimum 20 gage steel or 0.040-inch-thick aluminum.

    1. Provide non-removable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.
    2. Provide screw applied removable glazing beads on inside of glass, louvers, and other panels in doors.

PART 3 EXECUTION

3.1 INSTALLATION

A. General: Install standard steel doors, frames, and accessories in accordance with final shop drawings, manufacturer's data, and as herein specified.
B. Placing Frames: Comply with provisions of SDI-105 "Recommended Erection Instructions For Steel Frames," unless otherwise indicated.

1. Except for frames located at drywall installations, place frames prior to construction of enclosing walls and ceilings. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
2. Install fire-rated frames in accordance with NFPA Standard No. 80 and San Francisco Building Code requirements (See UBC Standard 43-2).
3. In metal stud partitions, install at least 3 wall anchors per jamb at hinge and strike levels. In closed steel stud partitions, attach wall anchors to studs with screws.
4. In in-place drywall partitions install knock down slip-on drywall frames

C. Door Installation: Fit hollow metal doors accurately in frames, within clearances specified in ANSI/SDI-100.

1. Install fire-rated doors with clearances as specified in NFPA Standard No. 80 San Francisco Building Code requirements (See UBC Standard 43-2).

3.2 ADJUST AND CLEAN

A. Prime Coat Touch-up: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.
B. Protection Removal: Immediately prior to final inspection, remove protective plastic wrappings from pre-finished doors.
C. Final Adjustments: Check and readjust operating hardware items, leaving steel doors and frames undamaged and in complete and proper operating condition.

SECTION 08330 OVERHEAD COILING DOORS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. San Francisco Building Code 1995 Edition.

1.2 SUMMARY

A. Extent of overhead coiling doors is shown on drawings.
B. Types of overhead coiling doors include the following:

1. Overhead service doors.
2. Overhead fire doors.

C. Provide complete manual operating door assemblies including door curtains, guides, counterbalance mechanism, hardware, operators, and installation accessories.
D. Painting is specified in Division 9.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's product data, roughing-in diagrams, and installation instructions for each type and size of overhead coiling door. Provide operating instructions and maintenance information, and complete information describing fire release system including electrical rough-in instructions.
B. Shop Drawings: Submit shop drawings for special components and installations which are not fully dimensioned or detailed on manufacturers data sheets.
C. Label Certification: Submit UL certification for oversize fire-rated doors and frames that each assembly has been constructed with materials and methods equivalent to requirements for labeled construction.

1.4 QUALITY ASSURANCE

A. Furnish each overhead coiling door as a complete unit produced by one manufacturer, including hardware, accessories, mounting and installation components.
B. Unless otherwise acceptable to the Engineer, furnish overhead coiling door units by one manufacturer for entire project.
C. Insert and Anchorages: Furnish inserts and anchoring devices which must be set in concrete or built into masonry for installation of units. Provide setting drawings, templates, instructions and directions for installation of anchorage devices. Coordinate delivery with other work to avoid delay.
D. Metal stud details in drawings for installation of inserts and anchorage devices.
E. Wind Loading: Design and reinforce overhead coiling doors to withstand a 20 lb. per sq. ft. (85 mph) wind loading pressure unless otherwise indicated.
F. Fire Door Assemblies: Furnish fire door assemblies which comply with NFPA No. 80 and have been fire tested, rated and labeled in accordance with ASTM E 152. Furnish each door with a metal UL label as evidence of rating, with label indicating rating in hours of duration of exposure to fire and letter designation of location for which assembly is designed.
G. Automatic Closing: Provide automatic closing device and governor, operating when activated by temperature rise and melting of 160 degrees F (71 degrees C) fusible link. Construct governor unit to be inoperative during normal door operations. Design release mechanism for easy resetting.
H. Provide manufacturer's standard U.L. labeled smoke detectors and electromechanical door holder release devices where indicated.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide following rolling doors of the Cookson Company, Overhead Door Corp., or approved equal.

1. Rolling Fire Doors: Type FD-1, PUSH-UP.
2. Rolling Service Door: Type FCM-MOTOR, Alternate mounting.

2.2 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtain: Fabricate overhead coiling door curtain of interlocking slats designed to withstand required wind loading, of continuous length for width of door without splices. Unless otherwise indicated, provide slats of material gage recommended by door manufacturer for size and type of door required, and as follows:

1. Steel Door Curtain Slats: Structural quality, cold-rolled galvanized steel sheets complying with ASTM A 446, Grade A, with G90 zinc coating, complying with ASTM A 525, and phosphate treated before fabrication.

   a. Provided No. 5 slat, 22 gauge steel, manufactured by the Cookson Company, Overhead Door Corp., for rolling counter fire doors.
   b. Provide No. 4 slat, 16 gauge steel, manufactured by the Cookson Company or Overhead Door Corp., for rolling service door.

B. Bottom Bar: Consisting of 2 angles, each not less than 1_" x 1_" x 1/8" thick, either galvanized or stainless steel or aluminum extrusions to suit type of curtain slats.

1. Provide a replaceable gasket of flexible vinyl or neoprene between angles as a weather seal and cushion bumper for manually operated doors unless shown as an overlapping joint.

C. Curtain Jamb Guides: Fabricate curtain jamb guides of steel angles, or channels and angles with sufficient depth and strength to retain curtain loading. Build-up units with minimum 3/16" thick steel sections, galvanized after fabrication. Slot bolt holes for track adjustment.

D. Secure continuous wall angle to wall framing by 3/8" minimum bolts at not more than 30" o.c., unless closer spacing recommended by door manufacturer. Extend wall angles above door opening head to support coil brackets, unless otherwise indicated. Place anchor bolts on exterior wall guides so they are concealed when door is in closed position. Provide removable stops on guides to prevent over-travel of curtain, and continuous bar for holding windlocks.

2.3 COUNTERBALANCING MECHANISM

A. Counterbalance doors by means of adjustable steel helical torsion spring, mounted around a steel shaft and mounted in a spring barrel and connected to door curtain with required barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
B. Counterbalance Barrel: Fabricate spring barrel of hot-formed structural quality carbon steel, welded or seamless pipe, of sufficient diameter and wall thickness to support roll-up of curtain without distortion of slats and limit barrel deflection to not more than 0.03" per ft. of span under full load.
C. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Provide cast steel barrel plugs to secure ends of springs to barrel and shaft.
D. Fabricate torsion rod for counterbalance shaft of case-hardened steel, of required size to hold fixed spring ends and carry torsional load.
E. Brackets: Provide mounting brackets of manufacturer's standard design, either cast iron or cold-rolled steel plate with bell mouth guide groove for curtain.
F. Hood: Form to entirely enclose coiled curtain and operating mechanism at opening head, and act as weather seal. Contour to suit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods, and any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sag.

    1. Fabricate steel hoods for doors of not less than 24 gauge hot-dip galvanized steel sheet with G 90 zinc coating, complying with ASTM A 525. Phosphate treat before fabrication.
    2. Furnish automatic drop baffle to guard against passage of smoke or flame.

2.4 PAINTING

A. Shop clean and prime ferrous metal and galvanized surfaces, exposed and unexposed, except faying and lubricated surfaces, with door manufacturer's standard rust inhibitive primer.

2.5 MANUAL DOOR OPERATORS

A. Provide manual operators except where electric door operators are indicated. When not shown, provide chain hoist operator unit.
B. Manual Push-Up Operation: Design counterbalance mechanism so that required lift or pull for door operation does not exceed 25 lbs. Adjust operating mechanism so that curtain can be easily stopped at any point in its travel and to remain in position until movement is reactivated.

    1. Provide galvanized steel lifting handle and slide bolt lock on inside bottom bar.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install door and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports in accordance with final shop drawings, manufacturer's instructions, and as specified herein.

    1. Install fire-rated doors to comply with NFPA 80.

B. Upon completion of installation including work by other trades, lubricate, test and adjust doors to operate easily, free from warp, twist or distortion and fitting weathertight for entire perimeter.

1. Test door closing when activated by operation of smoke detector fire release system.

SECTION 08710 DOOR HARDWARE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This Section covers items known commercially as finish or door hardware that are required under the Contract Documents for swing, sliding, and folding doors, except special types of unique hardware specified elsewhere.
B. This Section includes but is not limited to the following:

1. Hinges
2. Lock cylinders and keys
3. Lock and latch sets
4. Bolts
5. Closers
6. Door trim units
7. Kick plates
8. Weather-stripping and seals
9. Thresholds
10. Astragals on pairs of doors

C. Related Sections: The following sections contain requirements that relate to this Section:

1. Division 8 Section 08111 "Standard Steel Doors and Frames" for silencers integral with hollow metal frames.
2. Division 5 Section 05500 "Metal Fabrication" for gate hardware except padlocks.

D. Products furnished but not installed under this Section include:

1. Cylinders for locks on entrance doors.
2. Final replacement cores and keys to be installed by the City.

1.2 RELATED DOCUMENTS

A. Reference standards include but are not limited to:

1. Manufacturers recommendations and standards.
2. S.F. Building Code, 1995 Edition.

1.3 HARDWARE SELECTION

A. Selection and Ordering: Furnish door hardware as selected by Engineer and in such quantities as provided for under the Contract Documents.
B. The Contractor shall require that the door hardware supplier's responsibilities shall be as follows:

1. Submittals: Submit through Contractor required product data, final hardware schedule, separate keying schedule, and samples as specified in this Section, unless otherwise indicated.
2. Construction Schedule: Inform Contractor promptly of estimated times and dates that will be required to process submittals, to furnish templates, to deliver hardware, and to perform other work associated with furnishing door hardware for purposes of including this data in construction schedule. Comply with this schedule.

3. Coordination and Templates: Assist Contractor as required to coordinate hardware with other work in respect to both fabrication and installation. Furnish Contractor with templates and deliver hardware to proper locations.
4. Product Handling: Package, identify, deliver, and inventory door hardware specified in this Section.
5. Discrepancies: Based on requirements indicated in Contract Documents in effect at time of door hardware selection, furnish types, finishes, and quantities of door hardware, including fasteners, and City's maintenance tools required to comply with specified requirements and as needed to install and maintain hardware. Furnish or replace any items of door hardware resulting from shortages and incorrect items at no cost to the City. Obtain signed receipts from Contractor for all delivered materials.

C. Contractor's responsibilities shall include but not be limited to the following:

1. Submittals: Coordinate and process submittals for door hardware in same manner as submittals for other work.
2. Construction Schedule: Cooperate with door hardware supplier in establishing schedule dates for submittals and delivery of templates and door hardware. Incorporate in construction schedule the times and dates related to furnishing hardware by door hardware supplier.
3. Coordination: Coordinate door hardware with other work. Furnish hardware supplier or manufacturer with shop drawings of other work where required or requested. Verify completeness and suitability of hardware with supplier.
4. Product Handling: Provide secure lock-up for hardware delivered to the site. Inventory hardware jointly with representative of hardware supplier and issue signed receipts for all delivered materials.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Section 12-1.06.
B. Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
C. Final hardware schedule coordinated with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Final Hardware Schedule Content: Based on hardware indicated, organize schedule into "hardware sets" indicating complete designations of every item required for each door opening. Include the following information:

   a. Type, style, function, size, and finish of each hardware item.
   b. Name and manufacturer of each item.
   c. Location of each hardware set cross referenced to indications on drawings both on floor plans and in door and frame schedule.
   e. Explanation of all abbreviations, symbols, and codes contained in schedule.
   f. Mounting locations for hardware.
   g. Door and frame sizes and materials.
   h. Keying information.

2. Submittal Sequence: Submit final schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work that is critical in the contract construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by door hardware, and other information essential to the coordinated review of schedule.
3. Submittal Sequence: Submit initial draft of final schedule along with essential product data in order to facilitate the fabrication of other work that is critical in the contract construction schedule. Submit final schedule after samples, product data, coordination with shop drawings of other work, delivery schedules, and similar information has been completed and accepted.
4. Keying schedule: Submit a separate detailed schedule indicating clearly how the Engineer's final instructions on keying of locks has been fulfilled.

D. Samples of each type of exposed hardware unit in finish indicated and tagged with full description for coordination with schedule. Submit samples prior to submission of final hardware schedule.

1. Samples will be returned to the supplier. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated in the work within limitations of keying coordination requirements.

E. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.5 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) from a single manufacturer.
B. Supplier Qualifications: A recognized architectural door hardware supplier, with warehousing facilities in the contract's vicinity, that has a record of successful in service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this contract and that employs an experienced architectural hardware consultant (AHC) who is available to Engineer and Contractor, at reasonable times during the course of the Work, for consultation.

1. Require supplier to meet with Engineer to finalize keying requirements and to obtain final instructions in writing.

C. Fire-Rated Openings: Provide door hardware for fire-rated openings that complies with NFPA Standard No. 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by UL, Warnock Hersey, FM, or other testing and inspecting organization acceptable to authorities having jurisdiction for use on types and sizes of doors indicated in compliance with requirements of fire-rated door and door frame labels.

1.6 PRODUCT HANDLING

A. Tag each item or package separately with identification related to final hardware schedule, and include basic installation instructions with each item or package.
B. Packaging of door hardware is responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two or more identical sets may be packed in same container.
C. Inventory door hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.
D. Deliver individually packaged door hardware items promptly to place of installation (shop or Contract site).

1.7 MAINTENANCE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 PRODUCTS

2.1 REQUIREMENTS

A. Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of finish hardware are indicated in the "hardware schedule" at the end of this Section. Products are identified by using hardware designation numbers of the following.

1. Manufacturer's Product Designations: The product designation and name of one manufacturer are listed for each hardware type required for the purpose of establishing minimum requirements. Provide either the product designated or, where more than one manufacturer is specified under the Article "Manufacturers" in Part 2 for each hardware type, the comparable product of one of the other manufacturers that complies with requirements.
2. ANSI/BHMA designations used elsewhere in this Section or in schedules to describe hardware items or to define quality or function are derived from the following standards. Provide products complying with these standards and requirements specified elsewhere in this Section.

    a. Butts and Hinges: ANSI/BHMA A156.1.
    b. Bored and Preassembled Locks and Latches: ANSI/BHMA A156.2.
    c. Exit Devices: ANSI/BHMA A156.3.
    d. Door Controls - Closers: ANSI/BHMA A156.4.
    e. Auxiliary Locks and Associated Products: ANSI/BHMA A156.5.
    f. Architectural Door Trim: ANSI/BHMA A156.6
    g. Template Hinge Dimensions: ANSI/BHMA A156.7.
    h. Door Controls - Overhead Holders: ANSI/BHMA A156.8.
    i. Interconnected Locks and Latches: ANSI/BHMA A156.12.
    j. Mortise Locks and Latches: ANSI/BHMA A156.13.
    k. Sliding and Folding Door Hardware: ANSI/BHMA A156.14.
    l. Closer Holder Release Devices: ANSI/BHMA A156.15.
    m. Auxiliary Hardware: ANSI/BHMA A156.16.
    n. Self-Closing Hinges and Pivots: ANSI/BHMA A156.17.
    o. Materials and Finishes: ANSI/BHMA A156.18.

B. EXIT AND FIRE DOORS

1. Exit doors, including each leaf of pairs of doors, shall always be openable from the inside by the simple turn of a lever or push on a panic bar without use of a key or any special knowledge or effort.
2. Hardware for fire doors shall conform to the requirements of Underwriter's Laboratories, Inc. "Fire Protection Equipment List." Latches for fire doors shall have 3/4" throw.

C. KEYING

1. Grandmaster - new Schlage level 3 GM , MK x 6, ck, 6 pin, 1246 keyway registered at the factory.
2. Construction key system with removable construction core cylinders.
3. Provide three (3) permanent keys per cylinder, cut as directed. Mark bows with "Do Not Duplicate" in impressed letters. Mark cylinders in concealed location and cut key with serial number. Tag cut key with schedule information. Provide two extractors for construction inserts.
4. Provide construction keys in quantity needed for construction, but no less than twenty-four. Deliver construction permanent keys from factory to owner. Deliver all construction keys to the City on completion of work.

2.2 MATERIALS AND FABRICATION

A. Manufacturer's Name Plate: Do not use manufacturers' products that have manufacturer's name or trade name displayed in a visible location (omit removable nameplates) except in conjunction with required fire-rated labels and as otherwise acceptable to Engineer.

1. Manufacturer's identification will be permitted on rim of lock cylinders only.

B. Base Metals: Produce hardware units of basic metal and forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units by applicable ANSI/BHMA A156 series standards for each type of hardware item and with ANSI/BHMA A156.18 for finish designations indicated. Do not furnish "optional" materials or forming methods for those indicated, except as otherwise specified.

C. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware that has been prepared for self-tapping sheet metal screws, except as specifically indicated.

D. Furnish screws for installation with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of this other work as closely as possible including "prepared for paint" surfaces to receive painted finish.

E. Provide concealed fasteners for hardware units that are exposed when door is closed except to the extent no standard units of type specified are available with concealed fasteners. Do not use through-bolts for installation where bolt head or nut on opposite face is exposed in other work unless their use is the only means of reinforcing the work adequately to fasten the hardware securely. Where through-bolts are used as a means of reinforcing the work, provide sleeves for each through-bolt or use sex screw fasteners.

2.3 MANUFACTURES AND MODELS

A. Hinges

1. Manufacturers: McKinney or Hager, or equal.
2. Minimum number of hinges per door leaf, based on height of door:

up to 5'-0"	l pair
5'-1" to 7'-7"	1-1/2 pairs
7'-7" to 10'-0"	2 pairs
10'-1" to 12'-6"	2-1/2 pairs

3. Minimum height of hinges, based on width of doors:

Up to 3'-0"	4-1/2"
3'-1" to 4'-0"	5"

4. All hinges and pins shall be stainless steel.
5. Width of hinges shall be minimum which will provide clearance to trim and permit 180° swing.
6. All hinges shall have non-removable pins.
7. Hinge leaves shall be parallel and join tolerance shall be 0.012" maximum, gauge in closed position.
8. Hinge Types:

H1: - T4B3386, SS, BB1279, SS, BB1199, SS, or BB1191, SS or equal, 5 knuckle, heavy weight, ball bearing, stainless steel.

B. LOCKS, LATCHES AND BOLTS

1. GENERAL:

a. Locks and latches shall be Schlage Lock Company, L-series x 6 pin 1246 keyway, stainless steel lock front, lever, cylinder cap, strike, U.L. listed for fire doors, equipped with lever fire stops at all fire rated doors.
b. Design: 06
c. Strikes hall have lip dimensions to fit configuration of trim.
d. Finish: US32D (630) Satin Stainless Steel.
e. All latch bolts shall have 3/4" throw (UL listed).
f. Backset: 2-3/4" inches typical.

2. Lock and Latch Types: (Note: Prefix 18" and 12" shall be added to lockset and latch set number at all fire rated doors).

L1: Lockset L9060. Dead Latch Bolt. By both levers turning key inside lever locks or unlocks outside lever. Latch retracted by key from outside. Inside lever always free for immediate exit.
L2: Latchset L9010. No locking either side.
L3: Lockset L9456. By both levers. Turnlever in inside locks outside lever. Turning inside lever releases Turnlever. Emergency outside release.
L4: Dummy Trim L0172.
L5: Lockset L9050. Dead Locking Latchbolt. By both lever from outside by key. Outside lever locked or unlocked toggle in lock front.
L6: Lock by door manufacturer.

C. CLOSERS:

1. GENERAL

a. Manufacturers: LCN or Norton or equal.
b. Size closers in accordance with reference standards.
c. Closers shall allow for full swing of each door as shown on the drawings.
d. Finish shall be paint, colors as selected by the Engineer from manufacturer's standard colors.
e. Where holder type is scheduled at fire rated doors, provide fusible link release.
f. Closer that is used on fire rated doors shall be adjusted to an opening force of 15 pounds maximum.
g. Closer that is used on non-fire rated doors shall be adjusted as follows:

1. Interior Doors: opening force of 5 pounds maximum.
2. Exterior Doors: openings for core of 8.5 pounds maximum.

2. Closer Types:

C1: 4041 series or 7500 series or equal. Regular arm installation. Mount on hinge face of door (pull side).
C2: 4041 series or 7500 series or equal. Parallel arm installation. Mount on stop face of door (push side).

D. STOPS

1. GENERAL

Manufacturers:

a. Ives or Builders Brass Works or equal.
b. Provide with machine screws in threaded anchors at concrete and with self-tapping screws at stud partitions.
c. Finishes all be #630 or #626.

2. STOP TYPES:

S1 Floor stop, 3" height 444, or F121X or equal.
S2: Vinyl bumper, 408-1/2 or WC12X or equal.

E. BOLTS

1. GENERAL

a. Manufacturers: Ives or Glynn-Johnson or equal.
b. Finish #630.

2. BOLT TYPES

B1: Flush bolt heads: Minimum of 1/2-inch diameter rods of stainless steel or brass with minimum 12-inch long rod for doors up to 7'-0" in height.

F. KICK PLATES

1. GENERAL

Manufacturers:

a. Builders Brass Works, or Baldwin or Cipco, or equal.
b. Solid metal, not plated.
c. Bevel four edges.
d. Extend full width of door leaf, less 1-1/2 inches at single leaf and less than 1 inch at pairs.

2. Kick Plate Type:

K1: 10", 0.050" stainless steel.

G. THRESHOLDS:

1. GENERAL:

a. Manufacturers:

Pemko Manufacturing Co. (specified)
Zero Weather-stripping Company, or equal.

b. Thresholds shall be one piece full width of opening. Extend beyond jambs, miter cut and return ends to walls.
c. All doors at interlocking thresholds shall have hook strips.
d. Provide with machine screws in threaded expansion anchors at concrete.
e. Finish shall be mill finish aluminum.

2. Threshold Types:

T1: Saddle 1/2" x 4", No. 170A or 654A, or equal.
T2: Saddle 1/2" x 5", No. 566A, 2005 DS or equal.

H. WEATHERSTRIP AND SILENCERS:

1. GENERAL - WEATHERSTRIPS

a. Manufacturers: Weatherstrips - Pemko Manufacturing Co., Zero Weatherstripping Company or equal. Finishes of exposed aluminum shall be dark bronze color hard coat anodized.

2. SEAL TYPES:

W1: Neoprene strip No. 315 CR, or 139A, or equal at jambs and head.
W2: Automatic door bottom No. 420ASL or 360, or equal.
W3: Astragal, 355 DS, 44MA or equal.
W4: Weatherstripping by door manufacturer.

3. GENERAL - SILENCERS:

a. manufacturers: Silencer - Ives or Glynn-Johnson or equal.
b. Provide at each hinged door which does not have seals scheduled.

c. Provide three at single leaves and four at pairs.

I. Setting Compound

Caulking - DAP Butyl-flex, or Pecora BC-158 or Biddle's Butygrip or equal, color similar to finish of hardware.

PART 3 EXECUTION

3.1 INSTALLATION

A. Mount hardware units at heights indicated in following applicable publications, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by Engineer.

1. "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute.
2. NWWDA Industry Standard I.S.1.7, "Hardware Locations for Wood Flush Doors."

B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Division 9 sections. Do not install surface-mounted items until finishes have been completed on the substrates involved.

C. Set units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

D. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

E. Set thresholds for exterior doors in full bed of butyl-rubber or polisobutylene mastic sealant complying with requirements specified in Division 7 Section 07900 "Joint Sealants."

F. Weatherstripping and Seals: Comply with manufacturer's instructions and recommendations to the extent installation requirements are not otherwise indicated.

3.2 ADJUSTING, CLEANING, AND DEMONSTRATING

A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.

1. Where door hardware is installed more than one month prior to acceptance or occupancy of space or area, return to the installation during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

B. Clean adjacent surfaces soiled by hardware installation.

C. Instruct City's personnel in the proper adjustment and maintenance of door hardware and hardware finishes.

D. Six-Month Adjustment: Approximately six months after the date of substantial completion, the installer, accompanied by representatives of the manufactures of latch sets and locksets and of door control devices, and of other major hardware suppliers, shall return to the contract site to perform the following work:

1. Examine and re-adjust each item of door hardware as necessary to restore function of doors and hardware to comply with specified requirements.
2. Consult with and instruct City's personnel in recommended additions to the maintenance procedures.
3. Replace hardware items that have deteriorated or failed due to faulty design, materials, or installation of hardware units.

4. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

3.3 HARDWARE SCHEDULE

A. General: Provide hardware for each door to comply with requirements of Section "Door Hardware," hardware set numbers indicated in door schedule, and in the following schedule of hardware sets.

1. Hardware sets indicate quantity, item, manufacturer and product designation, ANSI designation, size, and finish or color, as applicable.

Hardware Group No. 1
Doors: 1

H1	Hinges
L3	Locks & Latches
C2	Closers
S1	Stops
-	Bolts/Exit Devices
K1	Kickplates
T2	Thresholds
W1 & W2	Weatherstrips & Silencers

Hardware Group No. 2
Doors: 2

H1	Hinges
L3	Locks & Latches
C2	Closers
S1	Stops
-	Bolts/Exit Devices
K1	Kickplates
T2	Thresholds
W1	Weatherstrips & Silencers

Hardware Group No. 3
Roll-Doors 3 & 4

	Hinges
L6	Locks & Latches
-	Closers
-	Stops
-	Bolts/Exit Devices
-	Kickplates
-	Thresholds
W4	Weatherstrips & Silencers

Hardware Group No. 4
Doors: 9

H1	Hinges
L2 L4	Locks & Latches
C2	Closers
S1 S1	Stops
B1	Bolts/Exit Devices
K1 K1	Kickplates

T1	Thresholds
W1 & W2	Weatherstrips & Silencers

Hardware Group No. 5
Doors: 11 & 12

H1	Hinges
L5	Locks & Latches
C2	Closers
S1	Stops
-	Bolts/Exit Devices
K1	Kickplates
T1	Thresholds
W1	Weatherstrips & Silencers

Hardware Group No. 6
Door: 13

H1	Hinges
L2	Locks & Latch
C2	Closers
S1	Stops
	Bolts/Exit Devices
	Kickplates
T2	Thresholds
W1	Weatherstrips & Silencers

Hardware Group No. 7
Doors: 5

H1	Hinges
L1	Locks & Latches
C2	Closers
S1	Stops
-	Bolts/Exit Devices
K1	Kickplates
T2	Thresholds
W1	Weatherstrips & Silencers

Hardware Group No. 8
Door: 6

H1	Hinges
L1 L4	Locks & Latch
C1 C1	Closers
S1 S1	Stops
B1	Bolts/Exit Devices
K1 K1	Kickplates
T2	Thresholds
W1	Weatherstrips & Silencers
W3	Astragal

Hardware Group No. 9
Doors: 8 & 10

H1	Hinges

L2	Locks & Latches
C2	Closers
S1	Stops
-	Bolts/Exit Devices
K1	Kickplates
T1	Thresholds
W1 & W2	Weatherstrips & Silencers

SECTION 09300 TILE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This Section includes the following items under the Contract Documents:

1. Unglazed ceramic mosaic tile.
2. Glazed wall tile.
3. Glazed ceramic mosaic tile.

B. Related Sections: The following sections contain requirements that relate to this Section:

1. Division 3 Section 03300 "Concrete Work" for monolithic slab finishes specified for tile substrates.
2. Division 7 Section 07900 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

1.2 RELATED DOCUMENTS

A. Reference standards include but are not limited to:

1. San Francisco Building Code 1995 Edition.

1.3 SUBMITTALS

A. Product data for each type of product specified.
B. Shop drawings indicating tile patterns and locations and widths of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

1. Locate precisely each joint and crack in tile substrates by measuring, record measurements on shop drawings, and coordinate them with tile joint locations, in consultation with Architect.

C. Samples for initial selection purposes in form of manufacturer's color charts consisting of actual tiles or sections of tile showing full range of colors, textures, and patterns available for each type and composition of tile indicated. Include samples of grout and accessories involving color selection.
D. Master grade certificates for each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
E. Material test reports from qualified independent testing laboratory indicating and interpreting test results relative to compliance of tile and tile setting and grouting products with requirements indicated.

1.4 QUALITY ASSURANCE

A. Single-Source Responsibility for Tile: Obtain each color, grade, finish, type, composition, and variety of tile from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

B. Single-Source Responsibility for Setting and Grouting Materials: Obtain ingredients of a uniform quality from one manufacturer for each cementitious and admixture component and from one source or producer for each aggregate.
C. Installer Qualifications: Engage an experienced Installer who has successfully completed tile installations similar in material, design, and extent to that indicated for Project.
D. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings".

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement of ANSI A137.1 for labeling sealed tile packages.
B. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.
C. Handle tile with temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If despite these precautions coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.6 PROJECT CONDITIONS

A. Maintain environmental conditions and protect work during and after installation to comply with referenced standards and manufacturer's printed recommendations.
B. Vent temporary heaters to exterior to prevent damage to tile work from carbon dioxide buildup.
C. Maintain temperatures at 50 deg F (10 deg C) or more in tiled areas during installation and for 7 days after completion, unless higher temperatures are required by referenced installation standard or manufacturer's instructions.

1.7 EXTRA MATERIALS

A. Deliver extra materials to Owner. Furnish extra materials that match products installed as described below, packaged with protective covering for storage and identified with labels clearly describing contents.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Unglazed Ceramic Mosaic Tile:

   a. Dal-Tile Corp.
   b. American Olean Tile Co., Inc.

2. Glazed Wall Tile:

   a. Dal-Tile Corp.
   b. American Olean Tile Co., Inc.

3. Latex-Emulsion-Based Latex-Portland Cement Mortars:

   a American Olean Tile Co., Inc.
   b. Laticrete International Inc.

4. Acrylic Emulsions for Latex-Portland Cement Grouts:

a. American Olean Tile Co., Inc.
b. Laticrete International Inc.

2.2 PRODUCTS, GENERAL

A. ANSI Standard for Ceramic Tile: Comply with ANSI A137.1 "American National Standard Specifications for Ceramic Tile" for types, compositions, and grades of tile indicated.

1. Furnish tile complying with "Standard Grade" requirements unless otherwise indicated.

B. ANSI Standard for Tile Installation Materials: Comply with ANSI standard referenced with products and materials indicated for setting and grouting.

C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:

1. Match color, texture, and pattern indicated by reference to manufacturer's standard designations for these characteristics.
2. Provide selections made by Engineer from manufacturer's full range of standard colors, textures, and patterns for products of type indicated.

D. Factory Blending: For tile exhibiting color variations within the ranges selected during sample submittals, blend tile in factory and package accordingly so that tile units taken from one package show the same range in colors as those taken from other packages and match approved samples.

E. Mounting: Where factory-mounted tile is required, provide back- or edge-mounted tile assemblies as standard with manufacturer unless another mounting method is indicated.

F. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating them with a continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.3 TILE PRODUCTS

A. Group 1: Unglazed Ceramic Mosaic Tile: Provide factory-mounted flat tile complying with the following requirements:

1. Composition: Porcelain.
2. Nominal Facial Dimensions: 2 inches by 2 inches.
3. Nominal Thickness: 1/4 inch.
4. Face: Plain with cushion edges.

B. Group 2: Glazed Wall Tile: Provide flat tile complying with the following requirements:

1. Nominal Facial Dimensions: 4-1/4 inches by 4-1/4 inches.
2. Nominal Thickness: 5/16 inch.
3. Face: Plain with cushion edge.

C. Trim Units: Provide tile trim units to match characteristics of adjoining flat tile and to comply with following requirements:

1. Size: As indicated, coordinated with sizes and coursing of adjoining flat tile where applicable.
2. Shapes: As follows, selected from manufacturer's standard shapes:

a. Base for Portland Cement Mortar Installations: Coved.
b. Wainscot Cap for Portland Cement Mortar Installations: Bullnose cap.
c. External Corners for Portland Cement Mortar Installations: Bullnose shape with a radius of at least 3/4 inch unless otherwise indicated.

f. External Corners for Thinset Installations: Surface bullnose.
g. Internal Corners: Field-butted square corners, except use coved base and cap angle pieces designed to member with stretcher shapes.
h. Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide a reduction in thickness from 1/2 inch to 1/4 inch across nominal 4 INCH dimension.

2.4 SETTING MATERIALS

A. Portland Cement Mortar Installation Materials: Provide materials complying with ANSI A108.1 and as specified below.

1. Waterproof Membrane: See TCI F 121-95
2. Reinforcing Wire Fabric: Galvanized welded wire fabric, 2 inches by 2 inches - WO.3 by WO.3 (16 ASW gage or 0.0625 inch diameter); comply with ASTM A 185 and ASTM A 82 except for minimum wire size.
3. Expanded Metal Lath: Provide diamond mesh lath complying with ASTM C 847 for requirements indicated below:

a. Base Metal and Finish for Interior Applications: Fabricate lath from zinc-coated (galvanized) steel sheet.
b. Configuration Over Studs and Furring: Flat.
c. Configuration Over Solid Surfaces: Self-furring.
d. Weight: 3.4 psf.

4. Latex additive (water emulsion) described below, serving as replacement for part or all of gauging water, of type specifically recommended by latex additive manufacturer for use with job-mixed Portland cement and aggregate mortar bed.

a. Latex Additive: Manufacturer's standard.

2.5 GROUTING MATERIALS

A. Latex-Portland Cement Grout: ANSI A118.6, color as indicated, composition as follows:

1. Latex additive (water emulsion) serving as replacement for part or all of gauging water, added at job site with dry grout mixture, with type of latex and dry grout mix as follows:

a. Latex Type: Manufacturer's standard.
b. Dry Grout Mixture: Commercial Portland cement specified or supplied by latex additive manufacturer.

1) Application: Use commercial Portland cement grout combined with latex additive for grouting joints in floor tile unless otherwise indicated.

2.6 ELASTOMERIC SEALANTS

A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer indicated that comply with requirements of Division 7 Section "Joint Sealers," including ASTM C 920 as referenced by Type, Grade, Class, and Uses.
B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.
C. One-Part Mildew-Resistant Silicone Sealant: Type S; Grade NS; Class 25; Uses NT, G, A, and as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and temperature extremes.

D. Multi-part pourable urethane sealant for use T: Type M Grade P; class 25, Uses T, M. A and as applicable to joint substrates indicated.
E. Available Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:

1. One-Part Mildew-Resistant Silicone Sealant:

a. "Dow Corning 786"; Dow Corning Corp.
b. "SCS 1702"; General Electric Co.
c. "863 #345 White"; Pecora Corp.
d. "Rhodorsil 6B White"; Rhone-Poulenc Inc.
e. "Proglaze White"; Tremco Corp.

2.7 MISCELLANEOUS MATERIALS

A. Temporary Protective Coating: Provide product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout, is compatible with tile and mortar/grout products, and is easily removable after grouting is completed without damaging grout or tile.

1. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as a temporary protective coating for tile.

2.8 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with requirements of referenced standards and manufacturers including those for accurate proportioning of materials, water, or additive content; type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce mortars and grouts of uniform quality with optimum performance characteristics for application indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and areas where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm, dry, clean, and free from oil or waxy films and curing compounds.
2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Blending: For tile exhibiting color variations within the ranges selected during sample submittals, verify that tile has been blended in factory and packaged accordingly so that tile units taken from one package show the same range in colors as those taken from other packages and match approved samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.
B. Field-Applied Temporary Protective Coating: Where indicated under tile type or needed to prevent adhesion or staining of exposed tile surfaces by grout, protect exposed surfaces of tile against adherence of mortar and grout by precoating them with a continuous film of temporary protective coating indicated below, taking care not to coat unexposed tile surfaces:

1. Grout release.

3.3 INSTALLATION, GENERAL

A. ANSI Tile Installation Standard: Comply with parts of ANSI 108 series of tile installation standards included under "American National Standard Specifications for the Installation of Ceramic Tile" that apply to type of setting and grouting materials and methods indicated.
B. TCA Installation Guidelines: TCA "Handbook for Ceramic Tile Installation"; comply with TCA installation methods indicated.
C. Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions except as otherwise shown. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so that plates, collars, or covers overlap tile.
E. Jointing Pattern: Unless otherwise shown, lay tile in grid pattern. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths unless otherwise shown.

    1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so that extent of each sheet is not apparent in finished work.

F. Lay out tile wainscots to next full tile beyond dimensions indicated.
Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw cut joints after installation of tiles.

    1. Locate joints in tile surfaces directly above joints in concrete substrates.
    2. Prepare joints and apply sealants to comply with requirements of Division 7 Section "Joint Sealers."

H. Grout tile to comply with the requirements of the following installation standards:

    1. For ceramic tile grouts (sand-Portland cement, dry-set, commercial Portland cement, and latex-Portland cement grouts), comply with ANSI A108.10.

3.4 FLOOR INSTALLATION METHODS

A. Ceramic Mosaic Tile: Install tile to comply with requirements indicated below for setting bed methods, TCA installation methods related to types of subfloor construction, and grout types:

    1. Portland Cement Mortar: ANSI A108.1

        a. Bond Coat: Latex-Portland cement mortar on cured bed, ANSI A108.5.
        b. Bond Coat: Portland Cement paste or dust coat on plastic bed or the following thin-set mortar on cured bed, ANSI A108.5, at Contractor's option:

        1) Latex-Portland cement mortar.

        c. Concrete Subfloors, Interior: TCA F112 (bonded).
        d. Concrete Subfloors, Interior, Waterproofing Membrane: TCA F121.
        e. Grout: Latex-Portland cement.

    2. Latex-Portland Cement Mortar: ANSI A108.5.

3.5 WALL TILE INSTALLATION METHODS

A. Install types of tile designated for wall application to comply with requirements indicated below for setting-bed methods, TCA installation methods related to subsurface wall conditions, and grout types:

1. Gypsum Board: ASTM C-36 or C-630

a. Masonry or Concrete, Interior: TCA GA-216.
b. Metal Studs, Interior: TCA W243-98.
c. ANSI A 108.5.
d. Grout: ANSI A 108.10.

3.6 CLEANING AND PROTECTION

A. Cleaning: Upon completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove latex-Portland cement grout residue from tile as soon as possible.
2. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's printed instructions, but no sooner than 14 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.
3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to brick and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.
C. Provide final protection and maintain conditions in a manner acceptable to manufacturer and installer that ensures that tile is without damage or deterioration at time of Substantial Completion.

1. When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
2. Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

SECTION 09500 ACOUSTICAL TREATMENT

PART 1 GENERAL

1.1 WORK INCLUDED

A. This Section covers the work necessary to furnish and install 2" thick mineral rock wool / fiberglass sound insulation with perforated sheet metal liner at interior walls as shown on the Drawings.

1.2 RELATED SECTIONS

A. Section 12-1.06 - Submittals
B. Section 08111 - Standard Metal Doors & Frames
C. Section 10200 - Louvers & Vents

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers - Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:

1. Empire Acoustical Systems, Inc.
2. CENTRIA
3. Or approved equal

2.2 MATERIALS

A. Panels shall be fabricated from sheet steel conforming to the structural quality of ASTM A-446 and galvanized according with ASTM A-525, Class G-90. Each panel shall have a cover width of 24 inches, with material thickness of 22 gauge. Panel shall be made of perforated cold-form steel.
B. Acoustical insulation shall be of mineral rock wool or fiberglass sound absorbing batt installed behind perforated face and be 2 inches thick. It shall have a 6 lbs. per cu. ft. density and conform with Federal Specification HH-1-558B and ASTM Standard E-136.

2.3 FINISH

A. All perforated sheet metal liner shall be factory galvanized and painted.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install sound absorptive acoustical panels in accordance with manufacturer's instructions, and as shown on Drawings.
B. Install acoustical panels plumb and square.
C. After installation, touch-up scratched or damaged surfaces.

SECTION 09505 REMOVABLE PANEL

PART 1 GENERAL

1.1 WORK INCLUDED

A. This section covers the work necessary to furnish all labor, materials, equipment and incidentals required to install removable acoustical metal panel as shown on the Drawings and as specified herein.
B. Furnish and install finished hardware, metal trim, acoustic material, and weather seal as shown on the Drawing.

1.2 RELATED SECTIONS

A. Section 09500 Acoustical Treatment
B. Section 07600 Flashing and Sheet Metal
C. Section 09900 Painting

1.3 QUALITY ASSURANCE

A. Fabrication: The removable panel and components shall be shop fabricated.

1.4 SUBMITTALS

A. Submit shop Drawings in accordance with Section 12-1.06
B. Shop Drawings shall be prepared and submitted for approval of the Engineer prior to fabrication.
C. Samples of color and finishes are to be submitted to the Engineer for approval.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to the following:

1. Exterior Wall Panel

   a. BHP Steel Bldg. Products USA, Inc.
   b. CENTRIA
   c. or approved equal

2. Interior Sound Absorptive Panel

   a. Empire Acoustical System, Inc.
   b. CENTRIA
   c. or approved equal

2.2 CONSTRUCTION AND DESIGN

A. Removable panel shall be constructed of welded tubular frame, shop primed, exterior corrugated siding and interior sound absorbing paneling. Panel shall be bolted into building opening as shown on the Drawings.
B. Fabricate structural tubular frame rigid, square, and true.

2.3 FINISH

A. Structural tubular frame - shop primed.
B. Exterior siding - baked enamel.
C. Interior sound absorptive panels - baked enamel

PART 3 EXECUTION

3.1 ERECTION

A. Insure opening is securely in place.
B. Install weatherstripping and seal as shown on the Drawings.

3.2 INSTALLATION AND WORKMANSHIP

A. Install panel in a neat workmanship manner with no unfinished edges or exposure.
B. At the completion of the installation, when directed, all exposed surfaces shall be cleaned to the satisfaction of the Engineer in accordance with manufacturer's recommendations.

SECTION 09511 ACOUSTICAL PANEL CEILINGS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. San Francisco Building Code 1995 Edition.

1.2 SUMMARY

A. This Section includes ceilings composed of acoustical panels and exposed suspension systems.
B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 15 Section "Heating, Ventilating, and Air Conditioning" for grills, registers, and diffusers in acoustical ceilings.
2. Division 16 Section "Lighting" for lighting fixtures in acoustical ceilings.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to Section 12-1.06.
B. Product data for each type of product specified.
C. Coordination drawings for reflected ceiling plans drawn accurately to scale and coordinating penetrations and ceiling-mounted items. Show the following:

1. Ceiling suspension system members.
2. Method of attaching suspension system hangers to building structure.
3. Ceiling-mounted items including light fixtures; air outlets and inlets; speakers; sprinklers; and special moldings at walls, column penetrations, and other junctures of acoustical ceilings with adjoining construction.
4. Minimum Drawing Scale: 1/8 inch = 1 foot.

D. Samples for verification of each type of exposed finish required, prepared on samples of size indicated below. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

1. 6-inch- (150-mm-) square samples of each acoustical panel type, pattern, and color.
2. Set of 12-inch- (300-mm-) long samples of exposed suspension system members, including moldings, for each color and system type required.

E. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
F. Product test reports from a qualified independent testing agency that are based on its testing of current products for compliance of acoustical panel ceilings and components with requirements.
G. Research reports or evaluation reports of the model code organization acceptable to authorities having jurisdiction that show compliance of acoustical panel ceilings and components with the building code in effect for this Contract.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed acoustical panel ceilings similar in material, design, and extent to that indicated for this Contract and with a record of successful in-service performance.
B. Fire-Performance Characteristics: Provide acoustical ceilings that are identical to those tested for the following fire-performance characteristics, per ASTM test method indicated below, by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.

1. Surface Burning Characteristics: As follows, tested per ASTM E 84 and complying with ASTM E 1264 for Class A products.

a. Flame Spread: 25 or less.
b. Smoke Developed: 50 or less.

2. Fire-Resistance Ratings: As indicated by reference to design designations in UL "Fire Resistance Directory," for types of assemblies in which acoustical ceilings function as a fire-protective membrane and tested per ASTM E 119.

   a. Protect lighting fixtures and air ducts to comply with requirements indicated for rated assembly.

C. Single-Source Responsibility for Ceiling Units: Obtain each type of acoustical ceiling panel from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.
D. Single-Source Responsibility for Suspension System: Obtain each type of suspension system from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

   1. Obtain both acoustical panels and suspension system from the same manufacturer.

E. Coordination of Work: Coordinate layout and installation of acoustical ceiling units and suspension system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system components (if any), and partition system (if any).
F. Preinstallation Conference: Conduct conference at Contract site to comply with requirements of Division 1 Section "Project Meetings."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels and suspension system components to Contract site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.6 PROJECT CONDITIONS

A. Space Enclosure: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet-work in spaces is completed and dry, work above ceilings is complete, and ambient temperature and humidity conditions are being maintained at the levels indicated for this Contract when occupied for its intended use.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide acoustical lay-in panels and tile as manufactured by Armstrong, United States Gypsum co. or approved equal.

2.2 ACOUSTICAL PANELS, GENERAL

A. Acoustical lay-in panels shall be as follows, unless otherwise specified herein or indicated on Drawings and/or schedules.

   1. In Emergency Generator and Electrical rooms: "Fissured Minaboard, Item 755," Color: White; 24" x 48" x 5/8" lay-in, as manufactured by Armstrong, or approved equal. See reflected ceiling plan for layout.

   2. Units shall be 5/8" thick by nominal 24" x 48" as required to fit suspension grid and with smaller size as required to provide for perimeter and special conditions.

3. Units shall conform to Federal Specification ASTM E1264, Class A, Flame Spread 0-25 (ASTM), UL Label, NRC 55, CAC minimum 35.

2.3 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C 635 requirements.
B. Finishes and Colors: Provide manufacturer's standard factory-applied finish for type of system indicated.

   1. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

C. Attachment Devices: Size for 5 times the design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.

   1. Postinstalled Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attachment of hangers of type indicated and with capability to sustain, without failure, a load equal to 5 times that imposed by ceiling construction, as determined by testing per ASTM E 488, conducted by a qualified testing agency.

      a. Type: Expansion anchors.

   2. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attachment of hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing agency.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

   1. Zinc-Coated Carbon Steel Wire: ASTM A 641 (ASTM A 641M), Class 1 zinc coating, soft temper.
   2. Size: Select wire diameter so that its stress at 3 times the hanger design load (ASTM C 635, Table 1, Direct Hung) will be less than the yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.

E. Hanger Rods: Mild steel, zinc coated, or protected with rust-inhibitive paint.
F. Flat Hangers: Mild steel, zinc coated, or protected with rust-inhibitive paint.
G. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide, formed with 0.0396-inch- (1-mm-) thick galvanized-steel sheet complying with ASTM A 446, G90 (ASTM A 446M, Z 275) Coating Designation, with bolted connections and 5/16-inch- (8-mm-) diameter bolts.
H. Edge Moldings and Trim: Metal or extruded aluminum of types and profiles indicated, or if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material and finish as that used for exposed flanges of suspension system runners.

   1. For lay-in panels with reveal edge details, provide stepped-edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
   2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
   3. For acoustical tile adhered to substrate, provide edge moldings at ceiling perimeters and where indicated.
   4. For narrow-face suspension systems, provide suspension system and manufacturer's standard edge moldings that match width and configuration of exposed runners.

2.4 NON-FIRE-RESISTANCE-RATED, DIRECT-HUNG SUSPENSION SYSTEMS

A. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from commercial quality cold-rolled electro-galvanized steel, with prefinished 15/16-inch- (24-mm-) wide metal caps on flanges; other characteristics as follows:

1. Structural Classification - Intermediate-duty system.
2. End Condition of Cross Runners - Override (stepped) or butt-edge type, as standard with manufacturer.
3. Cap Material and Finish - Steel or aluminum sheet as standard with manufacturer, baked polyester or anodized finish.
4. Provide 'Prelude 15/16" Exposed Tee System' as manufactured by Armstrong or approved equal.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and structural framing to which acoustical panel ceilings attach or abut, with installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordination: Furnish layouts for cast-in-place anchors, clips, and other ceiling anchors whose installation is specified in other sections.

1. Furnish cast-in-place anchors and similar devices to other trades for installation well in advance of time needed for coordinating other work.

B. Measure each ceiling area and establish the layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and conform to the layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with publications referenced below per manufacturer's instructions and CISCA "Ceiling Systems Handbook."

1. Standard for Ceiling Suspension System Installations: Comply with ASTM C 636 and ASTM E 580.

B. Arrange acoustical units and orient directionally patterned units in a manner shown by reflected ceiling plans.
C. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of the supporting structure or of the ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
4. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to

which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.

6. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise shown; and provide hangers not more than 8 inches (200 mm) from ends of each member.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Sealant bed: Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not over 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.18 mm in 3.66 m). Miter corners accurately and connect securely.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fitted accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide neat, precise fit.

1. Install hold-down clips in areas indicated and in areas required by governing regulations, or for fire-resistance ratings; space as recommended by panel manufacturer, unless otherwise indicated or required.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

SECTION 09650 RESILIENT FLOORING

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Extent of resilient flooring and accessories is shown on Drawings and in schedules.

1.2 RELATED DOCUMENTS

A. Reference standards include but are not limited to:

1. San Francisco Building Code 1995 Edition.

1.3 QUALITY ASSURANCE

A. Manufacturer: Provide each type of resilient flooring and accessories as produced by a single manufacturer, including recommended primers, adhesives, sealants, and leveling compounds and maintenance materials

B. Fire Test Performance: Provide resilient flooring which complies with the following fire test performance criteria as determined by an independent testing laboratory acceptable to authorities having jurisdiction.

1. Critical Radiant Flux (CRF): Not less than the following rating per ASTM E 648.

a. 0.45 watts per sq. cm.

2. Flame Spread: Not more than 75 per ASTM E 84.

3. Smoke Developed: Not more than 450 per ASTM E 84.
4. Smoke Density: Not more than 450 per NFPA 258.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical data for each type of resilient flooring and accessory.
B. Samples for Initial Selection Purposes: Submit manufacturer's standard color charts in form of actual sections of resilient flooring, including accessories, showing full range of colors and patterns available, for each type of resilient flooring required.
C. Samples for Verification Purposes: Submit the following samples of each type, color, and pattern of resilient flooring required, showing full-range of color and pattern variations.

1. Full size tile samples.
2. 2-1/2 long samples of resilient flooring accessories.
3. Welding beads for sheet flooring.
4. Other materials as requested.

D. Certification for Fire Test Performance: Submit certification from an independent testing laboratory acceptable to authorities having jurisdiction that resilient flooring complies with fire test performance requirements.
E. Maintenance Instructions: Submit 2 copies of manufacturer's recommended maintenance practices for each type of resilient flooring and accessory required.

1.5 PROJECT CONDITIONS

A. Maintain minimum temperature of 65° F (18°C) in spaces to receive resilient flooring for at least 48 hours prior to installation, during installation, and for not less than 48 hours after installation. Store resilient flooring materials in spaces where they will be installed for at least 48 hours before beginning installation. Subsequently, maintain minimum temperature of 55° F (13°C) in areas where work is completed.
B. Install resilient flooring and accessories after other finishing operations, including painting, have been completed. Do not install resilient flooring over concrete slabs until the latter have been cured and are sufficiently dry to achieve bond with adhesive as determined by resilient flooring manufacturer's recommended bond and moisture test.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

1. Manufacturers of Vinyl Composition Tile:

   a. Armstrong World Industries, Inc.
   b. Tarkett Inc.
   c. Azrock Floor Products Div., Azrock Industries, Inc.

2. Manufacturers of Rubber Wall Base:

   a. Burke Flooring Products Div., Burke Industries, Inc.
   b. Flexco Div., Textile Rubber Co.
   c. Johnson Rubber Co., Inc.
   d. C. Musson Rubber Co., Inc.
   e. Roppe Rubber Corp.

2.2 RESILIENT FLOORING COLORS AND PATTERNS

A. Provide color and patterns as indicated, or if not otherwise indicated, as selected by the Engineer from manufacturer's standards.
B. Vinyl Composition Tile: FS SS-T-312, Type IV;
12" x 12" unless otherwise indicated, and as follows:

1. Composition 1 - asbestos-free.
2. Gage: 1/8".

2.3 ACCESSORIES

A. Rubber Wall Base: Provide rubber base complying with FS SS-W-40, Type I, with matching end stops and preformed or molded corner units, and as follows:

1. Height: 4".
2. Thickness: 1/8" gage.

B. Metal Edge Strips: Of width shown and of required thickness to protect exposed edge of resilient flooring. Provide units of maximum available length, to minimize number of joints.

1. Material: Extruded aluminum with mill finish, unless otherwise shown.
2. Type: Butt type metal edge strips for concealed anchorage.
3. Type: Overlap type metal edge strips for exposed anchorage.

C. Adhesives (Cements): Waterproof, stabilized type as recommended by flooring manufacturer to suit material and substrate conditions.
D. Concrete Slab Primer: Non-staining type as recommended by flooring manufacturer.
E. Leveling and Patching Compounds: Latex type as recommended by flooring manufacturer.
F. Maintenance Materials: Manufacturer's recommended standard.

PART 3 EXECUTION

3.1 INSPECTION

A. Require Installer to inspect subfloor surfaces to determine that they are satisfactory. A satisfactory subfloor surface is defined as one that is smooth and free from cracks, holes, ridges, coatings preventing adhesive bond, and other defects impairing performance or appearance.
B. Perform bond and moisture tests on concrete subfloors to determine if surfaces are sufficiently cured and dry as well as to ascertain presence of curing compounds.
C. Do not allow resilient flooring work to proceed until subfloor surfaces are satisfactory.

3.2 PREPARATION

A. Prepare subfloor surfaces as follows:

1. Use leveling and patching compounds as recommended by resilient flooring manufacturer for filling small cracks, holes and depressions in subfloors.
2. Remove coatings from subfloor surfaces that would prevent adhesive bond, including curing compounds incompatible with resilient flooring adhesives, paint, oils, waxes and sealers.

B. Broom clean or vacuum surfaces to be covered, and inspect subfloor.
C. Apply concrete slab primer, if recommended by flooring manufacturer, prior to application of adhesive. Apply in compliance with manufacturer's directions.

3.3 INSTALLATION, GENERAL

A. Install resilient flooring using method indicated in strict compliance with manufacturer's printed instructions. Extend resilient flooring into toe spaces, door reveals, and into closets and similar openings.
B. Scribe, cut, and fit resilient flooring to permanent fixtures, built-in furniture and cabinets, pipes, outlets and permanent columns, walls and partitions.
C. Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other non-permanent marking device.

3.4 INSTALLATION OF TILE FLOORS

A. Lay tile from center marks established with principal walls, discounting minor offsets, so that tile at opposite edges of room area of equal width. Adjust as necessary to avoid use of cut widths less than 1/2 tile at room perimeters. Lay tile square to room axis, unless otherwise shown.
B. Match tiles for color and pattern by using tile from cartons in same sequence as manufactured and packaged if so numbered. Cut tile neatly around all fixtures. Broken, cracked, chipped, or deformed tiles are not acceptable.

    1. Lay tile with grain running in one direction.

C. Adhere tile flooring to substrates using full spread of adhesive applied in compliance with flooring manufacturer's directions.

3.5 INSTALLATION OF ACCESSORIES

A. Apply wall base to walls, columns, pilasters, casework and other permanent fixtures in rooms or areas where base is required. Install base in lengths as longs as practicable, with preformed corner units, or fabricated from base materials with mitered or coped inside corners. Tightly bond base to substrate throughout length of each piece, with continuous contact at horizontal and vertical surfaces.

    1. On concrete surfaces, or other similar irregular substrates, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.

B. Place resilient edge strips tightly butted to flooring and secure with adhesive. Install edging strips at edges of flooring which would otherwise be exposed.

3.6 CLEANING AND PROTECTION

A. Perform following operations immediately upon completion of resilient flooring:

    1. Sweep or vacuum floor thoroughly.
    2. Do not wash floor until time period recommended by resilient flooring manufacturer has elapsed to allow resilient flooring to become well-sealed in adhesive.
    3. Damp-mop floor being careful to remove black marks and excessive soil.
    4. Remove any excess adhesive or other surface blemishes, using appropriate cleaner recommended by resilient flooring manufacturers.
    5. Apply protective floor polish.

B. Protect flooring against damage during construction period to comply with resilient flooring manufacturer's directions.

    1. Protect resilient flooring against damage from rolling loads for initial period following installation by covering with plywood or hardboard. Use dollies to move stationary equipment or furnishings across floors.
    2. Cover resilient flooring with undyed, untreated building paper until inspection for substantial completion.

C. Clean resilient flooring not more than 4 days prior to date scheduled for inspections intended to establish date of substantial completion in each area of project. Clean resilient flooring by method recommended by resilient flooring manufacturer.

1. Strip protective floor polish, which was applied after completion of installation, prior to cleaning.
2. Reapply floor polish after cleaning.

3.7 EXTRA STOCK

A. Deliver stock of maintenance materials to the City. Furnish maintenance materials from same manufactured lot as materials installed and enclosed in protective packaging with appropriate identifying labels.

1. Tile Flooring: Furnish not less than one box for each 50 boxes or fraction thereof, for each type, color, pattern and size installed.

SECTION 09900 PAINTING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Reference standard include but are not limited to:

1. San Francisco Building Code 1995 Edition.

1.2 SUMMARY

A. This Section includes surface preparation, painting, and finishing of exposed interior and exterior items and surfaces specified in Divisions 6, 7, 8 and 10.

1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop-priming and surface treatment specified under other sections.

B. Paint exposed surfaces whether or not colors are designated in schedules, except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Engineer will select from standard colors or finishes available.

C. Painting is not required on prefinished items, finished metal surfaces, concealed surfaces, operating parts, and labels.

1. Prefinished items not to be painted include the following factory-finished components:

a. Metal toilet enclosures.
b. Acoustic materials.
c. Architectural woodwork and casework.
d. Finished mechanical and electrical equipment.
e. Light fixtures.
f. Switchgear.

2. Concealed surfaces not to be painted include wall or ceiling surfaces in the following generally inaccessible areas:

a. Foundation spaces.
b. Furred areas.
c. Utility tunnels.

d. Pipe spaces.
e. Duct shafts.

3. Finished metal surfaces not to be painted include:

a. Anodized aluminum.
b. Stainless steel.
c. Chromium plate.
d. Copper.
e. Bronze.
f. Brass.

4. Labels: Do not paint over Underwriters Laboratories, Factory Mutual or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 6 Section "Interior Architectural Woodwork" for shop-priming interior architectural woodwork.
2. Division 8 Section "Standard Steel Doors and Frames" for shop-priming steel doors and frames.
3. Division 9, Section 03300 "Concrete" for new and existing concrete walkway at Building 930 East Entrance.

1.3 SUBMITTALS

A. General: Submit the following according to Section 12-1.06.
B. Product data for each paint system specified, including block fillers and primers.

1. Provide the manufacturer's technical information including label analysis and instructions for handling, storage, and application of each material proposed for use.
2. List each material and cross-reference the specific coating, finish system, and application. Identify each material by the manufacturer's catalog number and general classification.
3. Certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

C. Samples for initial color selection in the form of manufacturer's color charts.

1. After color selection, the Engineer will furnish color chips for surfaces to be coated.

D. Samples for Verification Purposes: Provide samples of each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate.

1. Provide stepped samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and texture are achieved.
2. Provide a list of material and application for each coat of each sample. Label each sample as to location and application.
3. Submit samples on the following substrates for the Engineer’s review of color and texture only:

a. Concrete: Provide two 4-inch-square samples for each color and finish.
b. Ferrous Metal: Provide two 4-inch-square samples of flat metal and two 8-inch-long samples of solid metal for each color and finish.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to those indicated for the Contract that have resulted in a construction record of successful in-service performance.

B. Single-Source Responsibility: Provide primers and undercoat paint produced by the same manufacturer as the finish coats.
C. Field Samples: On wall surfaces and other exterior and interior components, duplicate finishes of prepared samples. Provide full-coat finish samples on at least 100 sq. ft. of surface until required sheen, color, and texture are obtained; simulate finished lighting conditions for review of in-place work.

1. Final acceptance of colors will be from job-applied samples.
2. The Engineer will select one room or surface to represent surfaces and conditions for each type of coating and substrate to be painted. Apply coatings in this room or surface according to the schedule or as specified.

a. After finishes are accepted, this room or surface will be used to evaluate coating systems of a similar nature.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the job site in the manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:

1. Product name or title of material.
2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.6 JOB CONDITIONS

A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 deg F (10 deg C) and 90 deg F (32 deg C).
B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 deg F (7 deg C) and 95 deg F (35 deg C).
C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by the manufacturer during application and drying periods.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers - Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Fuller O'Brien

2. Sinclair or equal.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions under which painting will be performed for compliance with paint application requirements. Surfaces receiving paint must be thoroughly dry before paint is applied.

1. Start of painting will be construed as the applicator's acceptance of surfaces and conditions within a particular area.

3.2 PREPARATION

A. General - Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted, or provide surface-applied protection prior to surface preparation and painting. Remove these items, if necessary, to completely paint the items and adjacent surfaces. Following completion of painting operations in each space or area, have items reinstalled by workers skilled in the trades involved.

B. Cleaning - Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease prior to cleaning. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation - Clean and prepare surfaces to be painted according to the manufacturer's instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime. Notify Architect in writing about anticipated problems using the specified finish-coat material with substrates primed by others.
2. Cementitious Materials - Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen, as required, to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.

   a. Use abrasive blast-cleaning methods if recommended by the paint manufacturer.
   b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's printed directions.
   c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.

3. Ferrous Metals - Clean ungalvanized ferrous metal surfaces that have not been shop-coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with recommendations of the Steel Structures Painting Council (SSPC).

   a. Blast steel surfaces clean as recommended by the paint system manufacturer and according to requirements of SSPC specification SSPC-SP 10.
   b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
   c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by the paint manufacturer, and touch up with the same primer as the shop coat.

4. Galvanized Surfaces - Clean galvanized surfaces with nonpetroleum-based solvents so that the surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

D. Materials Preparation - Carefully mix and prepare paint materials according to manufacturer's directions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density; stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.
3. Use only thinners approved by the paint manufacturer and only within recommended limits.

E. Tinting - Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

A. General - Apply paint according to manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.
B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.

1. Paint colors, surface treatments, and finishes are indicated in the schedules.
2. Provide finish coats that are compatible with primers used.
3. The number of coats and the film thickness required are the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where sanding is required to produce a smooth even surface according to the manufacturer's directions.
4. Apply additional coats if undercoats, stains, or other conditions show through final coat of paint until paint film is of uniform finish, color, and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.
5. The term exposed surfaces includes areas visible when permanent or built-in fixtures, convector covers, covers for finned tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
6. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
7. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, nonspecular black paint.
8. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
9. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
10. Finish exterior doors on tops, bottoms, and side edges same as exterior faces.
11. Sand lightly between each succeeding enamel or varnish coat.
12. Omit primer on metal surfaces that have been shop-primed and touch-up painted.

C. Scheduling Painting - Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. Allow sufficient time between successive coats to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.

D. Application Procedures - Apply paints and coatings by brush, roller, spray, or other applicators according to the manufacturer's directions.

1. Brushes - Use brushes best suited for the material applied.
2. Rollers - Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.

3. Spray Equipment - Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.

E. Minimum Coating Thickness - Apply materials no thinner than the manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.
F. Block Fillers - Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
G. Prime Coats - Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime-coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.
H. Stipple Enamel Finish - Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling such as laps, irregularity in texture, skid marks, or other surface imperfections.
I. Pigmented (Opaque) Finishes - Completely cover to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
J. Transparent (Clear) Finishes - Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections.

1. Provide satin finish for final coats.

K. Completed Work - Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with specified requirements.

3.4 CLEANING

A. Cleanup - At the end of each work day, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
B. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.5 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Engineer.
B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

1. Anti-graffiti clear coating for new cured concrete exterior surfaces shall be DEVOE No. 379 manufactured by ICI-DULUX, or approved equal.
2. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINT SCHEDULE

A. General: Provide the following paint systems for the various substrates indicated.

System No. 1

B. Ferrous Metal: Gloss.

1. Spot Primer - 621-04 Blox-rust primer coats over primer.
2. 1 Coat Primer - 621-04 Blox-rust Primer.
3. 2 Coats Alkyd Enamel - 312-XX Heavy Duty Industrial Enamel.

System No. 2

C. Galvanized Metal: Gloss

1. 1 Coat - Galvaprep (for new galvanized only)
2. 1 Coat Primer - 320-04 Ful Prime.
3. 2 Coats Alkyd Enamel - 312-XX Heavy Duty Industrial Enamel.

3.7 INTERIOR PAINT SCHEDULE

A. Provide the following paint systems for the various substrates, as indicated, or equal.

System No. 3

B. Ferrous Metal: Gloss.

1. Spot Primer - 621-04 Blox-rust primer coats over primer.
2. 1 Coat Primer - 621-04 Blox-rust Primer.
3. 2 Coats Alkyd Enamel - 312-XX Heavy Duty Industrial Enamel.

System No. 4

C. Galvanized Metal - Gloss

1. 1 Coat - Galvaprep (for new galvanized only)
2. 1 Coat - 320-04 Ful Prime.
3. 2 Coats Alkyd Enamel - 312-XX Heavy Duty Industrial Enamel.

System No. 5

D. Concrete, Plaster and Gypsum Drywall: Semi-gloss

1. 1 Coat: concrete masonry primer.
2. 2 Coats: 214-XX Acrylic Latex AA Enamel.

SECTION 10200 LOUVERS AND VENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This Section covers furnishing and installing the following items under the Contract Documents:

1. Fixed, extruded-aluminum louvers.
2. Fixed, acoustical louvers

B. Air intake louvers for HVAC terminal units are specified with units in Division 15.
C. Related Sections: The following sections contain requirements that relate to this section.

1. Division 7 Section 07900 "Joint Sealant" for sealants installed in perimeter joints between louver frames and adjoining construction.
2. Division 9 Section 09900 "Painting" for field-painting of louvers.
3. Division 16 Section "Electrical Connections" for electrical power connections for motor-operated adjustable metal wall louvers.

1.2 RELATED DOCUMENTS

A. Reference standards include but are not limited to:

1. San Francisco Building Code 1995 Edition.

1.3 DEFINITIONS

A. Louver Terminology: Refer to AMCA Publication 501-85 for definitions of terms for metal louvers not otherwise defined in this section or referenced standards.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. Structural Performance: Design, engineer, fabricate, and install exterior metal wall louvers to withstand the effects of loads and stresses from wind and normal thermal movement, without evidencing permanent deformation of louver components including blades, frames, and supports; noise or metal fatigue caused by louver blade rattle or flutter; and permanent damage to fasteners and anchors:

1. Wind Load: Uniform pressure (velocity pressure) of 20 lbf per sq. ft. acting inwards or outwards.
2. Normal thermal movement is defined as that resulting from the following maximum change (range) in ambient temperature. Base design calculations on actual surface temperatures of metals due to both solar heat gain and night time sky heat loss.

   a. Temperature Change (Range): 100 degrees F (55.5 degrees C).

B. Air Performance, Water Penetration, and Air Leakage Ratings: Provide louvers complying with performance requirements indicated as demonstrated by testing manufacturers stock units, of height and width indicated, according to Air Movement and Control Association (AMCA) Standard 500.

1.5 SUBMITTALS

A. Product data for each product indicated.
B. Shop drawings of louver units and accessories. Include plans, elevations, sections, and details showing profiles, angles, spacing of louver blades; unit dimensions related to wall openings and construction; free areas for each size indicated; and profiles of frames at jambs, heads and sills.

1. Where installed products are indicated to comply with certain structural design loadings, include structural computations, material properties, and other information needed for structural analysis which has been prepared by, or under the supervision of, a qualified professional engineer.

C. Samples for initial selection purposes in form of manufacturer's color charts showing full range of colors available for those units with factory-applied color finishes.

D. Samples for verification purposes of each type of metal finish required, prepared on 6-inch square metal samples of same thickness and alloy indicted for final unit of Work. Where finishes involve normal color and texture variations, included sample sets showing full range of variations expected.

1.6 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain louvers and vents from a single source where alike in one or more respects with regard to type, design, and factory-applied color finish.
B. Qualify welding processes and welding operators in accordance with D1.2 "Structural Welding Code - Aluminum" and D1.3 "Structural Welding Code - Sheet Steel."

1. Certify that each welder employed in unit of Work of this section has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
2. Testing for recertification is Contractor's responsibility.

C. SMACNA Standard - Comply with SMACNA "Architectural Sheet Metal Manual" recommendations for fabrication, construction details, and installation procedures.

1.7 PROJECT CONDITIONS

A. Field Measurements - Check actual louver openings by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of the Work.

1. Where field measurements cannot be made without delaying the Work, guarantee opening dimensions and proceed with fabrication of louvers and vents without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to guaranteed dimensions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers - Subject to compliance with requirements, manufacturers offering products which may be incorporated in the Work include, but are not limited to, the following:

1. Louvers:

a. Airolite Co.
b. American Warming Co.
c. Dowco Products Group

2.2 MATERIALS

A. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer to produce required finish.
B. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5 or T-52.
C. Fasteners: Of same basic metal and alloy as fastened metal, unless otherwise indicated. Do not use metals which are corrosive or incompatible with materials joined.

1. Use types, gages, and lengths to suit unit installation conditions.
2. Use Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.

D. Anchors and Inserts: Of type, size, and material required for type of loading and installation indicated. Use nonferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or expansion bolt devices for drilled-in-place anchors.
E. Bituminous Paint: SSPC-Paint 12 (cold-applied asphalt mastic).

2.3 FABRICATION, GENERAL

A. General: Fabricate louvers and vents to comply with requirements indicated for design, dimensions, materials, joinery, and performance.
B. Preassemble louvers in shop to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

D. Fabricate frames, including integral sills, to fit in openings of size indicated with allowances made for fabrication and installation tolerances of louvers, adjoining construction, and perimeter sealant joints.
E. Include supports, anchorages, and accessories required for complete assembly.
F. Provide vertical mullions of type and at spacings indicated but not further apart than recommended by manufacturer, or 72 inches o.c., whichever is less. At horizontal joints between louver units provide horizontal mullions except where continuous vertical assemblies are indicated.
G. Provide sill extensions and loose sills made of same material as louvers, where indicated, or required for drainage to exterior and to prevent water penetrating to interior.
H. Join frame members to one another and to fixed louver blades as follows, unless otherwise indicated, or size of louver assembly makes bolted connections between frame members necessary:

1. With fillet welds, concealed from view.

2.4 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Continuous Horizontal Fixed Blade Louvers: Extruded aluminum frames and louver blades with supporting framework concealed from view from outside face of louver by placing braces, mullions, and brackets on inside face; with close fitting, field-made splice joints in blades designed to permit expansion and contraction without deforming blades or framework; and complying with the following requirements:

1. Louver Depth: 6 inches, unless otherwise indicated.
2. Frame Type: Channel flange.
3. Frame Thickness: 0.125 inch, unless otherwise indicated.
4. Louver Blade Thickness: 0.125 inch, unless otherwise indicated.
5. Louver Blade Profile: Plain blade with no center baffle.
6. Louver Blade Angle: 45 degrees, unless otherwise indicated.
7. Louver Blade Spacing: 6 inches o.c. for 6 inch deep, 45 degree angle louver blades.
8. Louver Free Area: Not less than 6.83 sq. ft. for 48 inch wide by 48 inch high section.
9. Exterior Corners: Prefabricated corner units with mitered and welded blades aligned with straight sections, with concealed bracing.

2.5 FIXED, ACOUSTICAL LOUVERS

A. Fixed Extruded-Aluminum Louvers: Extruded-aluminum acoustical lowever frames and blades filled on interior with mineral-fiber, rigid-board, acoustical insulation retained by perforated metal sheet.

1. Louver Depth: 6 inches (150 mm), unless otherwise indicated.
2. Frame Material: Aluminum, 0.125 inch (3.18 mm).
3. Blade Material: Aluminum sheet, 0.080 inch (2.0 mm).
4. Blade Angle: 45 degrees, unless otherwise indicated.
5. Blade Spacing: 6 inches (150 mm) o.c. for 6-inch-(150-mm) deep louvers.
6. Standard Free Area: Not less than 4 sq. ft. (0.37 sq.m).
7. Airborne Sound Transmission Loss: STC 10 per ASTM E 413, determined by testing per ASTM E 90.

2.6 LOUVER SCREENS

A. General: Provide louvers with screens at locations indicated.
B. General: Provide each exterior louver with louver screens complying with the following requirements:

1. Screen Location for Fixed Louvers: Interior face, unless otherwise indicated.
2. Screening Type: Bird screening, unless otherwise indicated.
3. Screening Type: Insect screening where indicated.

C. Secure screens to louver frames with stainless steel machine screws, spaced at each corner and at 12 inch o.c. between.

D. Louver Screen Frames: Fabricate screen frames with mitered corners to louver sizes indicated and to comply with the following requirements:

1. Metal: Same kind and form of metal as indicated for louver frames to which screens are attached.

a. Reinforce extruded aluminum screen frames at corners with clips.

2. Finish: Same finish as louver frames to which louver screens are attached.
3. Type: Rewireable frames with a driven spline or insert for securing screen mesh.

E. Louver Screening for Aluminum Louvers: Fit aluminum louver screen frames with screening covering louver openings and complying with the following requirements:

1. Bird Screening: 1/2 inch square mesh formed with 0.080 inch diameter copper wire.

2.7 FINISHES, GENERAL

A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.
B. Finish louvers after assembly.

2.8 ALUMINUM FINISHES

A. Fluorocarbon 3-Coat Coating System: Manufacturer's standard 3-coat thermo-cured system composed of specially formulated inhibitive primer, fluorocarbon color coat, and clear fluorocarbon topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinyldene resin by weight; complying with AAMA 605.2.

1. Color and Gloss: As selected by Engineer from manufacturer's standard choices for color and gloss.

PART 3 EXECUTION

3.1 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions and directions for installation of anchorages which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

3.2 INSTALLATION

A. Locate and place louver units plumb, level, and in proper alignment with adjacent work.
B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
C. Form closely fitted joints with exposed connections accurately located and secured.
D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
E. Repair finishes damaged by cutting, welding, soldering, and grinding operations require for fitting and jointing. Restore finishes so there is no evidence of corrective work. Return items which cannot be refinished in field to shop, make required alterations and refinish entire unit, or provide new units.
F. Protect galvanized and nonferrous metal surfaces from corrosion or galvanic action by application of a heavy coating of bituminous paint on surfaces which will be in contact with concrete, masonry, or dissimilar metals.
G. Install concealed gaskets, flashings, joint fillers, and insulation, as louver installation progresses where required to make louver joints weathertight. Comply with Division 7 Section "Joint Sealers" for sealants applied during installation of louver.

3.3 ADJUSTING AND PROTECTION

A. Protect louvers and vents from damage of any kind during construction period including use of temporary protective coverings where needed and approved by louver manufacturer. Remove protective covering at time of Substantial Completion.
B. Restore louvers and vents damaged during installation and construction period, so that no evidence remains of correction work. If results of restoration are unsuccessful, as judged by Engineer, remove damaged units and replace with new units.

1. Clean and touch-up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

C. Test operation of adjustable wall louvers and adjust as needed to produce fully functioning units which comply with requirements.

3.4 CLEANING

A. Periodically clean exposed surfaces of louvers and vents, which are not protected by temporary covering, to remove fingerprints and soil during construction period; do not let soil accumulate until final cleaning.
B. Before final inspection, clean exposed surfaces with water and with a mild soap or detergent not harmful to finishes. Rinse thoroughly and dry surface.

SECTION 10425 SIGNS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This Section covers furnishing and installing the following types of signs under the Contract Documents:

1. Panel signs.
2. Dimensional letters.

B. Related Sections: The following sections contain requirements that relate to this Section:

1. Division 2 Section, "Site Improvements" for roadway signs and traffic signals.
2. Division 15 Section 15190 "Equipment Identification" for labels, tags, and nameplates for mechanical equipment.
3. Division 16 Section, "Electrical Identification" for labels, tags, and nameplates for electrical equipment.
4. Division 16 Section, "Emergency Lighting" for illuminated exit signs.
5. Also see detail drawing for building signage.

1.2 RELATED DOCUMENTS

A. Reference standards include but are not limited to:

1. San Francisco Building Code 1995 Edition.

1.3 SUBMITTALS

A. General - Submit the following in accordance with Section 12-1.06.
B. Product Data: Include manufacturer's construction details relative to materials, dimensions of individual components, profiles, and finishes for each type of sign required.

C. Shop Drawings - Provide shop drawings for fabrication and erection of signs. Include plans, elevations, and large-scale sections of typical members and other components. Show anchors, grounds, reinforcement, accessories, layout, and installation details.

1. Provide message list for each sign required, including large-scale details of wording and layout of lettering.

D. Samples - Provide the following samples of each sign component for initial selection of color, pattern and surface texture as required and for verification of compliance with requirements indicated.

1. Samples for initial selection of color, pattern, and texture:

a. Cast Acrylic Sheet and Plastic Laminate: Manufacturer's color charts consisting of actual sections of material including the full range of colors available for each material required.

2. Samples for verification of color, pattern, and texture selected, and compliance with requirements indicated:

a. Cast Acrylic Sheet and Plastic Laminate - Provide a sample panel not less than 8-1/2 inches by 11 inches for each material indicated. Include a panel for each color, texture, and pattern required. On each panel include a representative sample of the graphic image process required, showing graphic style, and colors and finishes of letters, numbers, and other graphic devices.

1.4 QUALITY ASSURANCE

A. Single-Source Responsibility - For each separate type of sign required, obtain signs from one source from a single manufacturer.
B. Design Criteria - The Drawings indicate sizes, profiles, and dimensional requirements of signs. Other signs with deviations from indicated dimensions and profiles may be considered, provided deviations do not change the design concept. The burden of proof of equality is on the proposer.

1.5 PROJECT CONDITIONS

A. Field Measurements - Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers - Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:

1. Manufacturers of Panel Signs:

a. Architectural Graphics, Inc.
b. Mohawk Sign Systems
c. Vomar Products, Inc.

2. Dimensional Letters:

a. Metal Arts.
b. A.R.K. Ramos
c. Or approved equal.

2.2 MATERIALS

A. Cast Acrylic Sheet - Provide cast (not extruded or continuous cast) methyl methacrylate monomer plastic sheet, in sizes and thicknesses indicated, with a minimum flexural strength of 16,000 psi when tested in accordance with ASTM D 790, a minimum allowable continuous service temperature of 176 deg. F (80 deg. C), and of the following general types:

   1. Transparent Sheet - Where sheet material is indicated as "clear," provide colorless sheet in matte finish, with light transmittance of 92 percent, when tested in accordance with the requirements of ASTM D 1003.
   2. Opaque Sheet - Where sheet material is indicated as "opaque," provide colored opaque acrylic sheet in colors and finishes as selected from the manufacturer's standards.

B. Plastic Laminate - Provide high-pressure plastic laminate engraving stock with face and core plies in contrasting colors, in finishes and color combinations indicated or, if not indicated, as selected from the manufacturer's standards.

C. ABS Plastic - Provide high-impact thermoplastic composed of copolymers of acrylonitrile, butadiene, and styrene.

D. Fasteners - Use concealed fasteners fabricated from metals that are not corrosive to the sign material and mounting surface.

E. Anchors and Inserts - Use nonferrous metal or hot-dipped galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

F. Colored Coatings for Acrylic Plastic Sheet - Use colored coatings, including inks and paints for copy and background colors, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are nonfading for the application intended.

2.3 PANEL SIGNS

A. Panel Signs - Comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.

   1. Produce smooth, even, level sign panel surfaces, constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally.
   2. Vinyl applied accessibility sign on glass or on metal toilet partition door.

B. Unframed Panel Signs - Fabricate signs with edges mechanically and smoothly finished to conform with the following requirements:

   1. Edge Condition: Beveled.
   2. Edge Color for Plastic Laminate: Edge color same as copy.
   3. Corner Condition: Radius corners.

C. Laminated Sign Panels - Permanently laminate face panels to backing sheets of material and thickness indicated using the manufacturer's standard process.

D. Graphic Content and Style: Provide sign copy that complies with the requirements indicated for size, style, spacing, content, position, material, finishes, and colors of letters, numbers, and other graphic devices.

E. Engraved Copy: Machine-engrave letters, numbers, symbols, and other graphic devices into sign panel on the face indicated to produce precisely formed copy, incised to uniform depth. Use high-speed cutters mechanically linked to master templates in a pantographic system or equivalent process capable of producing characters of the style indicated with sharply formed edges.

   1. Engraved Plastic Laminate: -ngrave through the exposed face ply of the plastic laminate sheet to expose the contrasting core ply.

F. Raised Copy: Machine-cut copy characters from matte-finish opaque acrylic sheet and chemically weld onto the acrylic sheet forming sign panel face. Produce precisely formed characters with square cut edges free from burrs and cut marks.

1. Panel Material: Matte-finished opaque acrylic sheet.
2. Raised Copy Thickness: Not less than 1/32 inch.
3. Letter Style: Helvetica Medium.

2.4 DIMENSIONAL LETTERS

A. Sign foam lettering in font style "copperplate", _-inch thick and 12-inch high. Dimensional letters to be applied to concrete forms by concrete contractors. The effect will be recessed letters into the concrete and read in all caps, "BAY BRIDGE PUMP STATION".

PART 3 EXECUTION

3.1 INSTALLATION

A. General - Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.

1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.

B. Wall Mounted Panel Sign -: Attach panel signs to wall surfaces using the methods indicated below:

1. Silicone-Adhesive Mounting - Use liquid silicone adhesive recommended by the sign manufacturer to attach sign units to irregular, porous, or vinyl-covered surfaces. Use double-sided vinyl tape where recommended by the sign manufacturer to hold the sign in place until the adhesive has fully cured.
2. Shim Plate Mounting - Provide concealed aluminum shim plates 1/8 inch thick, with predrilled and countersunk holes, at locations indicated and where other mounting methods are not practicable. Attach the plate with fasteners and anchors suitable for secure attachment to the substrate. Attach panel sign units to the plate using the method specified above.

3.2 CLEANING AND PROTECTION

A. At completion of the installation, clean soiled sign surfaces in accordance with the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

SECTION 10800 TOILET AND BATH ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This Section includes toilet and bath accessory items as scheduled under the Contract Documents.
B. Ceramic tile accessories are specified in Division 9 Section 9300 "Tile."

1.2 RELATED DOCUMENTS

A. Reference standards include but are not limited to:

1. San Francisco Building Code 1994 Edition.

1.3 SUBMITTALS

A. General - Submit the following according to Section 12-1.06.
B. Product data for each toilet accessory item specified, including construction details relative to materials, dimensions, gages, profiles, mounting method, specified options, and finishes.
C. Maintenance instructions including replaceable parts and service recommendations.

1.4 QUALITY ASSURANCE

A. Inserts and Anchorages - Furnish accessory manufacturers' standard inserts and anchoring devices that must be set in concrete. Coordinate delivery with other work to avoid delay.
B. Single-Source Responsibility - Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise acceptable to the Engineer.

1.5 PROJECT CONDITIONS

A. Coordination - Coordinate accessory locations, installation, and sequencing with other work to avoid interference with and ensure proper installation, operation, adjustment, cleaning, and servicing of toilet accessory items.

1.6 WARRANTY

A. Warranty Period - 2 years from date of substantial completion.
B. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering toilet accessories that may be incorporated in the Work include, but are not limited to, the following:

1. A & J Washroom Accessories.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.
5. General Accessory Manufacturing Co.
6. McKinney/Parker.

2.2 MATERIALS, GENERAL

A. Stainless Steel - AISI Type 302/304, with polished No. 4 finish, 0.034-inch (22-gage) minimum thickness.
B. Galvanized Steel Sheet: ASTM A 527, G60.
C. Chromium Plating - Nickel and chromium electro-deposited on base metal, ASTM B 456, Type SC 2.
D. Mirror Glass - Nominal 6.0-mm (0.23-inch) thick, conforming to ASTM C 1036, Type I, Class 1, Quality q2, and with silvering, electro-plated copper coating, and protective organic coating.
E. Galvanized Steel Mounting Devices - ASTM A 153, hot-dip galvanized after fabrication.
F. Fasteners - Screws, bolts, and other devices of stainless steel.

2.3 COMBINATION PAPER TOWEL DISPENSER AND WASTE RECEPTACLE

A. Recessed-Mounted Paper Towel Dispenser and Waste Receptacle: Fabricate of type 304, 22-gauge stainless steel with satin finish equipped with tumbler lockset.

1. Paper Towel Dispenser: Capacity not less than either 350 C-fold or 475 multifold paper towels.
2. Waste Receptacle: Capacity 3.0 gal.

2.4 TOILET TISSUE DISPENSER

A. Roll-In-Reserve Dispenser: Fabricate of stainless steel for mounting indicated below, size to store and dispense either 4-1/2-inch-diameter or 5-inch-diameter core tissue rolls, with reserve roll placed in service by automatic release or by action of manual release bar. Hinge front of unit with pivot hinge and secure with tumbler lockset.

1. Mounting: Surface mounted, concealed anchorage.

2.5 GRAB BARS

A. Stainless Steel Type: Provide grab bars with wall thickness not less than 0.05 inch (18-gage) and as follows:

1. Mounting: Exposed, manufacturer's standard flanges and anchorages.
2. Clearance: 1-1/2-inch clearance between wall surface and inside face of bar.
3. Gripping Surfaces: Smooth, satin finish.
4. Heavy-Duty Size: Outside diameter of 1-1/2 inches.

2.6 SOAP DISPENSER

A. Liquid Soap Dispenser: Surface-mounted soap dispenser shall be Type-304 stainless steel with satin finish. Soap dispenser shall have concealed, vandal-resistant mounting. Locked, hinged stainless steel lid for top filling. Capacity shall be 40-fluid-ounce.

2.7 SEAT-COVER DISPENSER

A. Surface-Mounted Type: Fabricate of stainless steel with concealed opening at bottom for filling; capacity not less than 250 seat covers.

2.8 MISCELLANEOUS ACCESSORIES

A. Mop and Broom Holder/Utility Shelf: Combination unit with 0.05-inch (18-gage), Type 304, stainless steel shelf with 1/2-inch returns, 0.062-inch (16-gage) support brackets for wall mounting. Provide 0.062-inch (16-gage) stainless steel hooks for wiping rags on front of shelf, together with spring-loaded, rubber hat, cam-type mop/broom holders; 1/4-inch-diameter stainless steel drying rod suspended beneath shelf. Provide unit 36 inches long and complete with four mop/broom holders and three hooks.

2.9 MIRROR UNITS

A. Stainless Steel Framed Mirror Units: Fabricate frame with angle shapes not less than 0.05 inch (18 gage), with square corners mitered, welded, and ground smooth. Provide in No. 4 satin polished finish.

1. Shelves: Fabricate of stainless steel in same gage and finish as mirror frame, approximately 5 inches deep by width of mirror. Turn down and return edges for additional rigidity. Weld shelves securely to bottom of mirror frame; provide concealed, rigid bracket supports for widths exceeding 36 inches.

2.10 FABRICATION

A. General: Only a maximum 1-1/2-inch-diameter, unobtrusive stamped manufacturer logo, as approved by Architect, is permitted on exposed face of toilet or bath accessory units. On either interior surface not exposed to view or back surface, provide additional identification by either a printed, waterproof label or a stamped nameplate, indicating manufacturer's name and product model number.
B. Surface-Mounted Toilet Accessories, General: Except where otherwise indicated, fabricate units with tight seams and joints, exposed edges rolled. Hang doors or access panels with continuous stainless steel piano hinge. Provide concealed anchorage wherever possible.
C. Framed Mirror Units, General: Fabricate frames for glass mirror units to accommodate wood, felt, plastic, or other glass edge protection material. Provide mirror backing and support system that will permit rigid, tamperproof glass installation and prevent moisture accumulation, as follows:

1. Provide galvanized-steel backing sheet, not less than 0.034 inch (22-gage) and full mirror size, with nonabsorptive filler material. Corrugated cardboard is not an acceptable filler material.

D. Mirror Unit Hangers: Provide system for mounting mirror units that will permit rigid, tamperproof, and theftproof installation, as follows:

1. Heavy-duty wall brackets of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

E. Keys: Provide universal keys for access to toilet accessory units requiring internal access for servicing, resupply, etc. Provide minimum of six keys to the Engineer.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install toilet accessory units according to manufacturers' instructions, using fasteners appropriate to substrate as recommended by unit manufacturer. Install units plumb and level, firmly anchored in locations and at heights indicated.
B. Secure mirrors to walls in concealed, tamperproof manner with special hangers, toggle bolts, or screws. Set units plumb, level, and square at locations indicated, according to manufacturer's instructions for type of substrate involved.
C. Install grab bars to withstand a downward load of at least 250 lbf, complying with ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust toilet accessories for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items.
B. Clean and polish all exposed surfaces strictly according to manufacturer's recommendations after removing temporary labels and protective coatings.

SECTION 11060 VALVES

PART 1 GENERAL

1.1 SECTION INCLUDES

The Contractor shall furnish and install:

A. Manual and control valves in the piping systems as shown on the Drawings and as specified in this Section.
B. Valve accessories.
C. All other components and testing as required to provide complete and functional valve installation

1.2 RELATED SECTIONS

A. Section 11070 - Pumps
B. Section 11072 - Seal Water Pumping System
C. Section 13400 - Station Control System with RTU/PLC
D. Section 15000 - Mechanical General Requirements
E. Section 15001 - Process Piping-General
F. Section 15003 - City-Furnished Ductile Iron Pipes, Fittings & Gate Valves
G. Division 16 - Electrical

1.3 REFERENCE STANDARDS

A. ANSI/AWWA C111/A21.11 - Rubber Gasket Joints From Ductile Iron and Gray Iron Pressure Pipe And Fittings
B. AWWA C500 - Gate Valves-3 in. Through 48 in.-For water and other liquids
C. AWWA C506 - Double Check Valve Types

1.4 SUBMITTALS

Submittals shall be made as required in Section 12-1.06. In addition, the following specific information shall be provided:

A. Information on all external connections, piping, tubing, wiring, etc.
B. Specification sheets and catalog cuts of all components and accessories.
C. Manufacturer's installation instructions.
D. The Contractor shall provide with his/her submittals a manufacturers' suggested list of spare parts for all equipment furnished under this section. Such list shall include all spare parts which the manufacturer(s) expect to be required for maintenance/replacement purposes during the first two years of equipment operation. The list shall include part numbers, part description and current pricing. Prices are to be valid for a period of one year following the date of system commissioning.
E. The Contractor shall submit four (4) copies of field testing procedures for each valve type furnished under this section. Submit for review and approval by the Engineer.
F. Submit outline of O & M Manual format and contents per the requirements of Section 12-1.18.

1.5 QUALITY ASSURANCE

A. Similar items of equipment specified herein shall be the end product of one manufacturer in order to achieve standardization of appearance, operation, maintenance, spare parts and manufacturer's services.
B. Manufacturers of equipment furnished under this Section shall have a minimum of five (5) years verifiable experience in the manufacture of such equipment and availability of spare parts in warehouse in the vicinity within thirty miles from the City and County of San Francisco.

1.6 WARRANTY

A. The Contractor shall furnish a two (2) year warranty for all work covered by this section per the requirements of Section 12-1.03.

1.7 MANUFACTURERS' SERVICES

A. Each Manufacturer's representative supplying control valves for this contract shall be present at the job site and/or classroom designated by the State for the minimum man-days listed for the services identified below, travel time excluded.

1 man-day for inspection of the installation of the assemblies, and certification of the installation.

1 man-day for functional and performance testing.

1 man-day for pre-startup classroom or jobsite training.

B. An authorized manufacturer's representative from each supplier of control valves shall inspect the installation of all work furnished under this section and shall provide a certificate of satisfactory installation in accordance with the provisions of Section 12-1.19.

PART 2 PRODUCTS

2.1 GENERAL

A. All valves shall be complete with all necessary operators, actuators, handwheels, chain wheels, extension stems, floor stands, worm and gear operators, operating nuts, chains, wrenches, and other accessories or appurtenances which are required for the proper completion of the work. Operators, actuators, and other accessories shall be sized and furnished by the valve supplier and factory mounted.
B. Valves shall be suitable for the intended service. Renewable parts including discs, packing, and seats shall be of types recommended by valve manufacturer for intended service, but not of a lower quality than specified herein.
C. Valves and operators shall be suitable for the exposure they are subject to, buried, interior or exterior, as applicable. They shall have all safety features required by CAL-OSHA.
D. Unless otherwise shown, valves shall be the same size as the adjoining pipe.
E. All units shall have the name of the manufacturer and the size of the valve cast on the body or bonnet or shown on a permanently attached plate in raised letters.

2.2 DESIGN FEATURES

A. Brass and bronze components of valves and appurtenances which have surfaces in contact with the water shall be alloys containing less than 16 percent zinc and 2 percent aluminum.
B. Approved alloys are of the following ASTM Designation:

1. B61, B62, B98,(Alloy Uns No. C65100, C65500, OR C66100), B139 (Alloy Uns No. C51000), B584 (Alloy Uns No. C90300 OR C94700), B164, B194, AND B127.
2. Stainless steel alloy 18-8 may be substituted for bronze at the option of the manufacturer and subject to review of the Engineer.

C. All gland bolts on iron body valves shall be bronze and shall be fitted with brass nuts.
D. Valve ends shall be as specified, as shown on the drawings, and to suit the adjacent piping and pressure range.

2.3 VALVE OPERATORS

A. General: All valves shall be equipped with operators. The valve operator types, as specified herein, describe only the general characteristics of the operator. The operator shall be compatible with the valve with which it will be used and shall be of the same manufacturer, or a product that is recommended by the valve manufacturer. The operator shall be sized to operate the valve for the full range of pressures and velocities imposed by the service.
B. Manual Operators

1. General

a. Manual handwheel operators shall be provided unless otherwise shown or specified. Ferrous handwheels shall be galvanized and painted the same color as the valve and associated pipeline. Lever operators may be supplied on quarter-turn type valves 4 inches and smaller, if recommended by the manufacturer; however, operator force shall not exceed 40 pounds under any operating condition, including initial breakaway.
b. When the maximum force required to operate a valve under full operating head exceeds 40 pounds, gear reduction operators shall be provided. Gear operators shall be totally enclosed and lubricated.

c. On quarter-turn valves, the valve operators shall be of the self-locking type to prevent the disc or plug from creeping and shall be provided with position indicators to show the position of the valve disc or plug. Operators of the work and gear type shall have self-locking worm gears, one-piece design, of gear bronze material, accurately machine cut. The worm shall be hardened alloy steel, with thread ground and polished. Operators of the geared traveling nut type shall have threaded steel reach rods with an internally threaded bronze or ductile iron nut.

2. Exposed Operators

a. Exposed operators shall be furnished with chain wheel operators (CWO), geared operators (GO), extension stems, floor stands, and other elements to permit operation from the normal operating level. Maximum distance from flooring to horizontal centerline of valve above which a chain wheel operator as required is 8 feet. Chain wheel operators shall not be furnished for valves whose centerline height above floor level is less than 8 feet.
b. Lever type operators shall have some means of being fixed in any given position to prevent accidental movement; shall be of rugged, non-corrosive construction; and shall be fully compatible with the valve.

3. Buried Operators

a. Buried service operators on valves larger than 2 1/2 inches shall have a 2-inch AWWA operating nut. Buried Operators on valves 2 inches and smaller shall have cross handle for operation by forked key all moving parts of the valve and operators shall be enclosed in a housing to prevent contact with the soil.
b. Buried service operators for quarter-turn valves shall be designed to withstand 450 foot-pounds of input torque at the fully open or fully closed positions without damage to the valve or operator and shall be grease packed and gasketed to withstand a submersion in water to 10 psi.
c. Valves shall be installed with extension stems, as required, or as shown, and valve boxes.

2.4 VALVE ACCESSORIES

A. T-Handled Operating Wrenches: Provide one (1) galvanized operating wrenches, 4 feet total length, Mueller No. A-24610, Clow No. F-2520, or equal. Provide one (1) galvanized operating key for cross handled valves.
B. Valve Boxes: Valve boxes shall be buffalo two-piece sliding type, cast iron, with 5-1/4-inch shaft of appropriate length for the installation. The word water or sewage shall be cast into the top of the lid, as appropriate for the service. Extension pieces, if required, shall be the manufacturer' s standard type. Units shall be Mueller H-10364, Clow Corporation F-2452, or equal. All units shall be complete with all necessary bases and accessories.
C. Extension Stems For Valve Operators: Valve operating extension stems shall be provided to bring the operating nut to a point 6 inches below the surface of the ground, grating and/or box cover. Extension stems shall be constructed of steel and shall be complete with a 2-inch square operating nut.
D. Chain Wheels And Guides: Chain wheels and guides shall be Figure 804 as manufactured by the Walworth Company; Figure G-5680 as manufactured by Clow Corporation; Series W or LWG as manufactured by DeZurik Corporation; or equal. Chain wheels and guides shall be galvanized. Chains shall be of the size recommended by the valve manufacturer and shall extend to within 4 feet of the operating floor. Chains shall be heavily galvanized. Where chains hang in normally traveled areas, appropriate "L" type tie-back anchors shall be provided and located as directed by the engineer.

2.5 VALVES

A. Gate Valves

1. All gate valves 2 1/2 inches and smaller:

a. For copper tubing: Class 150, bronze body, threaded, rising stem, union bonnet, solid bronze wedge disc, Stockham B120, or equal.
b. For Steel Pipe: Class 125 , IBBM, OS&Y, solid wedge disc, flanged, bolted bonnet, Stockham G623, or equal.

2. All gate valves 3 inches and larger shall be cast iron body, bronze mounted with flanged ends, solid wedge gate and outside screw and yoke. Valves shall be rated 125 pounds SWP and 200 pounds WOG, and shall be Walworth Figure 726F, Crane No. 465-1/2, or equal.

B. Ball Valves

1. Ball valves 2 inches and smaller, for general water and air service, shall be all bronze, end entry type, with screwed end, full bore ports, Teflon seat and packing and hand lever operators, rated 400 psi at 200 degrees F. Install union adjacent to valves to provide access to seats. Valve shall be Jenkins figure no. 900-T, Lunkenheimer figure no. 708HST, or equal.

C. Check Valves

1. Check valves 2 inches and smaller shall be all bronze, with screwed ends and cap, regrinding seat, Y-Pattern body and swing type disc. Valves shall be rated for 125-pound SWP, 200-pound WOG, and shall be Walworth figure 406, Crane No. 37, or equal.

D. Backflow Prevention Device

1. Reduced pressure backflow prevention valve shall consist of two independent "Y" configured check valves, one differential valve, two shut-off end valves and four test cocks. Device shall have ductile iron body, flanged and epoxy coated.

2. The device shall be constructed so all internal parts including seat rings, can be serviced from side or removed while assembly is in line. Device shall be rated at 175 psig working pressure with head loss not to exceed 12.5 psi at velocities from zero up to and including 7.5 fps. Unit shall be Febco Model 825YD, or equal.

E. Pressure Reducing Valve

1. Pressure reducing valve shall be globe pattern, 125# flanged, diaphragm actuated, single seat, hydraulically operated and shall maintain a steady downstream pressure regardless of upstream pressure variation. The stem shall be guided through the center for at least 100% of the stem travel. The main valve body shall be ductile iron coated inside and outside with fused epoxy. The control system shall be direct acting, spring loaded, adjustable pilot valve with brass body and stainless steel internals. The pilot system shall include a strainer and an adjustable orifice assembly. The diaphragm shall be Buna N with heavy Nylon reinforcement. The seat disc shall be Buna N to insure drop tight closure. The valve shall be No. ACV 115 Pressure Reducing Valve as manufactured by Watts Regulator Co., or equal.
2. Strainer shall be of the "Y" type, flanged, with bronze body and removable stainless steel screens as manufactured by Watts Regulator Co., or equal.

2.6 MISCELLANEOUS VALVES

A. AUTOMATIC DRAIN TRAP

1. Automatic drain trap shall be snap action float type suitable for liquid drainage. The float and leverage system shall be constructed of stainless steel, valve and seat of hardened chrome steel, and body and cap of cast iron. Provide 3/4-inch diameter NPT inlet and outlet connections and shall be suitable for 250 psig working pressure. The trap shall be Armstrong No. 71-A; Powell or equal.

B. SOLENOID VALVE

1. Brass body soft-seated two-way with 120V AC coil. Maximum pressure differential capability shall be 100 psig. Solenoid valves shall not require a minimum pressure to either open or close. Solenoid operators shall be molded coil in NEMA 4 enclosure. Manufacturer: Magnetrol; ASCO Red Hat; or equal.

2.7 CONTROL VALVE

A. PUMP CONTROL CHECK VALVE

1. The booster pump control valve shall be designed for installation on the discharge of booster pumps to eliminate starting and stopping surges caused by the pump. The valve shall be equipped with a built-in lift type check feature to prevent reverse flow, operating independently of the solenoid control. The valve shall be hydraulically operated, single diaphragm actuated, angle pattern.
2. The main valve shall consist of two distinct operating chambers that are detachable and completely independent of the flow through the main valve body. The diaphragm assembly shall be the only moving part and shall form a seal between the two operating chambers. Packing glands and/or stuffing boxes are not permitted. There shall be no pistons operating the main valve or pilot controls.
3. The flexible, non-wicking, FDA approved diaphragm shall consist of nylon fabric bonded with synthetic rubber compatible with the operating fluid. The diaphragm must withstand a Mullins Burst Test of a minimum of 600 psi per layer of nylon fabric and shall be cycle tested 100,000 times to insure longevity.
4. The main valve seat, the power unit body and the stem bearing in the valve cover shall be removable. All necessary repairs and/or modifications other than replacement of the main valve body shall be possible without removing the valve from the pipeline.

Material Specification	
Valve Size	6-inch
Main Valve Body and Cover	Ductile Iron
Main Valve Trim	Bronze
End Detail	Class 150 Flange
Pressure Rating	250 psi
Temperature Range	Standard
Rubber Material	Buna N
Coating	Standard Factory Primer

5. Pilot Control System: The valve operation shall be controlled by an externally mounted pilot control system with a four-way solenoid operated pilot. The solenoid shall be designed to operated on AC current and have a manual operator installed. Pilot system includes four-way solenoid pilot valve, opening and closing speed controls, shut off valves, strainers and CVS-1 shuttle valve to provide the highest available operating pressure to the pilot system.
6. An adjustable limit switch assembly shall be mounted on the main valve, connected to the main valve stem. It shall be actuated by opening and closing of the valve and easily adjusted to operate at any point of the valve's travel. The limit switch will be used to complete the pump off cycle. The actuating point of the limit switch shall be adjustable.

Material Specification for Pilot Control	
Pressure Rating	300 psi
Trim	316 Stainless Steel
Rubber Material	Buna N
Tubing and Fittings	316 Stainless Steel
Operating Fluids	Water
Solenoid Voltage	120 VAC
Solenoid Enclosure Type	Nema 4X

7. Manufacturer: Cla-Val Co. Model 60-11; Golden Anderson Valve; or approved equal.

B. SURGE ANTICIPATOR VALVE

1. The surge anticipator valve shall control high pressures and power failure surges by bypassing system pressure that exceeds the high pressure control setting and also by opening a preset amount when sensed pressure decreases below a preset minimum in anticipation of a surge.
2. The valve shall be hydraulically operated, single diaphragm-actuated and globe or angle pattern. The valve shall consist of three components: the body with seat installed, the cover with bearings installed and the diaphragm assembly. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve separating operating pressure from line pressure. Packing glands and/or stuffing boxes are not permitted and there shall be no pistons operating the main valve or pilot controls.
3. The diaphragm shall consist of nylon fabric bonded with synthetic rubber compatible with the operating fluid and must withstand a Mullins Burst Test of a minimum of 600 psi per layer of nylon fabric and shall be cycle tested 100,000 times to insure longevity.

Material Specification	
Valve Size	3-inch
Main Valve Body and Cover	Ductile Iron
Main Valve Trim	Bronze
End Detail	Class 150 Flanges
Pressure Rating	250 psi
Temperature Range	Standard
Rubber Material	Buna N
Coating	Standard Factory Primer

4. Pilot Control System: The pressure relief pilot shall be an adjustable, spring-loaded, normally closed diaphragm control designed to permit flow when upstream pressure exceeds the control setting. The low pressure pilot shall be an adjustable, spring loaded, normally open diaphragm control designed to open when the sensed pressure fails below the control setting and close when pressures are normal. The pilot system shall contain an adjustable hydraulic limiter to limit valve travel during low pressure opening without affecting high pressure relief valve travel. The contractor shall connect the sensing/pilot supply connection to the main header with minimum _ inch 316 stainless steel pipe or tubing.

Material Specification for Pilot Control	
Pressure Rating	400 psi
Temperature Range	Standard
Rubber Material	Buna N
High Pressure Adjustment Range	100 to 450 psi
Low Pressure Adjustment Range	30 to 300 psi

5. Manufacturer - Cla-Val Co. Model 52-03; Golden Anderson Valve; or approved equal.

PART 3 EXECUTION

3.1 GENERAL

A. Bolt holes of flanged valves shall straddle the vertical centerline of the pipe run. Prior to installing flanged valves, flange faces shall be thoroughly cleaned. After cleaning, insert gasket and bolts, and tighten the nuts progressively and uniformly. If flanges leak under pressure, loosen or remove the nuts and bolts, reseat or replace the gasket, retighten and/or reinstall the nuts and bolts, and retest the joints. Joints shall be watertight at test pressures before acceptance.

B. Thoroughly clean threads of screwed joints by wire brushing, swabbing, or other approved methods apply approved join compound to threads prior to making joints. Joints shall be watertight at test pressures before acceptance.

3.2 INSTALLATION

A. Valves

1. Where manually operated valves are over 6 feet 9 inches above the floor line, chain wheel and guide assemblies or chain lever assembles shall be furnished and installed for operation of the valves, unless otherwise directed by the engineer.
2. General, unless otherwise indicated on the drawings, all valves installed in horizontal runs of pipe having centerline elevations 4 feet 6 inches or less above the finish floor shall be installed with their operating stems vertical. Valves installed in horizontal runs of pipe having centerline elevations between 4 feet 6 inches and 6 feet 9 inches above the finish floor shall be installed with their operating stems horizontal. If adjacent piping prohibits this, the stems and operating handwheel shall be installed above the valve horizontal centerline as close to horizontal as possible. Valves installed in vertical runs of pipe shall have their operating stems oriented to facilitate the most practicable operation.
3. Isolation Valves: A line size ball valve and union shall be installed upstream of each solenoid valve, in-line flow switch, or other in-line electrical device, excluding magnetic flowmeters, for isolation during maintenance.
4. Access Doors: Location of valves shall be as required to provide accessibility for control and maintenance. Furnish access doors where necessary for valve access.

5. Supports: All flanged valve shall be properly supported with stands and no valve shall be supported by flange bolts.
6. Anchor Bolts: Anchor bolts for valve support, floor stands, stem guides, etc. shall be in accordance with Section Fabricated Metalwork and Castings.
7. Valves shall be located and positioned to provide adequate access and clearance for manual operation (if manual operation is required), maintenance access and valve replacement.

3.3 TESTING

A. Field Testing - Valves

1. Valves shall be tested at the same time that the adjacent pipeline is tested. Joints shall show no visible leakage under test. Repair joints that show signs of leakage prior to final acceptance by the City. If there are any special parts of control systems operators that might be damaged by the pipeline test, they shall be properly protected. The Contractor will be held responsible for damage caused by the testing.
2. Pump control valves and surge valve shall also be tested during pump test and system functional test.
3. If requested by the engineer, the valve manufacturer shall furnish an affidavit stating the materials options furnished and that he has complied with these and other referenced Specifications.

3.4 PAINTING

A. All valves furnished under this section shall be factory prime painted and finish coated by the contractor per the requirements of Section 15191 and the manufacturer's recommendations. The more stringent standard shall govern.

SECTION 11070 PUMPS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. The Contractor shall:

1. Install four (4) State-furnished horizontal multi-stage splitcase pumps.

2. Furnish and install one (1) sump pump with level control.
3. Furnish installation labor, accessories and testing required to provide complete and functional pumping systems as shown on the Drawings and as specified herein.

1.2 EQUIPMENT NUMBERS

BBW-MP1
BBW-MP2
BBW-MP3
BBW-MP4

1.3 RELATED SECTIONS

A. Section 13400 - Station Control System with RTU/PLC
B. Section 15000 - Mechanical General Requirements
C. Section 15001 - Process Piping - General
D. Division 16 - Electrical

1.4 REFERENCE STANDARDS

A. The work of this section shall conform to the latest edition of all applicable codes and standards, including, but not necessarily limited to, the following:

1. City & County Of San Francisco Plumbing Code
2. Standards of the American Hydraulic Institute
3. American Hydraulic Institute Test Code
4. NEMA-National Electrical Manufacturer's Association
5. NEC-National Electric Code
6. AFBMA-American Friction Bearing Manufacturer's Association
7. UL-Underwriter's Laboratories

1.5 SYSTEM DESCRIPTION

A. Sump Pump Performance Requirements	
Rated Capacity	42 gpm at 5 Feet TDH
Speed	3500 rpm Maximum
Motor Requirement	0.4 HP; 115 Volts; Single Phase; 60 Hz

B. State-furnished Main Pump Performance	
Liquid Pumped	City Water
Largest Solid Passing	5/8 Inch Diameter
Pumping Temperature	(PT) 75º F
Specific Gravity at PT	1.01 Maximum
Net Positive Suction Head Available (NPSHA)	20.5 Feet
Rated Capacity	900 GPM
Total Dynamic Head	475 Feet
Efficiency	70%
Maximum Speed	3600 RPM
Shutoff Head	610 Feet
Motor Requirement	200 HP; 460 Volts; 3 Phase; 60 Hz

1.6 SUBMITTALS

The Contractor shall submit:

A. Outline of O & M Manual format and contents per the requirements of Section 12-1.18.

1.7 QUALITY ASSURANCE

A. Like items of equipment specified herein shall be the end products of one manufacturer in order to achieve standardization for maintenance, operation, spare parts and manufacturer's service.
B. Factory testing of all pumps furnished under this Section is required. Refer to Article 2.3, "Source Quality Control."
C. Manufacturer of equipment furnished under this Section shall have a minimum of ten (10) years verifiable experience in the manufacture of the pump models specified.

1.8 WARRANTY

A. The Contractor shall furnish two (2) year Warranty for all work covered by this Section per the requirements of Section 12-1.03.

1.9 WARRANTY CONDITIONS FOR STATE-FURNISHED, CONTRACTOR-INSTALLED MECHANICAL EQUIPMENT

A. With respect to all components, equipment and materials pre-purchased by the State and installed by the Contractor:

1. The General Contractor agrees to provide the complete installation of the following equipment and materials, which shall be supplied by the State. The Materials are as follows:

   a. Four (4) horizontal splitcase pumps.

2. The General Contractor warrants to the State and the City that all installation work performed hereunder shall be done in a workmanlike manner and in conformance with the highest industry standards. All installation work shall be free from defects and conform to the applicable federal, state and local building codes. In the event that any materials are found to be damaged as a result of said installation work, the General Contractor agrees to immediately replace the damaged materials, along with any other adjacent work which may be damaged or displaced by so doing, at no cost to the State and the City.
3. The General Contractor warrants that the installation work shall not render void any express or implied project equipment warranty from the manufacturer(s) of the 4 main pumps.

1.10 DELIVERY AND HANDLING

A. The Contractor shall transport the State-furnished main pumps with their original crates intact from 1990 Newcomb Avenue to the jobsite in one trip. Contractor shall be fully responsible for all damage incurred to the pumps during transportation and subsequent construction.

1.11 MANUFACTURER'S SERVICES

A. The Contractor shall provide the services of an experienced and authorized manufacturer's representative for the State-furnished pumps who shall be present at the jobsite and/or classroom designated by the Resident Engineer for the minimum man-days listed for the services shown below, travel time excluded:

3 man-days for inspection, installation assistance, and certification of proper installation
1 man-day for functional testing
1 man-day for pre-startup classroom or jobsite training

Assume $85.00/hour for bid purposes.

B. The Pump manufacturer's local representative shall be present upon delivery of the 4 main pumps to the job site. Upon actual delivery and uncrating of the pumps, the manufacturer's representative and the Contractor shall conduct a joint inspection of all 4 main pumps to determine whether visible damage has occurred to the pumps while in transit. Upon determination that the pumps have suffered no visible damage during transit and that the 4 main pumps appear to be ready in all respects for installation and incorporation into the work of this Contract, the Contractor shall immediately transmit a letter to the Engineer and to the City's Resident Engineer stating this fact and that the Contractor thereupon assumes full responsibility for the safe handling and protection of the pumps during construction.

C. Upon completion of the pump installation, the pump manufacturer's representative shall provide a certificate stating that:

The pumps have been installed in accordance with the manufacturer's recommendations;
The pumps have been inspected by a manufacturer's authorized representative and;

The pumps have been serviced with the proper initial lubricants;
All applicable safety equipment has been properly installed;
The proper mechanical and electrical connections have been made;
The pumps are ready for start-up.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Sump Pump Flygt Model BS 41 Or approved equal

2.2 EQUIPMENT

The complete pumping unit shall be designed to operate throughout its entire range without overload, vibration, or cavitation.

A. Design Requirements

The pump shall be a submersible dewatering pump with integral float switch which can be set to activate the pump when water reaches a pre-set level.

The pump's cable entry shall be sealed against water penetration and functionally separated from the cable's strain relief device.

The pump's motor shall be non-overloading for its entire performance range and shall be sized and designed for 10 starts per hour.

The pump shaft shall be stainless steel.

The pump liquid end shall include a semi-open multi-vane impeller made of abrasion-resistant fiberglass reinforced noryl..

The pump shell shall be made of stainless steel. Static seals shall be leakproof O-rings. All fasteners shall be stainless steel.

Pump discharge shall be furnished with 1-1/2 inch schedule 80 PVC piping and a PVC ball check valve with a threaded union connector and Viton "O" ring seals.

2.3 SOURCE QUALITY CONTROL

A. A factory test certified by the pump manufacturer for each pump furnished under this Section shall be performed on the pumps actually furnished, and written results of such testing shall be furnished to the Engineer.
B. Factory tests shall conform to the Hydraulic Institute Standard test code.

PART 3 EXECUTION

3.1 INSTALLATION

A. All pumps shall be installed in strict accordance with the pump manufacturer's written installation instructions and recommendations.

3.2 FIELD TESTING

A. Functional Test

1. Prior to plant startup, all equipment described in this Section shall be inspected for proper alignment, quiet operation, proper connection, and satisfactory performance by means of a functional test.
2. Vibration Test: Triaxial measurements shall be performed on all pumps installed under this Section. Readings shall be taken on each bearing housing for all pumps and motors provided. The overall allowable limit of mechanical vibration for any pump and motor bearing during this test shall not exceed 0.1 inches/second peak velocity in accordance with ISO Standard 2372. Test shall be performed under full load with machine operating at maximum speed.

B. Performance Test

1. The Contractor shall perform field tests on all completed pump assemblies. A test log shall be presented to the Engineer upon the completion of each test that records the following:

   a. Flow, as measured by plant instrumentation and/or storage volumes.
   b. Pump discharge pressure as measured by calibrated gauges, converted to feet of the liquid pumped and corrected to pump centerline, calculated velocity heads at the suction and discharge flanges, and total head, all tabulated in psig.
   c. Drive motor voltage and amperage measured for each phase.
   d. Motor manufacturer's guaranteed power factor and efficiency at 1/4, 1/2, 3/4 and full load.
   e. All test data plotted on the pump curve.

3.3 IDENTIFICATION

A. Equipment Identification Plates: 16-gauge Type 316 stainless steel identification plates shall be securely mounted in readily visible locations on all pumps furnished under this Section. The plates shall bear, in 1/4 inch die-stamped lettering, the equipment identification numbers indicated in this specification and as shown on the Drawings.

3.4 PAINTING

A. Equipment installed under this Section shall be factory prime painted and finish coated by the Contractor per the requirements of Section 15191 and the manufacturer's recommendations. The more stringent standard shall govern.

SECTION 11551 MAGNETIC FLOWMETER

PART 1 GENERAL

1.1 SECTION INCLUDES

The Contractor shall furnish and install:

A. One (1) 10 inch diameter magnetic flowmeter as shown on the Drawings.

B. All associated signal conversion equipment, illuminated indicating LCD meter display, power and signal wiring, power supplies, cabling, grounding equipment, piping, pipe mounting flanges, and field testing all miscellaneous hardware as required to provide a complete and functional magnetic flow metering system.

1.2 RELATED SECTIONS

A. Section 15000 - Mechanical General Requirements
B. Section 15001 - Process Piping
C. Section 13400 - Station Control System with RTU/PLC
D. Division 16 - Electrical

1.3 SYSTEM DESCRIPTION

A. Design Requirements

1. The flowmeter shall operate on the principle of magnetic induction to measure the volume flow of electrically conductive liquid. The primary head field coils which generate the magnetic field shall be energized by pulsed direct current from a signal converter.
2. The flowmeter shall be furnished with a metering tube.

3. The signal converter shall be field programmable by integral keypad to allow the user to set the desired range of velocities. The instantaneous flow rate and flow total shall appear on an LCD display. Self diagnostics and adjustable damping shall also be provided. The output from the signal converter shall not be interrupted during converter programming.

B. Performance Requirements

1. The flowmeter shall be capable of measuring flowrate of 0 -3000 GPM.
2. The flowmeter shall be capable of measurement velocities between 0.03 feet/second to 30 feet/second with accuracy of +/- 0.5% of flowrate over the full range of flows described above.
3. The flowmeter shall have a minimum pressure rating at ambient temperature of 350 psi.

1.4 SUBMITTALS

A. Submit complete specifications, catalog information and cuts, descriptive drawings and literature for the magnetic flowmeter to be furnished under this Section, with all exceptions to the Specifications noted.
B. Submit manufacturer's installation instructions and recommendations.
C. The Contractor shall provide with his/her Submittals, a manufacturers' suggested list of spare parts for all equipment furnished under this Section. Such list shall include all spare parts which the manufacturer(s) expect to be required for maintenance/replacement purposes during the first two years of equipment operation. The list shall include part numbers, part description and current pricing. Prices are to be valid for a period of one year following the date of system commissioning.
D. Submit six (6) copies of complete flowmeter field testing and calibration procedures for review and approval by the Engineer.
E. Provide manufacturer's certification of satisfactory factory test performance.
F. Submit manufacturer's recommendations for painting and coating of flowmeters.
G. Submit outline of O & M Manual format and contents per the requirements of Section 12-1.18.

1.5 QUALITY ASSURANCE

A. Like items of equipment specified herein shall be the end product of one manufacturer in order to achieve standardization of appearance, operation, maintenance, spare parts and manufacturer's services.
B. Units furnished shall be accompanied by written documentation of certified factory calibration and testing. Each unit shall be calibrated and factory tested for accuracy, repeatability and flow range.

C. Manufacturers of equipment furnished under this Section shall have a minimum of five (5) years verifiable experience in the manufacture of such equipment.

1.6 WARRANTY

A. The Contractor shall furnish a two (2) year Warranty for all work covered by this Section per the requirements of Section 12-1.03.

1.7 MANUFACTURER'S SERVICES

A. The Contractor shall provide the services of an experienced, authorized manufacturer's representative for the equipment specified herein who shall be present at the jobsite and/or classroom designated by the Resident Engineer for the minimum man-days listed for the services shown below, travel time excluded:

1 man-day for installation assistance, inspection, and certification of the installation

1 man-day for functional testing/training

B. An authorized manufacturer's representative shall inspect the installation of all equipment furnished under this Section and shall provide a certificate of satisfactory installation in accordance with the provisions of Section 12-1.19.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Rosemount
B. Foxboro
C. or approved equal.

2.2 EQUIPMENT

A. Magnetic Flowmeter

1. The flowmeter shall be the magnetic type, short form, with characterized coil design in the horizontal position.
2. The flowmeter shall be furnished with a steel metering tube. Forged steel flat faced flanges shall be provided at the metering tube ends. The flanges shall be 300 lb. ANSI outside diameter and drilling. Face to face laying length shall not exceed 1.5 times the meter diameter.
3. The flow tube shall be lined with polyurethane molded into the flow tube.
4. The electrodes shall be Hastelloy C. The electrodes shall be field replaceable.
5. The meter shall remain unaffected by density or viscosity changes or by "normal" upstream or downstream piping configurations.
6. The unit shall have an accuracy of +/- 0.5% full scale for analog flow to current signals and +/- 1.0% on pulse rate signals with 0.25% of full scale repeatability. Accuracy indicated is for the entire system including secondary equipment furnished with the flowmeter.
7. The flow tube shall be epoxy polyester coated low copper aluminum.
8. The interconnecting cabling shall be provided by the flow tube manufacturer.

B. Signal Converter

1. The converter shall be capable of receiving a low level AC signal directly from the magnetic flowmeter and converting it to an analog 4-20 mA DC current output.
2. The converter housing shall be suitable for wall mounting and shall be rated NEMA 4X.

3. The converter shall include automatic quadrature rejection and adjustable damping circuitry. All converters shall be provided with a built-in seven digit counter, a direct-reading range dial, and indicating test light. There shall be complete interchangeability between signal converter and magnetic flowmeters. The range span shall be continuously adjustable between 0.03 and 30.0 feet per second. The converter shall operate per specifications at liquid conductivities as low as 5.0 micromhos per centimeter.
4. The system accuracy, including the magnetic flow meter, shall be plus or minus 1.0% of full scale. Repeatability shall be 0.25% of full scale.
5. The converter shall have the optional feature of simultaneously transmitting both a pulse and analog signal independent of additional converters.

2.3 SOURCE QUALITY CONTROL

A. Provide factory testing of actual unit furnished under this Section. Factory testing shall be performed to demonstrate accuracy and repeatability.

PART 3 EXECUTION

3.1 INSTALLATION

A. The magnetic flowmeter shall be mounted in the pipeline with minimum straight runs upstream and downstream of the metering tube per manufacturer requirements.

3.2 FIELD TESTING

A. The Contractor shall provide initial system commissioning. Field calibration shall furnish proof that installed flowmeter meets the performance requirements of Paragraph 1.3 of this Section.
B. The Manufacturer's representative shall provide six (6) copies of complete written testing and calibration procedures and shall instruct City personnel on-site in the execution of these procedures.

3.4 PAINTING

A. The flowmeter units shall be painted in strict accordance with the manufacturer's recommendations and Section 15191 of these Special Provisions. The more stringent standard shall govern.

SECTION 13400 STATION CONTROL SYSTEM WITH RTU/PLC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. RTU/PLC hardware and software, support equipment, testing, spares.
B. Control Panel, wiring, relays, and miscellaneous components.
C. CSU/DSU, digital modem.
D. Communication requirements.
E. Lake Merced SCADA system modifications.
F. Yerba Buena Island RTU/PLC and miscellaneous control work.

1.2 SUMMARY OF REQUIREMENTS

A. The Contractor shall furnish and install an RTU for the Bay Bridge Pump Station mounted in the enclosure specified. The Contractor shall program the RTU and configure the local operator interfaces (LOI) to perform the functions specified herein. The Contractor shall furnish and deliver all RTU and LOI standard programming and diagnostic software necessary for the expansion and maintenance of the RTU by the City.
B. The Contractor shall furnish and install controls and input/output as specified and as shown on plans.

C. The Contractor shall coordinate with others to establish the communication with Lake Merced SCADA system.
D. The Contractor shall provide training for CDD personnel as specified.
E. The Contractor shall furnish a spare identical RTU/PLC enclosed unit, for each RTU furnished and installed.
F. The Contractor shall furnish and install an RTU at Yerba Buena Island Bldg. 225 mounted in the enclosure specified. The Contractor shall program the RTU and configure the local operator interfaces (LOI) to perform the functions specified herein. The Contractor shall furnish and deliver all RTU and LOI standard programming and diagnostic software necessary for the expansion and maintenance of the RTU by the City.

1.3 DEFINITIONS

A. Control Circuit: Any circuit operating at 80 volts AC or DC or more, whose principal purpose is the conveyance of information and not the conveyance of energy for the operation of an electrically powered device.
B. Control Room: An environmentally controlled room intended for housing digital control equipment, computers, large control panels, etc. and generally intended to be regularly occupied by operators.
C. Data Sheets: Data sheets as used in this Specification shall comply with the requirements of ISA S20.
D. Electrical Isolation: Pertaining to an electrical node having no direct current path to another electrical node. As used in this specification, electrical isolation refers to a device with electrical inputs and/or outputs which are galvanically isolated from ground, the device case, the process fluid, and any separate power supply terminals, but such inputs and/or outputs are capable of being externally grounded without affecting the characteristics of the device or providing a path for circulation of ground currents. The terms "galvanic isolation", "electrical isolation", "isolation", or similar terms shall mean electrical isolation whenever used in Section 127, or whenever used in specifications for electrical control and instrumentation equipment in any other Divisions of these contract documents. Unless otherwise specified, electrical isolation for analog signal devices shall be rated 250 volts AC continuous, and 1500 volts AC for one minute, in accordance with ANSI/IEEE C39.5-1974.
E. Lan: Local Area Network.
F. Leased Line: Full duplex digital telephone circuit leased from the local telephone company, sometimes referred to as ADN or Advanced Digital Network.
G. Panel: An instrument support system which may be either a flat surface, a partial enclosure, or a complete enclosure for instruments and other devices used in process control systems. Unless otherwise specified or clearly indicated by the context, the term “panel” in these contract documents shall be interpreted as a general term which includes flat panels, enclosures, cabinets and consoles.
H. Power Circuit: Any circuit operating at 80 volts (AC or DC) or more, whose principal purpose is the conveyance of energy for the operation of an electrically powered device.
I. Remote Site: Used to refer to locations other than the Operations Control Centers where remote terminal units are used to retrieve data from the City's facilities.
J. RTU/PLC or RTU: remote terminal unit including PLC, Local Operator Interface, communication devices, I/O equipment and other support equipment mounted in enclosure.
K. SCADA: Supervisory Control and Data Acquisition.
L. SCADA Server: Application processor that communicates with remote terminal units at remote sites to acquire real-time data and, where applicable, issue control commands to be carried out at the remote site. Sometimes referred to as a Master Control Station (MCS).
M. Signal Circuit: Any circuit operating at less than 80 volts AC or DC.
N. Signal Types: The following types of signals are referenced in this Division. All definitions below are for circuits operating at less than 80 volts DC or AC.

1. Low Level Analog: A signal that has a full output level of 100 millivolts or less. This group includes thermocouples and resistance temperature detectors.
2. Digital Code: Coded information such as that derived from the output of an analog to digital converter or the coded output from a digital computer or other digital transmission terminal. This type includes those cases where direct line driving is utilized and not those cases where the signal is used to modulate a carrier.
3. Pulse Frequency: Counting pulses such as those emitted from speed transmitters.
4. High Level Analog: Signals with full output level greater than 100 millivolts but less than 50 volts, including 4-20 mA DC transmission.
5. Modulated Signals: Signals emanating from modems or low level audio signals. Normal signal level is plus 4 dBm to minus 22 dBm. Frequency range is 300 to 1.5 megahertz.

6. Discrete Events: Isolated contact closures monitored by solid state equipment. If the isolated contacts are located in enclosures containing power or control circuits, this signal shall be treated as low voltage control.
7. Low Voltage Control: Contact closures monitored by relays, or control circuits, operating at less than 30 volts and 250 milliamperes.

O. Two-Wire Transmitter: A transmitter which derives its operating power supply from the signal transmission circuit and therefore requires no separate power supply connections. As used in this specification, two-wire transmitter refers to a transmitter which provides a 4 to 20 milliampere current regulation of signal in a series circuit with an external 24 volt direct current driving potential and a maximum external circuit resistance of 600 ohms.

1.4 REFERENCE STANDARDS

A. All materials and workmanship shall conform to the latest published applicable provisions of the following codes and standards:

Standards	Title
NFPA	National Electrical Code (NEC
ANSI/NEMA ICS 1	General Standards for Industrial Controls and Systems
ANSI/NEMA ICS 2	Industrial Control Devices, Controllers, and Assemblies
ANSI/NEMA ICS 3	Industrial Systems
ANSI/NEMA ICS 4	Terminal Blocks for Industrial Control Equipment and Systems
ANSI/NEMA ICS 6	Enclosures for Industrial Controls and Systems
ANSI/NEMA 250	Enclosures for Electrical Equipment (1000 Volts maximum)
EIA RS-310-C	Racks, Panels, and Associated Equipment
ANSI C37.13	Low-Voltage AC Power Circuit Breaker (600 Volt Insulation Class)
ANSI C57.13	Requirements for Instrument Transformers
ANSI/IEEE	Electrical Isolation for Analog Signal Devices C39.5-1974
ANSI/IEEE C37.90	Guide to Surge Withstand Capability (SWC) (formerly IEEE 472) Tests
ANSI/ISA S51.1	Process Instrumentation Terminology
EIA 232D	Interface Between Data Terminal Equipment and Data Communications Equipment Employing Serial Binary Data Interchange
ISA - 11th Edition	Standards and Recommended Practices for Instrumentation and Control
ISA S5.4	Instrument Loop Diagrams
ISA S20	Specification Forms for Process Measurement and Control Instrumentation, Primary Elements, and Control Valves
ISA S50.1	Compatibility of Analog Signals for Electronic Industrial Process Instruments
ISA S51.1	Process Instrumentation Terminology
MILSPEC	Electrical Insulating Compound
MIL-I-46058C	

B. Codes and Regulations

The following codes are a part of Section 127 as specified and modified. Apparent conflicts between the contract documents and the listed codes shall be submitted to the City for resolution in accordance with Section 12, prior to ordering materials or performing affected work. The standards in the following codes shall not be violated without written approval by the City.

Code	Title
NEC	National Electrical Code (NFPA 70)
UBC	Uniform Building Code
	California State Electrical Code Title 24
	San Francisco City and County Building Code
	San Francisco City and County Electrical Code

C. Underwriters Laboratories, Inc.

Unless otherwise specified, electrical equipment and systems provided under this contract shall be listed and labeled for the purpose for which they are used by the Underwriters Laboratories, Inc. (UL). Components used shall be UL recognized. Unique electrical products are products for which there is no listing available from an approved testing laboratory and for which there is no nationally recognized standards of safety. The Contractor shall have all unique electrical products for example, the RTU/PUC unit in enclosure approved for safety and compliance to NEC by an independent testing laboratory approved by Department of Building Inspection, per San Francisco Electrical Code 90-78.

1.5 SUBMITTALS

A. In addition to the submittal requirements in accordance with Section 12, the following shall be provided to the Engineer for approval before fabrication and shipment:

1. Catalog information, descriptive literature, wiring diagrams, and shop drawings for all components of the control system, including the RTUs and Pump Select Control Panel.
2. Block diagram showing all major RTU components.
3. Bill of materials: List of all RTU components. Group components by type and include:

    a. Manufacturer, model number, and part number.
    b. Component description.
    c. Quantity supplied.
    d. Reference to component catalog information.

4. Interconnecting diagrams showing all RTU elements, interconnecting cables and wiring termination, power and grounding requirements, and all termination to interacting elements and subsystems, such as the Pump Select Control Panel.
5. Outline drawings showing equipment external dimensions, enclosure materials, and installation requirements.
6. Installation details of all equipment.
7. Input/output (I/O) list, in EXCEL format (include disk copy). The following fields shall be included: RTU/PLC I/O point description, PID tag name, point or analog address, engineering units, alarm setpoints, priorities and alarm status, I/O rack number, tag number of source or final control element, RTU module and termination identification, I/O status and function shall be listed for discrete points, ranges and units shall be listed for analog points and alarm actuation values.

B. Software submittals:

1. Provide five (5) complete sets of standard user's manuals for software used to program the RTUs and the control system. These manuals shall cover all aspects of programming, documenting, and implementation of process controls.

2. Submit the following material during program development stage. This submittal shall be reviewed by the Engineer prior to preliminary software development:

   a. Ladder diagram description: an overview description of each ladder logic program; generally describes the programming methods and techniques used to implement the functional requirements of the loop specifications in Section 13400.
   b. Ladder diagram logic listings: Each I/O point shall have a tag number and/or description. Ladder rungs shall have comments that describe the function of the rungs. Provide the following additional information integral to the ladder listings to document the RTU program:

   1. I/O point cross reference list.
   2. Internal coil cross reference list.
   3. Data register cross reference list.
   4. Listing of all program special functions. Include descriptions and pertinent memory locations used, and programmed values.
   5. Listing of all programmed PID loops by numbers. Include function descriptions for all memory locations and status registers used and generated in the loop, as well as loop tuning values. Programmed values of all pertinent memory locations used shall be shown.
   6. Timers, counters, integer add and subtract, move, master control relay, and jump functions shall show all memory locations used and their programmed values.

   c. Variable data memory storage record, indicating the memory location and description of the variable date; i.e. tag number, timer number, counter number, manually input values.

   d. Controller loop specification sheets that document specific memory locations and data to be entered into the RTU to configure each three-mode controller, including:

   1. Process Variable:

      i. Address
      ii. Calculation description
      iii. Calculation address
      iv. Range
      v. Engineering units

   2. Control Calculations

      i. Remote setpoint address
      ii. Calculation description
      iii. Calculation address
      iv. Controller gain setting
      v. Controller reset setting
      vi. Controller rate setting
      vii. Normal or reverse output
      vii. Auto/Manual
      ix. Cascade

   e. Not used
   f. Preliminary Software Documentation: Submit at least 4 weeks prior to Factory Demonstration Test. Include full detail version of all the material above, and preliminary process graphics and function keys assignments.
   g. Submit software printout and on diskettes.

C. Final Software Documentation: Provide a final version of the material described above and all programming of the RTUs and control system on floppy diskettes. All software shall be the original software licensed to the City of

San Francisco. Submit software suppliers' letter of authenticity with the diskettes. Certificate shall authorize the City of San Francisco complete usage of the software including downloads to the RTUs and auxiliary systems.

D. Verified test results promptly upon completion of test.

1.6 ENVIRONMENTAL REQUIREMENTS

A. RFI/EMI Protection

The Contractor shall wire all equipment in a manner that shall provide protection from RFI/EMI noise. Cabinets shall have proper grounding for the shields and connectors to a single point for the purpose of eliminating the RFI/EMI noise.

B. The Contractor shall provide all the necessary equipment to comply with the following standards:

1. Electromagnetic Compatibility ANSI/IEEE C63.12-1987.
2. Federal Communications Commission (FCC) Radiation Limits, Types 1 and 2.

C. Environmental Conditions

Unless otherwise specified, all equipment provided under this contract shall, as a minimum, be suitable for operation in the ambient conditions specified below:

1. Remote Sites	Indoors
Temperature	0 to 50 degrees C
Humidity	10 to 80 percent (non-condensing)
2. All Areas	
Dust	50 ug/m^3
Electromagnetic Radiation	5V/m (27Hz-960Hz)

D. Seismic Requirements

All equipment and components such as electrical panels and other items including their supports and anchorages, supplied by the Contractor, shall be designed in accordance with the provisions of the appropriate sections of the City and County of San Francisco Building Code, 1994 edition and the 1997 edition of the Uniform Building Code Zone 4 to withstand seismic loads in addition to other loads. Equipment shall not be required to function properly during periods of seismic disturbance but shall be capable of manual restart following a disturbance.

Design shall be performed and stamped by a licensed structural engineer registered in the State of California who shall certify that the designs are in conformance with the Uniform Building codes and that all applicable loads, including seismic, have been designed for.

1.7 WARRANTIES, MAINTENANCE, AND SUPPORT SERVICES

A. RTU System Warranty

The RTU system warranty shall consist of a full scope, in-place warranty that shall last for two years from the Date of Substantial Completion. All software and equipment components provided by the Contractor that are part of the completed system shall be covered by the warranty. The Contractor shall coordinate any warranties provided by third party suppliers and cause them to be registered in the name of the City.

B. Preventive Maintenance

The Contractor shall provide the services of factory-trained service technicians, for the period from Notice to Proceed through the end of the System warranty, for the purpose of performing preventive maintenance. All equipment shall be systematically inspected, cleaned, aligned, adjusted, lubricated, calibrated and otherwise

serviced as required to assure proper performance. Equipment manufacturer service recommendations shall be followed where applicable. The preventive maintenance service interval (time-between-service activities) for each piece of equipment shall be that recommended by the equipment manufacturer in accordance with industry practice. The cost to provide preventive maintenance during this period including parts, labor, travel, and subsistence, shall be included in the contract price. Prior to start of in-service use of each part of the System, the Contractor shall provide to the City a schedule for this maintenance service.

All preventive maintenance activities shall be documented with service reports which shall identify the equipment being serviced, state the condition of the equipment, describe all work performed, and list materials used. The report shall also include the name of the technician performing the work and his/her signature. A copy of all service reports shall be delivered to the City on the day the work is performed. For preventive maintenance performed before the System is shipped, the service reports shall be accumulated by the Contractor and made available to the City.

All preventive maintenance procedures shall be planned and accomplished in such a manner as to minimize disruption of the City's water system operation. No preventive maintenance procedure shall be allowed to jeopardize the City's ability to monitor and control system operation.

At the City's option, City's maintenance personnel may participate in any preventive maintenance procedures.

C. Corrective Maintenance

The Contractor shall provide the services of factory-trained service technicians for the purpose of performing corrective maintenance on all RTU system hardware and software. The period of coverage for each piece of equipment shall begin upon initial equipment purchase or manufacture and shall continue through the end of the System Warranty. The service technicians shall reside no more than five hundred miles from San Francisco.

The City, at City's option, may elect to employ its own maintenance staff to locate and remove a defective component. In this case the City will return the defective component to a repair location as instructed by the Contractor. The Contractor shall repair or replace the defective component and return the properly working unit to the City within fifteen (15) days.

D. Software Maintenance

After any System software function or equipment has been placed in service and tested, City personnel shall be permitted, at no additional cost to the City, to add, modify, and delete control programs, displays, data base, and reports that were previously developed by the City. Performance of such actions by the City shall not release the Contractor from satisfying any guarantee or maintenance requirements, or any other specified requirements.

E. Software Update Services

Starting with installation of the RTU System and continuing until the end of the System Warranty, the Contractor shall provide, install, and commission updates to the RTU programming, and computer manufacturer provided software within ninety (90) days from when such updates are announced and release by the manufacturer. All updates shall be provided which are necessary to maintain the System in compliance with the Contract Specifications and Drawings, or which are necessary to maintain technical and service support of the System by the Contractor and/or the original equipment manufacturer(s).

1.8 TRAINING

A. Provide the RTU/PLC hardware and software Manufacturer's standard published courses conducted by the manufacturer's full-time professional instructors who are certified to have gained the technical knowledge and instructional skills necessary to provide an effective product training. Provide training for up to 6 City Instrument/Operations Engineers in the maintenance of the hardware and software configuration. The instructors' qualifications, published course descriptions, and topical outlines shall be submitted to the Engineer for review and approval within three months of contract award. The training shall cover the following areas:

1. Hardware Maintenance:

Provide a minimum of two instructor days of onsite classroom training for the City's Instrument/Operations Engineers in the maintenance of the hardware. Training shall include:

a. Standard hardware features.
b. Specific training for the actual hardware configuration provided.
c. Test, adjustment, and calibration procedures.
d. Troubleshooting, component removal, replacement and periodic maintenance.
e. System repairs and validation.
f. Provide all equipment, instruments, simulation kits, calibration tools, etc. needed for the training of 6 students. No more than two students shall share any set of tools or instruments at any time.

2. Software Configuration and Maintenance:

a. System Configuration:

Provide a minimum of four instructor days of factory training in the software configuration of the RTU. This training shall be provided at the factory or training center before the Factory Demonstration Tests. Factory training shall be performed within the San Francisco area. If training cannot be provided in the San Francisco area, the Contractor shall cover all travel expenses.

Software training shall be designed for students having either the equivalent of a class on personal computers or RTU programming experience and familiar with Windows. Upon completion, the student shall be able to:

i. Operate the system on a day-to-day basis.
ii. Make programming changes.
iii. Assist hardware maintenance technicians in diagnosing problems with the system.
iv. Reconfigure the control system.
v. Perform general programming and documentation of the program.
vi. Develop dynamic color graphics depicting the actual process for these facilities.
vii. Design custom menus linking the displays, develop and use recipes, generate production reports, collect historical trend data, setting up system security, setting process alarms, etc.
viii. Diagnostic and troubleshooting: Capabilities, usage, and interpretation of results.
ix. Ladder logic, programs, and functions.

b. Advanced System Configuration

Provide a minimum of four instructor days of factory training for Intellution FIX advanced system configuration. This training shall be provided at the factory or training center before the Factory Demonstration Tests. Factory training shall be performed within the San Francisco area. If training cannot be provided in the San Francisco area, the Contractor shall cover all travel expenses.

Advanced software training shall be designed for students having completed the software configuration training above or the equivalent experience. Upon completion, the student shall be able to:

i. Understand the software system architecture.
ii. Transfer process data to a relational data base.
iii. Retrieve historical data for display and scroll using a view screen.
iv. Understand and use of the software standard command language and scripts.
v. Use of redundant configuration schemes and configuration for automatic failover.
vi. Use diagnostic tools to troubleshoot hardware and software problems.

c. System Operations:

Provide a minimum of two instructor days at the jobsite for City personnel in the operation of the system. Training, as a minimum, shall include:

i. Operational features of the process equipment/system and the control system functions.
ii. Control loop functions.
iii. Operation of each loop: For example Start/Stop of equipment, Auto/Manual control, control setpoint settings, control mode selection, alarm setpoints and acknowledgment, failure modes, etc.
iv. Interface with other control loops, process equipment interlocks, and other systems.
v. Component performance requirements, limitations and functions.
vi. Instrument I/O calibration procedures and conversion factors for the specific process measurement.
vii Instrument operational and maintenance requirements.
viii. Operator interface to local panels and control stations.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS FOR RTU/PLC

The RTU shall be a self-contained unit capable of collecting data through electrically dry relay contacts, 4 to 20 mA DC analog, high level AC input signals, and contact-making pulsing devices supplied by the City. The RTU shall also be capable of providing AC and DC control outputs, both momentary and latching, the contacts of which will be used by the City for remote control. The Contractor shall provide all interposing relays that may required to interface with the field signals.

The RTU shall have stand alone calculation and control capability to perform both on/off and variable signal loop control using setpoints downloaded from the SCADA Server. The RTU shall have the capability of controlling at least ten external variables simultaneously with cycle times such that each control loop is updated in two seconds maximum period.

Programming languages which execute only on one vendor's RTU are not acceptable. The RTU shall be programmable in one or more of the following high level languages:

1. Relay Ladder Logic (RLL).
2. C.
3. Functional Block Diagrams.
4. Sequential Functions Charts.
5. Structured Text.
6. Real-time BASIC.

All BASIC type programming languages shall support the following features and operations:

1. Arrayed variables.
2. Subroutines.
3. Alphanumeric display generation using cursor controls and PRINT statements.
4. Iterative looping in selectable steps while or until conditions are met.
5. Conditional branching on error and timer interrupts, and logical conditions.
6. Conditional branching to multiple line locations depending on value of variable .
7. Variable names up to six characters.
8. Ability to swap variables and pass parameters to subroutines using PUSH/POP argument stack.
9. Ability to read and write real-time Year, Month, Day, Hour, Minute, and Second.
10. Ability to assign strings of characters to variables.
11. Ability to read and write analog and discrete real-time inputs and outputs.
12. Ability to branch to appropriate program locations in response to operator interface keystrokes.
13. Ability to assign, read, and w rite at least 30 independent real-me event timers, to 100 mS resolution.
14. Trigonometric functions.
15. Random number generation.
16. Mathematical exponentiation of negative fractional exponents.
17. LOG operator.
18. Square root, addition, subtraction, multiplication, division.
19. Logical OR, AND, XOR operators.
20. ABS, NOT, INTEGER, SGN operators.
21. PI stored constant.

22. e stored constant (2.7182818).
23. ASCII and CHR operators for string manipulation.

RTU shall be expandable such that the RTU can accommodate at least 50% more I/O points than required for this job.

2.2 RTU EQUIPMENT REQUIREMENTS

A. General

The RTUs shall be programmable solid-state electronic units. They shall have stand-alone restarting capability, i.e., it shall not be necessary to reload software programs for common logic, communications, and I/O processing at the RTU to resume operation following a loss of power. All configuration information and control strategies shall be resident in battery backed up RAM with at least a five year battery life.

All electronic components shall be mounted on plug-in printed circuit cards or modular subassemblies. Gold-plated contacts shall be provided for all printed circuit cards and multi-pin connectors. Each printed circuit card and subassembly shall be model and serial numbered to uniquely identify it. Printed circuit cards shall have quick disconnect field terminations.

RTU I/O subsystems shall be Modbus protocol compatible; and shall be able to interface with existing Lake Merced Intellution FIX.

As a minimum the RTU shall have LEDs to indicate whether the CPU and I/O subassemblies are functioning.

All point inputs and outputs, communication equipment, and power supplies shall pass the IEEE Std 472-1974 (ANSI C37.90a-1974) Surge Withstand Capability Test. All Discrete Input, Discrete Output, and Analog Output signals shall be optically isolated.

Printed circuit cards and I/O modules shall be replaceable without turning off RTU and control power ("hot swap") without causing mis-operation.

B. RTU Common Logic

The RTU shall:

1. Receive data from and transmit data to the communications channel.
2. Perform address decoding and error checks, and transfer data to and from the point input/output logic.
3. Respond to commands for retrieving data.
4. Provide a real-time clock function which can be set via a download from the SCADA Server.
5. Prevent selection of more than one control point in a command sequence.
6. Protect against single component failures causing a false control command, damage to other logic, or false transmission to the SCADA Server.
7. Inhibit relays from being energized erroneously during the initial power up period of the RTU.
8. Protect against over/under voltage conditions from the City's power source and/or from causing false control commands, damage to logic, or false transmissions to the SCADA Server.
9. Provide a minimum of 32 independently running and independently resettable timers with one millisecond resolution for access by the RTU applications programs.
10. Provide RTU diagnostics remotely from the SCADA Servers via communications links used between the RTU and the SCADA Server.

C. RTU Communications Interface

1. The RTU shall each be able to support at least five communications ports of the EIA232 type to support the following functions:

    a. Primary Communications with SCADA Server.
    b. Back-Up Communications with SCADA Server.
    c. RTU to RTU Communications: Each RTU shall have this port to support RTU to RTU communications (Subsection 13400-2.03-B.4) and Store and Forward Reporting (Subsection 13400-2.03-B.3) when the RTU is acting as a pass through node. The specific method of data reporting to be used shall be determined by the communications media.

d. Local Input/Output (I/O) Subsystems: (see Subsection 13400-2.02-H).
e. Local Operator Interface: (see Subsection 13400-2.07-B).
f. Test Set: (see Subsection 13400-2.05-A).

2. It is acceptable that the functions be supported with five communications ports by letting the test set share a port with the Local Operator Interface.

Each of the above communications functions shall operate at 19.2 kbps. If Spread Spectrum or MAS Radio are used as the medium then they shall operate at 9600 bps.

For communications between the RTUs and the SCADA Servers and for RTU to RTU communication between RTUs, the RTU shall be configurable to support any combination of the following communications media:

a. Advanced Digital Network (ADN) Leased Telephone Lines.
b. Very Small Aperture Terminal Satellite Communications.
c. Multiple Address System (MAS) Radio.
d. Dial-up Phone.
e. Spread Spectrum Radio Communications (RTU to RTU communications only).

3. The RTUs primary communications with the SCADA Server is Advanced Digital Network (ADN) leased telephone lines.

a. Advanced Digital Network (ADN) Leased Telephone Lines:

The RTU is designated as having leased line communications and shall be provided with a CSU/DSU unit. The RTU CSU/DSU units shall be 24 VDC powered to operate off the RTU battery back-up power during power disruptions.

When using ADN communications, the SCADA Server and RTU shall use a polled method of data reporting (Subsection 13400-2.03-B).

b. Very Small Aperture Terminal Satellite Communications:

The RTU shall have an EIA232D serial port operating at 19.2kbps for communicating with the Very Small Aperture Terminal.

When using VSAT communications, the SCADA Server and RTU shall use a quiescent method of data reporting (Subsection 13400-2.03-B).

c. Multiple Address System (MAS) Radio

When using MAS communications, the SCADA Server and RTU shall use modems with 28.8 kbps speed and V.34bis and V.42bis complaint and utilize a polled method of data reporting (Subsection 13400-2.03-B).

d. Dial-Up Phone

When using Dial-Up communications, the SCADA Server and RTU shall use modems with 28.8 kbps speed and V.34bis and V.42bis complaint and utilize a quiescent method of data reporting (Subsection 13400-2.03-B).

D. Discrete Inputs

The Contractor shall be responsible for the RTU interface with status and alarm contacts. For the "dry" contacts, the RTUs shall sense the states of these contacts by applying 24 VDC and observing the extent to which current flows. The minimum current flowing through the City's closed contacts shall be two milliamperes. The maximum allowable contact sensing current shall be 20 milliamperes. The maximum resistance of an City's status circuit, when open, will be 50,000 ohms.

Each discrete input shall be filtered for contact bounce and isolated from high electrical noise. A valid status shall be defined to be a state which is stable for a time period of 10 milliseconds.

E. Control Output Requirements

Two types of control output shall be provided by the RTU, as follows:

1. Momentary Output - consists of those outputs which are closed for a preset time duration (adjustable at the RTU). An adjustable timer shall be provided for each momentary output, adjustable from 0.1 to 15.0 seconds. If the command is repeated before the relay has timed out the timer shall automatically reset for the full time period. The Contractor shall supply plug-in indicating type interposing relays with dry single form "C" contacts rated to 10 Amps at 120 VAC. Sockets and coil surge suppression diodes shall be provided. Relays shall be rated for a minimum of 10 million operations at full rated load.
2. Maintained Output - consists of those outputs where the relay remains in the energized state until a reset command is issued. The Contractor shall supply plug-in indicating type relays with single form "C" rated to 10 Amps at 120 VAC. Sockets and coil surge suppression diodes shall be provided. Relays shall be rated for a minimum of 10 million operations at full rated load.

F. Analog Control Capability

The RTU shall have the capability of adding analog output modules which shall be a 4-20 MA at 24 VDC; suitable for interfacing to an electronic three mode controller or direct to a variable frequency drive.

The analog outputs shall be isolated from the 24 VDC power supply and ground. Isolators shall be provided, if required, to implement this function.

G. Analog Inputs

Analog inputs from the transducers shall be read and processed by the RTU, using a single analog-to-digital (A/D) converter and analog switch (multiplexer) to sequentially select each input in turn.

The A/D converter shall have a digital resolution of 11 bits plus sign and a relative accuracy of 0.1 percent of full scale or better plus or minus the least significant bit. From the analog input to the digital output of the A/D converter, the overall accuracy shall be 0.25 percent of full scale or better, including the effects of temperature over the specified ambient temperature range.

Common mode noise rejection shall be at least 110 Db from 0 to 60 Hz. Differential mode noise rejection shall be at least 90 Db at 60 Hz.

Analog inputs from the transducers shall be 4-20 MA DC.

The analog inputs shall be isolated from the 24 VDC power supply and ground. Isolators shall be provided, if required, to implement this function.

H. Local Input/Output (I/O) Subsystems

All I/O shall consist of DIN-rail mound modules which communicate with the RTU via RS-485 communications using MODBUS protocol at 19.2 KBaud.

I/O subsystems shall include modules for all types of discrete and analog I/O described above. I/O subsystems shall be provided complete with communications and power supply modules, as required to fit the application.

2.3 RTU SOFTWARE REQUIREMENTS

A. General

The RTU operating system is not specifically required to be UNIX or POSIX-compliant or a UNIX variant but must be real-time and multi-tasking.

The RTU shall accept new information via download from the SCADA Server over the communications lines.

The RTUs may use any protocol for communicating with the SCADA Servers and for RTU to RTU exchanges; however, the Contractor shall provide the City with their protocol definition in sufficient detail to describe all messages and timing parameters. The City shall be able to disseminate the protocol definition without restriction for use in obtaining additional RTUs and/or SCACA Servers that are compatible with the protocol.

The RTUs shall support having data points from differently named sites wired in as I/O points and reporting them to the SCADA Server with the proper site identification.

B. Data Reporting Methods

The RTU shall be able to use a variety of communications methods to report data to the SCADA Server. Both polled and quiescent methods of data reporting shall be supported. The RTU shall also support Store and Forward reporting and RTU to RTU communications. The RTU shall use leased telephone lines to communicate with Lake Merced. The method of data reporting to be used with each communications media is specified in Subsection 13400-2.02-C.

The RTU shall determine when to report data based upon two criteria. Either criteria shall be sufficient for the RTU to report to the SCADA Server. These criteria apply to both polled and quiescent methods of data reporting.

1. A value has changed at the RTU. A change may be a discrete value changing state or an analog value changing by more than a deadband amount since the last time the analog value was reported to the SCADA Server. Each analog value shall have its own unique deadband used for this purpose.
2. The data integrity interval has passed. Periodically, the RTU shall report all of its data to the SCADA Server. This period shall be the integrity latency interval for the RTU 5 minutes. In the polled method of data reporting, the SCADA Server shall initiate the request for data. In the quiescent mode the RTU shall initiate the data reporting; data latency of 20 seconds.

a. Polled Reporting

The polled method of reporting shall be based upon the SCADA Server periodically querying the RTUs for any that should be reported.

b. Quiescent Reporting

A quiescent method of reporting data to the SCADA Server which does not rely upon the SCADA Server initiating the request shall be supported. If the RTU detects a busy communication channel when it attempts to report data, it shall stop its reporting and retry after a delay. The RTU shall employ appropriate algorithms to insure that multiple RTUs sharing a communications channel shall not get into simultaneous contention because they all use the same delay interval before retrying.

The RTU shall maintain On Scan/Off Scan status as requested by the SCADA Server. Those points which are set to Off Scan shall not be reported to the SCADA Server.

The RTU shall insure that a minimum period of time has passed since it last reported anything to the SCADA Server. The minimum period shall be independently configurable for each RTU and shall be able to be any value between five seconds and five minutes.

The RTU shall, upon receiving a request from the SCADA Server, report all their data to the Server. This shall normally occur when the SCADA Server undergoes a failover or restart.

3. Store and Forward Reporting

The RTU shall each support Store and Forward Reporting.

4. RTU to RTU Communications

The RTU shall each support RTU to RTU communications. In addition to being able to report data directly to the SCADA Server, the RTUs shall have the capability to report data to another RTU without going through the SCADA Server. The RTU to RTU communications port (see Subsection 13400-2.02-C)

shall be used for this function. Data acquired by RTU to RTU communications shall be stored in the RTU's data base and be available for use in its control strategies.

C. Data Downloads From SCADA Server

The RTU shall support the downloading of data values from the SCADA Server via the primary or back-up communications channel to the Server. The RTU shall store the value locally for use by control strategies or any other purpose to which data at an RTU may be put, e.g., view on the Local Operator Interface.

D. Signal Processing Software

1. Time Stamping of Data

The RTU shall provide a time stamp for data it reports to the SCADA Server. A single time stamp for all of the points being reported at a time shall be sufficient. When using the polled method of data reporting, the RTU shall set the time stamp to be the time when the poll request is received by the RTU. When in the quiescent method of data reporting, the time stamp shall be set when the RTU determines that it should report data to the SCADA Server.

2. Discrete Data Processing

The RTU shall store the last scanned state of every discrete indication and shall detect changes by comparing these states with newly scanned states as they are received.

The RTU shall, if indicated for the given point, invert the raw status value to normalize the interpretations of discrete values.

3. Analog Data Processing

The RTU shall provide the capabilities as described below for all analog data:

a. Engineering Units Conversion - Analog point raw values shall be converted to engineering units by the RTU via a linear transformation, EU = A (raw value) + B, where scale "A" and offset "B" are user defined on a per point basis. The capability shall be provided to perform a square root of the raw analog value prior to the linear transformation.
b. Alarm Checking - The instrument range (validity) alarm condition shall be tested. Instrument range violations shall be alarmed to the SCADA Server by placing an out-of-range indicator in the variable field for the analog value.
c. Report By Exception - The RTUs shall be capable of the following report by exception processing. Analog values shall be processed and reported to the SCADA Server on a report by exception basis. A dead band value shall be assignable to each analog point and the point will not be processed by the RTU unless the analog value has changed by this amount.
d. Arithmetic Computation - Capability shall be provided to generate new variables from the simple arithmetic operations of addition, subtraction, multiplication, division, and square root. All analog variables (both measured and internally computed) shall be available in forming new calculated variables. Computed variables shall be treated the same as field data for all data processing functions.
e. Averaging - Capability shall be provided to derive averages of selected measurements. The averaging algorithm shall average over a programmer adjustable number of data samples (covering a period of one to 60 minutes).
f. Comparison - Capability shall be provided to compare analog variables (both measured and internally computed) with each other and with operator adjustable limits for purposes of generating new discrete variables. These discrete variables shall be processed identically to other variables and may be used to generate alarms or be used in Boolean logic functions.
g. Rate-Of-Change Limit Checking - Analog data shall be checked for rate-of-change limit values. The SCADA System shall check each analog value for the total net change in value since the last scan of the value, and compare it against predefined limit value. An alarm shall be generated if the limit is

exceeded. A user entered deadband value equal to a percentage of the limit value shall also be used, similar to high/low limit checking, in determining the return-to-normal condition.

h. Flow Rates - Flow rate values shall be calculated by the RTU. Flow rates shall be calculated as zero (no flow) when the associated prime mover is not active i.e. pump not running or valve closed.

For water differential pressure data, the square root of the differential pressure (multiplied by a meter factor) signal is directly proportional to the flow rate. These flow rate values shall be converted to flow total values at the same conversion rate as the pulse data above in order to provide compatible flow rate and flow total data for the data base.

i. Flow Accumulations - The RTU shall maintain a flow accumulation file for each flow signal. The calculated gallon per minute flow rate for each flow shall be accumulated every minute to provide an hourly flow total in gallons. This flow accumulation file shall have the accumulation for the current hour to the latest minute and the previous 23 hourly accumulations. The hourly flow accumulations shall be transmitted to the master at the completion of the hourly totalization. The other accumulation values shall only be transmitted when requested.

j. PID Control - The RTU shall provide Proportional, Proportional + Integral (P + I), and Proportional + Integral + Derivative (PID) control for positioning final control elements such as chemical metering pumps and control valves. Parameters for tuning the performance of PID control loops, such as proportional gain, shall be adjustable through LOI at the RTU and through the RTU test set/programmer.

4. Special Functions

In addition to the signal processing described in the previous subsections, the RTUs shall perform some special functions. These include:

a. Totalization of the local equipment run times and number of starts. These totals to be sent to the SCADA Server upon demand. The RTU shall handle any totalizer rollover. The totals shall be resettable based upon a command from the SCADA Server.

b. Accumulate the first four hours of data after loss of communication with the SCADA Server. This data to be retained until uploaded to the SCADA Server. Enough storage shall be provided at the RTU to store data under the conditions where, for each data latency period for the RTU, 30% of the analog and 20% of the discrete values change enough that they normally would be reported to the SCADA Server. When loss of communications with the SCADA Server occurs, the RTU shall switch to a quiescent type of data reporting with the exception that the data is “reported” to a buffer storage area rather than to the SCADA Server.

E. RTU Control Command Response

When a control command has been issued from a SCADA Server, the RTU shall either temporarily at a quicker data latency of fifteen seconds report the current value of the controlled point or shall initiate an unsolicited message to the SCADA Server when the desired controlled point has changed.

2.4 FUNCTIONAL CONTROL STRATEGY NARRATIVE

A. Functional narratives which describe operational sequences and specific equipment requirements are supported by Process and Instrumentation Drawings (P&IDs). The Contractor shall use the P&IDs for support in developing the control strategy. All details of RTU control logic are not completely indicated by the P&IDs and functional narrative. Therefore, the Contractor shall review the P&IDs and functional narrative with the City when developing the control strategy.

B. Bumpless Transfer

Control strategies shall be configured such that when control is switched from RTU-Auto to the Manual mode of operation the transfer shall be bumpless. Discrete control outputs shall hold their state and analog outputs shall be sequenced to minimize disruption to the process. Bumpless transfer shall be provided whenever possible.

C. Deviation Alarms

Control strategies shall check that command outputs have resulted in the correct control feedbacks being received. Deviation alarms shall be configured for all loop setpoints and analog outputs. Deviation alarms shall be configured for all discrete control devices (motors, valves, etc.).

The device deviation shall check that proper feedback status has been received within an adjustable period (0 - 30 minutes) after issuing a command output.

D. Loss of Signal

Control strategies shall be designed such that loss of process variable signals from sensors result in final control elements remaining in their last commanded state, and appropriate alarms being sent to the SCADA Server.

E. Pump Control Strategy Description

1. This pump station is used on the city treated water distribution system to feed one of two possible reservoirs on Yerba Buena Island. The suction manifold for this pump station draws water directly from a pipeline. The function of the pump station is to maintain pressure on the distribution system within acceptable limits, and to maintain level in destination reservoir. Multiple pumps supply a common discharge manifold. Pumps shall be interlocked to prevent drawing down tanks or reservoirs on the suction side of the pumps. The control strategy resides in the RTU, so level from distant reservoirs must be telemetered to the pump station. The control strategy must adapt to changing conditions, such as time-of-day, and operator override of pump starting and stopping.
2. Monitoring and controls shall be designed and implemented to operate as follows:

Pump Controls - General - The individual pumps shall be operable in both manual and automatic control modes. Each pump can be run manually by placing the “MANUAL-AUTO” switch in “MANUAL” position. This bypasses all automatic controls.

The pumps can be allowed to operate automatically. If the “MANUAL-AUTO” switch is placed in the “AUTO” position, the pumps shall be controlled by the RTU.

Pump Controls - Local Only - RTU control is normally a level setpoint control, with supervisory Start/Stop override via the SCADA system The RTU shall select the 3 million tank level setpoint or the 1 million tank level setpoint based on the position of a switch on Yerba Buena Island switch control. The pump station discharge is tied to a 10” main feed on the Bay Bridge. If communications is lost from Yerba Buena RTU and the SCADA master station, the RTU shall stop all pumps. Two pumps and only two pumps shall be on at any time; which pumps will start is selected at the Pump Select Control Panel. Levels and level switch information is available from Yerba Buena Island and Lake Merced. Yerba Buena Island levels shall be compared to Lake Merced levels; if there is a discrepancy an alarm shall be generated back to Lake Merced.

Pump Controls - SCADA - If communications has been available from the SCADA master station for more than an adjustable “SCADA Comm Restoration” period, the RTU is to control the pumps based solely on remote reservoir level, if available. If reservoir level is in error, low level and high level points from Yerba Buena or from Lake Merced, may control the pumps.

Reservoir level is controlled within an adjustable deadband about the level setpoint. As level falls below the deadband, or the low level switch is on, for more than an adjustable time period two pumps are called to run. These two pumps are chosen from manual switch at station. If pump fails after being called, an ALARM is generated.

As reservoir level rises above the setpoint for more than an adjustable time period, the pumps are stopped.

The pump time-of-day energy reduction settings are stored in the RTU, and are configurable from the local operator interface panel at the RTU. When “Time-Of-Day Control Mode” is enabled, the normal level setpoint is lowered by an adjustable “On-Peak Control Percentage” between two SCADA-adjustable times of day designated as “On-Peak Period Start” and “On-Peak Period Stop”. Similarly, the normal level setpoint is lowered by an adjustable “Partial-Peak Control Percentage” between two SCADA-adjustable time periods of day which occur immediately before and after the “On-Peak” period. The beginning and end of these periods are designated as “Partial-Peak Period Start” and “Partial-Peak Period Stop”. “Time-Of-Day Control Mode” is enabled and disabled from both the SCADA master station and the local operator interface at the pump station.

If the pumps are pumping and the flow switch YBI does not respond to flow after a time limit.

When SCADA control is available, operators shall be able to override pump starting and stopping from the SCADA master station. If the reservoir level is above the lower deadband level, operators shall be able to force two (only) pumps to start. Once manually started via SCADA, the pump(s) shall continue to run until control reservoir level rises to the upper level control deadband limit or high level switch is activated. If the operator enters a value for a “SCADA Pump Run” period, the pump(s) shall continue to run for that period. Similarly, if the reservoir level is below the upper deadband, operators shall be able to force one or more pumps to stop.

3. SCADA Monitoring/Control. See I/O List for additional points

Station flowrate
Station supply pressure
Station discharge manifold pressure
"Station Low Pressure" alarm
3 Million Reservoir level
3 Million Reservoir low level alarm
3 Million Reservoir high level alarm
1 Million Reservoir level
1 Million Reservoir low level alarm
1 Million Reservoir high level alarm
Flow at Yerba Buena Island
"Manual" control switch status for each pump
"Run" control switch status for all pumps
"Select" control switch status for all pumps
"Off" control switch status for all pumps
"Auto" control switch status for all pumps
"Run" commands from SCADA for each pump
Desired pressure setpoint from SCADA system
Desired pressure control deadband from SCADA system
Desired reservoir minimum level control setpoint from SCADA system
"Running" status for all pumps
"Pump Trouble" status for all pumps
Common Alarm

4. Local Operator Interface (LOI) Monitoring/Control:

Station flowrate
Station supply pressure
Station discharge manifold pressure
3 Million Reservoir level
3 Million Reservoir low level alarm
3 Million Reservoir high level alarm
1 Million Reservoir level

1 Million Reservoir low level alarm
1 Million Reservoir high level alarm
Flow at Yerba Buena Islan
"Running" status for all pumps
"Pump Trouble" status for all pumps
Pump run times for each pump

F. Commercial Power Failure and Engine/Generator Standby Power Control:

In the case of power failure, if the pumps are pumping they shall stop pumping and the AUTO pumps run output shall go off. The engine/generator set shall be inhibited from starting until the UPS battery back up low power signal is generated or the level from the reservoir is at the low level setpoint. If the UPS supplying the RTU has a low battery power signal, the engine/generator shall start, transfer and run until the batteries are charged up. This cycle shall repeat until normal power is established. If the reservoir low level setpoint is reached the engine/generator shall start, transfer and the pumps shall turn on and run until the high reservoir level signal turns them off. When the pumps are turned off the generator shall shut down until needed again.

G. Station Monitoring and Alarming Control Strategy Description:

This strategy describes intrusion, fire, power failure, and common monitoring and alarming. This monitoring and alarming shall be designed and implemented to operate as follows:

1. Station Intrusion Monitoring and Alarming: The station shall have a station entry keyswitch for the operator. This keyswitch shall close a contact wired in parallel across the series-wired intrusion detection switches mounted on doors, hatches, and/or other locations. When the operator enters a station and inserts the key in the keyswitch, the series-wired intrusion detection switches shall be bypassed. The RTU shall monitor the status of the keyswitch/intrusion detection loop. If this loop opens and remains open for 10 seconds or more, the RTU shall generate a "Station Intrusion" alarm.
2. RTU Intrusion Monitoring and Alarming: The RTU enclosure shall have an entry detection limit switch. This switch shall open a contact when the RTU enclosure door is not fully closed. The RTU shall monitor the status of the switch. If this switch opens and remains open for 5 seconds or more, the RTU shall generate an "RTU Intrusion" alarm.
3. Fire Monitoring and Alarming: The station has a fire suppression chemical system and water sprinkler system. The fire suppression chemical system is in the electrical room only. This chemical system shall provide a contact on alarm. The RTU shall monitor the status of the detector contact. When the chemical system is ready to release chemicals, the fire suppression system shall be interlocked with the station main breaker to trip out the breaker. This will remove power to the station except the UPS system. The water system shall have a flow switch with NC contact that opens on water flow. The station shall have six smoke detectors wired in tandem as shown on E-5. If a contact opens and remains open for 5 seconds or more in these systems, the RTU shall generate an alarm from the respective system.
4. Commercial Power Failure Monitoring and Alarming: The RTU enclosure shall have a commercial power monitoring relay. This relay shall close a contact when the commercial power has failed. The RTU shall monitor the status of the relay contact. If this contact closes and remains closed for 5 seconds or more, the RTU shall generate a "Commercial
5. Common Alarming: The RTU shall generate a "Common Alarm" relay contact output when any alarm occurs at that station. This relay contact shall activate a "Common Alarm" indicator light on the door of the RTU enclosure.
6. Local Operator Interface (LOI) Display

   Station intrusion alarm
   RTU intrusion alarm
   Station fire alarm
   Commercial power failure alarm

7. RTU Panel Indication

Common alarm (indicator light)

8. SCADA Monitoring

Station intrusion alarm
RTU intrusion alarm
Station fire alarm
Commercial power failure alarm

2.5 PRESSURE SPIKE DETECTION

The RTU shall read selected analog pressure values and store them every 100ms. Up to 5 minutes of data shall be saved in a "circular" buffer. The RTU shall determine when a spike occurs in the readings beginning with one minute prior to the spike. The RTU shall then continue with monitoring the readings. The RTU shall be able to store five minutes worth of readings in addition to the current five minute circular buffer for each point designated for this type of monitoring.

The RTU need not store a time stamp with every reading but it shall store the time associated with the readings in a manner that the SCADA Server can reconstruct the time the spike occurred.

The RTU shall report to the SCADA Server and notify the operator that a pressure spike has been detected and shall report the saved readings in a manner that doesn't impact the normal reporting of data.

The RTU shall use an algorithm to detect the occurrence of a spike that is based on magnitude of the current reading compared to a filtered average of past readings and also based on the rate of change of the analog value. The algorithm shall have SCADA adjustable parameters so that it can be tuned for the different characteristics of the individual points, such as pressure spike-to-average pressure ratio and pressure averaging period.

Points that have this processing performed shall have the analog signal wired to two input points: one wired to a transducer for normal range of values and the second wired to a separate transducer calibrated to cover the spike range values.

2.6 RTU SUPPORT EQUIPMENT

A. The RTU Test Set/Programmer shall be based in a laptop personal computer. The RTU Test Set shall be suitable for transporting between sites with rechargeable battery power for at least 6 hours operation. In addition to field programming the RTU, The Test Set shall provide the following functions:

1. Simulation of SCADA Server messages to an RTU.
2. Simulation of RTU messages to the SCADA Server.
3. Ability to view the transmitted or received messages.
4. Ability to control the bit patterns of messages initiated from the test set. This shall include the capability of forcing errors in the error code check bits.
5. Selection of continuous and manual initiation of transmission.
6. Access the RTU database, examine/modify the parameters, run calibration and diagnostic routines.
7. Display all digital input and output status, all analog inputs and outputs in engineering units, and current setpoints of control variable.
8. Issue control commands.
9. Perform RTU hardware diagnostic tests.
10. View and edit all programs and parameters.

Test sets shall be sufficiently sturdy and ruggedized to withstand the physical and environmental conditions typical for field usage.

2.7 PERFORMANCE REQUIREMENTS

While simultaneously meeting all other requirements, the RTUs shall:

A. Drive the communications channel (primary or back-up media) to the SCADA Server at a sustained rate of up to 19,200 bps.

B. Drive the RTU to RTU communications channel at a sustained rate of up to 9,600 bps.
C. Sample each field input at least once per second.

2.8 RTU CONTROL PANELS

A. Physical and Miscellaneous Specifications

The enclosure shall:

1. Be NEMA 12 pad-lockable.
2. Contain RTU, batteries, surge arresters, circuit breakers, fuses, relays, transformers, terminal strips, nameplates, terminal labels, wire ducts, universal spiral wraps and any necessary parts for a complete systems as shown on the drawings and specified herein.
3. Contain expansion space to accommodate the ultimate point counts in Part 3.
4. Contain RTU's discrete I/O and analog I/O circuit boards.
5. House the communications interface equipment.
6. Be free standing. (Bay Bridge Pump Station RTU only)

Each RTU enclosure shall have a normally closed intrusion switch mounted on door assembly by the Contractor that will open when the door opens. This switch action shall be processed as a discrete point and reported to the SCADA Server. This alarm point is included in the RTU point list.

B. Local Operator Interface

The Contractor shall provide a Local Operator's Interface (LOI) Panel that displays all monitored values and alarm conditions. The LOI shall have 4 rows of 20 columns as a minimum, RS232 serial interface, Modbus protocol, and a minimum of four function keys. The panel shall be 24 VDC powered and constructed such that the electronics printed circuit board is separated from the key pad to prevent usage of the keypad from applying pressure on the electronics.

The Contractor shall provide LOI configuration software suitable for operation on a standard IBM compatible laptop computer. The Contractor shall provide the cabling required to connect the LOI to the RTU, and to the configuration computer.

The LOI shall be as manufactured by Maple Systems Spectrum Controls, Kessler-Ellis Products, or equal.

2.9 NAMEPLATES

Machine engraved, three ply laminated phenolic nameplates shall be provided for all panels and cabinets as shown on the Contract Drawings. Nameplates shall be black with white lettering. Nameplate engraving shall be as shown on Contract Drawings. Nameplates shall be attached to the panel with a minimum of two self-tapping 316 stainless steel sheet metal screws. The height of each character shall be a minimum of _", except as noted.

2.10 WIRING AND ELECTRICAL DEVICES

The Contractor shall provide the wiring and electrical devices specified below and install these and internal panel wiring as shown on the Contract Drawings. This section applies to Pump Select Control Panel unless labeled not applicable, (N/A for Pump Select Control Panel). All spare RTU input/output points shall be wired to terminal blocks.

A. Power Distribution

Unless otherwise specified, power for instrumentation equipment shall be obtained from a dedicated 120 volts, 60 hertz distribution panel circuit.

The cabinet shall be equipped with a 120 Vac main power disconnect circuit breaker and power distribution circuit breakers as shown on the Contract Drawings. The main power disconnect breaker shall be a one pole breaker rated at the amperage shown on the Contract Drawings. Distribution circuit breakers shall be single pole rated at the amperage shown on the Contract Drawings. The circuit breakers shall be rated at 250 VAC maximum with a short circuit rating of 10,000 amps for all breaker ratings. The circuit breakers shall be mounted on a standard DIN rail, and shall be Allen-Bradley Channel Mounting Type, or equal.

For each power distribution circuit breaker, a neutral return terminal block shall be installed at the bottom of the breaker trail. The neutral return terminal block shall be standard DIN rail mounted, and shall be rated to carry required amperes and accept up to two 12 AWG wires. This terminal block shall conform to the requirements specified herein.

The cabinet shall be provided with grounding type receptacle power outlets for 120 VAC power supply connections as shown. Each piece of equipment which is equipped with an AC power cord shall be plugged into a power outlet.

B. Panel Connection Wire and Cable

All cable furnished by the Contractor, including cable with any and all wires terminated at both ends within the same panel or enclosure and cable with any wires terminated at more than one panel or enclosure, shall conform to the requirements specified below.

1. Power and Control Cable

Power and control wiring shall be single conductor stranded copper NFPA 70 Type MTW. Power wiring from the main circuit breaker to distribution breakers shall be 12 AWG minimum. All other single conductor 120 VAC and 24 Vdc power and common return wiring, common ground buses, and all common logic bus circuits shall be 16 AWG minimum. Circuits protected by 15 Amp circuit breakers shall be 14 AWG minimum. All power wiring shall be rated for 600V and 80 degrees C.

2. Single Conductor Wire

All single conductors used for logic, RTU input/output and discrete control circuit wiring shall be No. 18 AWG stranded conductor copper, Belden Type 9918 (0.080-inch O.D.), or equal.

3. Multi-Conductor foil Shield Cable (MCF)

All multi-conductor cable used for logic, RTU input/output and discrete control circuit wiring shall be No. 18 AWG stranded copper conductors with polyvinyl/chloride jacket. The cable shall be rated for a minimum of 300 volts and 80 degrees C. The cable shall have an overall aluminum/polyester foil shield with drain wire, Alpha 5380/90 Series XTRA-Guard 1, or equal.

4. Analog Signal Cable

Wiring for 4-20 milliampere, 1-5 volt DC signals and other analog signals shall be No. 18 AWG stranded copper twisted pair shielded cable, 80 degrees C rated, UL listed, 0.35 inches maximum outside diameter, with 100 percent coverage aluminum/polyester tape, foil shield and No. 18 AWG stranded tinned copper drain wire.

Alpha 5430 Series XTRA-Guard 1, or equal. Multi-pair analog signal cable shall be individually shielded (with drain wire) No. 18 AWG stranded conductor copper with a 100 percent aluminum/polyester foil shield with No. 18 AWG drain wire and an outer PVC jacket.

The cable is designated MSP on the Contract Drawings. The cable shall be rated for 300V, 80 degrees C (NEC Article 300-3). MSP cables shall not be routed in enclosures containing 480V equipment.

5. Multi-Individual Conductor (MIC)

Multi-individual conductor cables used for logic, RTU input/output and discrete control circuit wiring shall be number 18 AWG stranded copper conductors with polyvinyl/chloride jacket. The cable shall be rated for a minimum of 600V and 80 degrees C. The cable shall be Alpha 5420 Services XTRA-Guard 1, or equal.

C. Wire Tagging

All panel connection wiring shall be tagged at terminations with machine printed slip-on type tags. The Contractor shall show wire/cable tag designations on all wiring diagrams submitted to the City. There shall be a tag placed within two inches of any wiring termination. The tag shall be fixed to the wire to prevent the tag from sliding more than two inches from the terminal as the result of gravity and vibration.

1. Power and Control Circuits

Control circuit, logic bus, and power circuit wires shall be tagged as defined in this Subsection:

a. Control Circuits - Each individual connection wire shall be tagged at both ends of the wire with number. The tag shall be placed on the wire within two inches of the terminal to which the wire is terminated. The Contractor shall assign a unique number for each wire within panel.
b. Power Circuits - All 120 VAC power wires shall be tagged with the designation "120 VAC" followed by the circuit breaker number shown on the Contract Drawings, then followed by a letter designating whether the wire carries the line (L), neutral (N) or power ground (PG). Positive 24 VDC power circuit and power bus wires shall be tagged with the designation "+24 VDC" followed by the circuit breaker number shown on the Contract Drawings, and 24 VDC power returns shall be designated with "24 VDC COMMON".
c. Wire Colors - Control, logic bus, and power conductors in panels shall have the following insulation colors:

Usage	Color
Line Powe	Black
Neutral	White
Power Ground	Green
+24 VDC Panel Bus	Red
+24 VDC Field Bus	Orange
24 VDC Common	Gray
Control	Red
Status and Alarm	Blue

2. Signal Circuits

Signal circuit multi-conductor cables shall be tagged at each end with the designation shown on the wiring diagram. Each signal conductor shall be tagged at each end with the designation of the terminal block to which it is connected. Individual conductors in each pair of twisted-pair cable shall have distinctly different colors, such as black and white, black and clear, etc. Shield grounding conductors shall be green and shall be tagged “SG”.

D. Terminal Blocks

Unless otherwise shown or specified, terminal blocks shall be captive screw with pressure plate, DIN EN 50035 rail 600 volt rating. Terminal blocks shall be the type specified in the following table, or equal:

Description	Type	Application
Terminal Block	Phoenix UK5, or equal	120 Vac Neutral
Grounding Terminal	Phoenix USLKG4	Equipment or Signal Grounding Block
Disconnect Terminal Block Loop w/ Test Socke	Phoenix UKK5-MTK-P/P, or equal	4-20 ma Current Loop
Terminal Block Test w/ Test Socket	Phoenix UK5 w/ PSB 3/10/4 Test Plug Socket, or equal	1-5 VDC Analog Signals
Terminal Block	Phoenix UK5, or equal	24 VDC Supply Ckt Shield Drains
Diode Bridged Block	Allen-Bradley 1492-HM2D, or equal	Diode Logic Circuits

Wire Bridged Block	Allen-Bradley 1492-HM2C, or equal	Logic Circuits
End Clamps	Phoenix Type E/UK	Each Group of Blocks
Terminal Markers - Terminal Marking Card	Phoenix Type SBS Blocks as required	All Termina
Terminal Strip Marker	Phoenix Type KLM	Each Group of Blocks
Insertion Strip	Phoenix Type ES/LP	As Required

The Contractor shall provide Phoenix Contact UK6.3 fused disconnects with light indicators for 24VDC and 120VAC circuits with fuses as shown on the drawings.

E. Terminal Tags, Covers, and Markers

Each terminal strip shall have a unique identifying alphanumeric code designation at one end and a plastic marking strip running the entire length with a unique number for each terminal. The Contractor shall assign terminal strip numbers from the number "1" and continuing in ascending cardinal order. The terminal strip designation shall be the letters "TB" followed by the terminal strip number. The strip and terminal point designations shall be machine printed and 1/8 inch high.

Terminal blocks carrying 120 VAC power circuits shall be provided with a transparent, hinged cover for personnel protection and accessibility.

F. Wire Routing

Wires shall be routed in slotted plastic wire-ways with snap covers. Wires carrying 120 VAC shall be separated as much as possible from other wires and signal cables, and shall be routed only in ducts shown on the Contract Drawings to be for 120 VAC. If the power wiring has to cross the signal wiring, the crossing shall be as close to a right angle as possible. Ducts shown for 24 VDC shall be used for all other wires and cables. Routing of 120 VAC in combined ducts shall be minimized. Wires and cable shall be routed along the shortest route between termination points, excepting routes which would result in routing 120 VDC and other wires and cables in the same duct. Wires and cables shall have sufficient length to allow slack and to avoid any strain or tension in the wire or cable. Wires and cables shall be placed in the ducts in a straight, neat, and organized fashion and shall not be kinked, tangled, or twisted together.

G. Wire Terminations

Single wire and cable conductors shall be terminated according to the requirements of the terminal device.

For captive screw pressure plate type terminals, the insulation shall be removed from the last 0.25 inches of the conductor. The conductors shall be inserted under the pressure plate to full length of the bare portion of the conductor and the pressure plate tightened without excess force. No more than two conductors shall be installed in a single terminal. All strands of the conductor shall be captured under the pressure plate.

For screw terminals, appropriately sized forked spade lugs shall be used. Lugs shall be crimp-on type that form gas tight connections. All crimping shall be done using a calibrated crimping tool made specifically for the lug type and size being crimped.

On shielded cables, the drain wire shall be covered with insulating tubing along its full bare length between the cable jacket and the terminal lug or terminal pressure plate.

H. Switches

All pilot push-button and selector switches shall be equipped with at least one set of unused (spare) Form C contacts.

1. Push-button Switches

Push-buttons shall be flush head, heavy-duty, NEMA 13, oil-tight, nominal 1.5 inch diameter. The push-buttons shall be the color indicated on the Contract Drawings. Unless otherwise specified, push-buttons shall be momentary contact type, and shall be equipped with electronic duty gold plated contacts

rated at 1 ampere at 28 VDC. Push-button switches shall be Microswitch Type PT, Westinghouse Type PB2, General Electric Type CR104P, or equal.

2. Multi-light Selectors and Indicators

Multi-light position selector switches and indicator lights shall be heavy duty, oil tight, NEMA 13, nominal 2.3 inch square. Contact arrangements shall be as shown on Contract Drawings. Where "push" or "turn and push" is indicated, contact operation shall be momentary. All other contact operation shall be maintained. Contacts shall be heavy duty, rated at 10 Amperes, 120 VAC. Indicator lights shall be provided in the selector positions and with the colors shown. Selector and indicators shall be engraved as shown on the front panel drawing. Multi-light selectors and indicators shall be Microswitch Type CMC, or equal.

I. Electro-Mechanical Relays

Control relays shall be UL approved, and provided with four form C silver contacts rated at 3 amperes at 28 VDC and 120 VAC, and shall be hermetically sealed. Where the Contract Drawings show a requirement for more than four contacts for a single control relay, two relays shall be provided with the coils wired in parallel. Coils shall be 24 VDC or 120 VAC, as indicated. Relays shall be mounted on sockets with retainers, and shall be wired with drop out voltage spike suppression diodes in parallel with all coils, with the cathode of the diode connected to the positive side of the coil. Electro-mechanical Control Relays shall be Potter and Brumfield KH series, or equal. Control relays mounted in the Pump Station Motor Panels shall be heavy-duty power type relays rated at 10 amperes, 120V, minimum. These relays shall be Idec type PR3PA-UL with indicator light, Potter and Brumfield, or equal.

J. Cabinet Lighting (N/A for Pump Select Control Panel)

The panel shall be provided with an internal incandescent light as shown on the Drawings. Lights shall operate from 120 VAC, and shall be wired to power through a door-mounted switch which shall be activated by opening the cabinet door, to be located and wired as shown. Cabinet lights shall be Hoffman A-LTDB1, or equal.

K. Power Line Surge Protector

The panel shall be provided with a 120 VAC, 20 ampere service power line surge protector as shown. The surge protectors shall be heavy duty, multi-stage, and high speed. Response time shall be 5 nanoseconds maximum, and shall allow 340 Volts maximum peak surges to pass through. The protector shall be wired to the cabinet ground bar via a dedicated #8 AWG solid copper wire. The power line surge protectors shall be EDCO Type HSP-121, or equal.

L. Telephone Line Surge Protector/Lightning Arrestor (N/A for Pump Select Control Panel)

The panel shall be provided with a telephone line surge protector as shown. Protector shall be wired to the cabinet ground bar via a dedicated #8 AWG solid copper wire. The arrestor shall be ESP, Model ESP4002, or equal.

M. Panel Ground (N/A for Pump Select Control Panel)

The panel shall be provided with a 1 inch high x 0.25 inch thick solid copper grounding bus bar across the bottom of the panel, as shown on the Drawings. The grounding bar shall be mounted on insulated standoffs so that no electrical connection is made between the grounding bar and the cabinet through the mounting. The ground bar shall be drilled and tapped for a 0.25-20 screws at 0.5 inch intervals along its entire length.

An uninsulated solid copper #8 AWG ground wire shall be attached between the ground bar and the panel enclosure, and between the ground bar and the mounting panel. The ground connection to the enclosure and panel shall be made by sanding the paint finish off a small area, drilling a hole for a 0.25 inch bolt and mounting a 0.25-20 bolt to the panel to serve as a grounding stud. The grounding stud shall be attached with a nut and flat washers on both sides of the enclosure/panel, and with an inside tooth star lock washer next to the panel

surface. The star lock washer shall be on the inside surface of the enclosure, and the front surface of the mounting panel. The grounding wire shall be secured to the stud with a nut and inside tooth star lock washer. These grounding points shall be located within 12 inches of the bottom of the grounding bar.

N. Power Supply (N/A for Pump Select Control Panel)

The panel shall be provided with a 24 VDC switching type power supply connected to the batteries via current steering diodes and battery charging current-limiting resistor as shown on the Contract Drawings.

These power supplies shall operate from 120 VAC input power and shall provide direct current output current of 12 Amperes at 24 VDC at 50 degrees C, and shall be adjustable from 22.5 to 33.5 VDC by screwdriver operated adjustment. Input power regulation shall be 0.2% from 105 to 130 VAC. Output load regulation shall be 0.2% maximum from zero to full load. Ripple shall not exceed 0.5% at full load. The power supplies shall have integral output current limiting and overvoltage protection. The power supplies shall have fully enclosing cases.

O. Batteries (N/A for Pump Select Control Panel)

Batteries shall be gell cell types, 12 volts D.C., 40 Amp-hour. The panel shall have four batteries configured to provide 24 volts.

P. Cooling Fans and Blowers (N/A for Pump Select Control Panel)

The panel shall be provided with cooling fans or blowers and thermostats.

The panel shall be provided with exhaust or blowers rated 120 VAC, 275 cfm at zero static pressure at 3100 rpm, with exhaust grilles and filters. Intake grilles and filters shall be provide separately mounted. Noise level shall not exceed 56 dB.

Q. Wiring Duct

Plastic wiring duct shall be slotted type with dust cover, Panduit Type E or NE, as required.

2.11 CSU/DSU

A. General

The CSU/DSU shall be fully compatible with Pacific Bell's ADN Point-to-Multi Point and ADN Point-to-Point services and shall be the Motorola, or approved equivalent, and meet the requirements listed below.

B. CSU/DSU (Stand Alone)

The Contractor shall provide CSU/DSUs as stipulated below that meet the following requirements. The CSU/DSU shall:

1. Be capable of both synchronous and asynchronous transmission (user selectable).
2. Be capable of synchronous DTE data rates of 1.2, 2.4, 4.8, 9.6, 19.2 and 56 Kbps.
3. Be capable of asynchronous DTE data rates: 1.2, 2.4, 4.8, 9.6 and 19.2 Kbps.
4. Be capable of data rate matching from a DTE data rate of 9.6 or 19.2 Kbps to the circuit data rate of 56 Kbps.
5. Be capable of performing loopback testing on the CSU and DSU.
6. Provide an RJ-48S, 4-wire, full-duplex line interface.
7. Provide an RS-232 DTE interface.
8. Operate from a 24 VDC, negative ground power source.

C. One CSU/DSU at Lake Merced and one in Bay Bridge Pump Station RTU. See 2.15 for further required CSU/DSUs.

2.12 COMMUNICATIONS CABLES

A. Power Cables

Refer to Section 13400 2.10-B-1.

B. RS-232 Interface Cables

The Contractor shall provide an RS-232 cable for interfacing the CSU/DSU to the RTU. The cables shall:

1. Be Black Box Type EDQ cable, or approved equivalent.
2. Be capable of being run at lengths up to 300 feet at data rates of 56 and 19.2 Kbps.
3. Have an 85% tinned copper braid shield.
4. Have a 100% aluminum foil shield.
5. 24 AWG conductor gauge.
6. Be custom cut to length and connectorized so that no extra length must be taken up in the racks and panels other than what is necessary for strain relief and normal slack.

C. Phone Patch Cables

The Contractor shall provide phone patch cables and connectors for connecting the CSU/DSU to the Pacific Bell ADN circuit. The patch cables shall:

1. Be compatible with the RJ-48SCADA Server receptacles provided on the CSU/DSU and Pacific Bell's ADN circuit.
2. Be shielded.

D. Telephone Cable

The telephone cable from the Pacific Bell service point to the demarcation point shall be supplied and installed by Pacific Bell, and shall meet the latest Pacific Bell standards for ADN services.

E. RJ-48S Telephone Receptacles

The RJ-48S telephone receptacles shall be supplied and installed by Pacific Bell for each ADN circuit and shall meet the latest Pacific Bell standards for ADN services.

2.13 MISCELLANEOUS

A. Telephone Backboard

The Contractor shall provide a telephone backboard as shown on plans. The backboard shall be a 4'x4' piece of _" plywood mounted on the wall, for the termination of the ADN circuit. The telephone backboard shall be the location of Pacific Bell's demarcation point.

2.14 LAKE MERCED SCADA SYSTEM MODIFICATIONS

A. Contractor shall furnish and install CSU/DSU at Lake Merced and any additional hardware necessary to get the new Bay Bridge Pump Station monitoring and control information into the existing Intellution FIX system. Contractor shall modify and/or program existing communication interface equipment at Lake Merced. **Pre-bid inspection can be arranged through the Electrical Engineer at (415) 558-4581 to survey existing equipment at Lake Merced Pump Station.**

B. Contractor shall modify the existing Intellution FIX system to input and output the information from and to the Bay Bridge Pump Station as outlined above, including inputting all listed I/O for the station.

C. Contractor shall develop and implement screen layouts similar to those existing to make the Bay Bridge Pump Station information available to the operators. Final screen design shall be subject to CDD approval.
D. Contractor shall furnish documentation of all work, both paper copy and disk copy; including "as built" block diagrams, programming I/O list with point tags and addresses.

2.15 YERBA BUENA ISLAND (YBI) WORK SEE E-14.

A. Furnish and install RTU/PLC at Building 225. RTU/PLC shall be as specified above and shown on plan I-11, modified in size due to much smaller I/O requirements.
B. Furnish and install CSU/DSU at Bay Bridge Pump Station to bring in YBI information. Connect to Bay Bridge Pump Station RTU.
C. Required I/O:

3 million tank level
3 million tank high level
3 million tank low level
1 million tank level
1 million tank high level
1 million tank low level
YBI flow

D. Modify program in existing Modicon Micro PLC to output state of YBI flow, 3 million tank high level and low level.
E. Furnish and install remote diaphragm seal pressure sensors and transmitters: one at 3 million tank and one at 1 million tank. Calibrate for level sensing. Furnish and install high and low level switches and cable assemblies at 3 million tank and 1 million tank. At 3 million tank furnish and install conduit and wiring to Nema 3R junction box, then furnish and install conduit & wiring to bring signals into Bldg 225. Furnish and install conduit and wiring to connect to new RTU. At 1 million tank furnish and install Nema 3R junction box on tank surface, surface mounted conduit & wiring down side of tank, pullbox, underground conduit & wiring into Bldg 243, conduit & wiring into existing junction box. Splice to existing wired to bring signals to Bldg. 225. At Bldg. 225 pick up signals from existing spares and route via conduit and wire to new RTU.

2.16 INSTRUMENTS

A. Gauge Pressure Transmitter: Range as shown on drawings Rosemount 3051C Series or Honeywell 100 Series or equal.

1. Remote pressure diaphragm seals shall be by same manufacturer as pressure transmitter.

B. Pressure Gauge: Suction: 0- 100 PSI, Discharge: 0- 300 PSI by Omega or Davis or equal.
C. Pressure Recorder: Honeywell Truline DR 4500, Eurotherm Chessell #392 or equal.
D. Loop Isolator: by Action, or Moore, or equal.
E. Cable suspended tilt-type liquid level switch: Scientific Technology Incorporated FG series, or Flygt or equal.

PART 3 EXECUTION

3.1 TEST REQUIREMENTS

All work shall undergo comprehensive testing to demonstrate that it performs individually and as an integrated system to meet all requirements.

All equipment and functions shall be tested, even if a specific test is not defined in this Section.

The Contractor shall furnish qualified technical personnel to perform all testing and verification. The personnel shall be familiar with the equipment, software, and systems before being assigned to the test program.

The Contractor's test personnel shall be responsible for performing tests at the factory, performing system installation and integration at the City's facilities, performing the Site Demonstration Test, and providing support during the Operational Reliability Test.

The City retains the right to observe all test activities including any and all subsystem preparation, pretests, burn-ins, troubleshooting, retests, warm-up, and software modification and/or update. The project schedule and monthly progress reports shall include information about these type of test activities.

A. RTU Factory Demonstration Test

The RTU Factory Demonstration Test shall be performed to verify that the equipment is manufactured and assembled correctly, is operating as designed, and is in compliance with the contractual requirements for the deliverables.

The Equipment Factory Demonstration Test shall include individual end-item verification and integrated tests of all hardware. These tests shall include:

1. Verification of the correct inventory of hardware, including cables, printed circuit boards, and spare parts.
2. Demonstration of all hardware and software diagnostic and maintenance capabilities.
3. Demonstration that all system size and expansion requirements have been met.
4. Demonstration that all equipment requirements are met.

B. SWC Certification

SWC certification shall be provided on all field-wiring terminals of the RTU. Certification documents shall be provided to the City.

C. Burn-In Test

The Contractor shall provide certification that the RTUs meet the ambient temperature requirements and have been tested to screen for infantile failures. If this certification is not provided by the RTU manufacturer, the Contractor shall conduct the following test.

The RTU shall be placed in a room having an ambient temperature of 60 degrees C with the RTUs connected to a data channel and to equipment simulating actual field equipment to be monitored or controlled. They shall remain energized at this temperature for a minimum period of 48 hours. During this 48-hour test period, the RTU shall have its various modes of operation exercised periodically. Any equipment failures shall be corrected and shall cause the test to be rerun in its entirety.

D. RTU Functional Test

The RTU shall successfully pass the following functional test to be performed under ambient temperature in conjunction with the master station and/or a test set simulating the master station:

1. A close and open operation on each control point from the System or the simulated master, showing proper sequence of operation.
2. Verify the proper operation on relays.
3. A test showing that the proper indications are given at the master or the simulated master when one or more status input points change momentarily.
4. A simulation test of a status change followed by an intermittent failure of the communication channel, showing proper indication of the status change by the System upon recovery of the communication failure.
5. Telemeter readings of selected analog points to verify that the readings are within the specified accuracy when the inputs are at 25, 50, and 100 percent of full-scale.
6. A test showing that as a result of a scan request from the master, all requested analog, indication, and alarm points are transmitted from the RTU.
7. A test to verify the proper operation of the battery backup. External power will be removed from RTU during the simulation tests and left off until the battery low voltage signal is generated.

This test will demonstrate (1) no RTU or communication disruption when power is removed, (2) operation of the commercial power failure relay, (3) battery backup for at least four hours, and (4) proper operation of the battery low voltage relay.

F. RTU Field Tests

Each RTU shall be tested after its installation as follows:

1. Verify that all wiring connected to the RTU has been completed.
2. Verify that there is no visible or suspected damage to the RTU, including the enclosure.
3. Verify that the RTU processor and I/O properly form a completed unpowered state (including loss of backup power).
4. Verify that all equipment in the RTU enclosure powers up and appears ready for operation.
5. Verify that the battery backup system operates properly.
6. Performs the End-to-End test specified above.

G. Panel Shop Testing

The Contractor shall shop test the panels and correct any defects discovered prior to delivery. These tests shall consist of the following:

1. The Contractor shall verify that each wiring connection is made properly by checking electrical continuity, assuring that connections have less than one Ohm resistance end to end, and that no cross continuity exists between separate circuits.
2. The Contractor shall conduct a test of all power circuits and power supply equipment to verify that proper voltages are delivered and all power supply equipment is operating according to the manufacturer's specifications. These tests shall be witnessed by the City's representative. The Contractor shall certify the results in writing to the City.
3. The Contractor shall functionally test each provide electrical device to verify correct operation. The Contractor shall also test each input/output point. Inputs shall be exercised at the location in the panel the greatest distance in the circuit from the RTU chassis and verified through to the RTU processor. Results shall be demonstrated on a programming terminal.

Each output shall be exercised from a programming terminal and verified through to the panel location the greatest distance in the circuit from the RTU chassis.

At a minimum, analog inputs and outputs shall be tested at 0%, 25%, 50%, 75%, and 100% of range. This test shall be witnessed by the City's representative and the Contractor shall certify the results in writing to the City. The Contractor shall test the operator interface unit, including simulated alarm conditions.

4. The Contractor shall test Ground Fault Interrupter (GFI) receptacles and circuit breakers for proper operation by methods sanctioned by the receptacle manufacturer.

3.2 EQUIPMENT FABRICATION AND ASSEMBLY

A. Panel Fabrication

1. Materials

The panel shall use painted steel. Each shall be provided with full-height rear and side interior panels mounted to rails located at the top, bottom, and middle of the enclosure. All enclosures shall be Hoffman Engineering Company, Rittal, or equal.

2. Dimensions

Indoor cabinets less than 60 inches high and weighting more than 100 pounds shall be provided with floor stands to raise the top of the panel to 60 inches above the floor or work platform or, if panel weights less than 100 pounds and wall space is available, wall mounting may be used in lieu of a floor stand.

The enclosure and interior panel shall be constructed using the following minimum stretcher-leveled sheet steel sizes:

Minimum Enclosure

Enclosure Height	Steel Thickness	Panel Thickness
6"-57"	14	12

Heavier sheet metal shall be used if required to meet seismic requirements, required to meet design standards in this section, or needed due to Contractor's selection of equipment.

No single door shall exceed 36 inches in width.

Class "B" (Medium) Panel (Not Installed in Vault) shall be

wall-mounted or freestanding, NEMA 12, single door, 36 inches wide by 48 inches high by 24 inches deep enclosures, equipped with padlocking three-point door latches and handles. The panel shall be suitable for outdoor use. The panel shall be sized to accommodate ultimate point counts of 36 Discrete Inputs, 24 Analog Inputs, 24 Digital Outputs, and 4 Analog Outputs.

3. Coating

Metal surfaces of panels and cabinets shall be prepared, primed, and finish coated in accordance with the requirements of this Specification and the coating manufacturer's recommendations. Scratches or blemishes in panel faces shall be filled prior to finishing. One coat of primer shall be applied at the manufacturer's recommended dry film thickness and allowed to dry prior to applying the first finish coat.

Finish coat shall be a polyurethane or epoxy enamel with a minimum dry film thickness of 3 mils. Cabinet interiors shall be Fed. Std. Color 27880, white. Exterior color of cabinets mounted indoors shall be Fed. Std. 26306, gray.

4. Face-Mounted Instrument Reinforcement

Face-mounted devices shall be mounted to panel doors using mounting methods recommended by the component manufacturer with mounting kit parts provided by the component manufacturer specifically for the component. If such a mounting method causes the door to deform or allows the component to sag so as not to be perpendicular to the door surface, then the Contractor shall design and install appropriate reinforcement to prevent these conditions.

5. Miscellaneous

Face-mounted equipment shall be flush or semi-flush, with flat black escutcheons. Cutouts for future equipment and holes resulted from removal of existing devices shall be blanked off with suitable covers as required to retain the cabinet's NEMA rating. Component identification as shown on Contract Drawings shall be hot ink stamped on the panel interior.

Panel size and layout shown on Contract Drawings are general in nature and are not intended to represent all configurations.

All miscellaneous hardware and fittings shall be 316 stainless steel.

Panels less than 72 inches high installed freestanding shall be provided with steel floorstands.

Panel shall be shimmed to precise alignment so doors operate without binding.

Wiring shall be supported independently of terminations by lacing to panel support structure or by slotted flame retardant plastic wiring channels. Wiring channel fill shall not exceed 40 percent of cross section area.

3.3 COORDINATION WITH PACIFIC BELL

A. The Contractor shall coordinate the following work to be completed by Pacific Bell. Pacific Bell shall:

1. Pull the phone cable, specified in Subsection 13400-2.11-D, and a 3/8" polypropylene rope (for pulling additional cable in the future) through the conduit, from the Pacific Bell service point to the telephone backboard. The cable run shall be continuous throughout the entire run.
2. Install the ADN circuit, terminated into the RJ-48S telephone receptacle specified in Subsection 13400-2.11-E, on the telephone backboard.
3. Activate the ADN circuit(s).

3.4 INSTALLATION OF THE CSU/DSUs AT THE RTU SITES

A. Surge Protectors

The Contractor shall install an ADN surge Protector for each CSU/DSU to protect the equipment from electrical transients traveling down the telephone circuits. The line surge protectors shall be designed for digital leased telephone lines operating at 56 Kbps. Series resistance shall be 4.7 Ohms. Clamping voltage shall be 55 volts. Capacitance shall be less than 25 pF. Response time shall be less than one nanosecond. Power handling shall be 10,000 amperes. Insertion loss shall be 0.3 dB at 2 Mbps. Two RJ-45 jacks shall be provided for the data lines. Pins 1,2, 7 and 8 shall be protected. A #12 AWG grounding wire with ring terminal shall be provided.

B. The Contractor shall install the CSU/DSU, specified in Subsection 2.11, at the RTU and at Lake Merced Control Room. The Contractor shall:

1. Perform any configuration required for the CSU/DSU to allow the unit to function with Pacific Bell's ADN Point-to-Multi-Point services. This may include, but not limited to, programming, setting jumpers or configuring dip switches to set the DTE data rate (19.2 Kbps), the data rate of the ADN circuit (56 Kbps) and to choose between asynchronous or synchronous communications, whichever is required for the ADN Multi-Point services.
2. Install the CSU/DSU in the RTU enclosures as specified.
3. Interface the CSU/DSU to the surge Protector and ADN Multi-Point circuit using the cable specified.
4. Interface the CSU/DSU to the RTU using the RS-232 cable specified.
5. Install the CSU/DSUs at the end-node and pass-through node in the RTU enclosures as specified in Section 7410.
6. Interface the CSU/DSUs to the surge protector and ADN Multi-Point circuit with recommended cable.
7. Interface the CSU/DSUs to the RTUs using the RS-232 cable specified in Subsection 13400-2.12-B.

3.5 INSTRUMENTATION INSTALLATION

A. Manufacturer's installation instructions and this paragraph shall be strictly adhered to in the erection of all instrumentation and equipment. Where conflicts arise between the requirements of this paragraph and the manufacturer's installation instructions, the Engineer shall be consulted for resolution. Where erection procedures are not specified, API RP550 shall be used as a guide.

B. Instruments and equipment shall be installed as specified on the Drawings such that ports and adjustments are accessible for in-place testing, calibration, and maintenance. Where possible, equipment shall be located between 48 inches and 60 inches above the floor. Instrumentation equipment shall be mounted for unobstructed access, but mounting shall not obstruct walkways. Where appropriate, Contractor shall use quick disconnect pressure taps for calibration with appropriate isolation valves. Instruments shall be located as close as possible to their associated equipment. Instruments shall not be mounted where shock or vibration will impair their operation.

C. Galvanized steel used for support of instrumentation systems shall be hot-dip galvanized after fabrication. Support systems, including panels, shall be designed to prevent deformation greater than 1/8 inch under the attached instrument load plus an external load of 200 pounds in any direction.

D. All field instruments shall be labeled with one-half inch wide stainless steel tape embossed with the instrument tag number and attached to the instrument with 18 gauge stainless steel wire. All control panels, enclosures, devices and equipment shall be labeled with a nameplate. As a minimum, nameplates shall include item name and equipment number.

E. Process connections shall be made in compliance with this paragraph, and as shown on the Drawings. Process connections shall be arranged where possible such that instruments may be readily removed for maintenance without disruption of process units or draining of large tanks or vessels. Unions or flange connections shall be provided as necessary to permit removal without rotating instrumentation equipment.
F. Electrical power and control wiring and equipment shall be in compliance with this section and Division 16. Unless otherwise specified or shown on the Drawings, power for instrumentation equipment shall be obtained from a 120-volt, 60 Hertz power distribution panel. This power may carry substantial amounts of electrical noise. The Contractor shall provide power line conditioning equipment necessary to satisfy the requirements of the instrumentation and control system.
G. Electric signal connections to equipment shall be make on terminal blocks, unless the product specified in the Contract Documents is only available with suitable locking plug and receptacles cable assemblies, in which case cable assemblies may be used. When flexible cable assemblies are provided with the instrument, the cable assemblies may be used without watertight flexible conduit provided the installation is not subject to mechanical damage and the length of exposed cable assemblies does not exceed 3 feet.

SECTION 14120 BRIDGE CRANE

PART 1 GENERAL

1.1 SECTION INCLUDES

The Contractor shall furnish and install:

A. One (1) 2 ton capacity underhung single girder bridge crane, runway hangers and beams, trolley and hoist.
B. Related structural supports including bracings, crane stops and crane rail end brackets.
C. All components, materials, installation labor, electrical power and control wiring components, functional and operational testing as required to provide a complete and functional bridge crane system as shown in the Drawings.

1.2 SUBMITTALS

A. Submittals shall be made in accordance with the provisions stated in the Section 12-1.06 of the main contract specifications.
B. Submittals shall include structural member and support design details and calculations performed and signed by a Registered Professional Engineer, currently registered in the State Of California.
C. Shop Drawings of all supports including any structural elements required for the bridge crane system.
D. Cal-OSHA Load Test and Certification documents

1.3 RELATED SECTIONS

Section 15000 - Mechanical General Requirements
Division 16 - Electrical

1.4 QUALITY ASSURANCE

A. Like items of equipment specified herein shall be the end product of one manufacturer in order to achieve standardization of appearance, operation, maintenance, spare parts and manufacturer's services.
B. Units furnished shall be accompanied by written documentation of factory testing.

1.5 REFERENCE STANDARDS

A. The under-hung single girder bridge crane shall conform to the latest edition of the ANSI/ASME B30.17 Overhead And Gantry Crane.
B. All electrical components shall be furnished in accordance with the applicable requirements of the National Electrical Code (NEC) State and Local Electrical Codes and Standards of the National Electrical Manufacturer's Association (NEMA).

PART 2 PRODUCTS

2.1 DESIGN REQUIREMENTS

A. General

1. All bridge crane equipment shall be designed to occupy the space provided, as shown on the Drawings.
2. Design stresses and safety factors shall be in accordance with reference standards.
3. All building clearances shall be as designed in reference standards.
4. Runway rails shall conform to the cross sections and weights per yard specified in ASCE Standards. Specific service ratings shall be as shown on the Drawings or as recommended by the crane manufacturer. Rails, rail clamps and bolts, crane stops and conductors shall be provided by the crane manufacturer.
5. All equipment furnished under this Section shall be constructed with due regard for safety of operation and shall conform to ANSI B 30.2.0 and B 30.11 safety code and all applicable CAL/OSHA regulations.
6. Rated load of the system shall be marked on the hoist and be clearly legible from the loading position.

B. Bridge Specifications:

1. The crane girders shall be fabricated from structural shapes and shall be designed and proportioned to resist all vertical, lateral, and torsional forces.
2. The bridge end trucks shall be designed in accordance with reference standards. End trucks shall be provided with rail sweeps and impact absorbing bumpers or other automatic means providing equivalent stopping effect, all in compliance with applicable OSHA regulations.
3. Runway stops shall be attached to resist the force applied when contacted and shall be located at the limits of travel of the bridge. Runway stops shall not engage the wheels.
4. Wheels shall be rolled or forged steel with treads and flanges heat treated, or cast iron wheels with chilled tread. Wheels shall have a minimum tread hardness of 425 Brinell. All clearances, wheel loads, and manufacturing tolerances shall be in accordance with reference standards. Wheel axles shall be made of alloy steel, accurately machined and ground to receive inner bearing races. When rotating axles are used, wheels shall be mounted on axles with a press fit and keys, or with keys alone.
5. Bridge driving system will be of dual drive configuration. Each end truck will be equipped with a helical gear motor reducer and drive motor connected to one set of end truck wheels.
6. All gears shall be of the helical, spur, or herringbone type, made from rolled or cast steel, with machine cut teeth having a 20-degree pressure angle. All horsepower ratings shall be in accordance with American Gear Manufacturer's Association Standards.
7. Bearings shall be combination radial and thrust type, double-row, angular contact ball bearings, or single-row tapered roller bearings, either pre-lubricated and sealed, or fitted for pressure lubrication. All pressure lubrication fittings shall be located in accessible locations for ease of maintenance.
8. Bridge brakes shall be supplied for the motion concerned and shall have rated torque capacities as described in reference standards.

C. Trolley SPECIFICATIONS

1. The trolleys shall be electric motor driven.
2. The trolley frames shall be of welded steel construction. The frames shall be of rigid construction so that the load is transmitted to the running surface without undue deflection. Provisions shall be made to prevent a drop of more than one inch in case of axle failure.
3. Electric motor drives shall drive the trolley wheels either directly through a gear and pinion or spur gear arrangement between the drive shaft and trolley wheels, or through an additional gear reduction between the motor and trolley drive shaft.
4. Wheels shall be rolled or forged steel with treads and flanges heat treated, or cast iron wheels with chilled tread. Wheels shall have a minimum tread hardness of 425 Brinell. All clearances, wheel loads, and manufacturing tolerances shall be in accordance with reference standards.
5. Wheel axles shall be made of alloy steel, accurately machined and ground to receive inner bearing races. When rotating axles are used, wheels shall be mounted on axles with a press fit and keys, or with keys alone.

6. All gears shall be of the helical, spur, or herringbone type, made from rolled or cast steel, with machine cut teeth having a 20-degree pressure angle. All horsepower ratings shall be in accordance with AGMA Standards.
7. Bearings shall be combination radial and thrust type, double-row, angular contact ball bearings, or single-row tapered roller bearings, either pre-lubricated and sealed, or fitted for pressure lubrication. All pressure lubrication fittings shall be located in accessible locations for ease of maintenance.
8. Trolley brakes shall be supplied for the motion concerned and shall have rated torque capacities as specified in reference standards.

D. HOIST SPECIFICATIONS

1. Hoist shall be electric wire rope, as specified in the Performance Requirements of this Section.
2. The hoisting machinery shall consist of a rope drum, driven through suitable gear reductions by an electric motor operator, load blocks, hooks, hoisting rope, sheaves, and hoist braking. The diameter of the drum shall be not less than 24 times the diameter of the hoisting cable and shall be grooved to receive the full lift of the hoisting cable without overlapping. The drum shall be of sufficient size and length so at least two turns of the hoisting cable remain on the drum with the hook in its low position.
3. The rope drum and its surrounding members shall be constructed so as to minimize abrasion, crushing or jamming of the hoist rope. The load blocks shall be of the enclosed type and shall guard against jamming. Hoisting rope shall be extra flexible, improved plow steel wire rope made especially for hoist service.
4. Hooks shall have sufficient ductility to open noticeably before hook failure as a result of abuse or overload. The load hook shall be equipped with safety latch and shall be free to rotate 360 degrees with rated load, and shall be positively held in place with locknuts, collars, or other suitable devices.
5. The hoist shall be provided with two brakes, each brake capable of independently holding the hoist's rated load capacity. One brake shall be a FAIL-SAFE electric brake, connected to the motor shaft or on a shaft in the hoist gear train. The second brake shall be a mechanical load brake operating in the gear case. Both brakes shall operate when power to the motor is de-energized or if there is a power failure.

E. ELECTRICAL EQUIPMENT

1. The crane manufacturer shall furnish and assemble all electrical equipment on the crane including motors, motor starters, pendant control, and conduit. Bridge conductors may be removed for shipment. All wire on the crane shall be furnished by the crane manufacturer, cut to length and installed for shipment.
2. The electrical equipment shall be furnished in accordance with the applicable requirements of Article 610 of the latest issue of the National Electrical Code, and the installation and wiring shall be made in accordance with Division 16, ELECTRICAL.
3. Motors shall be squirrel-cage type and shall be built in accordance with NEMA standards, rated on not less than a 30-minute basis, with temperature rise in accordance with the latest NEMA Standards for the class F insulation and enclosure used, and shall be provided with anti-friction bearings. Squirrel-cage motors shall be NEMA Design D, with high starting torque, low starting current and high slip at full load. The motor shall be inherently protected from an overload through thermal contacts embedded 120 degrees apart in the motor windings. These contacts shall be temperature sensitive and shall de-energize the motor in the event of excessive temperature rise.
4. Cable reel conductors with flexible conductor cable housed in a circular wheel shall be used unless the manufacturer has an enclosed bus bar U.L. listed for Class I, Division 1 locations.
5. Festooned tag line conductor shall consist of a flexible conductor cable, supported by wire rope or monorail system that will dispense and retrieve the flexible conductor cable during trolley travel without twisting or tangling.
6. Grounding of the equipment and provisions for grounding the equipment to external grounding systems shall be in accordance with the requirements of the NEC and State and Local regulations.
7. Motor controllers shall be full-voltage reversing type magnetic starter housed in a NEMA Type 7 enclosure. Each controller shall be provided with at least one over-current device in accordance with NEC Article 610 and an ambient compensated overload relay for each leg of the individual motors. Minimum starter size for motors 1 HP and above shall be NEMA Size 1 and Size 0 for motors less than 1 HP.
8. The electric crane shall be equipped with a hermetically sealed push-button control station enclosed in a NEMA 9X (fiberglass) enclosure and suspended from the trolley or hoist. The push-button enclosure shall

be supported with chain or wire rope. The control wire cable shall be attached to the push-button enclosure support at no more than 6 foot intervals. The control station shall contain push-buttons for control of the hoist and trolley and an ON/OFF switch to operate a main line contactor which shall remove power from the push-buttons. Provide control transformers in the controller housing to supply 120 VAC to the push-button control station.

9. Acceleration control at each hoist and trolley combination shall be provided with a device to provide soft starting characteristics with any load and gentle acceleration throughout cycle.

2.2 PERFORMANCE REQUIREMENTS

A. General:

1. Runway

Equipment Capacity - 2 tons
Equipment Location - Pump Room
Design requirement - Seismic Zone 4
Overall runway length - Approximately 44 feet
Mount Design - Ceiling mounted
Main Power Supply - 460 Volts AC, insulated 3 phase conductor bar electrification, 60 Hz

2. Bridge Crane:

Type - Single girder, under-hung
Rated Capacity - 2 ton
Speed - Single speed, 50 fpm
Design requirement - Seismic Zone 4
Overall Bridge Span: - 26 feet 6 inches
Track Festoon System - Standard duty “C”
Power Supply - 230/460-3-60 VAC

3. Electric Hoist:

Type - Motor-driven trolley suspension
Rated Capacity - 2 ton
Speed - Single speed hoist, 10 fpm
Single speed trolley, 35 fpm Hoist lift – 15' of 2 part chain with standard chain container
Power Supply - 230/460-3-60 VAC

4. Special Conditions:

Bridge crane hook travel must cover area as shown on drawings.

5. Accessories:

All required OSHA operating and safety devices.

6. Crane Manufacturers:

a. Bay Area Crane & Hoist (BACH) Service Group, Inc.
b. WPH Crane Services
c. Or equal

PART 3 EXECUTION

3.1 INSTALLATION

A. Bridge Crane system erection, including hoist and/or crane assembly, field wiring, installation, and starting shall be in accordance with the manufacturer's printed instructions. The Contractor shall secure the services of the crane system manufacturer's Field Engineer to advise on field assembly and installation as necessary.
B. The equipment shall be provided with all necessary lubrication fittings and lubrication. Before initial startup at final installation, all bearings, gears, etc., shall be lubricated in accordance with manufacturer's recommendations.

3.2 FACTORY TESTING

The bridge crane system shall be assembled, wired completely, and given no-load running tests at the manufacturer's plant before shipment. Running tests shall be performed with the control that will operate the hoist or trolley in service.

3.3 MANUFACTURER'S CERTIFICATE

An authorized manufacturer's representative shall inspect the installation of all equipment furnished under this Section and shall provide a certificate of satisfactory installation in accordance with the provisions of Section 12-1.19.

3.4 SPARE PARTS

The Contractor shall provide a complete list of Manufacturer's recommended spare parts for all equipment furnished under this Section. The list shall include part numbers, part description and current pricing.

3.5 FIELD TESTING AND OPERATIONAL TRAINING

A. The Manufacturer's representative shall provide six (6) copies of complete written testing procedures and shall instruct City personnel on-site in the execution of these procedures.
B. A manufacturer's representative for the bridge crane system specified in this Section shall be present at the jobsite for the total minimum number of two man-days to perform the following services:

1. Installation assistance, inspection and certification of the installation.
2. Pre-startup jobsite training.
3. Performance testing.

C. The Contractor shall conduct field tests with the equipment in its installed position. Systems shall be tested at no load and at 125 percent rated load. Test shall be in compliance with CAL/OSHA requirements and shall demonstrate to the Engineer that the equipment will perform satisfactorily throughout the complete range of operation. During tests, the Contractor shall make complete final adjustments and alignment and replace or revise equipment found deficient. The Contractor shall provide all weights and slings required for testing and remove same after approval of tests.

3.6 PAINTING

The monorail equipment shall be painted in strict accordance with Section 15191 of these Special Provisions.

3.7 WARRANTY

The Contractor shall furnish a two (2) year Warranty for all work covered by this Section per the requirements of Section 12-1.03.

SECTION 15000 MECHANICAL GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

A. The requirements of this Section shall apply to all work of Divisions 11, 14 and 15.

B. The Contractor shall provide all labor, materials, supervision and incidentals and perform all operations necessary for the installation of complete and operable mechanical systems as required under the Contract Documents.
C. The Contractor shall provide all piping and ventilating equipment, materials, and accessories, painting, hangers and supports and other related mechanical work required under the Contract Documents.
D. The Contractor shall be responsible to determine all items and quantities required. The Contractor shall provide complete, automatic, continuous, safe, operational and functioning systems, fully tested and coordinated with the work of other sections.
E. The Contractor shall repair all damage done to premises as a result of this installation and remove all debris left by those engaged in this installation.
F. The Contractor shall provide all rigging transportation and hoisting necessary for the placement of all mechanical equipment in the final location shown on the Drawings.
G. The Contractor shall provide all necessary disassembly and re-assembly of equipment furnished under Divisions 11 and 15 should this be required in order to move equipment into final locations shown on the Drawings.
H. The Contractor shall cooperate with other trades, State and City operations personnel and other Contractors working at the site in putting all mechanical installations in place when space required is accessible.
I. The Contractor shall provide temporary scaffolding necessary for performance of the work in Divisions 11 and 15.
J. The Contractor shall provide all cutting and patching for the work of Divisions 11 and 15 including pipe sleeves for all holes in walls, roofs, floors and ceilings.
K. The Contractor shall provide waterproofing as necessary for the installation work of Divisions 11 and 15.
L. The Contractor shall provide painting and coating systems for all equipment furnished under Divisions 11 and 15.
M. The Contractor shall provide and install curbs and pads at locations shown on the Drawings.

1.2 RELATED SECTIONS

A. Section 05500 - Fabricated Metalwork and Miscellaneous Items.
B. Section 03300 - Concrete.

1.3 REFERENCES

A. When equipment is specified by manufacturer's name and catalog designations, published data in effect on the date of Bid Opening shall be considered a part of this Specification.
B. Provide work in accordance with applicable Standards, codes and recommendations including, but not limited to the following partial list of agencies:

1. American Society Of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).
2. Air Movement And Control Association (AMCA).
3. AISC - American Institute of Steel Construction.
4. ICBO - International Conference of Building Officials.
5. American Society Of Mechanical Engineers (ASME).
6. AWS - American Welding Society.
7. Occupational Safety And Health Administration (OSHA).
8. National Fire Protection Association (NFPA).
9. Underwriter's Laboratories (UL).
10. National Electric Code (NEC).
11. National Electric Manufacturer's Association (NEMA).
12. City and County of San Francisco Plumbing Code.
13. City and County of San Francisco Building Code.
14. City and County of San Francisco Electrical Code.
15. City and County of San Francisco Mechanical Code.
16. Regulations Of The California State Fire Marshall.
17. FM - Factory Mutual.
18. American Society for Testing and Materials (ASTM).

C. Nothing in the Contract Documents shall be construed to permit work not conforming to the applicable laws, ordinances, rules and regulations.
D. When requirements of the Contract Documents exceed requirements of applicable laws, ordinances, rules, or regulations, the requirements of the Contract Documents shall take precedence.
E. It is not the intent of the Contract Documents to repeat requirements of codes except where necessary for completeness or clarity.

1.4 QUALITY ASSURANCE

A. Inspection, Start-up and Field Adjustment: The work may be reviewed at any time by the Engineer. The Contractor shall provide 24 hour minimum notice to the Engineer that the work is ready for review under the following conditions:

1. Change of Contract Work, including but not limited to equipment and piping runs, orientations and detailed installations other than that previously approved by the Engineer.
2. Work not shown in the Contract Drawings or submittals but are required for the completion of the Contract.
3. When requirements of the Contract call for review by the Engineer.
4. Equipment testing and start-up.
5. Prior to concealment of work in floors, walls, roofs and above ceilings.

B. Piping Installation Requirements

1. Welder's Qualifications: All welders shall be qualified in accordance with ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Qualifications.
2. Submit written certification held by welders performing the work of Divisions 11 and 15.
3. Welding procedures and testing shall comply with ANSI Standard B31.1.0 - Standard Code For Pressure Piping, Power Piping and the American Welding Society, Welding Handbook.
4. Soldering and Brazing procedures shall conform to ANSI B9.1 Standard Safety Code For Mechanical Refrigeration.
5. Provide U.L. fire rated sleeve/couplings for each pipe penetration or fixture penetration passing through walls, partitions, shafts and ceilings. All pipe penetrations shall comply with ASTM E-814/U.L.-1479 Standards.

1.5 MANUFACTURER'S INSTRUCTIONS

A. The Contractor shall obtain and pay strict attention to equipment manufacturer's instructions in all cases. Where such instructions are in conflict with the Drawings and Specifications, the Contractor shall consult with the Engineer for a final decision before installing the work.

1.6 SUBSTITUTIONS

A. Do not offer substitutions unless a thorough check of the field condition is made. In the event that a substitution is permitted, the Contractor shall furnish Drawings of revised arrangements caused by Substitutions at no cost to the State and City.
B. If the approved substitution affects system design or the required size or capacity of other equipment, piping, or electrical work, the Contractor shall make necessary changes as required by the Engineer. All engineering and materials attributed to the approved substitution shall be provided at no cost to the State and City.

1.7 SUBMITTALS

A. The Contractor shall submit large scale detail layout drawings for the installation work of Divisions 11 and 15 as specified under Article 1.9.

1.8 PRODUCT DELIVERY, STORAGE AND HANDLING

A. The Contractor shall identify materials and equipment delivered to site to permit check against Submittals list and shop drawings.
B. The Contractor shall protect products and materials from loss or damage. Replace lost or damaged materials and equipment with new materials at no cost to the State and City.
C. The Contractor shall be responsible for damage to all of the work and premises prior to acceptance by the State and City. Should any new equipment become damaged, the Contractor shall restore it to its original condition and finish before final acceptance. Damage to State and City property and to the work of other Divisions, caused by the work of this Division shall be replaced or repaired by, and at the expense of, the Contractor to the satisfaction of the Engineer. All exposed materials shall be clean at the time of acceptance of the installation for Substantial Completion.
D. Lubrication Of Mechanical Equipment

1. Prior to system testing and acceptance by the State and City, all mechanical equipment and equipment components requiring lubrication, greasing or periodic changing of oil, shall be given complete final lubrication, greasing or a fresh change of oil. The type of lubricant shall be in strict accordance with the manufacturer's instructions.
2. The Contractor shall be responsible to insure that the above has been accomplished and he/she shall not permit rotating or other mechanical equipment to be started until the Engineer has verified that the work described in Sub-Paragraph 1 above has been accomplished.
3. The Contractor shall furnish complete data regarding lubricants, grease and oils required and shall be furnished as a part of mechanical equipment Submittals, as follows:

   a. For Liquid Lubricants, specify:

      1) Viscosity grade in ISO units.

      2) Viscosity in SUS units at 100 degrees F and/or 210 degrees F.

      3) AGMA classification for gear oils.

4. SAE classification where applicable.

   a. For Grease Lubricants, specify:

      1) NGLI number.
      2) Thickener type and percent.
      3) Dropping point.
      4) Base oil viscosity range, in SUS units at 100 degrees F.

1.9 COORDINATION OF THE WORK

A. The Contractor shall be responsible to work out all "tight" conditions, (i.e., where close physical tolerances may present difficulty during installation,) involving work of this Division and work of other Divisions in advance of installation. If necessary, and before work proceeds in these areas, the Contractor shall prepare supplementary Drawings and additional work necessary to overcome these "tight" conditions at no additional cost to the State and City.
B. The Contractor shall coordinate electrical interlocks of mechanical equipment with the work of Division 16 - Electrical.
C. The Contractor shall provide templates, information, and instructions for the work of other Divisions to properly locate holes and openings to be cut out or provided for mechanical work.
D. The Contractor shall prepare large scale detailed layout Drawings showing locations of equipment, piping, control panels and all other elements of mechanical systems required to be provided as part of the work of

Divisions 11 and 15. Include sections of all congested areas to shown relative positions and spacing of affected elements. Symbols and designations used on Record Drawings shall match those used in Contract Documents.

1.10 MECHANICAL SYSTEM ACCEPTANCE

A. Prior to the granting of Substantial Completion by the State and City:

1. The Contractor shall demonstrate complete, uninterrupted operation of all Division 11 and 15 systems with no mechanical or electrical malfunction for seven consecutive calendar days, following all testing, startup and commissioning requirements.
2. The final approved O & M Manuals shall be submitted to the Engineer.
3. All required training of City personnel shall have been completed.

B. Final Inspection - The Contractor shall complete the following items in addition to the requirements of the General Requirements Section:

1. Completion of the installation of all systems required under the Contract Documents.
2. Uninterrupted operation of all Division 11 and 15 systems with no mechanical or electrical malfunction for seven consecutive calendar days.
3. Prior to system acceptance, all rotating or moving parts of mechanical equipment shall be given final lubrication, oil change or greasing required for proper operation.

C. Engineer's acceptance shall be contingent upon:

1. Completion of final review and correction of all deficiencies.
2. Satisfactory completion of the acceptance tests which shall demonstrate compliance with all performance and technical requirements of the Contract Documents.
3. Satisfactory completion of the O & M training program and submis sion of all O & M manuals and Drawings required by the Contract Documents. Approved O & M manuals and drawings shall be the basis of the O & M training program.
4. Providing the maintenance tools and spare parts required by the Contract Documents.

1.11 MAINTENANCE SERVICE

A. The Contractor shall provide the manufacturer's recommended maintenance to equipment, controls, associated components and materials furnished under this Contract immediately after the system is placed in productive use until approval of the Contractor's application for final payment has been approved.

1.12 MISCELLANEOUS MECHANICAL REQUIREMENTS

A. Adequate clearance for maintenance and repair access to all mechanical equipment shall be maintained. Manufacturer's clearance requirements shall be used as minimum guidelines.
B. Gauges, thermometers and other indicating devices shall be installed so that they may be easily read from the floor level.
C. Finish work shall present a neat and workmanlike appearance.
D. Warning signs shall be placed on all machines driven by electric motors which are controlled by fully automatic starters. The Contractor shall refer to Section 3320, Article 7, Subchapter 7, General Industry Safety Orders, Title 8, California Administrative Code. The Contractor shall verify compliance by submitting a copy of pertinent pages of Title 8, California Administrative Code requirements to the Engineer.
E. All lubrication points shall be accessible. Where this is impossible, provision shall be made for lubrication at an accessible location. Where oil is used as a lubricant, an oil level indicator with capped and vented filling connection shall be provided in an accessible location. All equipment, including automatic dampers and control linkages shall be thoroughly lubricated before the equipment is operated and before acceptance by the City.

PART 2 PRODUCTS

2.1 MATERIALS

A. Identify materials and equipment by manufacturer's name and nameplate data. Remove unidentified materials and equipment from site.
B. Equipment specified by manufacturer's number shall include all accessories, controls, and other components listed in catalog as standard with equipment. Furnish optional or additional accessories as required.
C. Where no specified make of material or equipment is mentioned, request the name and type of a recommended product from the system or equipment manufacturer.
D. Equipment and material damaged during transportation, installation, or operation shall be considered as totally damaged and shall be replaced with new. Variance from this will be permitted only with written approval by the Engineer.

PART 3 EXECUTION

3.1 PRE-INSTALLATION CONFERENCE

A. The Contractor shall convene a pre-installation conference as specified in Section 12-1.23 to review items of coordination in Article 1.9 above.

3.2 INSTALLATION

A. Manufacturer's Directions shall be strictly followed.
B. Equipment: Accurately set and level with supports neatly placed and properly anchored. Seismic bracing and anchorage shall be provided per Section 12-1.17 of the main contract specifications. No allowance will be made for failure to foresee means of placing or installing equipment into position.
C. All equipment shall be seismically braced in accordance with the requirements of SMACNA and UBC, seismic Zone 4 Requirements.
D. Protection: Protect the work of other Sections as well as the Work of this Section.

3.3 PERFORMANCE

A. Cutting and Patching:

1. Perform all cutting and patching, including structural reinforcing, necessary for the Work of this Division in accordance with the requirements of the governing Section.
2. Perform no cutting or patching without prior approval by the Engineer. Repair damage done by cutting and patching to original condition in Engineer's opinion.
3. The Contractor shall be responsible for all damage to premises or Work of other Divisions caused by leaks or breaks in piping, duct work or equipment furnished or installed as part of the Work of this Division during construction and guarantee period.

B. Curbs, Flashings, Sleeves, Chases and Inserts:

1. The Contractor shall provide all required curbs, flashings, sleeves, chases, inserts, anchor bolts, and similar items.
2. Sleeves and chases shall be prohibited in structural members, except as shown on the Drawings.
3. Locate and size openings for pipes and ducts through walls, roof, and other building components as part of the Work of this Division. The framing of all openings shall be provided as part of the Work of the Divisions in whose Work opening is made.

3.4 TESTING AND ADJUSTING

A. General

1. Furnish all labor, equipment, materials, supervision and incidentals required for the work.
2. Test mechanical systems in sections as Work progresses. Systems or sections previously tested shall become parts of any repeated test when it becomes part of distribution or collection system.
3. Repair leaks by remaking with approved new material. Makeshift leak stopping will not be accepted.
4. Should any equipment or material fail during testing, immediately remove and replace the defective material or equipment with new; retest system.
5. Perform all tests in accordance with requirements of authorities having jurisdiction.
6. Upon completion of the work, provide Certificates of Satisfactory Installation as required by the various technical sections of Divisions 11 and 15. Provide other Certifications as required by the individual Specification Sections.

B. Testing, Balancing & Adjusting

1. After completion of testing and adjustment, operate systems and equipment under normal working conditions for five (5) days and show specified performance. If, in the opinion of the Engineer, performance of equipment or systems is not in accordance with specifications, equipment shall be adjusted or replaced at the Contractor's expense.
2. Before the City assumes the full operation of the work, replace all air filters.
3. Lubricate each item of equipment, including motors, if required, before operation.

3.5 NOISE

A. Eliminate all objectionable noise or vibration caused by mechanical systems to the extent of adjustments to installed equipment and appurtenances.
B. Completely correct noise problems caused by failure to make installation in accordance with Contract Documents, as specified hereinafter, including labor and materials required as a result of such failure.

3.6 OPERATION AND MAINTENANCE MANUAL

A. Refer to Section 12-1.19. The approved Operation & Maintenance Manuals shall be the basis of all Operation & Maintenance training.

3.7 OPERATION AND MAINTENANCE TRAINING

A. Refer to individual Specification Sections.
B. Prior to Substantial Completion of the contract and before final payment is made, the Contractor shall arrange training for City personnel.
C. The training shall be provided by the equipment manufacturer's engineer, and shall cover a thorough discussion of the O&M manual which includes but is not limited to, operation and maintenance of the specific equipment and systems installed, telltale signs of equipment malfunctioning and their solutions, other pertinent topics that relate to optimum system operation and energy conservation.

3.8 WARRANTY

A. Refer to Section 12-1.03.

3.9 RESTORATION AND FINAL CLEANING OF WORK AREAS

A. Walls, floors and ceiling of the existing facility that are damaged during the course of construction shall be repaired, patched, grouted or restored accordingly to match surrounding finishes.
B. Debris accumulated by the Contractor during construction, and unused materials and equipment not meant to be salvaged shall be removed from the work area as Contractor's property and, at the conclusion of the project but prior to start-up, the areas shall be adequately cleaned and, if required, hosed down with domestic water.

3.10 EQUIPMENT ANCHORING DEVICES

A. All anchoring devices covered under Divisions 11 and 15 which are designed to be embedded in concrete shall be cast in place at the time such concrete is poured.
B. The Contractor shall note that cast in place anchoring devices and expansion anchors are not interchangeable. Approval by the Engineer shall be required when the use of expansion anchors is proposed by the Contractor.
C. Testing of Expansion Anchors: Anchors drilled into concrete and which are to be loaded in tension shall be proof-tested to two times the maximum allowable load. Fifty (50%) percent of all anchors shall be proof tested. In the event of a single failure, testing of all remaining anchors shall be performed as directed by the Engineer. Additional testing required because of a test failure shall be done at no additional cost to the State and City.
D. When anchoring and leveling mechanical equipment, provide leveling nuts, flat washers and locking nuts. The anchor bolts shall have sufficient exposed extension to accommodate the installation any required leveling nuts and washers. Any templates used in setting anchor bolts shall be furnished by vendor.
E. Anchor bolts and expansion anchors embedded in concrete shall be stainless steel.
F. Anchor bolts shall each have the required exposed extension to accommodate the installation of the mechanical equipment with the leveling nut, washer(s) and locknut.
G. Templates used in setting up the anchor bolts shall be manufacturer's furnished templates.

SECTION 15001 PROCESS PIPING - GENERAL

PART 1 GENERAL

1.1 WORK INCLUDED

A. This section covers the work included in Divisions 11 and 15 of these special provisions as necessary to furnish and install complete and functional process piping systems as specified herein, and as further specified in individual Piping Systems Specifications in these Specifications.
B. This section also supplements the Specification of building services piping as furnished and installed under Section 15400-Plumbing Systems.
C. For trench excavation, backfill, pipe bedding, and material placed in pipe trenches, see Section 02221 - Trench Excavation and Backfill.

1.2 RELATED SECTIONS

A. Section 15003 - City-Furnished Ductile Iron Pipes, Fittings and Gate Valves
B. Section 15400 - Plumbing Systems

1.3 GROOVED END PIPE FITTINGS COUPLING COMPATIBILITY

To assure uniformity and compatibility of piping components in grooved end piping systems, all fittings and couplings shall be furnished by the same manufacturer.

1.4 SUBMITTALS

In addition to the requirements of Section 12-1.06, the following information shall be provided:

A. Exposed Piping

1. Double-line drawings of each piping system to the scale stated on the Contract drawings, locating each support, hanger, and expansion joint, including seismic bracing, identifying the type by catalog number or shop drawing detail number, and showing anchor locations and identifying them by shop drawing detail number.
2. Detailed installation drawings, catalog information, and complete component selection list for metal framing and pipe support systems in the pipe galleries, trenches, and other locations employing metal framing pipe support systems.

3. Piping thermal expansion calculations shall be furnished for all piping systems with operating temperatures below - 200 degrees F or over 300 degrees F, and piping systems over 150 degrees F with thermal expansion in any straight run of pipe in excess of 1/2 inch. These calculations shall include the effects of all equipment nozzles, anchor points, gravity supports, and seismic restraints.

B. Buried Piping: Before starting fabrication, the Contractor shall furnish the Engineer with pipe design calculations and shop drawings which shall include a laying plan and details of a standard pipe section, special fittings, and bends. Dimensions, coatings, linings and other pertinent information shall be shown. The laying plan shall show the location of each pipe section and each special length, with each piece numbered or otherwise designated in sequence. All outlets and bends shall be made up into special lengths so that, when installed, they will be located as indicated. Each pipe and fitting shall be marked on the outside to indicate the class of pipe and location number on the laying plan. Pipe shall be furnished and installed in accordance with the reviewed laying plan. All marking shall be coded to the shop drawings. Review of the drawings and laying plan by the Engineer shall not relieve the Contractor of responsibility for complying with all requirements of the Contract Documents.

PART 2 MATERIALS

2.1 GENERAL

The materials to be used for the piping systems shown on the Drawings are listed by service in the individual Piping Systems Specifications.

A. Galvanizing: Where galvanizing is specified, it shall be hot-dip applied only. Electroplated zinc or cadmium plating is unacceptable.

2.2 PIPE IDENTIFICATION AND PAINTING

All nonsubmerged exposed piping shall be painted, color coded, and labeled as specified in Sections 15190 - Identification Of Mechanical Equipment and Section 15191 - Painting.

2.3 PIPE JOINTS FOR EXPOSED PIPING

A. Steel pipe joints shall be welded in sizes 3 inches and larger and screwed 2-1/2 inches and less except when shown or specified otherwise.
B. On ductile iron pipe, grooved end joints shall be used wherever possible. Grooved end joints generally shall be rigid type in buildings and flexible type in the galleries and trenches between buildings and structures, except as shown otherwise on the Drawings. Flanges shall be used for pipe joints only when grooved end joints are unavailable, as on certain pipe sizes and fittings, and when specifically shown on the Drawings. Flanges will generally be shown on exposed piping 16-inch diameter and larger. Grooved end joints shall be not used in any submerged or confined corrosive area.

2.4 PIPE JOINTS FOR BURIED PIPING

A. Mechanical or push-on pipe joints shall be used for all buried ductile iron pipe. Joints for buried pressure pipe shall be "lock type" push-on joints or mechanical joints restrained by tie rods. Anchoring of retainer glands with set screws is not acceptable.
B. Steel pipe joints shall generally be welded in sizes 3 inches and larger and screwed 2 1/2 inches and less except when shown or specified otherwise.
C. Where flexible couplings as shown on the Drawings are used in pressurized pipe systems, the flexible couplings shall be provided with thrust ties for all pressured buried steel pipe. Flexible couplings shall be Dresser Style 38; Rockwell Style 411; or equal. Thrust ties shall sustain the force developed by 1-1/2 times the operating pressure specified.
D. No change in material or joint selection will be permitted after submittal of shop drawings and their final review by the Engineer.

2.5 GALLERY AND TRENCH PIPING EXPANSION PROVISIONS

All piping in the galleries and trenches shall be installed to allow for thermal expansion due to the differences between installation and operating temperatures. Anchor walls shall be installed as shown on the Drawings and shall withstand the hydraulic thrust and thermal forces and to direct and control the thermal expansion.

2.6 BUILDING PIPING EXPANSION PROVISIONS

Pipe anchors shall be placed where shown on the Drawings. Flexible couplings or expansion joints shall be provided for piping systems and at connections to equipment where shown. The Contractor may install additional pipe anchors and flexible couplings to facilitate piping installation, provided that he submits complete details describing location, pipe supports, and hydraulic thrust protection. Acceptable type of flexible couplings and expansion joints shall be as follows:

A. Metallic Piping Systems:

1. Flexible Couplings: Except as noted, flexible couplings for use with steel pipe shall be Dresser Style 38; Rockwell Style 411; or equal. Flexible couplings for use with ductile iron pipe shall be Dresser Style 53 or 153; Rockwell Style 431; or equal, with zinc-plated bolts and nuts. Thrust ties shall be provided as required and shown to sustain the force developed by 1-1/2 times the operating pressure specified. Couplings shall be painted in accordance with Section 15191 - Painting.
2. Transition Couplings: Transition couplings used to connect pipe with small difference in outside diameter shall be Dresser Style 162; Rockwell 413; or equal. Couplings shall be painted in accordance with Section 15191 - Painting.
3. Flanged Coupling Adapters: Flanged coupling adapters shall be Series 912 for ductile iron piping and Series 913 for steel piping, as manufactured by Rockwell International; or Style 127 for ductile iron piping and Style 128 for steel piping, as manufactured by Dresser Industries, Inc.; or equal. Where indicated, couplings shall be provided with thrust ties attached to steel pipe with welding lugs, and to ductile iron pipe with cast-in-place lugs or flange lugs and friction collars. Anchor studs placed perpendicular to the longitudinal axis of the pipe are unacceptable. Thrust protection shall be adequate to sustain the force developed by 1-1/2 times the operating pressures specified. Couplings shall be painted in accordance with Section 15191 - Painting.
4. Bellows Type Flexible Couplings: Bellows type flexible couplings shall be Mercer Style 500; Garlock Style 204; or equal, with single Hypalon bellows. Joints shall be flanged ,with steel retaining rings, rated for 135 psi maximum operating pressure and 220 degrees F maximum operating temperature.
5. Concrete Encased Couplings: Couplings encased in concrete shall be sleeve type couplings, Dresser, Rockwell, or equal, and not grooved end type couplings.

B. Nonmetallic Piping Systems:

1. Flexible Couplings and Expansion Joints: Flexible couplings and expansion joints shall be Teflon bellows type having two convolutions unless otherwise shown, with ductile iron flanges, drilled 150 psi ANSI standard, and Monel reinforcing bands. Joints shall be rated for 150 psi working pressure at 100 degrees F. Expansion joints shall be Metraflex Model T-1; Resistoflex No. R6904; or equal. Limit bolts shall be as specified for adjacent piping and shall sustain the force developed by 1-1/2 times the operating pressures specified.

2.7 PIPING SUPPORT SYSTEMS

A. General

1. Piping shall be supported, in general, as described hereinafter and as shown by the pipe support details on the Mechanical Standard Detail Drawings. The Contractor shall design all piping support systems. Special support and hanger details are shown to cover typical locations where standard catalog supports are inapplicable.
2. No attempt has been made to show all required pipe supports either on the Drawings or in the details. The absence of pipe supports and details on any drawings shall not relieve the Contractor of the responsibility for providing them throughout the pumping station.

3. Where piping connects to equipment, it shall be supported by a pipe support and not by the equipment.
4. Pipe support system components shall be designed to withstand the dead loads imposed by the weight of the pipes filled with water, any insulation, plus seismic loads. Commercial pipe supports and hangers shall have a minimum safety factor of 5.

B. Materials: Materials for piping supports, guides, hangers, and fasteners shall be selected based on the environment in which the support is located. Concrete anchors and anchor bolts shall be stainless steel and as specified in Section 05500: Fabricated Metalwork and Miscellaneous Items.

1. Submerged: Pipe supports below a plane 1 foot above the highest water level, and those installed below basin channel and wet well cover slabs shall be Type 316 stainless steel.
2. Corrosive: Pipe supports in areas of facilities designated as "Corrosive" shown on the Drawings and anywhere outdoors shall be Type 316 stainless steel. Fusion bonded epoxy-coated steel and fiberglass-reinforced plastic (FRP) support materials are acceptable alternatives, subject to review by the Engineer.
3. Non-Corrosive: Pipe supports in remaining indoor areas shall be hot-dipped galvanized steel with Type 316 stainless steel fasteners. All galvanized materials shall be coated per Section 15191 - Painting Of Mechanical Equipment.
4. All pipe support assemblies and their components including anchors, nuts and washers inside the pump station shall be type 316 stainless steel. All outdoor pipe supports shall be galvanized steel.

C. Gallery and Trench Piping

1. In general, piping in pipe galleries and trenches shall be supported by a metal framing system, Unistrut, Kin-Line, or equal. Provide concrete insert channels, Unistrut Series P-3200; Kin-Line Series C13512; or equal, in accordance with the spacing as recommended by the metal framing manufacturers. The metal framing system manufacturer shall analyze the support requirements for the system and provide framing members, hangers, clamps, brackets, and guides suitable for the intended service and support loads, and as specified herein. Support loads shall be calculated for pipes filled with water. Included in this system shall be provisions for support of the electrical conduits. Framing support system beams shall be sized such that the beam stress does not exceed 25,000 psi and maximum deflection does not exceed 1/240 of span. Column members shall be sized in accordance with the manufacturer's recommended method.
2. Spacing of metal framing system will in general be satisfactory for steel and ductile iron pipe 3-inch and larger.

D. Building Piping

1. Horizontal piping shall be supported with adjustable swivel-ring, split-ring, or Clevis type hangers. Furnish protection shield and oversized roller hangers under all insulated piping.
2. Stacked horizontal rungs of piping along walls and in trenches shall be supported by a metal framing system attached to concrete insert channels. No pipe shall be supported from the pipe above it.
3. Pedestal pipe supports shall be adjustable, with stanchion, saddle, and anchoring flange. Provide neoprene waffle isolation pad under anchoring flanges, adjacent to equipment or where otherwise required to provide vibration isolation.
4. Horizontal piping hanger support rods shall attach to steel beams with C-clamps or beam clamps; to concrete with inserts, brackets or flanges fastened with flush shells; to wood not less than 2-1/2 inches thick with lag screws and angle clips.
5. Vertical piping hangers and supports shall be channel and pipe straps manufactured by Unistrut, Kin-Line, or equal.
6. Piping supports for vertical piping passing through floor sleeves shall be steel riser clamps.
7. Pipe hangers for copper and plastic piping shall be coated with a plastic or neoprene protective cover, Grinnell Figure 97C; Elcon No. 91; or equal. No metal portion of a hanger, support, or brace shall contact pipe directly.
8. Unless noted otherwise on the Drawings, horizontal pipe support or hanger spacing and hanger rod sizing for steel and ductile iron pipe shall be as follows:

Pipe Size	Maximum Support and Hanger Span	Minimum Rod Size Single Rod Hangers
1-inch & Smaller	6 feet	1/4 - inch
1-1/4 - inch thru 2-1/2 inch	8 feet	1/4 - inch
3-inch & 4-inch	10 feet	3/8 - inch
6-inch	12 feet	3/8 - inch
8-inch	12 feet	1/2 - inch
10-inch & 12-inch	14 feet	5/8 - inch

9. The load rating for universal concrete inserts shall not be less than that of the hanger rods they support.
10. When supporting ductile or cast iron pipe, locate hanger rods at all joints and at each change of direction.
11. Hanger rod sizing for copper pipe shall be same as for steel pipe. Hanger spacing shall be 2 feet less per sizes than for steel pipe, with 1-inch and smaller supported every 5 feet.
12. Hanger rod sizing for plastic pipe shall be same as for steel pipe. Spacing of hangers shall be as recommended by the manufacturer.
13. Hanger rod sizing and support spacing for stainless steel pipe shall be as shown in above table.
14. Vertical sway bracing shall be provided on 10-foot maximum centers unless otherwise shown on Drawings.
15. All piping shall be supported in a manner which will prevent undue strain on any valve, fitting, or piece of equipment. In addition, pipe supports shall be provided at changes in direction or elevation, adjacent to flexible couplings, and where otherwise shown. Pipe supports and hangers shall not be installed in equipment access areas or bridge crane runs.
16. Brace all piping 2-1/2 inch inside diameter and larger for Seismic Zone 4 forces in accordance with Section 2312(g) of the Uniform Building Code as published by ICBO, current edition. Placement of lateral supports for seismic loads which shall be provided at all changes in direction shall account for piping flexibility required for thermal expansion. See also paragraph submittals during construction hereinbefore specified.

2.8 JOINTS FOR DISSIMILAR PIPE

Joints between dissimilar buried pipe shall be made with flexible mechanical compression joint coupling with No. 305 stainless steel banks as manufactured by Joints, Inc. (Calder) of Gardena, CA; Fernco Joint Sealer Co. of Ferndale, MI; or equal, or a concrete closure collar as directed by the Engineer.

2.9 SERVICE SADDLES FOR PLASTIC PIPE

Service saddles for PVC pipe shall have solid polypropylene bodies with Buna-N seals and stainless steel worm drive clamps, or polypropylene threaded inserts with vinyl coated steel saddle bodies and Type 216 stainless steel bolts. Saddles shall be Rockwell, Style 315 or 317; Dresser, Style 194; or equal.

2.10 SLAB, FLOOR, WALL AND ROOF PENETRATIONS AND CLOSURES

Piping penetrations of slabs, floors, walls, and roofs shall be as shown on the Drawings. It shall be the Contractor's responsibility to verify the size, type, and location of all building and structure penetrations prior to pouring concrete.

A. Ductile Iron Wall Pipes

1. Provide ductile iron wall pipes where ductile iron piping passes through concrete walls, floors, slabs, and roofs which are to be watertight and where shown on the Drawings. Wall pipe end connections shall be as shown on the Drawings and as specified in the applicable Detail Piping Specification. Wall pipes shall be of a thickness equal to or greater than the connecting piping in the line and shall comply with the requirements for fittings in the applicable Piping Systems Specification.

2. All pipes shall be provided with thrust collars which shall be of ductile iron and cast integral with the wall pipe where offered by the manufacturer. All wall pipes that cannot be cast with integral thrust collars shall be fabricated by welded attachment to the pipe. All welds shall be done in the manufacturer's shop by qualified welders and shall be electric arch of ductile iron with NI-55 or FC-55, nickel-iron-carbon weld rod. The thrust collars shall be ductile iron, welded continuously around the pipe on both sides of the ring. Thrust collars shall have a minimum safety factor of 2. The Contractor shall submit the manufacturer's test report substantiating the pressure rating and safety factor specified and welder's certificates. Wall pipes shall be as manufactured by American Cast Iron Pipe Company, U.S. Pipe and Foundry, or equal.
3. Flanges set flush with the face of concrete shall be tapped for stud bolts. Coat wall pipes as specified in Section, Painting. Support wall pipes by form work to prevent contact with reinforcing steel.

B. Pipe Sleeves

1. Piping passing through concrete or masonry shall be installed through hot-dipped galvanized standard weight steel pipe sleeves or stainless steel pipe sleeves where shown on the Drawings.
2. All sleeves in exterior or water-bearing walls shall have a center flange for water stoppage. The annular space between pipes and sleeves in exterior walls shall be watertight. The joint shall be caulked with rubber sealant, or sealed by a modular mechanical unit consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall sleeve. The interconnected rubber links shall be assembled with zinc phosphate-plated steel bolts and nuts and steel pressure plates under each bolt head and nut to prevent the nut from turning when the bolt is tightened. Tightening of the bolts shall cause the rubber sealing links to expand, resulting in a watertight seal between the pipe and wall sleeve opening. Closures shall be sized according to manufacturer's instructions for the size of pipes shown on the Drawings.
3. Wall sleeves shall be coated with the appropriate system for the intended location as specified in Section 15191 - Painting Of Mechanical Equipment. When placing non-insulating type wall sleeves in concrete forms, support them by form work to prevent contact with the reinforcing steel.

2.11 INSULATING FLANGES, COUPLINGS, AND UNIONS

Materials and rating shall be in accordance with the applicable Detail Pipe Specification. Dielectric flanges and unions shall be as distributed by Epco Sales, Inc. of Cleveland, OH; Capitol Insulation Unions; or equal. Insulating couplings shall be Dresser STAB-39; R.H. Baker Series 216; or equal.

2.12 TAPE WRAP

Tape wrap shall be 15-mil butyl rubber adhesive, polyethylene - backed tape as manufactured by Polyken Division of the Kendall Company, Boston, MA; Royston Laboratories, Inc., Pittsburgh, PA; or equal.

2.13 HEAT SHRINK WRAP

Heat shrink wrap shall be a cross-linked polyolefin wrap or sleeve with a mastic sealant. Wrap or sleeves shall be Raychem WPC, TPS, flange seal, or equal. Wrap type shall be as recommended by the manufacturer for the specific joint.

2.14 POLYETHYLENE BAGGING

Polyethylene bagging for buried ductile iron and cast iron piping shall be 8 mils minimum thickness, manufactured in accordance with the latest edition of AWWA C-105.

2.15 INSULATION

A. Indoor Piping Systems

1. Insulate indoor piping, with rigid fiberglass insulation wrapped with factory-applied, kraft reinforced vapor barrier jacket with pressure-sensitive, self-sealing alp, UL rated. Circumferential joints shall be sealed with matching pressure-sensitive butt strips. Insulation shall be Owens-Corning Fiberglas ASJ/SSL-11, Manville Micro-Lok 65 with AP-T jacket, or equal.
2. Insulate indoor fittings with premolded insulation or mitered segments, wired in place, and finished with a thin coat of insulating cement, or wrapped with soft fiberglass insulation inserts covered with premolded

PVC fitting covers. Secure cover and wrap throat and seams with matching PVC tape. Fitting covers shall be Zeston, Speedline, or equal.

3. Insulation at each pipe hanger or support shall include inserts installed between piping and hanger or support. Inserts shall consist of preformed rigid pipe insulation of thickness equal to adjoining insulation. Inserts shall be 10 inches in length and shall include vapor barrier.

B. Outdoor Piping Systems: Insulate outdoor piping and fittings the same as specified for indoors. Cover piping and insulation with 0.016-inch thick aluminum jacket. The jacket shall be held in place by a continuous friction type joint, providing a positive weatherproof seal over entire length of jacket. The Circumferential joints shall be secured with preformed snap straps containing weatherproof sealant. Cover outdoor fittings with matching preformed aluminum jackets, two-piece elbows and flange covers, secured with stainless steel bands. Fitting covers shall be as manufactured by Childers, Papco, or equal. All insulation material R-values for domestic HWS/HWR, HVAC HWS/HWR and shall comply with the California Energy Commission, Table 2-53 E.

PART 3 EXECUTION

3.1 PIPE PREPARATION AND HANDLING

A. Each pipe and fitting shall be carefully inspected before the exposed pipe or fitting is installed or the buried pipe or fitting is lowered into the trench. The interior and exterior protective coating shall be inspected, and all damaged areas patched in the field with material similar to the original, except damaged glass-lined pipe. Any damaged glass-lined pipe shall not be used and shall be promptly removed from the plat site. Clean ends of pipe thoroughly. Remove foreign matter and dirt from inside of pipe and keep clean during and after laying.

B. Use proper implements, tools, and facilities for the same and proper protection of the pipe. Carefully handle pipe in such a manner as to avoid any physical damage to the pipe. Do not drop or dump pipe into trenches under any circumstances.

3.2 PREPARATION OF TRENCH

A. Line and Grade

1. Do not deviate more than 1-inch from line or 1/4-inch from grade. Measure for grade at the pipe invert, not at the top of the pipe, because of permissible variation in pipe wall thickness.
2. Grade the bottom of the trench by hand to the line and grade to which the pipe is to be laid, with proper allowance for pipe thickness and for gravel cushion when specified or indicated. Remove hard spots that would prevent a uniform thickness of bedding. Before laying each section of the pipe, check the grade with a straightedge and correct any irregularities found. The trench bottom shall form a continuous and uniform bearing and support for the pipe at every point between bell holes, except that the grade may be disturbed for the removal of lifting tackle.

B. Bell (Joint) Holes: At the location of each joint, dig bell (joint) holes of ample dimensions in the bottom of the trench and at the sides where necessary to permit easy visual inspection of the entire joint.

C. Removal of Water: Provide and maintain ample means and devices at all times to remove and dispose of all water entering the trench during the process of pipe laying. The trench shall be kept dry until the pipe laying and jointing are completed. Removal of water shall be in conformance with specifications in Section 02221: Trench Excavation and Backfill.

D. Prevent Trench Water and Animals From Entering Pipe: When the pipe laying is not in progress, including the noon hours, the open ends of pipe shall be closed, and no trench water, animals, or foreign material shall be permitted to enter the pipe.

E. Pipe Cover: Minimum pipe cover shall be 4 feet unless otherwise indicated.

3.3 LAYING BURIED PIPE

A. All buried pipe shall be prepared as hereinbefore specified and shall be laid on the prepared pipe base and bedded to ensure uniform bearing. No pipe shall be laid in water or when, in the opinion of the Engineer, trench

conditions are unsuitable. Joints shall be made as hereinbefore specified for the respective types. Take all precautions necessary to prevent uplift and floating of the pipe prior to backfilling.

B. Where the pipe is connected to concrete structures, the connection shall be made as shown. If the connection is not shown, make connection such that a standard pipe joint is located no more than 18 inches from the structure.

C. Connecting Dissimilar Pipe Materials

1. Connect dissimilar pipe materials by means of a flexible coupling specified under Joints for Dissimilar Pipe or a concrete closure collar as directed by the Engineer.
2. Use concrete closure collars only when approved by the Engineer, and then only to make connections between dissimilar pipe when standard rubber gasketed joints or flexible couplings are impractical. Before the closure collars are poured, wash the pipe to remove all loose material and soil from the surface on which the concrete will be placed. Wet nonmetallic pipe thoroughly prior to pouring the collars. Wrap and securely fasten a light gauge of sheet metal or building felt around the pipe to insure that no concrete will enter the line. Place reinforcement as shown on the Drawings. Make entire collar in one pour using 3,000 psi concrete and extend a minimum of 12 inches on each side of the joint. The minimum thickness around the outside diameter of the pipe shall be 6 inches. No collar shall be poured in water. After the collars are poured and have taken their initial set, cure by covering with well-moistened earth.

3.4 INSTALLATION OF EXPOSED PIPING

A. Unless shown otherwise, piping shall be parallel to building lines. Hangers on adjacent piping shall be aligned where possible on common size ranges.

B. Lateral supports for seismic loads shall be provided at all changes in direction.

C. All pipe flanges shall be set level, plumb, and aligned. All flanged fittings shall be true and perpendicular to the axis of the pipe. All boltholes in flanges shall straddle vertical centerline of pipes.

D. Unions shall be installed where required for piping or equipment installation, even though they are not shown on the Drawings.

E. Plastic flanges shall be bolted up using a filler gasket at any joint with a raised face. The filler gasket shall bear the bolt load uniformly and remove the flange moment from that part of the flange protruding beyond the outer edge of the raise face.

F. Piping shall be installed without springing or forcing the pipe in a manner which would set up stresses in the pipe, valves, or connected equipment.

G. Required straight runs of piping upstream and downstream of flow measuring devices shall be smooth.

H. Where valve handwheels are shown, valve orientation shall be as shown. Where valve handwheels are not shown, valves shall be oriented to permit easy access to the handwheels, and to avoid interferences.

3.5 ANCHORAGE AND EXPANSION PROVISIONS

All piping shall be anchored against thrust developed by internal pressures. In addition, provisions shall be made for the expansion and contraction which may occur in pipe due to temperature change. The Drawings do not show all required pipe anchorage and expansion provisions. The Contractor shall provide them in accordance with these Specifications.

3.6 VENTS AND DRAINS

Vent the high point and drain the low point of all pipelines, whether shown on the Drawings or not, with 3/4-inch gate valves on those pipelines 2-1/2-inch and larger and 1/2-inch gate valves on those pipelines 2-inch and smaller. Similarly, each high point of those pipelines running through stepped galleries shall be vented through a gate valve to the gallery floor scupper, whether shown or not. Valve types shall be suitable for the appropriate services as listed in the Valves Specification.

3.7 WALL PIPES AND PIPE SLEEVES

Wall pipes and pipe sleeves embedded in concrete walls, floors, and slabs shall be embedded as specified in Section Concrete and as shown. Support all pipes embedded in concrete walls, floors, and slabs with form work to prevent contact with the reinforcing steel.

3.8 INSTALLATION OF FLEXIBLE COUPLINGS, FLANGED COUPLING ADAPTERS, GROOVED JOINT COUPLINGS, AND SERVICE SADDLES

Prior to installation, thoroughly clean oil, scale, rust, and dirt from the pipe to provide a clean seat for the gasket. Care shall be taken that the gaskets are wiped clean before they are installed. If necessary, flexible couplings and flanged coupling adapter gaskets may be lubricated with soapy water or manufacturer's standard lubricant before installation on the pipe ends. Install in accordance with the manufacturer's recommendations. Bolts shall be tightened progressively, drawing up bolts on opposite sides a little at a time until all bolts have a uniform tightness. Workmen tightening bolts shall use torque-limiting wrenches.

3.9 INSTALLATION OF INSULATING FLANGES, COUPLINGS, AND UNIONS

Install insulating flanges, couplings, or unions wherever copper and ferrous metal piping are connected, wherever cathodically protected lines enter buildings, wherever submerged metallic piping is connected to unsubmerged piping, and where shown on the Drawings. Insulated joints connecting submerged piping to exposed piping shall be installed above maximum water surface elevation and before the first pipe support not having coated anchor bolts or adhesive-bonded concrete anchors. All submerged metallic piping shall be isolated from the concrete reinforcement.

3.10 INSULATION

A. All piping and equipment shall be insulated in accordance with manufacturer's instructions including type of insulating cements, lagging adhesives, and weatherproof mastics if different from those specified.
B. All insulation shall be applied over clean, dry surfaces with all joints butted firmly together, but not until piping system has been pressure tested and any leaks corrected. Insulation shall not extend beyond flanges nor cover nameplates or code inspection stamps. Insulation shall run continuous through wall openings, ceiling openings, and pipe sleeves, unless otherwise noted.
C. Where connection is shown to existing piping, the existing insulation shall be cut back to remove the portion damaged by the piping revisions, and new insulation installed. The joint between the old and new insulation shall be finished as herein before specified.
D. Precut, sized sections of closed cell rigid insulation with vapor barrier shall be inserted under piping and centered at each hanger location. Provide continuos vapor barrier at all joints between rigid insulation and pipe insulation.
E. Insulate all valve bodies, flanges, and pipe couplings. Provide removable insulation sections on all devices that require access for maintenance of equipment or removal, such as unions, trainer end plates, etc. Do not insulate flexible pipe couplings.
F. Finished appearance of all insulation shall be smooth and continuous. Provide coating of insulating cement where needed to obtain this result. Joints shall be lapped and the integrity of vapor seals maintained in strict accordance with manufacturer's instructions. Staples and screws shall not be used to secure components of systems that are vapor sealed.
G. Care shall be taken to apply the insulation and vapor barrier coating on exterior piping so that it will not be damaged when the prefabricated aluminum fitting covers are applied. The prefabricated aluminum covers shall serve as weatherproof enclosures over fittings. No screws or rivets shall be used in fastening the fitting covers, as they may puncture the vapor seal.
H. Exterior flanges and unions shall have removable prefabricated aluminum covers.
I. Piping shall be coated as specified in the Piping System Specifications prior to installing the pipe insulation.

3.11 TESTING

A. General

Conduct pressure and leakage tests on all newly installed pipelines. Furnish all necessary equipment and material and make all taps in the pipe, as required. The Engineer will monitor the tests. Test pressures shall be as specified in the individual Piping System Specification Sections.

B. Testing New Pipe Which Connects to Existing Pipe

New pipelines which are to be connected to existing pipelines shall be tested by isolating the new pipe with grooved end pipe caps, spectacle blinds, or blind flanges.

C. Preparation and Execution

1. Buried Pressure Piping

   a. Both an initial leakage test and a final acceptance leakage test shall be performed on all buried pressure piping. The initial leakage test may be conducted with either the trench partially backfilled or with no backfill in place (subject to approval by the Engineer) during which time the joints are to be exposed and available for inspection during the test. The final acceptance leakage test shall not be conducted until after the piping trench has been completely backfilled.
   b. Buried pressure piping that is to be pneumatically tested or subjected only to an initial service leak test shall have all joints exposed for the acceptance test.

2. Exposed Pressure Piping: Conduct the tests on exposed piping after the piping has been completely installed, including all supports, hangers, and anchors, but prior to insulation.
3. Where piping is between two anchor walls in the galleries, limit testing to one system at a time to avoid excessive loading on the walls.

C. Hydrostatic Leak Tests

1. Equipment: Furnish the following equipment for the hydrostatic tests:

Amount	Description
2	Graduated containers
2	Pressure gauges
1	Hydraulic force pump
	Suitable hose and suction pipe as required

2. Procedure - Exposed Piping: Water shall be used as the hydrostatic test fluid unless otherwise specified. Test water shall be clean and shall be of such quality as to minimize corrosion of the materials in the piping system. Vents at all high points of the piping system shall be opened to purge air pockets while the piping system is filling. Venting during the filling of the system also may be provided by the loosening of flanges having a minimum of four bolts or by the use of equipment vents. All parts of the piping system shall be subjected to the test pressure specified in the Piping Systems. The hydrostatic Specification test pressure shall be continuously maintained for a minimum time of 30 minutes and for such additional time as may be necessary to conduct examinations for leakage. Examination for leakage shall be made at all joints and connections. The piping system, exclusive of possible localized instances at pump or valve packing, shall show no visual evidence of weeping or leaking. Any visible leakage shall be corrected at the Contractor's sole expense.

3. Buried Water and Wastewater Pressure Lines

   a. The hydrostatic testing of buried water and wastewater pipelines must be conducted in a different manner, as follows:
   b. Where any section of pipe is provided with concrete thrust blocking, do not make the pressure test until at least 5 days have elapsed after the thrust blocking is installed. If high-early strength cement is used for thrust blocking, the time may be reduce to 2 days. When testing cement-mortar lined piping, slowly fill the section of pipe to be tested with water and allow to stand for 24 hours under slight pressure to allow the cement-mortar lining to absorb water.
   c. Expel all air from the piping system prior to testing and apply and maintain the specified test pressure by means of the hydraulic force pump. Valve off the piping system when the test pressure is reached and conduct the pressure test for 2 hours, reopening the isolation valve only as necessary to restore

the test pressure. The pump suction shall be in a barrel or similar device, or metered so that the amount of water required to maintain the test pressure may be measured accurately. This measurement represents the leakage, which is defined as the quantity of water necessary to maintain the specified test pressure for the duration of the test period. No pipe installation will be accepted if the leakage is greater than the number of gallons per hour as determined by the following formula:

$$L = \frac{ND\,(P)^{1/2}}{7400}$$

In the above formula:

L = allowable leakage, in gallons per hour
N = Number of joints in the length of pipe tested
D = Nominal diameter of pipe, in inches
P = Test pressure during the leakage test, in pounds per square inch

d. The Contractor shall correct any leakage greater than the allowance determined under this formula at the Contractor's sole expense.

D. Pneumatic Leak Tests

1. Equipment: Furnish the following equipment for the pneumatic tests:

Amount	Description
1	Pneumatic compressor separator-dryer system capable of providing oil-free dry air and equipped with one or more full capacity safety relief valves set at a pressure of not more than 105 percent of the required primary test pressure.
1	Calibrated test gauge

2. Procedure

a. Pneumatic testing shall be performed using accurately calibrated instruments and oil-free, dry air. Tests shall be performed only on exposed piping, but only after the piping has been completely installed, including all supports, hangers and anchors, and inspected for proper installation. All parts of the piping system shall be subjected to the test pressure specified in the Piping and Valve Schedule shown on the Drawings. The Contractor shall recognize the hazards associated with air testing and shall take all necessary precautions to protect test personnel and City's operating personnel. All piping to be tested shall be secured to prevent damage to adjacent piping and equipment in the event of a joint failure. Any appurtenant instruments or devices that could be damaged by the test shall be removed from the piping or suitably isolated prior to applying the test. Prior to starting the test, the Contractor shall notify the Engineer and the City's personnel representative.

b. A preliminary pneumatic test not to exceed 25 psig shall be applied to the piping system prior to final leak testing, as a means of location major leaks. Examination for leakage, detected by soap bubbles, shall be made at all joints and connections. After all visible leaks have been corrected, the pressure in the system shall gradually be increased to not more than 1/2 of the test pressure, after which the pressure shall be increased to not more than 1/2 of the test pressure, after which the pressure shall be increased in steps of approximately 1/10 of the test pressure until the required test pressure has been reached. The pneumatic test pressure shall be continuously maintained for a minimum time of 4 hours and for such additional time as may be necessary to conduct a soap bubble examination for leakage. The piping system, exclusive of possible localized instances at pump or valve packing, shall show no evidence of leakage. Any visible leakage shall be corrected at the Contractor's sole expense.

c. Following pneumatic testing, line which are to carry flammable gases shall be thoroughly purged with nitrogen to assure that no explosive mixtures will be present in the system during the filling process.

E. Initial Service Leak Tests

1. Equipment: Equipment used for initial service leak testing may be the same as that specified under Hydrostatic And Pneumatic Leak Tests hereinbefore, or the pump or compressor connected to the piping system.

2. Procedure: The initial service leak test shall be performed by gradually bringing the piping system up to normal operating pressure and holding it there continuously for a minimum time of 10 minutes. Examination for leakage shall be made at all joints and connections. Soap bubbles shall be used to detect leaks in pneumatically-tested systems. The piping system, exclusive of possible localized instances at pump or valve packing, shall show no visual evidence of weeping or leaking. Any visible leakage shall be corrected at the Contractor's sole expense.

F. Test Records: Records shall be made of each piping system installation during the test. These records shall include:

1. Date of test
2. Description and identification of piping tested
3. Test fluid
4. Test pressure
5. Remarks, to include such item as:

a. Leaks (type, location)
b. Repairs made on leaks

6. Certification by Contractor and signed acknowledgment by Engineer

3.12 INTERIM CLEANING

A. Care shall be exercised during fabrication to prevent the accumulation of weld rod, weld spatter, pipe cuttings and filings, gravel, cleaning rags, etc., within piping sections. All piping shall be examined to assure removal of these and other foreign objects prior to assembly. Shop cleaning may employ any conventional commercial cleaning method if it does not corrode, deform, swell, or otherwise alter the physical properties of the material being cleaned.

3.13 FINAL CLEANING

A. Following assembly and testing and testing and prior to final acceptance, all pipelines installed under this section, except plant process air lines and instrument air lines, shall be flushed with water and all accumulated construction debris and other foreign matter removed. Flushing velocities shall be a minimum of 5 feet per second. Cone strainers shall be inserted in the connections to attached equipment and left there until cleaning has been accomplished to the satisfaction of the Engineer. Accumulated debris shall be removed through drains 2-inch and larger or by dropping spools and valves. Immediately following drainage of flushed lines, the piping shall be air dried with compressed air.
B. Plant process air and instrument air piping shall be blown clean of loose debris with compressed air.
C. Final cleaning shall be accomplished prior to hydrostatic testing. The Engineer shall be notified when such final cleaning has been accomplished.

3.14 CORROSION PROTECTION OF ATMOSPHERIC EXPOSED PIPING ACCESSORIES

All atmospheric exposed surfaces of galvanized steel, brass, copper and bronze piping components including, but not limited to, pipe hangers, supports, expansion joints, pipe guides, flexible couplings, vent and drain valves and fasteners shall be painted in accordance with Section 15191 - Painting Of Mechanical Equipment.

A. Exterior Coating for Exposed Galvanized and Mill Type Steel Pipe: Shop prime and finish coats in accordance with Section 15191 - Painting Of Mechanical Equipment.
B. Interior Lining: All carbon steel piping that is to be lined with coal-tar epoxy, as noted in the Piping Systems Specification be as specified in Section 15191 - Painting Of Mechanical Equipment. Lining shall be shop applied by the pipe supplier.
C. Exterior Protection for Buried, Submerged or Embedded Pipe:

1. All merged or embedded carbon steel piping shall be coated with coal-tar epoxy, and coating shall be as specified in Section 15191 - Painting Of Mechanical Equipment.
2. All abraded areas of coal-tar epoxy coatings on carbon steel pipe to be submerged or embedded shall be cleaned and repaired to provide a protective covering equal to the original and acceptable to the Engineer.
3. Buried steel shall be coated by hand taping with pipe tape. The pipe surface shall be solvent cleaned, SSPC-SP 1, and wire brushed, SSPC-SP 3, to remove all dirt and loose rust and mill scale, and immediately primed with the tape manufacturer's recommended primer in accordance with the manufacturer's recommendations. The tape shall be spirally applied to the pipe with a 50 percent overlap minimum after the primer has thoroughly dried. Joints shall be tape wrapped or heat shrink wrapped. Joints shall be completed above grade or a sufficient size hole excavate beneath the couplings to permit joint wrapping without contamination. Tape wrapping and heat shrink wrap are specified under Materials.

D. Exterior Protection for Buried or Submerged Piping Accessories: Exterior protection shall be in accordance with Section 15191 - Painting Of Mechanical Equipment. Coating shall be applied by a qualified coating applicator.

3.16 CORROSION PROTECTION FOR DUCTILE IRON AND CAST IRON SOIL PIPE

A. For Atmospherically Exposed Ductile Iron: Exterior protection shall be in accordance with Section 15191 - Painting Of Mechanical Equipment.
B. Cement Linings: All piping that is to be cement-lined shall be lined and seal coated with Type II or Type III cement in accordance with ANSI A21.4/AWWA C104. All ductile iron pipe shall be cement-lined and seal coated, except where noted otherwise in the Pipe Systems Specification.
C. Exterior Protection for Buried Pipe: Buried ductile iron and cast iron soil piping shall be wrapped with polyethylene bagging, 8 mils minimum thickness, manufactured in accordance with the latest edition of ASTM D1248, Type I, Class C, Grade E1 and installed in accordance with AWWA C105 and the manufacturer's recommendations.

3.18 PIPE PAINTING AND COLOR CODING

A. Painting and color coding of piping systems shall be as specified in Section 15191 - Painting Of Mechanical Equipment, and in accordance with the Piping System Specification shown on the Drawings. Painting and color coding shall be applied to the exterior covering of insulated piping.

3.19 DISINFECTION

Pipelines intended to carry potable water shall be disinfected before placing in service. Disinfecting procedures shall conform to AWWA C651-86, as hereinafter modified or expanded.

A. Flushing: Before disinfecting, flush all foreign matter from pipeline. Provide hoses, temporary pipes, ditches, etc., as required to dispose of flushing water without damage to adjacent properties. Flushing velocities shall be at least 2.5 fps. For large diameter pipe where it is impractical or impossible to flush the pipe at 2.5 fps velocity, clean the pipeline in place from the inside by brushing and sweeping, then flush the line at a lower velocity.
B. Disinfecting Mixture

1. Disinfecting mixture shall be a chlorine-water solution having a free chlorine residual of 40 to 50 ppm. The disinfecting mixture shall be prepared by injecting:

a. A liquid chlorine gas-water mixture

b. Dry chlorine gas
c. A calcium or sodium hypochlorite and water mixture into the pipeline at a measured rate while fresh water is allowed to flow through the pipeline at a measured rate so that the combined mixture of fresh water and chlorine solution or gas is of the specified strength.

2. The liquid chlorine gas-water mixture shall be applied by means of a standard commercial solution feed chlorinating device. Dry chlorine gas shall be fed through proper devices for regulating the rate of flow and providing effective diffusion of the gas into the water within the pipe being treated. Chlorinating devices for feeding solutions of the chlorine gas or the gas itself must provide means for preventing the backflow of water into the chlorine cylinder.
3. If the calcium hypchlorite procedure is used, first mix the dry power with water to make a thick paste, then thin to approximately a 1 percent solution (10,000 ppm chlorine). If the sodium hypochlorite procedure is used, dilute the liquid water to obtain a 1 percent solution. The following proportions of hypochlorite to water will be required:

Product	Quantity	Water
Calcium Hypochlorite (65-70 percent C1)	(1) 1 lb	7.5 gal
Sodium Hypochlorite (5.25 percent C1)	(2) 1 gal	4.25 gal

a. Comparable to commercial products known as HTH, Perchloron, and Pittchlor.
b. Known as liquid laundry bleach, Clorox, Purex, etc.

C. Point of Application: Inject the chlorine mixture into the pipeline to be treated at the beginning of the line through a corporation stop or suitable tap in the top of the pipeline. Clean water from the existing system or another source shall be controlled so as to flow slowly into the newly installed piping during the application of chlorine. The rate of chlorine mixture flow shall be in such proposition to the rate of water entering the pipe that the combined mixture shall contain 40 to 50 ppm of free available chlorine. Valves shall be manipulated so that the strong chlorine solution in the line being treated will not flow back into the line supplying the water. Use check valves if necessary.
D. Retention Period

1. Treated water shall be retained in the pipeline long enough to destroy all nonspore-forming bacteria. With proper flushing and the specified solution strength, 24 hours is adequate. At the end of the retention period, the disinfecting mixture shall have a strength of at least 10 ppm of chlorine.
2. Operate all valves, hydrants, and other appurtenances during disinfection to assure that the disinfecting mixture is dispersed into all parts of the line, including dead ends, new services, and similar areas that otherwise may not receive the disinfecting solution.
3. Do not place concentrated quantities of commercial disinfectants in the line before it is filled with water.
4. After chlorination, flush the water from the permanent source of supply until the water through the line is equal chemically and bacteriologically to the permanent source of supply.

E. Disposal of Disinfecting Water: Dispose of disinfecting water in an manner that is acceptable to the San Francisco Department Of Public Health and that will protect the public and publicly used receiving waters from harmful or toxic concentrations of chlorine. Do not allow disinfecting water to flow into a waterway without adequate dilution or other satisfactory method of reducing chlorine concentrations to a safe level.
F. Submit 3 copies of all disinfection testing results to the Engineer.

SECTION 15003 CONTRACTOR AND CITY FURNISHED DUCTILE IRON PIPES, FITTINGS AND GATE VALVES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. The Contractor shall furnish and install cement-lined ductile iron flanged pipes, fittings and gate valves specified herein and as shown in Drawings M-4 and M-5.
B. The Contractor shall install City-furnished cement-lined ductile iron push on pipes, fittings and gate valves specified herein and as shown in Drawings M-4, M-6.1 and M-6.2.
C. The work of this section includes coordinating, pickup and transporting City-furnished materials from San Francisco Water Department yard to jobsite, installation labor, temporary utility piping, piping accessories, flexible expansion joints, temporary and permanent piping support systems, thrust blocks, pipe painting, identification, cleaning, hydrostatic testing and returning of surplus pipe to the Water Department yard as shown on the Contract Drawings and as specified in order to provide complete and functional water supply piping system.

1.2 RELATED SECTIONS

A Section 11060 - Valves
B. Section 15000 - Mechanical General Requirements
C. Section 15001 - Process Piping - General
D. Section 15191 - Painting of Mechanical Equipment

1.3 REFERENCE STANDARDS

Cited Standards shall be the most recent edition:

ANSI B16.1 - Cast Iron Pipe Flanges and Flange Fittings, Class 125, 250, and 800
ASTM A47 - Ferritic Malleable Iron Castings
ANSI A21.51 - Ductile - Iron Pipe, Centrifugally Cast in Metal Mold or Sand-Lined Molds, For Water or Other Liquids
AWWA C151 - Ductile - Iron Pipe, Centrifugally Cast in Metal Mold or Sand-Lined Molds, For Water or Other Liquids

1.4 SUBMITTALS

A. Complete piping layout including all pertinent dimensions of all pipe, fittings and equipment. Piping and equipment shop drawings with installation details, pipe support locations, and types shown thereon shall be submitted to and approved by the Engineer at least 30 days prior to requesting materials from the City.
B. The arrangement of equipment, piping and appurtenant items shown on the Contract Drawings is schematic only and may be varied where necessary to fit the approved equipment. All such variations shall be approved in advance by the Engineer and the Contractor shall bear the cost of any such redesign.
C. The Contractor's installation drawings, after approval by the Engineer, shall be used to supplement the Contract Drawings. Shop drawings shall include detailed piping drawings for all piping systems of 2-1/2 inches and larger, indicating appurtenant equipment dimensions which have been used in determining the piping layout dimensions. Piping details of systems 2 inches and smaller may be schematic at the Contractor's option.
D. Shop Drawings and calculations of seismic bracing and piping/equipment anchoring shall be submitted for review and approval by the Engineer prior to fabrication.
E. Prior to pickup of any pipes, fittings or gate valves, the Contractor shall submit a requisition for review and approval by the Resident Engineer itemizing each material with size and quantity.

1.5 EXCAVATION PERMIT

A. The Contractor will be required to secure an excavation permit from the Department of Public Works, Bureau of Street Use and Mapping, 875 Stevenson Street, Fourth Floor. No street work will be allowed by the Contractor without an excavation permit. See Section 12-1.31 Excavation Code Requirements.

1.6 CITY-FURNISHED MATERIALS

A. Materials furnished by the San Francisco Water Department will include push-on joints ductile iron pipes, fittings, gate valves and associated gaskets. Materials will be made available to the Contractor at the yard of the Water Department, 1990 Newcomb Avenue, or at such other locations as may be specified by the Resident Engineer. The Contractor is advised to thoroughly inspect all materials supplied by the Water Department prior to acceptance of such materials. Any defective material accepted by the Contractor shall be repaired or the cost of replacing defective materials shall be borne by the Contractor except that the Water Department will furnish the necessary materials to replace the defective materials. The Contractor shall provide all labor, tools and equipment required to load materials at the storage areas, haul such materials to the jobsite and return and unload surplus materials to the storage areas from which they were obtained. The Contractor shall notify the Resident Engineer immediately upon determination of the amount and type of materials required from the Water Department. No materials will be issued to the Contractor without a requisition itemizing such materials and signed by the Resident Engineer. Due to the uncertainties involved in maintaining an adequate stock of the materials required, the Water Department does not guarantee that all of said materials will be available to the Contractor at such time as he requests them. To avoid unnecessary inconvenience to him the Contractor, before starting work, shall ascertain the amount of material of various kinds that is available immediately for the work and shall conduct the job accordingly. The Water Department reserves the right at all times to withhold such materials as in its opinion may be required for the maintenance of the system or for emergencies which may arise. The Contractor shall hold the City free from any liability for damages due to failure of the Water Department to furnish the above specified materials when requested, either before the commencement or during the progress of the specified work. The Contractor shall not subject any materials supplied by the San Francisco Water Department to any unnecessary jars or shocks during the progress of the work. The Contractor shall be responsible for all said materials and such materials lost or damaged by the Contractor shall be replaced at his own expense.

1.7 QUALITY ASSURANCE

A. All pipe and fittings delivered to the job site shall be clearly marked to identify the material, class, and thickness. All material shall be new and free of defects.

B. Installation of equipment furnished under this Section shall have a minimum of ten (10) years verifiable experience in the installation of such equipment.

1.8 WARRANTY

A. The Contractor shall furnish a two (2) year Warranty for all work covered by this Section per the requirements of Section 12-1.03.

PART 2 PRODUCTS

2.1 CITY-FURNISHED MATERIALS

A. Pipe and fittings

1. 12-inch Buried Suction: Tyton Joint Pipe and Fitting with Field Lok (TM) restraining gaskets, as manufactured by U.S. Pipe and Foundry Company.
2. 12-inch Buried Discharge: TR Flex Restrained Joint Pipe and Fittings with TR Flex Gripper Ring and TR Flex pipe field weldments for restraint of field cut pipe, as manufactured by U.S. Pipe and Foundry Company.

B. Gate Valves

All gate valves 3 inches and larger shall be standard “S.F.W.D.” gate valve as manufactured by U.S. Pipe, New York ‘Metropolitan’ style double disc.

C. Lubricant

Lubricant for grooved end or mechanical joint end piping shall be manufacturer's standard.

2.2 CONTRACTOR-FURNISHED MATERIALS

A. Pipe and fittings

3-inch, 6-inch, 8-inch, 10-inch and 12-inch Aboveground Suction and Discharge: Ductile Iron Flanged Pipe with threaded flanges and flanged fitting including gaskets, Class 53 and meeting the requirements of ANSI/AWWA C151/A21.51. Ductile iron flanged pipe and fittings shall be manufactured by U.S. Pipe, or equal.

B. Gate and Control Valves

Refer to Specification Section 11060, “Valves”.

C. Flexible Expansion Joints

Flexible expansion joints shall be manufactured of ductile iron conforming to the material properties of ANSI/AWWA C153/A21.53. All flexible expansion joints shall consist of an expansion joint designed and cast as an integral part of a ball and socket type flexible joint, having a minimum of 15° deflection per ball and 4" minimum expansion. Flexible joints shall be 12-inch mechanical joint by mechanical joint double ball. Flexible expansion joints shall be Flex-Tend as manufactured by EBAA Iron, Inc., or approved equal. Restraint Harness for restraining the push on joint for the adjacent pipeline shall consist of restraint ring on the spigot joined to aductile iron follower gland behind the bell. The restraint shall be Megalug as manufactured by EBAA Iron, Inc. or approved equal.

D. Bolts

For Class 125 - 316 stainless steel, ASTM A312, Grade A
FF Flanges - hex head bolts & ASTM A563, Grade A hex head nuts

E. Valve box, frame and cover

Buried valve shall be furnish with valve box, frame and cover per Specifications Section 11060.

2.3 THRUST BLOCKS

A. The Contractor shall design buried and exposed pipes and piping manifold to transfer thrust to thrust blocks and thrust braces shown on the Drawings. All buried angular bends of 11-1/4 degree or larger shall be secured in place by use of concrete thrust blocks. No additional thrust blocks shall be permitted. Horizontal and vertical pipe supports shown on the Drawings are schematic and may be relocated to suit the design, provided that the relocated supports do not interfere with other equipment shown on the Drawings. Contractor shall submit locations and types of support for approved by the Engineer.

PART 3 EXECUTION

3.1 GENERAL

A. As specified in Section 15001 Process Piping - General, and as further specified herein.

3.2 INSTALLATION

A. Handling Pipe

Care shall be taken not to damage the cement lining when handling the pipe.

B. Cutting Pipe

Cut pipe with milling type cutter, rolling pipe cutter, or abrasive saw cutter. Do not flame cut.

C. Dressing Cut Ends

1. Dress cut ends of pipe in accordance with the type of joint to be made.
2. Dress cut ends of push-on joint pipe by beveling, as recommended by the pipe manufacturer.
3. Dress cut ends of pipe for flexible couplings and flanged coupling adapters as recommended by the coupling or adapter manufacturer.

D. Pipe trench

Before any pipe may be installed, the grade of the trench bottom shall be approved by the Engineer. Immediately prior to installing the pipe, the Contractor shall remove all loose rocks and other objectable material from the bottoms of the trench and bell holes. When the trench is properly prepared, the pipe shall be lowered therein, singly, without jar or strain and assembled by piece inside the trench.

E. Fabrication Of Flanged Pipe

Flanged pipe shall be fabricated in the shop, not in the field, and pickup by Contractor for delivery to the jobsite with flanges in place and properly faced. Threaded flanges shall be individually fitted and machine tightened on matching threaded pipe by the Contractor. Contractor shall verify all controlling field dimensions before fabricating flanged pipes.

F. Jointing Pipe

1. Flanged - Prior to connecting flanged pipe, the faces of the flanges shall be thoroughly cleaned of all oil, grease, and foreign material. The rubber gaskets shall be checked for proper fit and thoroughly cleaned. Care shall be taken to assure proper seating of the flange gasket. Bolts shall be tightened so that the pressure on the gasket is uniform. Torque-limiting wrenches shall be used to ensure uniform bearing insofar as possible. If joints leak when the hydrostatic test is applied, the gaskets shall be removed and reset and bolts retightened.
2. Push-On Joint - Join pipe with push-on type joints in accordance with the manufacturer's recommendations. Provide all special tools and devices, such as special jacks, chokers, and similar items required for proper installation. Lubricant for the pipe gaskets shall be furnished to the Contractor from the during pickup of piping and no substitutes will be permitted under any circumstances. Any foreign matter in the socket shall be removed prior to installing the gasket, the gasket seat shall be thoroughly inspected to be certain it is clean. The gasket shall be wiped clean, flexed and then placed in the socket. A thin film of lubricant shall be applied with a paint brush to the exposed surface of the gasket. The last 6 or 7 inches of the pipe shall be thoroughly cleaned before applying a thin film of lubricant to the outside of the plain spigot to a line about one inch back from the end. The pipe spigot shall not be allowed to touch the ground or trench side after it is lubricated.

   When the pipe is cut in the field, the outside of the cut end shall be beveled about one-quarter inch at an angle of about 30 degree and the leading edge rounded.

   If the joint assembly is not accomplished with the application of reasonable force, the plain end of the pipe shall be removed to check the proper position of the gasket. Care shall be exercised to protect the pipe laid from any foreign materials or obstructions entering the pipe. At the end of each day, the Contractor shall, to the satisfaction of the Engineer, plug or cover the open end of the pipe laid.

The concrete for the thrust blocks shall be poured against a satisfactory bearing surface and be sufficient size to prevent any movement of the pipeline when subject to the hydrostatic test pressure.

G. Flexible Expansion Joints

1. Flexible expansion joints shall be installed in the locations shown on the drawings and in strict accordance with the manufacturer's written installation instructions and recommendations.
2. All push on joints along the pipeline 30 feet from the flexible joint shall be restrained by restraint harness to adequately transfer the load to the flexible expansion joint.

3.3 FIELD TESTING

A. Suction lines shall be hydrostatically tested at the pressure of 225 psig. Discharge lines shall be hydrostatically tested at the pressure of 325 psig. Test procedures shall be as specified in Section 15001 Process Piping - General.

Unless otherwise directed by the Engineer, the pipe joints shall be exposed during test.

The Contractor shall furnish all necessary labor, material and equipment, such as pumps, piping, connections, pressure gauges, etc., for the test. The Contractor shall also furnish and install necessary anchorage and blocking to prevent movement of the pipe under test.

If any section of the pipe under test develops a leak visible to the eye in the rubber gasket joints or the pipe itself, the Contractor shall repair or replace the defective portion of the pipe as directed by the Engineer. After all repairs are made, the pipe shall be retested.

3.4 CORROSION PROTECTION

As specified in Section 15001 - Process Piping - General.

3.5 SUPPORTS AND HANGERS

As specified in Section 15001 - Process Piping - General.

3.6 PAINTING AND COATING

A. Aboveground Piping

Equipment furnished under this Section shall be prime painted and finish coated by the Contractor per the requirements of Section 15191 - Painting of Mechanical Equipment.

3.7 DISINFECTION AND DECHLORINATION

Disinfection and dechlorination shall be done by San Francisco Public Utilities Commission forces. The Contractor shall notify the SFPUC with TWO WEEKS ADVANCE NOTICE through the Resident Engineer that the pump station and pipeline are ready for disinfection.

SECTION 15190 EQUIPMENT IDENTIFICATION

PART 1 GENERAL

1.1 SECTION INCLUDES

Contractor shall provide and install the following equipment identification:

A. Nameplates
B. Pipe Markers

1.2 RELATED SECTIONS

A. Section 15000 - Mechanical General Requirements
B. Section 15191 - Painting of Mechanical Equipment

1.3 SUBMITTALS

A. The Contractor shall submit details of proposed nameplates and pipe markers including a sample of each showing sample symbols, lettering style and size, color coding and banding.
B. Upon approval of this submittal, the Engineer will furnish the Contractor a complete listing of wording, lettering and numbering for each equipment item to be identified by nameplate.
C. The Contractor shall furnish and install 16-gauge Type 316 stainless steel identification plates for all equipment required by individual Specification Sections to be identified. The plates shall be securely mounted on the equipment in readily visible locations. The plates shall bear, in 1/4-inch die-stamped lettering, the equipment identification numbers indicated in the Specifications and as shown on the Drawings.

1.4 REFERENCE STANDARDS

A. ANSI Standard A 13.1-1981; Scheme for the Identification of Piping Systems
B. ANSI Standard Z 35.1 1968 Signage Standards
C. OSHA Standard 1910:45 Signage Standards

1.5 WARRANTY

The Contractor shall provide a two (2) year Warranty for all work covered under this Section per the requirements of Section 12-1.03.

PART 2 PRODUCTS

2.1 NAMEPLATES

A. Stainless Steel engraved nameplates with lettering 3/4" high, minimum, shall be applied to all pumps, control valves, flowmeter, instrumentation and control panels.
B. Nameplates and adhesive shall be resistant to oils, vibration moisture, solvents and weathering.

2.2 PIPE MARKERS

A. Shall include directional flow arrows and pipe markers, color coded for marked fluid and placed:

1. Adjacent to each branch and fitting.
2. At each branch and riser take-off
3. At each pipe passage through walls, floors and ceilings.
4. On all above-grade straight pipe runs every 20 feet.

B. Marker lettering sizes to be as 1 1/4 inches high.
C. Pipe markers shall be 2-1/4 inch by 9 inch vinyl, weather resistant with the following legends shown below.
D. The background colors, bands and legends listed below shall be painted on the entire length of the piping system.

Pipe Line	Legend	Pipe Background Color	Band Color	# Bands
City Water	Domestic	Blue	None	None
Rainwater Leader	RWL	Gray	None	None
Drain & Waste	Waste	Black	None	None

Vent	Vent	Gray	None	None
Diesel Fuel	Fuel	Brown	None	None
Sump Pump Discharge	SPD	Black	None	None

E. Manufacturer to be Seton "Weather-Code" outdoor pipe markers; Brady or equal.

F. Lettering, coloring and nomenclature shall conform to ANSI A 13.1-1981

PART 3 (BLANK)

SECTION 15191 PAINTING OF MECHANICAL EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

Mechanical equipment and piping, covered under Divisions 11, 14 and 15, not pre-finished and painted by the manufacturer shall be painted by the Contractor in accordance with the provisions of this Section.

The Contractor shall provide the following:

A. Samples.
B. Surface preparation of all mechanical equipment surfaces to be painted.
C. Application of coating systems in accordance with paint manufacturer's instructions.

1.2 RELATED SECTIONS

Section 15000 - Mechanical General Requirements

1.3 SUBMITTALS

A. The Contractor shall submit complete product data and four (4) adequately sized samples of each color for painting and finishing sufficiently in advance so that no delay shall occur in the work.

1.4 REFERENCE STANDARDS

A. Surface preparation shall be performed in strict accordance with the methods currently published by the Steel Structures Painting Council (SSPC) as listed in this Section.
B. Safety coating colors shall comply with Occupational Safety and Health Standards, Section 1910.44, "Safety Color Code For Marking Physical Hazards". Parts of mechanical equipment to be painted with these colors are identified in these OSHA Standards. Such equipment includes but is not limited to: belt guards; emergency stop buttons for machinery; dangerous parts of machines which may cut crush, shock or otherwise injure operating personnel. The Contractor shall identify all such requirements and provide safety color coatings accordingly.

1.5 WARRANTY

A. The Contractor shall furnish a two (2) year Warranty for all work covered by this Section per the requirements of Section 12-1.03.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. International Protective Coatings
B. Copp Division of Carboline

C. Ameron
D. Or equal.

2.2 COATING SYSTEMS

(DFT = Dry Film Thickness)
Model Numbers shown are International Protective Coatings.

COATING SYSTEM NO.	SUBSTRATE	SURFACE PREP.	PRIMER	DFT MILS	FINISH	DFT MILS
1	Structural Steel, Zinc Coated	SP.1 & SP.2,	760HS	5	565 HS	4
2	Galvanized Steel, Non-Submerged	SP.1	TPA830	2	990 HS	2
3	Steel, Submerged Potable Water	SP.10	785HS	5	785HS	5
4	Black Steel Piping	SP.7	298HS	2	870HS	4
5	Insulated Piping	Clean & Dry	515	1.5	530	2
6	Steel Buried In Concrete	SP.7	100	6	100	6
7	Asphalt Coated Pipes	Clean & Dry	767	1	530	2
8	Motors, Pumps, (Factory Primed)	SP.1	280HS	2	990HS	2
9	Copper Piping	SP.1	VTA 528/ VTA 529	1	870HS	2
10	Cast Iron/ Ductile Iron	SP.1 & SP.2	298HS	2	870HS	4
11	(Outdoor Exposed) PVC Pipe	SP.1	280HS	2	990HS	2
12	Stainless Steel (304, 316)	SP.7	298HS	2	990HS	2

A. Safety Coatings:

1. Use Interthane 990HS in standard OSHA colors (2 mils , DFT), polyurethane gloss finish:

   a. Red - 99072
   b. Orange - 99073
   c. Yellow - 99074
   d. Blue - 3A422W
   e. Green - 3A421W
   f. White - 99010
   g. Black - 99002

2. The Contractor shall use colors specified to comply with the Occupational Safety and Health Standards, Section 1910.44, "Safety Color Code for Marking Physical Hazard." Parts of mechanical equipment to be painted with these colors are specified in this particular section of the OSHA standards.

PART 3 EXECUTION

3.1 INSTALLATION

A. All coating systems shall be applied in strict accordance with the manufacturer's written instructions and recommendations.
B. Where a substrate requires a primer and a finish coat, such painting work shall be applied in one prime coat and two finish coats, each of which shall be a different shade or hue so that a visual inspection can be made to verify the number of coats applied.
C. In the event that the requirements of this Section conflict with any manufacturer's specific coating or painting requirements for the service intended by the Contract Documents, the more stringent requirement or standard shall govern.

SECTION 15200 VIBRATION ISOLATION & SEISMIC CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. The Contractor shall furnish and install seismic and vibration restraint systems as required under the Contract Documents.
B. The work of this section includes, but is not limited to:

1. Vibration isolation and seismic restraints.
2. Anchorage, supports and bracing.
3. Duct and pipe bracing.

1.2 RELATED SECTIONS

A. Section 11070 - Pumps
B. Section 11072 - Seal Water Pumping System
C. Section 15000 - Mechanical General Requirements.
D. Section 15001 - Process Piping - General
E. Section 15003 - City-Furnished Ductile Iron Pipes, Fittings & Gate Valves
F. Section 15300 - Fire Protection System
G. Section 15400 - Plumbing System
H. Section 15480 - Diesel Fuel Supply and Engine Exhaust System
I. Section 15503 - Centrifugal Exhaust Fan

1.4 REFERENCE STANDARDS

A. Vibration isolation and seismic restraint work shall conform to the latest edition of all applicable codes and standards; includes, but is not necessarily limited to the following:

1. Seismic Design Guidelines, Chapter 12 of GSA Handbook, Facilities Standards for the Public Building Service PBS P 3430.1A.
2. OSHPD - Office of Statewide Health Planning and Development.
3. The Sheet Metal Industry Fund of Los Angeles. The Plumbing and Piping Industry Council Inc. of Los Angeles. "Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems" OSHPD No. R0010.
4. SMACNA - Sheet Metal and Air Conditioning Contractor's National Association.
5. UBC - Uniform Building Code, 1991 Edition.

B. In case of a conflict, the more stringent requirements shall govern.

1.5 SYSTEM DESCRIPTION

A. Design Requirements

1. All equipment, piping, and ductwork shall be adequately restrained to resist seismic forces. Restraint devices shall be designed and selected to meet seismic requirements as defined in the latest issue of the Uniform Building Code and applicable State and local codes in accordance with Seismic Zone 4 with minimum restraint capability of 1.0g.
2. All vibration isolators shall have either known undeflected heights or other markings so that, after adjustment, when carrying their load, the deflection under load can be verified, thus determining that the load is within the proper range of the device and that the correct degree of vibration isolation is being provided according to the design.
3. All isolators shall operate in the linear portion of their load versus deflection curve. Load versus deflection curves shall be furnished by the manufacturer, and must be linear over a deflection range of not less than 50 percent above the design deflection.
4. All neoprene mountings shall have a shore hardness of 40 to 65, after minimum aging of 20 days or corresponding oven-aging.
5. Design isolators to suit vibration frequency to be absorbed and the load imposed. Isolator units to have adequate area and distribution to obtain proper resiliency under machine load and impact without permitting excessive movement when starting.
6. Vibration isolator spring diameter shall be no less than their deflected height. Select spring with a 50 percent overload factor.
7. Unless otherwise indicated, all equipment mounted on vibration bases shall have a minimum operating clearance of 1 inch between structural steel bases and floor or support base beneath. Check clearance space to ensure that no scrap of hardware has been left to possibly short circuit isolation base.
8. All isolators exposed to the weather shall have neoprene coated springs and hot-dipped galvanized steel components. Aluminum components shall be etched and painted. Nuts, bolts and washers shall be type 316 stainless steel.

B. Performance Requirements

1. The ratio of lateral to vertical stiffness shall not be less than 0.9 nor greater than 1.5.
2. Wave motion through the isolator shall be reduced to the following extent: Isolation above the resonant frequency shall follow the theoretical prediction based upon an undamped single degree of freedom system with a minimum isolation of 50 decibels above 150 cycles per second.
3. Air handling equipment subjected to excessive horizontal air thrust shall be furnished with isolated thrust resistors to limit displacement to 1/4".
4. Isolators for equipment installed outdoors shall be designed to provide adequate restraint due to normal wind conditions and to withstand wind loads of 30 lbs/sq.ft. applied to all exposed surface of the isolated equipment.

1.6 SUBMITTALS

A. Seismic Bracing Systems - Pre-approved by OSHPD:

Submittals shall include:

1. System component brochure describing components used and detailed installation instructions.
2. Loads to be transmitted to the structure at anchors points.
3. OSHPD valid pre-approved number.

B. Vibration Isolator and Seismic Restraint manufacturer's submittal shall include the following:

1. Catalog cuts and data sheets on specific vibration isolators and seismic restraints to be utilized showing compliance with the specifications as specified.

2. List showing items of equipment, piping, etc., to be isolated and seismically restrained, the isolator type and model number selected, isolator loading and deflection, and reference drawing showing frame construction where applicable. Provide seismic restraint details.
3. Drawing showing equipment frame construction for machine including dimensions, structural member sizes, support point locations, etc.
4. Provide seismic calculations, performed and certified by a Professional Engineer who is registered in the State of California.
5. Provide detailed installation instructions.

C. Anchor Bolt Calculations: Signed and stamped by a registered engineer in the State of California, and employed by the Contractor, shall be submitted showing adequacy of the bolt sizing, and type. Calculations shall include anchor embedment, minimum edge distance and minimum center distance. The design lateral forces shall be distributed in proportion to the mass distribution of the equipment.

E. Maintenance Data: Submit maintenance data for each type of vibration and seismic control products. Include this data, product data and shop drawings in maintenance manual; in accordance with Section 12-1.19.

F. Submit outline of O & M Manual format and contents per the requirements of Section 12-1.18.

1.7 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of vibration and seismic control products, of type, size, and capacity required, whose products have been in satisfactory use in similar service for not less than five (5) years. Except as otherwise indicated, obtain products from single manufacturer.

B. Manufacturer of vibration and seismic control products shall have the following responsibilities:

1. Determine vibration isolation and seismic restraint sizes and locations.
2. Provide equipment isolation systems and seismic restraints as scheduled or specified.
3. Guarantee specified isolation system deflection.
4. Provide fabricated equipment designed to safely accept external forces of one-half "g" load in all directions for all rigidly and resiliently supported equipment, without failure and permanent displacement of the equipment.

C. Installer's Qualifications: Firms with at least five (5) years successful installation experience on projects with HVAC and Plumbing systems similar to that required for this project.

D. Manufacturers of equipment furnished under this Section shall have a minimum of five (5) years verifiable experience in the manufacture of such equipment.

1.8 WARRANTY

A. The Contractor shall furnish a two (2) year Warranty for all work covered by this Section per the requirements of Section 12-1.03.

1.9 MANUFACTURER'S SERVICES

A. An authorized manufacturer's representative shall inspect the installation of all equipment furnished under this Section and shall provide a certificate of satisfactory installation in accordance with the provisions of Section 12-1.19 Manufacturer's and Contractor's Services.

PART 2 PRODUCTS

2.1 Manufacturers:

A. Proprietary Pipe Bracing Systems:

1. B-Line System
2. Super Strut

3. Kin-Line
4. Or Equal

B. Vibration Isolation & Seismic Restraint Systems:

1. Vibrex
2. Cal Dyne
3. Mason
4. Or Equal

2.2 SEISMIC CONTROL MATERIALS AND SUPPORT UNITS

A. Vibration Isolator, Earthquake-restrained:

General - All steel components shall be cleaned and painted. All nuts, bolts and washers shall be zinc-electroplated.

1. Neoprene Isolators: Elastomer isolators shall be of neoprene or high quality synthetic rubber with anti-ozone and anti-oxidant additives and shall incorporate the following:

   a. Threaded stud for bolting to equipment base.
   b. Bottom steel plates for bolting to subbase as required.
   c. Unit type design molded in oil-resistant neoprene.
   d. Neoprene to be compounded to be not greater then 70 durometer, with a minimum elongation 500 percent. Maximum compression set at 25 percent of the original deflection.
   e. Shall incorporate seismic restraint in all directions in accordance with UBC seismic zone 4 requirements.

2. Spring Isolators - Isolators shall incorporate the following:

   a. Minimum diameter equal to the loading operating height and horizontal spring stiffness 0.9 to 1.5 times rated vertical spring stiffness.
   b. Reserve deflection (from loaded to solid height) 50 percent of rated deflection with leveling device.
   c. Minimum 1/4" inch thick neoprene acoustical base pad on underside.
   d. Designed and installed so that ends of springs remain parallel.
   e. Provide built-in resilient vertical limit stops and incorporate seismic restraint in all directions in accordance with UBC seismic zone 4 requirements.

3. Pad-Type Isolators: Elastomer pad isolator shall incorporate the following:

   a. 5/16 minimum thickness
   b. 60 psi maximum loading
   c. Ribbed design
   d. 1/16 inch deflection per pad thickness
   e. Pads are isolation sandwiches made laminating a thick cork center core between two neoprene pads
   f. Top and bottom pads bonded at right angles to each.
   g. Cork and neoprene are oil and ozone resistant.

4. Suspension Type Isolators: Provide suspension type isolators encased in open steel brackets. Isolate hanger rods from isolator steel brackets with neoprene grommets.

   a. Suspension Type Neoprene Isolators: Provide hangers with springs and molded neoprene elements which conform with requirements for 'Neoprene Isolators' except that elements shall be double deflection type with at least 3/8 inch deflection.
   b. Suspension Type Spring Isolators: Provide hangers with springs and molded neoprene elements in series. Springs shall conform with requirements for springs of "Spring Isolators". Neoprene elements shall conform with requirements for "Neoprene Isolators". Provide isolators with adjustable spring

preloading devices where required to maintain constant pipe elevations during installation and when pipe operational loads are transferred to the springs."

B. Seismic Snubbers: Provide seismic snubbers, separate from spring isolators, for attachment to equipment base, designed to provide seismic restraint in all directions in accordance with UBC seismic zone 4 requirements. Each corner or side seismic restraint shall incorporate minimum 5/16 inch thick resilient pad limit stops. Snubbers shall be made of plate, structural members, or steel pipes in a welded assembly incorporating resilient pads. Snubbers shall be designed to have no contact during normal operation, and have a minimum clearances of 1/4 inch in all directions.
C. All anchor bolts and expansion anchors embedded in concrete shall be stainless steel.
D. Flexible Connectors For Piping:

1. Metal Flexible Connectors: Provide flexible connectors fabricated of Grade E phosphor bronze, Monel or corrugated stainless steel tube covered with comparable bronze or stainless steel braid restraining and pressure cover. Stainless steel grades shall be 304, 316 or 321 as required for the application. Live lengths shall be as indicated, but not less than that recommended by the manufacturer for continuous vibration application.
2. Elastomeric Flexible Connectors: Provide only where specifically indicated, elastomeric flexible connectors fabricated of multiple plies of tire cord fabric and elastomeric materials with integral reinforced elastomeric flanges with galvanized malleable iron back up rings. Provide steel restraint cables with fittings, nuts, steel washers and acoustical washers where elongation would exceed manufacturer's limits at operating pressure. Elastomeric connectors shall have either tubular or spherical configuration as required or indicated. Spherical type straight connectors shall have two spheres. Elbows shall have one sphere which forms the corner.

PART 3 EXECUTION

3.1 INSTALLATION

A. Seismic Restraint Systems - Shall maintain equipment, piping, ductwork in a captive position. Shall not short circuit vibration systems or transmit objectionable vibration or noise.
B. Piping Seismic Restraints - Support and brace all piping in accordance with the SMACNA "Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Systems" or OSHPD Pre-approved Proprietary Seismic Bracing Systems.
C. Ductwork Seismic Restraints:

1. Support and brace all ductwork in accordance with the SMACNA "Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Systems".

D. All fabricated steel structures shall be hot-dip galvanized in accordance with ASTM A123.
E. For Rotating equipment 10 HP and over:

a. For 3-1/2 inch and smaller pipe the first hanger of each pipe connected to equipment shall be a spring hanger having a deflection equal to the equipment isolation support static deflection.
b. For 4 inch and larger pipe the first two piping hanger supports of each pipe connected to the equipment shall be suspended from spring hangers having a deflection equal to that of the equipment support static deflection.

F. Flexible pipe connections shall be provided at pipe connections to all motorized equipment.
G. All installation shall be carried out in accordance with the manufacturer's written installation instructions and recommendations.

3.2 EQUIPMENT ANCHORS

A. All anchoring devices covered under this Section which are designed to be embedded in concrete shall be cast in place at the time such concrete is poured.
B. The Contractor shall note that cast in place anchoring devices and expansion anchors described in Paragraph C below are not interchangeable. Approval by the Engineer shall be required when the use of expansion anchors is proposed by the Contractor.
C. Testing of Expansion Anchors: Anchors drilled into concrete and which are to be loaded in tension shall be proof-tested to two times the maximum allowable load. Fifty (50%) percent of all anchors shall be proof tested. In the event of a single failure, testing of all remaining anchors shall be performed as directed by the Engineer. Additional testing required because of a test failure shall be paid for by the Contractor.

3.3 PAINTING

A. All equipment furnished under this Section shall be painted in strict accordance with the manufacturer's recommendations and Section 15191 of these Special Provisions.

SECTION 15300 FIRE PROTECTION SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wet-pipe sprinkler system
B. Clean agent fire suppression system
C. All labor, materials, equipment, and services necessary and required to complete and test the total systems.

1.2 REFERENCED STANDARDS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

1. NFPA 13 - Standard for the Installation of Sprinkler System.
2. NFPA Standards 62, 1990 Edition.
3. NFPA 70 - National Electric Code.
4. Factory Mutual (FM) Approval Guide.
5. Underwriters' Laboratories, Inc. (UL) list with quarterly supplements.
6. UL 262 - Gate Valves for Fire Protection Service.
7. UL 312 - Check Valves for Fire Protection Service.
8. Department of Transportation (DOT), Title 49 Code of Federal Regulations.
9. San Francisco Fire Department, Bureau of Fire Prevention, San Francisco Uniform Plumbing Code.
10. NFPA 2001 - Clean Agent Fire Extinguishing Systems

1.3 SYSTEM DESCRIPTION

A. Contractor shall furnish and install wet-pipe sprinkler system to provide coverage for the Pump Room, Generator Room, Chemical Room, Storage Room and Restroom. Sprinkler system shall comply to NFPA 13 Light Hazard Occupancy requirements for the required area.
B. Contractor shall furnish and install Clean Agent Fire Suppression System for the Electrical Room only. The Contract Drawing shows the general arrangement of the area to receive detection and suppression. The Contractor shall review the drawing so that all items that will effect the operation of the system such as exhaust fan, damper, air louver actuator, power shutoff, generator inhibit and door opening, etc., are considered.

1.4 SUBMITTALS

A. Wet-pipe Sprinkler System

1. Product Data: Provide data on sprinkler heads, valves, and specialties, including manufacturers catalogue information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
2. Plans are diagrammatic only and show preferred locations for control station and riser location. Contractor, at his discretion, may use the sample sprinkler layout, but is responsible for final design and construction of the system. Contractor shall submit (6) copies of shop drawings to the Engineer for distribution to the San Francisco Fire Marshal and to the Design Engineer for approval. Spacing of fire sprinklers shall be coordinated with lights, and heating and ventilation outlets prior to the installation. Drawings shall be the same scale, same sheet size, and shall bear a title block, in accordance with the Contract Drawings. Note that center-of-tile installation in pattern type ceilings is mandatory. If, upon preliminary submittal of Drawings, there are corrections to be made (such as head locations, pipe location and drain locations), corrections shall be made and the corrected Drawings shall be resubmitted at no cost to the State and City. These Drawings shall be corrected and reviewed before starting work.
3. Manufacturer's Certificate: Certify that system has been tested and meet or exceeds code requirements.

B. Chemical Fire Suppression System

1. Material and Equipment Information:

Material and equipment information shall including manufacturer's catalog cuts and technical data for each component or device used in the system. This shall include, but not be limited to the following:

a. Smoke detectors
b. Manual discharge switches
c. Control panel
d. Clean agent storage containers and mounting brackets
e. Nozzles and piping
f. Alarm and release devices

2. The Contractor shall submit drawings on the design built system for review prior to starting work.

1.5 GENERAL REQUIREMENTS

This installation shall be made in accordance with the drawings, specification and applicable National Fire Protection Association (NFPA) Standards, and all equipment shall be listed in the UL Fire Protection Equipment List and the Factory Mutual Approval Guide.

A. Wet-pipe Sprinkler System

1. Installer/Contractor shall specialize in performing work of this Section with minimum five (5) years experience. Furnish a list of at least five (5) representative installations made in the Bay Area.
2. Design sprinkler system under direct supervision of a Professional Engineer experienced in design of this work and licensed in the State of California.
3. Product Data, Shop Drawings: Bear stamp of approval of the San Francisco Fire Prevention Office.
4. Perform work in accordance with Municipality of San Francisco Uniform Plumbing Code.

B. Clean Agent Fire Suppression System

1. The manufacturer of the Suppression System hardware had detection components shall have a minimum of 10 years experience in the design and manufacture of similar installations providing satisfactory service.

All devices, components and equipment shall be the product of the same manufacturer.
All devices and equipment shall be U.L. listed and /or Clean Agent Fire Suppression approved.

2. The installing contractor must have a five (5) years experience in the design, installation, testing of Clean Agent, or similar, fire suppression systems. A list of systems of a similar nature and scope shall be provided on request.

1.6 WARRANTY

The Contractor shall furnish a two (2) year warranty for all the system components and the installation under this Section, shall be guaranteed against defects in design, materials and workmanship for the full warranty period which is standard with the manufacturer from the date of systems acceptance.

PART 2 PRODUCTS

2.1 WET-PIPE SPRINKLER SYSTEM

A. Sprinkler Heads - All sprinkler heads shall be _" orifice, 165°F temp rating, UL and FM approved automatic sprinklers.

1. Pump and Chemical Rooms: pendent style.
2. Generator and Storage Rooms and Restroom: recessed pendent style.

B. Piping

1. Above Ground: Provide Schedule 40 Black Steel Pipe, ASTM Designation A120 with black cast sprinkler type fittings.
2. Below Ground: Provide ductile iron push-on joint type, cement -lined, Class 54, and confirm with ANSI A21.51, complete with necessary adapters to make connections to galvanized or black steel pipe.
3. Screw connections shall be made metal-to-metal tight, and hemp or similar materials will not be permitted in joints. Insure that waterway is not reduced by pipe dope, nonstandard threads, or poor reaming.

C. Piping Specialties

1. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts rated 10 amp at 115-volt AC.
2. Electric Alarm: Electrically operated red enamelled gong with pressure alarm switch.
3. Floor-alarm Test Module and Main Drain Valve: Shall be Victaulic, Style #718, or equal.
4. Pipe Hangers and Couplings: Shall be approved by the engineer, and must be of substantial material and size, as required by the latest regulations of NFPA 13, Section 3-10.3.5. Anchor hangers to the building structure, and not to any furred sections, such as false ceiling.
5. Pipe Sleeves: Provide pipe sleeves of 24 gage galvanized steel in concrete walls where new pipes are required to pass through under this Section.

D. Valves:

1. Gate Valves: Where the gate valves are to be installed over 7 feet above finished floor, provide an extended stem to permit operation at a point of 7 feet above the floor.

Valve sizes _" to 2" shall be bronze body, screwed end, Stockham B-133, Crane No. 459, or equal.

Valves sizes 2-1/2" to 12" shall be iron body, flanged end, Stockham G-634, Crane No. 467, red-White Valve Corp. Fig. 423, or equal.

2. Check Valves: Shall be swing type with rubber faced checks for pressures not exceeding 250 psig.

2.2 CLEAN AGENT FIRE SUPPRESSION SYSTEM

A. DESCRIPTION AND OPERATION

1. The system shall provide a Clean Agent minimum design concentration of 7% by volume, in all areas and/or protected spaces, at the minimum anticipated temperature within the protected area. System design shall not exceed the NOAEL value of 9.0%, adjusted for maximum space temperature anticipated, unless provisions for room evacuation, before agent release, are provided.
2. The system shall be complete in all ways. It shall include all mechanical and electrical installation, all detection and control equipment, agent storage containers, clean agent, discharge nozzles, pipe and fittings, manual release and abort station, audible and visual alarm devices, auxiliary devices and controls, shutdowns, alarm interface, caution/advisory signs, functional checkout and testing, training and all other operations necessary for a functional, U.L. Listed and/or FM approved Clean Agent Suppression System.
3. Provide two (2) inspections during the first year of service. Inspections shall be made at 6 month intervals commencing when the system is first placed into normal service.
4. The Contractor shall be responsible for sealing and securing the protected space against loss and/or leakage during the 10 minute "hold" period.
5. The system shall supply dry contacts, rated as required, to interface with station controls as shown on Drawings and explained below:

    a. One contact to activate the main circuit breaker shunt trip in the main switch board. Contractor shall be responsible for compatibility of configuration.
    b. One contact to inhibit generator start when main power is turned off. Contractor shall be responsible to coordinate configuration between fire suppression system manufacturer and generator manufacturer.
    c. One NO contact that is energized closed, rated 20 amps, 120V. When fire is detected this contact opens causing electrical room ventilation openings to close and fan to go off.

B. MATERIALS AND EQUIPMENT

1. The Clean Agent System materials and equipment shall be standard products of the supplier's latest design and suitable to perform the functions intended. When one or more pieces of equipment must perform the same function(s), they shall be duplicated produced by one manufacturer. All devices and equipment shall be U.L. Listed and/or FM approved.
2. The system shall be designed in accordance with the manufacturer's guidelines. The clean agent shall be stored in Storage Containers. Containers shall be super-pressurized and shall be of high-strength alloy steel construction and confirm to NFPA 2001.
3. Each container shall have a pressure gauge and low pressure switch to provide visual and electrical supervision of the container pressure. The low pressure switch shall be wired to the control panel to provide an audible and visual alarm in the event the container pressure drops below 272 psi. Each container shall have a pressure relief provision that automatically operates when the internal temperature exceeds 150#F.

C. CONTROL PANEL

1. The Chemical System control panel shall perform the functions necessary to operate the detection and Chemical Fire Suppression System sequence of operations. The control unit shall be approved by Underwriters' Laboratories, Inc., and Factory Mutual as chemical system control units.

The control unit shall be housed in a wall mounted, sheet metal enclosure suitable for protecting electrical circuits. It shall be a NEMA Type 1 metal cabinet with hinged, locked doors.

D. WIRING

1. All wiring shall be furnished and installed by the Contractor, per Division 16 and Section 13400, as applicable.

PART 3 EXECUTION

3.1 WET-PIPE SPRINKLER SYSTEM

A. Installation:

1. Install equipment in accordance with manufacturers instructions.
2. Locate outside weatherproof electric alarm on building wall. Location to be determined in the field by the Engineer.
3. Place pipe runs to minimize obstruction to other work. Piping shall be concealed in ceilings at drop ceiling area and exposed in area without drop ceiling. Piping runs shall be checked beforehand and with other Trades to insure clearance. Piping shall be run in strict coordination with mechanical and electrical equipment, structural, and architectural conditions. When other work prevents installation of the piping, the Contractor shall reroute piping. The Contractor shall verify inverts and pitched lines of other Trades before starting work.
4. Flush entire piping system of foreign matter. Piping shall be flushed clean before installing sprinkler heads.
5. Hydrostatically test entire system.
6. Required tests shall be witness by Fire Marshal and Engineer.
7. Provide sleeve in wall for service main and support. Caulk enlarge sleeve and make watertight with pliable material.

B. Field Quality Control:

1. Tests: All test shall be conducted by the installing contractor. Test in accordance with San Francisco Uniform Plumbing Code and NFPA 13. The Waterglass test is prohibited.

Test in the presence of the Fire Marshall and the Engineer, at a pressure of 200 psig for 2 hours without evidence of leakage. All control valves shall be left properly sealed open at the completion of the Contract.

2. Notice: Notify the Fire Marshall and the Engineer in writing five days or more in advance that the tests will be conducted.
3. Field Service: Should any piece of apparatus, or new material fail, the Contractor shall correct (or repair) and retest at no extra cost to the State and City. Following the testing, the system shall be returned to a functional and operational condition at no extra cost.

3.2 CLEAN AGENT FIRE SUPPRESSION SYSTEM

A. The system shall be of central storage design. The storage tank(s) shall be located in the pump room as shown on the drawing.

B. Discharge nozzles shall distribute the chemical throughout the protected area. The nozzles shall be construction and designed to provide proper distribution and weight of the agent.

C. Distribution piping, and fittings, shall be installed in accordance with the manufacturer's requirements, NFPA2001 and approved piping standards and guidelines. All distribution piping shall be installed by qualified individuals using good, acceptable practices and quality procedures. All piping shall be adequately supported and anchored at all directional changes and nozzle locations.

All piping shall be reamed, blown clean and swabbed with suitable solvents to remove burrs, mill varnish and cutting oils before assembly.

All pipe threads shall be sealed with Teflon tape pipe sealant applied to the male thread ONLY.

D. System Inspection and Checkout

1. After the installation is complete, the system shall be inspected by factory trained personnel in accordance with the manufacturer's recommended procedures.
2. All wiring shall be tested for proper connection, continuity, and resistance to ground.
3. The complete system shall be functionally tested in the presence of the City and all functions including system and equipment interlocks must be operational at least ten (10) days prior to the final acceptance test.

4. Each detector shall be tested in accordance with the manufacturer's recommended procedures. The system and equipment interlocks such as door releases, audible and visual alarms, and equipment shut-downs shall function at that time.
5. Each circuit shall be tested for trouble by inducing a trouble condition to the system.

3.3 TRAINING REQUIREMENTS

A. Prior to final acceptance, the Contractor shall provide 4 hours operation training to City's personnel. Training session shall include emergency procedures, abort functions, system control panel operation, trouble procedures, and safety requirements. Session shall include a complete demonstration of the system. Dates and times of the training period shall be coordinated through the Resident Engineer not less than two weeks prior to session.

3.4 OEPRATION AND MAINTENANCE

A. Prior to final acceptance, the Contractor shall provide complete operation and maintenance instruction manuals to the City. All aspects of system operation and maintenance shall be detailed, including electrical schematics of all circuits, a written description of the system design, drawing illustrating control logic and equipment used in the system. Checklists and procedures for emergency situations, troubleshooting techniques, maintenance operations shall be included.

3.5 AS-BUILT DRAWINGS

A. Upon completion of each system, the Contractor shall provide four (4) copies of as-built drawings showing actual installation details, all equipment locations (manual stations, abort switches alarms, detectors, control panels) shall be shown, as well as exact conduit and piping rods details and agent storage positions. All facilities modifications shall be illustrated.

3.6 ACCEPTANCE TESTS

A. At the time “as-built” drawings and maintenance/operation Manuals are submitted, the Contractor shall submit a “Test Plan” which shall describe how the system will be tested. This shall include a step-by-step description of all tests and shall indicate type and location of test apparatus to be employed. The tests shall demonstrate that the operating and installation requirements have been met. All tests shall be conducted in the presence of the City and shall not be conducted until the “Test Plan” is approved.
B. Tests shall demonstrate that the entire control system functions as intended. All circuits shall be tested; automatic discharge, manual discharge, equipment shut-down, alarm devices and storage container pressure. In addition, supervision of each circuit shall be tested.
C. Upon acceptance by City, the complete system shall be reconditioned, containers refilled, and the system placed in operation within a nominal twenty-four (24) hour period. The Contractor shall provide written certification that all containers have been refilled as required.

3.7 WARNING SIGNS

A. Etched aluminum Warning Signs shall be provided at all Entrance and Exits of the protected area.

1. Entrance signs shall read: "WARNING - DO NOT ENTER ROOM WHEN ALARM SOUNDS, CHEMICAL BEING RELEASED".
2. Exit signs shall read: "WHEN ALARM SOUNDS, VACATE AT ONCE, CHEMICAL BEING RELEASED".

SECTION 15400 PLUMBING SYSTEMS

PART 1 GENERAL

1.1 SCOPE OF WORK

A. This section covers the furnishing and installing of a complete Plumbing System as shown on plans and as specified herein.
B. The work of this section includes but is not necessarily limited to the following:

1. Cold water supply including control valve station.
2. Roof and floor drains, waste and vents system.
3. All plumbing fixtures and trim.
4. One electrical water heater.
5. Pipe insulation as specified in Section 15001.
6. All excavation, trenching, backfilling and surface repair necessary for the installation of the plumbing work.
7. All cutting, notching, core drilling, patching and surface repair required for the installation of the plumbing work.
8. All other components, hydrostatic testing, piping disinfection, cleaning, and related work required to provide complete and functional plumbing systems as shown on the Drawings.
9. Coordination with the work of Division 16, Electrical.

1.2 RELATED WORK DESCRIBED IN OTHER SECTIONS

A. Section 10800 - Toilets and Bath Accessories
B. Section 11060 - Valves
C. Section 15000 - Mechanical General Requirements
D. Section 15001 - Process Piping - General
E. Division 16 - Electrical

1.3 CODES AND STANDARDS

Plumbing system shall conform to all applicable codes and standards, and as follows:

A. CODES:

1. Refer to Section 15000, “Mechanical General Requirements.”
2. California State Accessibility Standards
3. Uniform Plumbing Codes

B. STANDARDS:

1. ANSI - American National Standards Institute
2. ANSI - American Society of Sanitary Institute
3. ASTM - American Society for Testing and Materials
4. AWWA - American Water Works Association
5. CISIPI - Cast Iron Soil Pipe Institute
6. IAPMO - International Association of Plumbing and Mechanical Officials
7. PDI - Plumbing Drainage Institute
8. USC Foundation for Cross Connection Control

C. Unless otherwise indicated, the latest issue shall apply.

1.4 SUBMITTALS

A. Product Data: Provide manufacturer’s literature of all Part 2 - Products section.
B. Submit Certificate of Sterilization and Chlorination of Domestic Water System.
C. The Contractor shall submit shop drawings and seismic design calculations for all piping support systems and support locations in accordance with the requirements of this Section and Section 15200, Vibration, Isolation and Seismic Control.

D. The Contractor's installation drawings, after approval by the Engineer shall be used to supplement the Contract Drawings. Shop drawings shall include detailed piping drawings for all piping systems of 2-1/2 inches and larger, indicating appurtenant equipment dimensions which have been used in determining the piping layout dimensions. Piping details of piping systems 2 inches and smaller may be schematic at the Contractor's option.
E. Submit outline of O & M Manual format and contents per the requirements of Section 12-1.18.
F. Copy of C-36 license and list of installations for past 5 years, per Article 1.7,A, specified herein.

1.5 OPERATION AND MAINTENANCE DATA

A. Maintenance Data: Include components of system, servicing requirements, Record Drawings, inspection data, replacement part numbers and availability, and location and numbers of service center.
B. Refer to Section 12-1.18.

1.6 QUALITY ASSURANCE

A. All work pertinent to the Plumbing Work shall be done by a qualified, competent, Class G36 plumbing Contractor with an established reputation in the industry, who can furnish a verified list of satisfactory installations of this type for a past period of 5 years.
B. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture. All items of a given type shall be the product of the same manufacturer.

1.7 PERMITS, FEES AND INSPECTIONS

A. Provide, procure and pay for all permits, licenses, fees, etc., required to perform and complete a safe Plumbing installation.
B. Obtain services of a certified backflow preventer device tester to inspect and check for proper installation and operation in accordance with all applicable standards and health codes. Payment to such services shall be included in the bid package.
C. All inspections shall be by applicable codes.

1.8 COORDINATION

A. Contractor shall be responsible for coordinating and paying for all fees for permits and inspections to the water, and sewer utilities.
B. Coordinate under provisions of Section 15000.

1.9 WARRANTY

A. The Contractor shall furnish a two (2) year Warranty for all work covered under this Section per the requirements of Section 12-1.03.

PART 2 PRODUCTS

2.1 PLUMBING FIXTURES

A. Water Closet - shall be white, water saving 1.6-gallon flush design with elongated bowl, siphon jet flush action, minimum 2-5/8 inch passageway and 1-1/2 inch top spud. Manufacturer shall be Kohler Co., Kingston Model No. K-4430-C with seat Model No. K-4670-C, or equal. WC shall be installed at required height for ADA compliant.
B. Lavatory - shall be white, wall-mounted, 20" x 27" vitreous china, with 4" faucet centers. Manufacturer shall be Kohler Co., Morningside Wheelchair Model No. K-12636 with faucet Model No. K-13335, 1-1/4 inch cast brass "p" trap Model No. K-8998, or equal.
C. Service Sink - SS-1 shall be wall mounted, enameled cast iron, 24" x 20-1/4" with 8" faucet centers. Manufacturer shall be Kohler Co., Bannon Model No. K-6716, with K-8937 stainless steel rim guard, K-8905 rough-plated

faucet, K-6673 enameled inside trap standard and wall hanger supports, or equal. SS-2 shall be the same as SS-1 except no hot water service.

D. Flushometer - Shall be exposed, water saver flush valve compatible with approved water closet. Acceptable manufacturers are Sloan Valve Co., Delany, or equal.
E. Water Closet Support - Jay R. Smith or equal.
F. Hose Bibbs - Shall have _" female inlet and _" hose thread outlet, rough brass, short pattern faucet, and spout outlet vacuum breaker. Manufacturer: Chicago Faucets Model No. 15T with Model No. 293-6 tee handle and Model No. E27 vacuum breaker, or equal.

    1. Furnish one (1) 10-foot length of 1-1/2 inch rubber hose with 1-1/2 inch female NPT at both ends for the sump pump discharge piping. Manufacturer: B.F. Goodrich BFG General Service Black Cover Hose; Boston Industrial Hose; or equal.
    2. Furnish one (1) 25-foot length of _ inch garden hose with garden hose threads to fit all standard faucets. The hose shall be rubber water hose with maximum pressure of 100 psi rated.

G. Emergency Shower and Eye/Face Wash: (EEW)

    1. The emergency shower, eye wash unit shall be free-standing, operated by a foot treadle and/or push flag mechanism and shall include emergency signage. The unit shall comply with current ANSI (ANSI Z358.1) and Cal-OSHA standards and requirements.
    2. Eye Wash - Self-cleaning, non-clogging eye wash with quick opening, full-flow valves, stainless steel eye wash receptor, twin eye wash heads and face spray ring, stainless steel dust cover, copper alloy control valve and fittings. Heads shall be protected with dust covers that remove when water is turned on.
    3. Shower Head/Valve - Self-cleaning, non-clogging 10 inch diameter ABS Plastic shower head with elbow, rigid stainless steel rod which operates a stay open type 316 stainless steel ball valve.
    4. Manufacturers:

        a) Haws Model PVC Shower w/ Eyewash Model 8336
        b) Bradley equivalent
        c) Or equal.

2.2 WATER HEATER

A. Performance - EWH shall be 15 gallon storage capacity, Heater shall be rated at 1.5 KW, 120 Volt, single phase, 60 cycle AC and listed by Underwriters' Laboratories.
B. Tank - Shall have a maximum working pressure of 150 psi, ASME rated temperature and pressure relief valve, rigidly supported anode rod for maximum cathodic protection. All internal surfaces of heater exposed to water shall be glass-lined with an alkaline borosilicate composition fused-to-steel. Complete unit shall have additional insulation with a heavy fiberglass blanket, baked enamel jacket with 4" legs.
C. Element - Electric heating element shall be zinc plated copper sheath, screw-in design, Element operation shall be single element, non-simultaneous.
D. Control - Shall include a thermostat with each element and a high temperature cutoff.
E. Manufacturer - A.O. Smith Model No. ELJF-15, State Model equivalent, or equal.

2.3 PLUMBING SPECIALTIES

A. Roof Drains - Smith Model 1010-C-E-R, or equal. Cast iron body, combined flashing clamp and gravel stop with polyethylene dome, bottom outlet, low profile dome.
B. Overflow Drains - Smith Model 1080-C-E-R, or equal. Cast iron body, combined flashing clamp and gravel stop with polyethylene dome, bottom outlet, flooding dam type.
C. Floor Drains - FD-1 (Pump Rm.) and FD-2 (Chem. Rm.), galvanized cast iron, two piece body with double drainage flange, weep holes, heavy duty loose-set tractor grate, cast iron top. Body with integral trap, and _" primer tap. Manufacturers: Josam 36004; J.R. Smith equivalent; or equal.
D. Floor Drain - FD-5 (Gen. Rm.), same as FD-1 and FD-2, with 6-inch diameter galvanized cast iron funnel assembly on grate.

E. Floor Drains - FD-3 (Storage) and FD-4 (restroom), Cast iron body and flushing collar with nickel bronze adjustable strainer head, bottom outlet, no hub, and trap primer connection. Manufacturers: Smith Model 2010-B-P; Josam equivalent; or equal.
F. Wall drain - Pit style vertical wall drain, cast iron body with bronze backwater valve and cast iron secured grate, 6" side outlet. Manufacturers: Smith Model 7000-C; Zurn Z-629-C; or equal.
G. Roadway Drains: RD-1, RD-2 and RD-3 shall be heavy duty type, galvanized cast iron with loose set ductile iron grate and dome bottom strainer, 4" pipe size. Manufacturer: Smith Model 2570-G-M; Josam equivalent; or equal.
H. Cleanouts - ANSI D2513, provide threaded bronze cleanout plugs.

1. Floor Cleanouts - Provide cast iron floor cleanout with anchor flange, adjustable height polished bronze or nickel bronze rim and scoriated floor plate with “CO” cast in the plate, and countersink screws for installing floor plate flush with finished floor.
2. Cleanouts Exterior to Building - Provide cast iron cleanouts and countersink plugs. Provide cast iron cleanout box with cover.

I. Trap Primers - Fully automatic, all brass trap primer, activated by a drop in water pressure, no adjustment required. Provide gate valve at each trap primer.
J. Water Valves - Provide valves suitable for minimum of 125 psig and minimum of 180 F hot water. Valves shall have threaded end connections with union on all but one side of the valve, or solder end connections between bronze valve and copper tubing. Copper alloy and bronze valve body shall be ASTM B61 copper alloy. Every water supply branch line to fixtures shall be isolated with a gate valve. The valve shall be readily accessible.
K. Dielectric Connections - Provide at connections between copper and ferrous metal piping materials.
L. Escutcheon Plates - Provide one piece or split hinge type chrome-plated finish metal plates for piping passing through floors, walls and ceilings in exposed spaces. Inside diameter shall closely fit pipe outside diameter, or outside diameter of pipe insulation where pipe is insulated. Securely anchor plates in place with set screws or other approved positive means.
M. Pipe Sleeves - All piping passing through rough holes in concrete walls, etc., shall be protected by means of pipe sleeves made of galvanized steel pipe. Pipe sleeves passing through concrete shall have the space around the sleeves filled and neatly painted with cement plaster of the proper mix. Space between pipe and sleeves shall be filled with an approved material and design as listed in the U.L. Building Materials Directory.
N. Insulation - Insulation shall be 1" thick fiberglass for hot water piping Manufacturer: John-Manville, Owens-Corning, or equal.

2.4 PIPING AND FITTINGS

A. General: Sanitary Drain, Waste and Vent Piping: Fittings shall be long radius fittings, except fittings in vent piping may be short radius fittings.
B. Sanitary Sewer and Storm Water Piping, Buried Pipe Ductile Iron, AWWA C151

Pipe Size (Inches)	Thickness Class
3 & 4	51
6	50

Joints - Push-on, AWWA C111 as modified; neoprene gaskets.
Fittings - Ductile-iron or cast iron push-on joints, AWWA C110.
Lining - Standard thickness cement mortar lining for pipe and fittings, AWWA C104.
Protection - Polyethylene encasement, AWWA C105. Double-wrap flanged fittings, mechanical joints, or other appurtenances with significantly different outside diameters from the pipe.
Bonding - Bond ductile iron pipe to provide electrical continuity. Copper jumper strips shall be 1/16" thick by _" wide, U.S. Pipe Electro-Bond, American Cast Iron Pipe Company, or equal.

C. Sanitary Sewer and Storm Water Piping, Above Grade

Pipe - Cast Iron, ASTM A74 extra heavy service weight.
Joints - STM C564, neoprene gasket system or lead and oakum.

Fittings - Cast iron.

D. Domestic Water Piping, Buried

Copper tubing - ASTM B88, Type K, Soft temper for size up to 3 inches.

Fittings - Commercially pure wrought copper, socket joint, ASTM B75 dimensions.

Joints - Socket joint, ASTM B75 dimensions, conforming to ANSI B16.22, Lead-free solder, IAPMO approved.

E. Domestic Water Piping, Above Grade

Copper tubing - ASTM B88, Type L, Hard Drawn.
Fittings - ASME B16.18, cast bronze or ANSI B16.22 wrought copper and bronze.
Joints - Sockets joint, ASTM, B75, lead-free solder, IAPMO approved.

F. Vent Pipe: Service weight cast iron soil pipe and fittings, or type DWV copper pipe and fittings.

PART 3 EXECUTION

3.1 INSTALLATION

A. General - Installation of plumbing systems including fixtures, equipment, materials, and workmanship shall be in accordance with the IAPMO/Uniform Plumbing Code, San Francisco Plumbing Code.
B. Piping:

1. The general layout of piping on the drawings indicates branch runouts terminated at individual or groups of fixtures. The piping shall be considered continuous and finally connected to all fixtures and equipment.
2. Cover unoccupied fixture faucet holes with faucet hole covers.
3. Provide dielectric unions at all connections of non-ferrous piping to ferrous piping.
4. Provide air chambers 18" long one pipe size larger than rough-in shall be at all plumbing fixtures.
5. Route piping in orderly manner and maintain gradient.

3.2 FIELD TESTING

A. Before final acceptance of work, test each system as in service to demonstrate compliance with the contract requirements. Performance the following tests in addition to the tests specified in the Uniform Plumbing Code. Correct all defects in the work provided by the Contractor, and repeat the tests until the work is in compliance with contract requirements. Furnish water, electricity, instruments, connecting devices, and personnel for the tests.

Conduct tests prior to concealing piping. Backfill to extent required to prevent movement.

B. Water Piping: Hydrostatically test each piping system with no leakage or reduction in gage pressure for 2 hours to the following system working pressure:

Piping System Tested	Test Pressure (psig)	Test With
Hot and cold water	100	water

C. DWV Piping: Before the installation of fixtures, cap ends of each system, fill the piping with water to the roof and allow to stand until a thorough inspection has been made. After the plumbing fixtures have been set and their traps filled with water, subject the entire sanitary system to a final air pressure test of not more than 1.0 inch of water column and a smoke or peppermint test. Perform the air and smoke test with an approved smoke testing machine, which must show a clear passage of smoke and air throughout the entire system. The entire system must be proven absolutely tight under such test.

3.3 DISINFECTION

A. Disinfect under the provisions of 15001.

3.4 CLEANING AND FINISHING

A. Clean and protect work under the provisions of Section 15001.

SECTION 15480 DIESEL FUEL SUPPLY AND ENGINE EXHAUST SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. The Contractor shall furnishing and installing a complete and legal diesel fuel storage and delivery system and engine exhaust system consisting of:

1. One (1) 2,500 gal. underground diesel fuel storage tank system.
2. Diesel fuel delivery system consisting of primary fuel piping and secondary containment piping.
3. Fuel monitoring and leak detection system.
4. One (1) package design 75 gallon diesel fuel day tank system including fuel oil cooler.
5. Diesel engine/generator exhaust system and exhaust silencer.
6. Diesel fuel for testing and full tank of diesel fuel for the underground storage tank after completion of all testing for the fuel storage and delivery system.
7. All components, accessories and materials required to provide complete and functional diesel fuel storage and delivery system and engine exhaust system as shown on the Drawings.

B. All related and incidental work, all where and as shown on the plans and in accordance with these specifications.

1.2 RELATED SECTIONS

A. Section 02200 - Earthwork
B. Section 02530 - Groundwater Control
C. Section 03300 - Cast-In-Place Concrete
D. Section 13400 - Station Control System with RTU/PLC
E. Section 15000 - Mechanical General Requirements
F. Section 15001 - Process Piping - General
G. Section 15200 - Vibration Isolation & Seismic Control
H. Section 16620 - Packaged Engine Generator System

1.3 REFERENCE STANDARDS

All listed standards shall be the edition in effect on advertising date.

A. General:

1. City of San Francisco Building Code.
2. Standard Specifications Department of Public Works San Francisco,(SSDPWSF) dated July, 1986.
3. Standard Plans, S.F. Department of Public Works dated September 1987.

B. Underground Fuel Tanks and Equipment:

1. ASTM Standards Document Number D4021-86.

2. Underwriters Laboratories, Inc. (UL) Standard for Safety 1316, File MH 9061 (N) for Storage of Flammable Liquids.
3. National Fire Protection Association (NFPA)Standards:

    a. NFPA 30: Flammable and Combustible Liquids Code.
    b. NFPA 30A: Automotive and Marine Service station Code.
    c. NFPA 70: National Electrical Code.

4. State Water Resource Control Board (SWRCB) list for approved monitoring devices, LG-113-9 Underground Storage Tank and Line Leak Detection Methods.
5. City of San Francisco Plumbing Code, Chapter 12 - Fuel Gas Piping.
6. San Francisco Fire Code, Article 79 (entire article).
7. San Francisco Fire Department "Underground Storage Tank Installation Requirements".
8. UL Standard for Safety 1316, Table 14.1: Probe compatibly in listed fluids.
9. California Underground Storage Tank Regulations

1.4 SUBMITTALS

A. Submit complete specifications, catalog information and cuts, descriptive drawings and literature for each equipment item to be furnished under this Section.
B. Submittals shall include manufacturer's installation drawings for approval by the Engineer.
C. The Contractor shall provide six (6) copies of complete written field testing procedures for review and approval by the Engineer.
D. Submit outline of O & M Manual format and contents per the requirements of Section 12-1.18: Operation and Maintenance Data.
E. Final Record Drawings showing locations and depths of tanks, piping, electrical conduits, dispenser islands and all equipment installed under this section.
F. Operating permit with San Francisco Department of Public Health (SFDPH).

1.5 QUALITY ASSURANCE

A. Like items of equipment specified herein shall be the end products of one manufacturer in order to achieve standardization for operation, maintenance, spare parts, and manufacturer's service.

1.6 WARRANTY

The Contractor shall furnish a two (2) year Warranty for all work covered by this Section per the requirements of Section 12-1.03: Guarantee.

1.7 MANUFACTURER'S SERVICES

A. The Contractor shall provide and pay for the services of an authorized fuel tank manufacturer's representative to supervise installation of the tanks. The manufacturer's representative shall furnish a signed Certificate Of Satisfactory Installation. Such Certificate shall apply to the acceptance and functional testing of the tanks. Furnish written tank test results at the time of Contract Substantial Completion.
B. The Certificate of Satisfactory Installation and testing shall be provided in accordance with the provisions of Section 12-1.19. Prior to Substantial completion of the work of this Contract, the tank manufacturer's representative shall furnish to the Engineer, written manufacturer's Warranties covering all tanks furnished by the manufacturer.

1.8 PERMITS

Contractor shall obtain the following permits for the Underground Storage Tank (UST) installation:

A. San Francisco Department of Public Health (SFDPH)/HMUPA Underground Storage Tank Application for new tank installation:

A. DPH/HMUPA Closure/Modification Supplemental Application
B. SWRCB – UST Application – Form A
C. SWRCB – UST Application – Form B
D. SWRCB – UST Application – Form C – Certification of Compliance.

B. San Francisco Fire Department (SFFD) Tank Installation Permit
C. Bay Area Air Quality Management District (BAAQMD) – notification letter

PART 2 PRODUCTS

2.1 UNDERGROUND FUEL STORAGE TANKS

A. Underground tank shall be U.L. labeled, double wall Fiberglass Reinforced Plastic (RFP) with 100% resin and glass fiber reinforcement. The space between the primary and secondary shell walls shall allow for the free flow and containment of all leaked product from the primary tank. Tank shall have a reservoir filled with a brine solution for monitoring the leakage of the secondary containment.
B. Manufacturers: The tanks shall be manufactured by Xerxes Corporation, model DWT-II or Fluid Containment, model Hydroguard DWT-Type II or equal.

2.2 ANCHORING SYSTEM

A. Anchoring devices are required for all tanks specified in this contract.

2.3 TANK ACCESSORIES

A. Manways and Tank Containment Sumps:

Manways shall have 22" ID, flanged and complete with UL listed gaskets, plated bolts and covers.

Tank Sumps shall provide tight piping and conduit entrances and exits and shall be made of non-corrosive and dielectric material. Manufacturers: Fluid Containment, Xerxes, or equal.

B. Drop Tubes: Drop tubes shall be 4-inch in diameter. Manufacturers: EMCO-WHEATON Model No. A-20; OPW Model No. 61-T, or equal.
C. Gauge Plates: Gauge/deflector plates shall be installed under each service fitting and manway opening.
D. NPT Threaded Fittings:

All threaded fittings shall be constructed of a material consistent with the requirements of the UL label. All standard threaded fittings shall be half couplings and shall be 4" NPT. Strength: NPT fittings shall withstand a minimum of 150 ft-lbs torque and 1,000 ft-lbs bending.

E. Vent caps: Diesel Fuel: Manufacturers: OPW Model No. 523-S; EMCO-WHEATON Model No. A84-009; UNIVERSAL Model No. 45-20, or equal. Gasoline: CARB Certified - Manufacturers: Universal Model 46CS, EMCO - Wheaton Model A84-003 or equal.
F. Vent Termination at Tank (Float Extractor): Bronze, cast iron. Manufacturers: OPW Model 233 series; EMCO-WHEATON Model No. A79 series, or equal.
G. Overfill Prevention Valve: Two-stage shut-off valve at 95% and 98% of tank capacity. Valve body shall be cast aluminum, with rubber float, aluminum valve, piton seals, and aluminum upper and lower drop tubes. Manufacturers: OPW Model No. 61-SO; EMCO-WHEATON Model No. A1100-001, or equal.
H. Top Seal Adapter: Bronze/Aluminum, 4"x4" (coupling size and pipe size) with compatible threads to screw onto the tank fill pipe. Manufacturer: OPW Model No. 633-T- 8076; EMCO WHEATON Model No. A30-014, UNIVERSAL Model No. 724- 4040, or equal.
I. Foot Valve: Brass/bronze body with double poppet, metal to metal seat and mesh screen. Manufacturers: OPW Model 22; EMCO-WHEATON Model No. A439, or equal.

J. Valves and Appurtenances: Shall be of a type designed for use with fuel gas and diesel and shall be UL listed.

2.4 FILTER FABRIC

A. Filter fabric shall be designed for the use of preventing the migration of pea gravel with native soils. Polyethylene shall not be used as a filter fabric.
B. Manufacturers: Reemay, Inc. Model No. TYPAR 3401, Phillips Fibers Model SUPAC 4NP, Hoechest Celanese Corp. Model No. TREVIRA S1125, or equal.

2.5 PIPING AND PIPE FITTINGS

A. Primary fuel piping

1. All primary fuel piping shall be schedule 40, ASTM A53, black iron pipes and fittings including but not limited to connections for:

   a. main tank supply to day tank,
   b. day tank overflow to main tank,
   c. supply to and return from engine/generator, as recommended by manufacturer,
   d. vent sized as shown and as required by local codes and by UL142, NFPA31 and NFPA37 specifications.

2. Contractor shall make all connections to fixed installed pipe with pipe unions to facilitate tank service and removal.

B. Secondary containment piping

1. Secondary containment piping shall be installed at all above ground and underground diesel fuel piping.
2. Secondary containment piping shall be UL listed for containing petroleum products and shall be manufactured in accordance with ASTM D2310.
3. Piping shall be fiberglass filament wound with threaded and bonded bell and spigot ends or plain end by plain end. The piping shall be factory prooftested at pressure of 265 psig.
4. Piping fittings shall be compression two piece molded using an epoxy molding compound. Pipe joining adhesive and curing agents shall be UL listed DS-7000 adhesives.
5. Secondary containment piping shall be pressure tested at 100 psig to assure soundness of all joints and connections.

2.6 MANHOLES

A. Over Sump: H-20 rated cast iron ring, Manufacturers: Universal; Emco Wheaton or equal.
B. Over Gauge H-20 rated cast iron ring, Manufacturers: Pomeco, Model 06110 Series, CNI Raintight, Model 224RBSG; Emco Wheaton or equal.

2.7 LEAK MONITORING SYSTEMS AND ACCESSORIES

A. Tank leak monitoring system shall consist of an electronic monitoring console and sensors. The console shall include alarm warnings and shall generate an accurate inventory report. All sensors shall be compatible with the console.

B. Electronic Monitoring Console

1. The monitoring console, with built-in printer, shall be capable of continuously monitoring the following:

   a. Volume of fuel available (gallons)
   b. Fuel availability in height (inches) of fuel in the tank
   c. Ullage (gallons)

d. Water cumulated at bottom of tank (inches)
e. Fuel temperature (°F)
f. On-demand inventory and automatic inventory increase reports.
g. Presence of liquid in tank piping sumps and under the dispenser sumps.
h. Monitor water level in the brine reservoir.

2. Provide alarm capabilities for:

a. Theft
b. Low inventory
c. High water
d. Overfills
e. External inputs

3. The monitoring system shall be manufactured by: Veeder- Root INCON or equal.

C. Tank Monitoring Probe

1. The tank monitoring probe shall be third party certified to meet/or exceed U.S.E.P.A. performance standards of 0.1 gallon per hour Volumetric Tank Tightness Testing.
2. Manufacturers shall be VEEDER ROOT, Model Series 8473 MAG 1, INCON Model TSP-LL2 or equal.

D. Brine Reservoir Sensor

1. The sensor shall be constructed with materials suitable for prolonged, complete immersion in the brine monitoring liquid.
2. The probe sensor shall detect and report a change in liquid level either above (high level limit) or below (low level limit) the neutral level established during the initial filling and subsequent maintenance of the system. The sensor shall not operate by inducing an electrical current into the brine liquid.
3. The sensing range shall include a built-in allowance for pressure and thermal variation. Until the liquid level exceeds the allowable variation, the probe shall not send a signal to the monitor console.
4. Manufacturers shall be Veeder Root Model 7943 series, INCON Model TSP-HIS or equal.

E. Tank Piping and Dispenser Sump Sensor

1. Shall be made of non-corrosive and dielectric material. Sensors shall be hermetically sealed and intrinsically safe. Sensors shall be able of monitoring for presence of liquid.
2. Manufacturers shall be VEEDER ROOT, Liquid Sump Sensor, INCON Model TSP-ULS series or equal.

F. Overfill Alarm & Alarm Acknowledgment Switch

1. The overfill alarm shall have an adjustable audible alarm and a flashing indicator to provide an early warning of potential tank bulk delivery overfills. The alarm shall be housed in a NEMA 4 painted steel enclosure. Supply voltage shall be 120 VAC, 50/60 Hz.
2. The alarm acknowledgment switch shall be feature a push button switch and indicator light to turn off alarm unit.
3. The overfill alarm shall be manufactured by VEEDER ROOT, Model 790091-001, INCON Model TS-RA2 or equal. The alarm acknowledgment switch shall be manufactured by VEEDER ROOT, Model 790095-001, INCON Model TS-RK or equal.

G. Graduated dip stick and chart for manual measurement of fuel in tank.

2.8 SPILL CONTAINER:

Spill container shall be a “below grade” type. The assembly shall consist of:

1. An outer shell, with H-20 load rating grade cover, cast iron ring. Tack weld tank identification on ring or install a brass plate next to manhole to identify each tank.
2. A spill containment cell with a 5 gallon capacity.
3. Top Seal Caps: Self-aligning toggle and padlockable design with stainless steel pins and cams, Buna seal, and heavy duty corrosion resistant body. Manufacturers: OPW Model No. 634TT; EMCO-WHEATON Model No. A97, or equal.
4. Spill container shall be manufactured by OPW model 101 BG-1000 Series; EBW BG Series or equal.

2.9 DIESEL FUEL DAY TANK SYSTEM

A. General: Provide UL listed fuel oil day tank system complete with day tank including electrical control module, fuel oil supply pump, fuel level gauge, manual fill cap, piping and fittings, containment basin and accessories. Day tank shall be complete in all respects in order to provide the engine/generator set with a reliable, local source of fuel. Day tank shall be for use with main tank and fuel delivery system in order to provide an automatic, self-refilling fuel supply system.

B. Day tank ratings

1. Capacity: 75 gallons.
2. Power requirements: 115V AC, single-phase, 60 Hertz, 15A dedicated branch circuit.

C. Day tank construction

1. Day tank shall be constructed of minimum 12 gauge steel. Pipe thread connections shall be provided for fuel oil supply from main tank, supply to engine/generator, return from engine/generator, return to main tank, vent and drain with ball valve. The drain shall penerate the containment basin. A weatherproof, screened vent cap shall be provided as a loose item for field installation at the outdoor vent termination.
2. The tank shall have interior corrosion protection consisting of an epoxy coating. The exterior of the tank and interior and exterior of the containment basin shall receive a heavy duty, industrial anti-corrosion coating and shall be finish painted.
3. All day tank system components shall be protected by a removable steel equipment cover.
4. Day tank shall be factory leak tested at 5 PSI.
5. The tank shall be equipped with a welded steel channel base suitable for bolt attachment to a concrete pad.
6. The tank shall be installed and anchored within a steel containment basin having a minimum capacity of 150% of that of the day tank. The containment shall be protected against intrusion of debris and falling water.
7. The containment shall be equipped with a flow switch and mount wired to the electrical control module. Presence of fuel in the containment area will shut down supply pump motor and solenoid valve. The flow switch shall be provided with a dry relay contact (N.O. & N.C.; 1 amp at 120VAC) for remote annuciation.

D. Day tank control

1. The day tank shall be equipped with a UL-listed electrical control module which provides fuel level gauge, pump control (on at 88%, off at 100%), high-level warning at 106%, low-level warning at 70%, critical low-level shut off at 3%, fuel in containment basin, and functional signal.
2. All signals and warnings shall be indicated by LED lights. All warnings shall also be provided with contacts (N.O. & N.C.) for remote annuciation.
3. The module shall be manually controlled by ON, OFF, & TEST push buttons with an internal test button allow for periodic testing of all warning LEDs and remote annunciation relays.

E. Pump and motor

1. Pump shall be heavy duty 2 GPM self-priming, positive displacement, rotary gear pump with corrosion-resistant bronze housing and gears (with stainless steel shafts), and self-lubricating carbon bearings with lip-seals. Pump shall be mounted directly to the motor via a carbonator style, split-tang shaft coupling.
2. Motor shall be 1/3 HP, open drip-proof, (squirrel cage) single phase, auto thermal protected, bearing supported shaft, class B insulation for continuous 104 degree Fahrenheit (F) operation, 115 VAC, 60Hz.

F. System testing - The day tank system shall be supplied with manufacturers test certificates for:

1. Tank test: pressure test, leakproof test and structural integrity/appearance test.
2. Level controller: operational test and calibration of level sensors, level indicator, level control, alarms, and backup devices.
3. Pump: vacuum test, flow test, pressure test, leakproof test, ampere/voltage test, load test, and overload test.

G. Manufacturer:

1. Tramont, Model UTRS-75,
2. Pryco, PY75UL,
3. Or equal.

H. Accessories: Provide:

1. 1" ball valves
2. 1" solenoid valve - Brass body soft-seated two-way with 120V AC coil. Minimum pressure differential capability shall be 100 psig. Solenoid valves shall not require a minimum pressure to either open or close solenoid operators shall be molded coil in NEMA 4 enclosure. Manufacturer: Magnetrol; ASCO Red Hat; or equal.
3. 1" check valve.
4. 1" strainer; 100 to 120 mesh element.

2.10 DIESEL ENGINE EXHAUST SYSTEM AND SILENCER

A. The diesel exhaust system shall be double wall and shall have an outer jacket of aluminum coated steel 0.025" thick for 6" through 24" diameters and 0.034" thick for larger diameters. The inner flue gas carrying conduit shall be type 304 or 316 stainless steel. The inner liner shall be 0.035" nominal thickness for all diameters.
B. The pre-engineered exhaust system and published skin temperatures shall be laboratory tested and listed by Underwriters Laboratories for use with building heating equipment and appliances which produce exhaust flue gases at a temperature not exceeding 1400° F under continuous operating conditions. This exhaust system shall be designed to compensate for all flue gas induced thermal expansions.
C. Fiber insulated exhaust system (Model IPS) shall have a fiber insulation between the walls of 4 inches thick unless otherwise shown on the Drawing.
D. An explosion relief valve shall be incorporated into the exhaust system in accordance with NFPA 37.
E. The inner pipe joints shall be sealed by use of overlapping type V-Bands (P-OVB) with a premixed 2000° F sealant (P2000E). The outer channel bands shall be sealed with a 600° F sealant (P-600) where exposed to weather.
F. All parts exposed to the atmosphere shall be provided with a type 316 stainless steel outer jacket.
G. The exhaust system shall be provided with an exhaust silencer with muffler companion flanges and flexible, stainless steel exhaust fittings suitable for orientation as shown on the Drawings and sized in accordance with the engine manufacturer's instructions.

1. The exhaust silencer shall be critical type with minimum attenuation level of 25 dbA. The silencer shall be fabricated of aluminized steel with a coat of high-heat, rust-inhibiting primer and a top coat of high-resistant, silicone aluminum paint.

H. Manufacturers:

1. Exhaust pipe and fittings

a. Selkirk Metalbestos, Model IPS with manufacturer furnished floor guide, sized as shown on the Drawings;
b. Ampco,
c. Or equal.

2. Exhaust silencer

   a. Nelson Industried, Inc.,
   b. Onan Model 500DFGB Genset,
   c. Or equal.

I. The Contractor shall furnish, and install connected from the silencer, an automatic drain trap, snap-acting float type, suitable for liquid drainage. The float and leverage system shall be constructed of stainless steel, valve and seat of hardened chrome steel, and body and cap of cast iron. Trap shall have 3/4-inch diameter NPT inlet and outlet connections and shall be suitable for 250 psig working pressure. The trap shall be Armstrong No. 71-A; Powell or equal. Contractor to provide piping and discharge to floor drain.

PART 3 EXECUTION

3.1 INSTALLATION

A. All equipment supplied under this Specification shall be installed in strict accordance with manufacturer's written installation instructions and recommendations.
B. All underground piping shall have 2' cover minimum. Spacing of pipes inside the trenches shall be as per the pipes manufacturer's recommendation.

3.2 FIELD TESTING

A. Testing of piping

   1. The vent and secondary containment piping shall undergo a 5 psi air pressure test, after installation and before the final backfill. The flexible inner primary piping system shall be tested at 50 psi air pressure.
   2. Pressure testing of piping shall be performed for not less than 15 minutes for each line. No pressure loss is allowed.

B. Testing of Underground Storage Tank
   Tank shall be pressure tested per manufacturer’s recommendations and per requirements of NFPA 30 and authorities having jurisdiction.
C. Testing Leak Monitoring System Tests shall be performed 3 times for each mode to demonstrate system operation to the satisfaction of the Engineer and authorities having jurisdiction.
D. Testing of containment sump. Containment sump shall be tested for water tightness.
E. Interface and coordinate diesel fuel supply system, fuel monitoring system and day tank system including testing with Section 17400: Station Control System.
F. All tests shall be witnessed by the Engineer and inspectors from agencies having jurisdiction. The Contractor shall give the Engineer at least 72 hours advance notice prior to testing.

3.3 FILL STORAGE TANK

Contractor shall fill underground storage tank and day tank upon completion and passing of all field testing.

SECTION 15830 EXHAUST FANS

PART 1 GENERAL

1.1 SECTION INCLUDES

The Contractor shall furnish and install:

A. Eight (8) Centrifugal Roof Exhausters
B. One (1) Cabinet Exhaust Fan

C. Two (2) control dampers with electric actuators.
D. Associated ducts, grilles and vibration isolation equipment.
E. All components, materials, installation labor, functional and operational testing required to provide complete and functional exhaust system as shown in the Drawings.

1.2 RELATED SECTIONS

A. Section 13400 - Station Control System with RTU/PLC
B. Section 15000 - General Mechanical Requirements
C. Section 15200 - Vibration Isolation And Seismic Control
D. Division 16 - Electrical

1.3 REFERENCE STANDARDS

A. The work of this Section shall conform to the latest edition of all applicable codes and standards, includes, but is not necessary limited, to the following:

1. AMCA 99 - Standards Handbook.
2. AMCA 210 - Laboratory Methods of testing Fans for Rating Purposes.
3. AMCA 300 - Test Code For Sound Rating Air Moving Devices.
4. ANSI/AFBMA 11 - Load Ratings and Fatigue Life For Roller Bearings.
5. ANSI/AFBMA 9 - Load Ratings and Fatigue Life For Ball Bearings.
6. PSS 15 - 69 NBS Voluntary Product Standard.

B. In case of a conflict, request clarification from the Engineer, provided that where such documents have been adopted as a code or ordinance by the public agency having jurisdiction, such code or ordinance shall take precedence.

1.4 SYSTEM DESCRIPTION

A. Refer to exhaust fans and heaters schedules on Mechanical Drawings.
B. Interlock control dampers and exhaust fan in Electrical Room with Chemical Fire Suppression system to close dampers and fan when the fire suppression control station is activated.

1.5 SUBMITTALS

A. Shop Drawings: Indicate assembly of centrifugal fans and accessories including fan curves with specified operating point clearly plotted, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.
B. Product Data: Provide data on centrifugal fans and accessories including fan curves with specified operating point clearly plotted, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.
C. Manufacturer's installation instructions and recommendations.
D. The Contractor shall provide a complete list of Manufacturer's recommended spare parts for all equipment furnished under this Section. The list shall include part numbers, part description and current pricing. Prices are to be valid for a period of one (1) year following the date of system commissioning.
E. Submit outline of O & M Manual format and contents per the requirements of Section 12-1.18.

1.6 QUALITY ASSURANCE

A. Construct all fans and provide manufacturer's certification that such fans comply with the requirements of the latest editions of the Air Moving and Conditioning Association (AMCA) Standards and Bulletins.
B. Like items of equipment specified herein shall be the end product of one manufacturer in order to achieve standardization of appearance, operation, maintenance, spare parts and manufacturer's services.

C. Manufacturer's Qualifications

The fan manufacturer shall be a firm regularly engaged in manufacture of centrifugal exhaust fans, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.

D. Installer's Qualifications

The Contractor shall provide the services of a firm with at least 5 years successful installation experience on projects with HVAC systems similar to those required for this project.

E. The Contractor shall possess a California Contractor C-20 license.
F. Manufacturers of equipment furnished under this Section shall have a minimum of five (5) years verifiable experience in the manufacture of such equipment.

1.7 WARRANTY

A. The Contractor shall furnish a two (2) year Warranty for all work covered by this Section per the requirements of Section 12-1.03.

1.8 DELIVERY, STORAGE AND HANDLING

A. All fans shall be lifted by their bases or lifting eyes, not by the shaft or housing outlet.
B. The fans shall be stored in clean, dry locations in order to prevent rust and corrosion.
C. If outdoor storage is necessary, the fans shall be protected as well as possible against the elements.
D. Cover the fan inlets and outlets to prevent the accumulation of dirt and moisture in the housing. Lubricate bearings and wrap for weather protection.
E. If the units are to be stored for more than 30 days, they shall be inspected periodically, rotating the wheels and regreasing the bearings, in accordance with the manufacturer's recommendations.

PART 2 PRODUCTS

2.1 GENERAL

A. Fans used shall not decrease motor size, increase noise level, or increase tip speed by more than 10 percent, or increase inlet air velocity by more than 20 percent, from specified criteria. Fans shall be capable of accommodating static pressure variations of plus or minus 10 percent.
B. Performance Rating: Conform to AMCA Standards 210 and bear the AMCA Certified Rating Seal.
C. Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound rating Seal.
D. Fabrication: Conform to AMCA 99.
E. For motor Specification, refer to Division 16.

2.2 VIBRATION ISOLATION

A. Each fan covered under this Section shall be provided with vibration isolators with seismic restraints. See Section 15200.

2.3 CENTRIFUGAL ROOF EXHAUSTER

A. General: Roof exhaust fan shall be centrifugal belt driven type, of size and arrangement, and of capacity and having accessories as scheduled on plans and hereinafter specified.
B. Wheel: The fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. The wheel shall be statically and dynamically balanced with balancing weights welded to the wheel.
C. Housing: The fan housing shall be constructed of heavy gauge aluminum with a rigid internal support structure. The fan shroud shall have a roller bead for added strength.

D. Shaft: Fan shaft shall be AISI 1040 or C-1045 solid hot-rolled steel, accurately turned and polished, and with keyways. The shaft shall be designed so that the first critical speed is at least 25% over the maximum operating speed. Close tolerances shall be maintained where the shaft makes contact with the bearings.
E. Drive: Drive frame assemblies shall be constructed of heavy gauge steel and mounted on vibration isolators. Drive shall be sized to handle 150% of driven horsepower. Pulleys shall be of the fully machined cast iron type, keyed and securely attached to the wheel and motor shaft. Motor pulley shall be adjustable for final system balance.
F. Motor and drives shall be mounted on vibration isolators out of the airstream shall be heavy duty ball bearing type.
G. Bearings: All bearings shall be extra heavy duty, grease lubricated ball bearing and shall be designed for a minimum (L10) life in excess of 200,000 hours at the fan's maximum catalogued operating speed.
H. Provide a gravity backdraft dampers designed for horizontal mounting in the roof curb.
I. Manufacturers:

Greenheck Model GB, Carnes, or equal.

2.4 WALL EXHAUST FAN

A. Exhaust fan shall be ceiling mounted, horizontal discharge with exhaust duct and exterior hooded wall cap. Fan housing and scoll shall be constructed of corrosion resistant galvanized steel. Grilles shall be constructed of white high impact polystyrene. Fan wheel shall be forward curved type and dynamically balanced for vibration free operation.
Motor shall be 115/60/1 with built in thermal overload protection, sized to match fanloads and mounted on vibration isolators.
B. Manufacturers:

Greenheck, Penn Ventilator Co., or equal.

2.5 THERMOSTAT

Single stage thermostat for line voltage or low voltage temperature control of exhaust fan. UL listed. Manufacturer: Honeywell Tradeline model T42B; Barber Coleman; or equal.

2.6 CONTROL DAMPER

A. Control damper shall be very low leakage design. Damper frames shall be constructed of 16 gauge galvanized steel. Blades shall be air foil design with edge and jamb seals. Axles shall be ½_" diameter zinc plated steel rod mounted in nylon bushings. Linkage shall include a ½_" diameter control shaft extended 6" beyond the frame. Control damper as manufactured by Ruskin, Greenheck, or approved equal.
B. Motor Operator: with 2-position, spring return application (with power on, motor closes the damper; with power off, spring open the damper), 120-V, 60-Hz motor equipped with a SPDT limit switch for 100% close indication. Motor actuator as manufacturer by Tradeline, Barber Coleman, or approved equal.

PART 3 EXECUTION

3.1 TESTING

A. Performance - The fan design shall be tested in a laboratory approved by the Air Moving and Conditioning Association. The fans shall be rated based on these tests made in accordance with AMCA Standard 210, "Test Code for Air Moving Devices" and shall be subject to retesting every three years to provide assurance of continuing adherence to design and quality control.
B. Sound - The fan design shall be tested in a laboratory approved by the Air Moving and Conditioning Association. The fans shall have been rated based on these tests made in accordance with AMCA Standard 300, "Test Code for Sound Rating Air Moving Devices," and shall be published in accordance with AMCA Standard 301, "Method of Publishing Sound Ratings for Air Moving Devices."

C. Shop Performance - Each fan shall be run at the factory to assure proper operation of all rotating parts, including wheel, shaft, bearings, sheaves, and belts. Motors shall be tested for amperage draw by dampering the fan from free-flow to no-flow operating, to assure the motor selected will not overload at any condition.

3.2 PAINTING

A. Equipment furnished under this Section shall be factory prime painted and finish coated by the Contractor in accordance with requirements of Section 15191 and the manufacturer's recommendations. The more stringent requirement shall govern.

SECTION 16000 ELECTRICAL GENERAL PROVISIONS

PART 1 GENERAL

1.1 WORK INCLUDED

A. Division 16, ELECTRICAL, covers the work necessary for the complete electrical system. Furnish materials, labor and equipment in accordance with these specifications and the accompanying drawings. Furnish, install, connect and tag raceways and conductors to all equipment, devices, panels and other items under this contract.

See Division 1, GENERAL CONDITIONS, which contain additional information and requirements that apply to the work specified herein and are mandatory for this project.

B. This section covers general requirements applying to all sections included in Division 16, ELECTRICAL.
C. The requirements of this section also apply to all electrical work and equipment specified under other divisions of these specifications.

1.2 INSPECTION OF THE SITE AND EXISTING CONDITIONS

After award of Contract, verify the location of existing underground utilities. Protect all existing underground utilities during construction.

1.3 RESPONSIBILITY

The Contractor shall be responsible for:

A. Complete systems in accordance with intent of these Contract Documents.
B. Coordinating the details of facility equipment and construction for all Specifications Divisions which affect the work covered under Division 16, ELECTRICAL.
C. Furnishing and installing all incidental items not actually shown or specified, but which are required by good practice to provide complete functional systems.

1.4 INTENT OF DRAWINGS

A. Electrical plan Drawings are diagrammatic and show only general locations of equipment, devices and raceway, unless specifically dimensioned. The Contractor shall be responsible for the proper routing of raceway due to actual field conditions, subject to the approval of the Engineer.
B. Electrical design is based on minimum horsepower and current ratings. If the manufacturer and/or Contractor provides a unit with a larger horsepower or current rating, the Contractor shall be responsible for making all necessary changes to accommodate the larger unit and shall pay for all such changes including engineering design by a professional engineer registered in the State of California.
C. Number and size of wires which shall be installed in runs of conduit, where not shown on the Drawings shall be determined from the control diagrams provided by the manufacturer.

1.5 SUBMITTALS

A. Submittals shall be made in accordance with Section 12-1.06.

PART 2 MATERIALS AND EQUIPMENT, COMMON REQUIREMENTS

2.1 GENERAL

A. Unless otherwise indicated, provide all first-quality, new materials and equipment, free from any defects, in first-class condition, and to fit the space provided. Provide materials and equipment listed by UL wherever standards have been established by that agency. Where an equipment does not have a listing, it shall comply with paragraph C of Section 16050.

B. Where two or more units of the same class of material or equipment are required, provide products of a single manufacturer. Component parts of materials or equipment need not be products of the same manufacturer.

2.2 STANDARD PRODUCTS

Unless otherwise indicated, provide materials and equipment which are standard products of manufacturers regularly engaged in the production of such materials and equipment. Provide the manufacturer's latest standard design modified as required to conform to these specifications.

2.3 EQUIPMENT FINISH

Provide materials and equipment with manufacturer's standard finish color, except where specific color is indicated. If manufacturer has no standard color, finish equipment in accordance with Section PAINTING with ANSI No. 61, light gray color. Provide two (2) quarts of touchup paint.

2.4 EQUIPMENT HARDWARE

Hardware for outdoor equipment shall be stainless steel. Hardware for indoor equipment shall be painted stainless steel, galvanized steel, or stainless steel. Zinc or cadmium plated hardware is not acceptable. Hardware shall include, but not limited to, door handles, hinges, latches, bolts, nuts and other items. This provision shall take precedence over hardware provisions specified in other sections of Division 16, ELECTRICAL.

2.5 SEISMIC REQUIREMENTS

All panelboards, switchboard, transfer switches, luminaires and other equipment, including supports and attachments, shall be designed for seismic loading. Conform to SEISMIC LOADING DESIGN PROVISIONS in California Building Code for seismic zone and locations. See Section 12-1.17.

2.6 EQUIPMENT SUPPORTS

Provide equipment supports for all equipment in accordance with GENERAL CONDITIONS. All floor mounted electrical equipment shall be mounted on 3-inch concrete pads that are 2-inch larger around the plan dimensions of the equipment.

2.7 OUTDOOR EQUIPMENT

Provide equipment and devices to be installed outdoors or in unheated enclosures capable of continuous operation within an ambient temperature range of 20 degrees F to 105 degree F.

PART 3 EXECUTION COMMON REQUIREMENTS

3.1 GENERAL

A. Install materials and equipment in a workmanlike manner utilizing craftsmen skilled in the particular trade. Provide work which has a neat and finished appearance. Carry out work in accordance with NECA Standard of Installation unless otherwise specified.

B. Coordinate electrical work with Divisions 11, 14, 15, Mechanical; Section 13400 and work of other trades to avoid conflicts, errors, delays and unnecessary interference during construction.

C. Prior to fabrication and installation, check the approximate locations of light fixtures, electrical outlets and other electrical system components shown on Drawings for conflicts with openings, structural members and components of other systems and equipment having fixed locations. Submit suggested resolution of such conflicts for approval.

3.2 MATERIAL AND EQUIPMENT INSTALLATION

Follow manufacturer's installation instructions explicitly, unless otherwise indicated. Wherever any conflict arises between the manufacturer's instruction, codes and regulations and these contract documents, follow Engineer's decision. Keep copy of manufacturer's installation instructions on the job site available for review at all times.

3.3 CUTTING AND PATCHING

Lay out work carefully in advance. Do not cut or notch any structural member or building surface without specific approval of the Engineer. Carefully carry out any cutting, channeling, chasing or drilling of floors, walls, partitions, ceilings, paving or other surfaces required for the installation, support or anchorage of conduit, raceways or other electrical materials and equipment. Following such work, restore surfaces neatly to original condition. Use skilled craftsmen of the trades involved.

3.4 LOAD BALANCE

The Drawings and Specifications indicate circuiting to electrical loads and distribution equipment. Balance electrical load between phases as nearly as possible on panelboards, etc.

3.5 MOTOR ROTATION

After final service connections are made, check and correct the rotation of all motors.

3.6 CLEANING AND TOUCHUP

Keep the premises free at all times from accumulation of waste material, litter and rubbish. Upon completion of work, remove all materials, scraps and debris from premises and from interior and exterior of all devices and equipment. The interior of all electrical equipment shall be vacuumed and wiped free of dust just before final acceptance. Deenergization of equipment shall be approved by the City. Touch up scratches, scrapes or chips in interior and exterior surfaces of devices and equipment with finishes matching the type, color, consistency and type of surface of the original finish.

If extensive damage is done to equipment paint surfaces, refinish the entire equipment in a manner that provides a finish equal to or better than the factory finish, that meets the requirements of the Specifications and that is acceptable to the Engineer. Painting shall be in accordance with Section Painting. Unpainted boxes, cabinets and raceways that are mounted on walls that are painted or to be painted shall be painted the same color as the wall.

3.7 STANDARDS, CODES, PERMITS AND REGULATIONS

Perform all work; furnish and install all materials and equipment in full accordance with the latest applicable rules, regulations, requirements and specifications of the following:

1. Local Laws, Codes, Ordinances and Regulating Agencies
2. State and Federal Laws
3. National Electrical Code (NEC)
4. State Fire Marshal
5. Underwriters' Laboratories (UL)
6. National Electrical Safety Code (NESC)
7. American National Standards Institute (ANSI)
8. National Electrical Manufacturer's Association (NEMA)
9. National Electrical Contractor's Association(NECA); Standard Installation
10. Institute of Electrical and Electronics Engineers (IEEE)

SECTION 16050 BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.1 DESCRIPTION

A. This Section specifies the requirements for basic materials and methods for electrical work as necessary to support the Sections in Division 16 which specify particular categories of electrical work.
B. The Contract Drawings show facilities diagrammatically and do not show offsets, fittings, and accessories that may be required. Investigate carefully the structural and finish conditions affecting the work, and provide such fittings and accessories as required.

1.2 INTERFACE AND COORDINATION

A. Interface and coordinate the work of this Section with the other Sections of this Division 16, Electrical, as required to provide a complete and operable electrical installation.
B. Interface and coordinate also with the Sections under Divisions 11, 14, 15, Mechanical, which require electrical and services as part of the mechanical installation.
C. Interface and coordinate electrical work with Section 13400.

1.3 REFERENCE STANDARDS

A. American National Standards Institute (ANSI) C80.1: Rigid Steel Conduit-Zinc Coated.
B. American Society for Testing and Materials ASTM):

1. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
2. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
3. ASTM A386 - Zinc Coating (Hot-Dip) on Assembled Steel Products.
4. ASTM D790 - Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
5. ASTM D1000 - Pressure-Sensitive Adhesive Coated Tapes Used for Electrical Insulation.
6. ASTM D3005 - Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape.

C. Institute of Electrical and Electronics Engineers (IEEE).
D. International Conference of Building Officials (ICBO): Uniform Building Code (UBC).
E. National Electrical Testing Association (NETA): Acceptance Testing Specification.
F. National Electrical Manufacturers Association (NEMA):

1. NEMA KS1 - Enclosed Switches.
2. NEMA RN1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
3. NEMA WC 7 - Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
4. NEMA WD 1 - General Requirements for Wiring Devices.
5. NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.

G. National Fire Protection Association (NFPA):

NFPA 70: National Electrical Code (NEC).

H. Underwriters Laboratories, Inc. (UL):

1. UL 5: Surface Metal Raceways and Fittings.
2. UL 6: Rigid Metal Conduit.
3. UL 20: General-Use Snap Switches.
4. UL 50: Cabinets and Boxes.
5. UL 486: Wire Connectors and Soldering Lugs for Use with Copper Conductors.
6. UL 498: Attachment Plugs and Receptacles.

7. UL 514A: Metallic Outlet Boxes.
8. UL 514B: Fittings for Conduit and Outlet Boxes.

1.4 REGULATORY REQUIREMENTS

A. California Code of Regulations, Title 24, Part 2.
B. California Electrical Code, Title 24, Part 3.
C. CAL/OSHA Standards and California Electrical Safety Orders, Title 8.
D. National Electrical Safety Code (NESC).
E. City and County of San Francisco Department of Public Works Bureau of Engineering Standard Specification Part 6 Electrical Work.
F. City and County of San Francisco Electrical Code.

1.5 SUBMITTALS

A. Submittals shall be made in accordance with the applicable provisions of Section 12 Building Work, 12-1.06.
B. List of Materials: At least 30 days before beginning the work of this Section, submit a list of materials and equipment proposed for use together with applicable standards. Give name of manufacturer, brand name, and catalog number of each item. Submit the list complete at one time, with items arranged and identified in numerical sequence by Specification Section and Paragraph Number.
C. Compliance with Applicable Standards:

1. Where equipment or materials are specified to conform to the standards of organizations such as ANSI, ASTM, IEEE, NEMA, and UL, submit evidence of such conformance for review and record purposes.
2. The label or listing of the specified agency will be acceptable evidence.
3. Where an equipment does not have a label or listing by an approved agency, the Contractor may submit a written certificate from an approved, nationally recognized testing organization, adequately equipped and competent to perform such services, stating that the items have been tested and that the panels conform to the specified standards. Note, U.L. recognized components in U.L. listed enclosure will not satisfy panel listing requirements. Nationally recognized testing organizations shall be as approved by the Bureau of Building Inspection, Department of Public Works of the City and County of San Francisco. Up-to-date list of approved agencies can be obtained by contracting the Bureau of Building Inspection.
4. Submit evidence of compliance to seismic safety requirements in accordance with the California Building Code, Title 24.

D. Factory Test and Inspection Certification:

1. Except as otherwise specified herein, where factory tests and inspections for materials and equipment for which tests and inspections specified in referenced documents are waived, provide certified copies of reports for tests performed on previously manufactured identical materials or equipment within the previous 12 months.
2. Accompany test reports by signed statements from the manufacturer certifying that the previously tested material or equipment is physically, mechanically, and electrically identical to that proposed for the project. Include wiring and control diagrams.

E. Shop Drawings - Showing the exact location and arrangement of conduits stubbed into future equipment, cabinet, pullboxes and assigned spaces, conduit sleeves for future exposed conduits, and for fabricated work being furnished and installed under these Specifications. Submit such drawings before rough-in work, fabrication, and within ample time to prevent delays in the Work. Include electrical diagrams for equipment and equipment installation.
F. Field Test Reports - Certified field test reports of field tests, verifying performance of equipment and systems with Specification requirements.
G. Ninety days after Notice To Proceed, the Contractor shall submit a complete conduit layout plan for approval by the Engineer. No conduit shall be installed nor shall any concrete be poured until these plans are submitted and approved by the Engineer. Any delay caused due to late or incomplete submittal of these plans shall be borne by the Contractor.

H. Provide electrical schematic (elementary) diagrams which show all circuits and device elements in ladder-diagram form without regard to physical location. All wires shall be numbered consecutively on the diagrams. Wire numbers shall be unique. "Typical" schematic diagrams are not acceptable; provide individual diagrams for multiple pieces of equipment.

I. Connection (Wiring) diagrams - Provide diagrams showing the connections and physical relationship of electrical devices and apparatus in circuits or groups of circuit within each RTU, motor controller, or other identifiable unit of equipment. ANSI standard C37.2 and/or Y32.2 shall apply. Complete wiring of each unit shall be individually shown on separate drawings. Wiring diagrams shall have each wire identified according to the lead numbers on the elementary diagrams and shall specify wire sizes. Wire identification on terminal strips shall include the lead numbers assigned on the elementary diagrams, where applicable.

J. For service entrance equipment, meter base and other related materials, obtain written approval of submittals from PGE before submitting to the Engineer.

1.6 OPERATION AND MAINTENANCE MANUALS

A. Provide operation and maintenance manuals. In addition to the requirements below, O & M Data shall be made in accordance with the applicable provision 12-1.18 of Section 12 Building Work.

B. Include the following:

1. Corrected submittals are required.
2. Record (as-built) wiring diagrams, control schematic (elementary) diagrams, interconnection diagrams, and equipment drawings.
3. For all equipment suppliers, list of current names, addresses, and telephone numbers of those who should be contracted for service, information, and assistance.
4. Record (as-built) Contract Drawings marked with red pencil to show revisions to the electrical work when different from the original Contract Drawings. Prepare by obtaining new, clean sets of Contract from the City, and pay all costs for same.
5. Test results.

1.7 WARRANTY

A. In addition to the requirements below, warranty work shall be made in accordance with provision 12-1.03 of Section 12 Building Work.

B. The work and materials covered in this Section shall be guaranteed for a minimum period of 2 years from acceptance thereof against defective materials, design, and workmanship.

PART 2 PRODUCTS

2.1 GENERAL

A. Furnish materials and equipment of design, sizes, and ratings as indicated.

B. Furnish materials and equipment bearing label or classification listing of a national recognized testing laboratory where UL standards exist and such product labeling or listing is available. Electrical materials shall comply with NFPA 70 and NFPA 130 as required.

C. Methods of fabrication, assembly, and installation are optional unless otherwise indicated.

D. Provide products that are free from defects which may impair performance, durability or appearance, and of the industrial grade best suited for the purpose indicated or specified in these specifications.

E. Materials manufactured for use as raceways (except PVC conduit), boxes, cabinets, equipment enclosures, and their surface finish material shall be capable of being subjected to temperatures up to 932 degrees F (500 degrees C) for one hour and shall not support combustion.

2.2 CONDUIT AND FITTINGS

A. Galvanized Rigid Steel (GRS) Conduit and Accessories:

1. Provide conduit, couplings, elbows, bends, sealing fittings, and nipples conforming to ANSI C80.1 and UL 6, with each length bearing manufacturer's stamp and UL label.
2. Use only GRS conduit and accessories.
3. Fittings and Accessories:

    a. Provide separable watertight hub fittings with a gasket, separate nylon insulated throat, and a case-hardened locknut.
    b. Provide bushings of nylon-insulated metallic and grounding type.
    c. Provide conduit straps, clamps backs made of galvanized malleable iron.
    d. Rigid steel conduit shall be a minimum of 3/4-inch diameter at exposed and embedded portions.

B. Liquidtight Flexible Metallic Conduit and Fittings:

1. Provide conduit consisting of a core of flexible galvanized steel with an extruded liquidtight plastic or neoprene jacket overall. Jacket shall be moisture- and oil-proof, capable of conforming to the minimum radius bends of flexible conduit without cracking.
2. Provide conduits with a continuous copper bonding conductor spiral wound between the convolutions, as required by NEC Article 351-9.
3. Provide fittings conforming to UL 514B, cadmium-plated or zinc-coated, and approved for grounding in conformance with NEC article 351-9.

C. Conduit Expansion Fittings:

1. Fittings shall provide for a movement of 3/4-inch from normal in all directions.
2. Fittings shall allow for an angular deflection of 30 degrees in any direction.
3. Fittings shall be provide with flexible copper braid bonding jumper with thermal capacity to carry ground fault currents equal to wire sizes required by U.L. Standard 467 and the National Electric Code.
4. Fittings shall be O.Z. Gedney Type DX, Crouse-Hinds Type XD, or approved equivalent product.

2.3 CONDUIT HANGERS

A. Provided trapeze type multiple pipe or conduit hangers and supports as indicated or required.
B. Fabricate hangers from two or more steel hanger rods, a steel horizontal member, U-bolts, clamps, and other attachments as necessary for securing hanger rods, and conduits.
C. Provide galvanized hanger rods not smaller than 3/8-inch diameter, threaded either full length or for a sufficient distance at each end to permit at least 1-1/2 inches of adjustment.
D. Provide horizontal member meeting the following requirements:

1. Standard structural steel shapes such as angles or channels, 1-1/2 by 1-1/2 or 1-5/8 by 1-5/8 inches, 12 gauge, cold-formed, lipped channel, and designed to accept special spring-held hardened nuts for securing hanger rods and other attachments. Nuts and clamps shall be compatible with the channel.
2. Two or more channels may be welded together to form horizontal members of greater strength.
3. Galvanize after fabrication in accordance with ASTM A123 or ASTM A153, as applicable.

E. Design of conduit hangers shall meet the following requirements:

1. Capable of supporting a load equal to the sum of the weights of the conduits and wires, the weight of the hanger itself, plus 200 pounds.
2. The stress at the root of the thread of the hanger rods shall be not more than 9,475 psi at design load.
3. Size the horizontal member such that the maximum stress will be not more than 12,650 psi at design load.

2.4 INSERTS

A. Channel Inserts:

1. Fabricate from not less than 12 gauge steel channel having an overall size of 1-5/8 by 1-5/8 inches with continuous 7/8-inch wide slot, in lengths as indicated. Galvanize after fabrication.
2. Inserts for embedding in concrete shall conform to the following requirements:

    a. Fabricate from channels having a solid base.
    b. Weld concrete anchors to the channel during fabrication and before coating.
    c. Clean and galvanize after fabrication.
    d. Provide assemblies with a minimum pull-out load rating of 2,000 pounds per linear foot uniformly distributed, with a safety factor of three.
    e. Furnish channel inserts for installation embedded in concrete with the channel interior completely filled with styrofoam to prevent seepage of concrete into the channel during installation.

3. Inserts for surface mounting shall conform to the following requirements:

    a. Fabricate from channel having 3/8-inch by three-inch slots on four-inch centers in the base.
    b. Galvanize, ASTM A153, inserts for surface mounting on concrete surfaces and for installation in damp or wet areas.

B. Spot Inserts for Embedding in Concrete:

1. Steel, galvanized after fabrication, ASTM A153.
2. Design for a maximum loading of 800 pounds with a safety factor of three.
3. Knockout openings to accommodate either square or rectangular nuts.

2.5 SURFACE-MOUNTED METAL RACEWAYS AND FITTINGS

Provide surface-mounted metal raceways and fittings conforming to UL 5, NFPA 70 and NPFA 130.

2.6 OUTLET, JUNCTION, AND PULL BOXES

A. Provide outlet boxes, junction, and pull boxes conforming to NFPA 70, Article 370.
B. Electrical boxes shall conform to UL 50, Cabinets and Boxes, and UL 514B, Fittings for Conduit and Outlet Boxes.
C. Provide electrical boxes of the material, finish, type, and size indicated and as required for the location, kind of service, number of wires, and function. Boxes shall have mounting holes for No. 10-24 machine screws.
D. Provide boxes complete with accessible covers designed for quick removal and suitable for the purpose for which they will be used, except that boxes in which, or on which, no devices or fixtures are to be installed shall be equipped with flat or raised blank covers as required.
E. Boxes below 100 cubic inches in size shall be cast metal. Boxes over 100 cubic inches in size shall conform to the requirements for cabinets, except boxes in interface pull boxes shall be cast metal boxes with gasketed cast metal covers.
F. Covers shall be of same thickness as boxes and shall be secured in position by means of No. 10-24 stainless steel machine screws. Arrange covers to be readily and conveniently removed.
G. Provide brackets, supports, hangers, fittings, bonding jumpers, and other accessories as required.
H. Provide neoprene gaskets 1/8-inch thick for boxes subjected to weather. Provide fire resistant gaskets for pull boxes installed at the conduits for emergency equipment, feeder cables and fire protection circuits.
I. Provide each box with a grounding terminal as follows:

1. Provide grounding terminal of either a green-colored washer-in-head machine screw not smaller than No. 10-32 in a drilled, tapped, and threaded hole in the back of the box, or a grounding bushing with green-colored machine screw terminal attached to one of the conduits.
2. Provide grounding terminals in motor connection boxes.
3. Install grounding jumpers as specified in Section 16455, Grounding and Bonding.

J. Junction boxes shall be zinc-coated (galvanized) inside and outside. Where outlet boxes are used as junction boxes, they shall not be smaller than four inches square by 1-1/2 inches deep. Provide such boxes with gasketed cast metal flat blank covers.

2.7 CONNECTORS AND INSULATING TAPES

A. Splice and Terminal Connectors:

1. Provide termination fittings for use with the cable furnished, NEMA standard, and UL 486 listed.
2. Termination and splice fittings for No. 10 and smaller conductors shall be compression type. Wires to be connected together shall be grouped and fitted into an appropriately sized tin plated copper sleeve. After compressing with an appropriate tool, cover the connector with a nylon insulating cap. Wire splices shall comply with UL 486C. Screw-on and spring pressure type connectors shall not be used.
3. Termination and splice fittings for No. 8 and larger conductors shall be tool-applied compression connectors of material and design compatible with the conductors for which they are used.
4. Terminal connectors for conductors size No. 4/0 and larger shall be long-barrel, double-compression type, and shall be furnished with two NEMA standard bolting holes in the pad.
5. Provide heat-shrinkable insulator for every compression type connector.

B. Insulating Material for Splices and Terminations:

1. Provide insulating material for splices and termination of type accepted by the Engineer for the particular use, location and voltage, of 3/4-inch nominal width.
2. Plastic electrical insulating tape for general use shall be vinyl plastic with rubber-based pressure-sensitive adhesive, and shall be pliable at temperature of minus 18 degrees C to 105 degrees C. When tested in accordance with ASTM D3005, the tape shall have the following minimum properties:

    a. Thickness: Seven mils.
    b. Breaking Strength: 15 pounds per inch.
    c. Elongation: 200 percent.
    d. Dielectric Strength: 10,000 volts/mil.
    e. Insulation Resistance(Direct method of electrolytic corrosion): Ten megohms.

3. Rubber electrical insulating tape for protective overwrapping shall be silicone rubber with a silicone pressure-sensitive adhesive. When tested in accordance with ASTM D1000, the tape shall have the following minimum properties:

    a. Elongation: 525 percent.
    b. Dielectric Strength: 13,000 volts.
    c. Insulation Resistance (Indirect Method of Electrolytic Corrosion): Ten megohms.

4. Arcproof tape shall be flexible, comfortable organic fabric, coated one site with a flame-retardant flexible elastomer, self-extinguishing, with the following minimum properties:

    a. Thickness, ASTM D1000: 55 mils.
    b. Tensile Strength, ASTM D1682 - 50 pounds per inch.
    c. Thermal Conductivity, ASTM D1518 - 0.0478 Btu/hour/square foot/ degree F.
    d. Electrical Arc Resistance - Withstand 200 ampere arc for 40 seconds.

5. Mark each tape package to indicate shelf-life expiration date.

2.8 WIRING DEVICES

A. Switches:

1. Provide AC tumbler-toggle switches conforming to minimum requirements of UL 20 and the requirements herein specified, of specification grade and heavy duty type, Hubbell No. 1221, Bryant No. 4901, General Electric No. GE5951-1, or approved equivalent product.
2. Switches for use on incandescent or fluorescent lighting circuits shall be rated 20 amperes at 120 or 277 volts.

B. Receptacles:

1. Provide convenience outlet and power outlet receptacles conforming to UL 498 and NEMA WD 1 for heavy duty general use type; as indicated in suitable enclosures.
2. 120 volt convenience outlet receptacles shall be specification grade, NEMA 5-20R configuration single or duplex receptacles as indicated. Wire terminals shall be screw type.
3. GFI Receptacles: Receptacles with ground fault circuit interrupters (GFI) shall be UL listed, shall be duplex, shall have NEMA 5-20R configuration and rating, and shall fit standard-sized outlet boxes. Interrupters shall trip on a 5 mA ground fault, ont on overloads, shall be capable of interrupting 1,000 amperes without damage, and shall have provision for testing.
4. Special duty receptacles for 480 volt, 3 phase, 20 amp shall be specification grade, flush, with twist-lock configuration by Hubbel, Bryant or General Electric.

2.9 EQUIPMENT IDENTIFICATION

A. Refer to Section 15190, Mechanical Identification, for fabrication of equipment identification tags.
B. Provide identification tag for each switch, outlet, junction box, local control station, control panel, panelboard, disconnecting device, and dry-type transformer. Identify the system, component, circuit, and location being served.

2.10 ELECTRIC MOTORS

A. Unless otherwise specified, motors for general purpose use shall be Squirrel Cage induction, totally enclosed fan cooled meeting the following requirements:

1. Volts - 460 volts
2. Frequency - 60 Hertz
3. Phase - 3
4. Insulation - Class B or F
5. Service Factor - 1.15
6. Duty - Continuous
7. Bearings -Ball rated for 30,000 hrs operation
8. Power Factor - 0.8 minimum
9. Efficiency - 90% minimum

C. All motors furnished shall be designed and constructed to give satisfactory performance at any value or frequency and/or voltage 10% above or below normal. The motor shall be as manufactured by U.S. Electric Motors, General Electric Co., Reliance or equal.
D. Frames, End Bells, Fan Guards and Rain Guards:

1. Frames, including feet, bearing housings, and end bells shall be cast iron. Fan covers shall be cast iron or a proven plastic fiberglass equivalent. Cover openings shall be per NEMA MG1-1.26.10 "Guarded" requirements. Vertical motors shall be equipped with corrosion resistant rain guards.
2. Fans shall be non-sparking, corrosion resistant bronze alloy approved plastic. Cast iron fans may be used for non-explosion proof motors with the approval of the Engineer. All fans shall be bi-directional.
3. Fans shall be fastened to the shaft by key; band type clamping is not acceptable. A metal hub design shall be used for all plastic fans to assure positive attachment to the shaft.

E. Rating, Performance and Tests comply with all applicable Sections of NEMA MG1-1987.

2.11 LOCAL CONTROL STATIONS

A. Provide heavy duty local selector switch control stations as shown on drawings, rated at 600 volts and conforming to UL Standard 698, Crouse-Hinds, Appleton Electric or approved equal. Push-button stations for local control of equipment shall have maintained contacts or be manually lockable in the Stop position.

2.12 DISCONNECT SWITCHES

A. Provide safety switch disconnecting devices, enclosed, conforming to IEEE C37.35.
B. Heavy-duty Safety Switches (600 VAC):

1. Provide heavy-duty safety switches having electrical characteristics, and accessories as indicated on the Drawings. Ratings shall be as shown or per NEC 430-110.
2. Provide switches with NEMA 12 industrial duty enclosures inside the building and NEMA 4X Stainless Steel industrial duty enclosures outside the building, with metal nameplates, front cover mounted, containing a permanent record of switch type, catalog number, and hp ratings.
3. Provide handle with visible blades, reinforced fuse clips, nonteasible, positive, quick-make, quick-break mechanism, and padlockable in the OFF and ON positions.
4. Provide switches meeting NEMA KS 1 requirements.

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

A. Install electrical materials, equipment, and accessories in locations as indicated, rigid and secure, plumb and level, and in alignment with related and adjoining work to provide a complete and operable system. Do not weld electrical materials for attachment or support.
B. Control erection tolerance requirements so as to not impair the strength, safety, serviceability, or appearance of the installations. Determine exact locations of conduit. Route conduit parallel to building lines unless otherwise indicated.
C. The trade size, type, and general routing and location of conduits, raceways, and boxes shall be as indicated or specified.
D. Install exposed conduit so as to avoid conflicts with other work. Install horizontal raceways close to the ceiling or ceiling beams, and above water or other piping wherever possible.
E. Install individual conductors and multiple-conductor sheathed cables in conduits, raceways, cable trays, ducts, and trenches as indicated to complete the wiring systems.
F. Install switches, receptacles, special purpose outlets, and cover plates complete in a neat manner in accordance with the NFPA 70 and local electrical codes. Plug unused opening in boxes, cabinets, and equipment.
G. Use of explosive fasteners is prohibited.

3.2 CONDUIT AND FITTINGS

A. Electrical Conduit - Installation Requirements:

1. Install conduit in accordance with NFPA 70, NFPA 130, and as indicated. Prevent concrete and other materials from entering and obstructing the conduit, outlets, and pull and junction boxes. Do not use conduit smaller than 3/4-inch for exposed and embedded work.
2. Unless otherwise indicated, make conduit bends in accordance with NFPA 70, with not more than three quarter bends, 270 degrees total, per run of conduit for communications and four quarter bends, 360 degrees total otherwise. Where more bends are required in a particular run, install pull boxes as required to facilitate pulling conductors even if not indicate
3. Provide and install metallic numbering tags indicating the conduit number on both ends of all conduit. Identify the control and communication conduit and provide them with plug for open end.
4. Install conduit so that moisture collecting in the conduit will be drained to the nearest outlet or pull box.
5. Whenever exposed or buried conduit passes through an expansion or contraction joint in the structure, install the conduit at right angles to the joint, and provide an approved conduit expansion fitting at the

joint. Paint the conduit with an approved bituminous compound for one foot on each side of the expansion couples.

6. Provide expansion fittings in conduit runs where required to compensate for thermal expansion.
7. Rod and swab embedded conduit after installation to remove foreign matter. If obstructions are encountered which cannot be removed, or if conditions exist which may result in damage to wires and cables pulled through the conduit, install new conduit at no additional cost to the City.
8. After the conduit has been rodded and swabbed, install covers on boxes and protect conduit ends to prevent foreign material from entering the conduit.
9. Where conduit is exposed to different temperatures, seal the conduit to prevent condensation and passage of air from one area to the other.
10. Metallic conduits shall be electrically and mechanically continuous and connected to ground by bonding to the grounding system where required.
11. Apply conductive compound to the threads of threaded rigid conduit joints. Do not use compounds containing lead. Terminate the conduit in appropriate boxes at motors, switches, outlets, and junction points.
12. When field cutting of conduit is required, thread and ream the conduit to remove rough edges. Where a conduit enters a box or other fitting, provide a bushing to protect the wire from abrasion. Provide insulation type bushings and double locknuts on ends of rigid conduits terminating at steel boxes, panelboards, cabinets, motor starting equipment, and similar enclosures.
13. Support individual horizontal conduits not larger than 1-1/2 inches in diameter by means of one-hole conduit strap with back spacers or individual conduit hangers.
14. Space conduits installed against concrete surfaces 1/4 inch away from the surface by clamp backs or other approved means.
15. Support individual horizontal conduits larger than 1-1/2 inches in diameter by individual hangers and forged steel conduit strap for vertical runs.
16. Hanger rods used in connection with spring-steel fasteners, clips and clamps shall be either 3/8-inch diameter galvanized steel rods or, if concealed above a suspended ceiling, galvanized perforated steel strapping. Do not use wire for support of conduit.
17. Provide metallic tags indicating numbers and total angle of bends in conduits embedded in concrete.
18. In areas of floating slabs, install horizontal runs of conduit beneath the floating slab. Conduit shall pass through the floating slab only where required to terminate in a vertical direction as indicated. Provide a sleeve with an all around 1/4-inch clearance between sleeve and vertical conduit riser. Fill the space around the conduit with rubber-base waterproofing compound.
19. Tag unscheduled conduit in a manner acceptable to the Engineer for indoor installation only. All outside or potentially wet areas installations shall be GRS or PVC as appropriate.

B. Galvanized Rigid Steel(GRS)Conduit:

1. Terminate conduit installed for future extension with flush threaded couplings set to finished floor level or wall, unless otherwise indicated. Provide plug for open end. Extensions to existing work shall match existing size.
2. Properly support and anchor conduit to be embedded to maintain correct location and spacing and to prevent flotation during concreting operations. If necessary, provide, suitable metal supports.

C. Liquidtight Flexible Metal Conduit: Install liquidtight flexible metal conduit at structural construction joints, at motor connections, and where required so that liquids tend to run off the surface and not drain toward fittings. Provide sufficient slack to reduce the effects of vibration. Running threads are not acceptable. Where necessary for connecting to rigid conduits, use right and left hand couplings.

D. Pull Cords:

1. Provide nylon pull cords of tensile strength not less than 240 pounds in each conduit and duct. Leave pull cords in ducts and conduit.
2. Splices in pull cords will not be permitted.
3. Leave ample slack length at each end of pull cords.

E. Filling of Openings: Wherever slots, sleeves, or other openings are provided in floors and walls for the passage of raceways, conduits, and bus ducts, fill such opening as follows:

1. Provide fire-resistive filling material and installation for openings.
2. Where conduits passing through openings are exposed in finished rooms, use surface filling material that matches, and is flush with, the adjoining finished floor, ceiling, or wall.

3.3 CONDUIT HANGERS

A. Provide anchor bolts and anchorage items as required, and field check to ensure proper alignment and location. Provide templates, layout drawings, and supervision at the jobsite to ensure correct placing of anchorage items in concrete. Check embedded items for correctness of location and detail before concrete is placed.
B. Install supporting members, fastenings, framing, hangers, bracing, brackets, straps, bolts, and angles as required to set and connect the work rigidly. Conform to UBC requirements for Seismic Zone 4 location.
C. Support parallel conduits at the same elevation on multiple conduit hangers or channel inserts. Secure each conduit to the hanger or channel insert member by U-bolt, one-hole strap, or other specially designed and approved fastener suitable for use with the hangers or channel inserts.
D. Space supports not over 10 feet on center for vertical conduits spanning open areas. Securely anchor conduit at each end, and run so as not to interfere with the installation and operation of equipment at the location.
E. Support conduits and raceways above suspended ceilings from either the floor construction above or from the main ceiling support members, by using the applicable methods specified herein.

3.4 INSERTS

A. General: Install inserts in concrete so as to prevent contact between inserts and rebar and to prevent damage to the rebar coating during installation and placing of concrete.
B. Channel Inserts: Install embedded channel inserts with the slotted face flush with the finished concrete surface.
C. Spot Inserts: Install with the insert face flush with the finished concrete surface, firmly embedded, with no evidence of movement.
D. Field Tests: Test selected inserts, as required by the Engineer, by suspension of 800 pounds of weight from the insert. If there is evidence of failure, replace the inserts in a manner satisfactory to the Engineer at no change in the Contract Price and retest.

3.5 SURFACE METAL RACEWAYS

A. Install surface metal raceways, where indicated, in accordance with NFPA 70. Use fittings and accessories designed for the raceway.
B. Securely ground surface metal raceways to outlet boxes or to backplates and fixtures by means of bolts, screws, or other approved means and as specified in Section 16455, Grounding and Bonding.

3.6 OUTLET, JUNCTION, AND PULL BOXES

A. Install so that covers are readily accessible after completion of the installation.
B. Do not install boxes above suspended ceilings, except where the ceiling is of the removable type or where definite provisions are made for access to each box.
C. Boxes Set in Concrete:

1. Support boxes to prevent movement during placement of concrete.
2. Locate boxes and box knockouts in concrete so as not to interfere with the reinforcing steel.
3. Unused nailing holes or other holes in the side or bottom of the boxes shall be plugged or masked.
4. After installation, clean boxes placed in concrete and provide covers to prevent entry of dirt and debris.

3.7 GROUNDING AND BONDING

Install as specified in Section 16455, Grounding and Bonding.

3.8 WIRING DEVICES

A. Unless otherwise indicated on the Drawings, mount outlet and switch boxes on the surface of finished wall or ceiling.
B. Mount boxes so that the long axis of the devices will be vertical, unless otherwise indicated on the Drawings.
C. The mounting height indicated for a wall-mounted outlet or switch box shall be construed to mean the height from the finished floor to the horizontal centerline of the cover plate.
D. Install boxes located near doors on the lock side, even where the symbols appear on the hinge side as indicated, unless other locations are approved by the Engineer.
E. Locate switches 3 feet 3 inches above finish floor and general purpose receptacles 2 feet above finished floor, except as otherwise indicated on the Drawings.

3.9 WIRING

Install wiring as specified in Section 16120, Wires and Cables.

3.10 MANUAL CONTROL STATIONS

Mount manual/auto selector switches, on/off control stations, and push button stations on surface of finished wall 4 feet above finished floor, unless otherwise indicated on the Drawings.

3.11 DRY-TYPE TRANSFORMERS

Install dry-type transformers as indicated on the Drawings, in accordance with NEMA criteria, and as recommended by the manufacturer. Installation shall conform to California Building Code for Seismic Zone 4 location.

3.12 EQUIPMENT IDENTIFICATION

A. Mount equipment identification tags as specified in Section 15190, Mechanical Identification.
B. Mount equipment identification tags on or near the front cover of each switch, outlet, junction box, local control station, control panel, panelboard, disconnecting device, and dry-tape transformer. Do not cover existing equipment nameplates or other existing labeling.
C. Mount equipment identification tags only on flat, smooth surfaces.

3.13 DISCONNECT SWITCHES

A. Mount disconnecting devices so as to provide free and clear access to the disconnect mechanism and to allow opening and maintenance of the device.

SECTION 16120 WIRES AND CABLES

PART 1 GENERAL

1.1 DESCRIPTION

A. This Section specifies the requirements for furnishing, installing, and testing all low voltage power cables and wires, instrumentation cables, and the respective accessories as required. Excepted is the panel wiring for RTU/PLC and communication cables which are specified in Section 13400.
B. Interface and coordinate the work of this Section with Section 16050, Basic Electrical Materials and Methods.

1.2 RELATED SECTIONS

A. Section 16050, Basic Electrical Materials and Methods
B. Section 16455, Grounding and Bonding
C. Section 16480, Motor Control Section 16500, Lighting
E. Section 13400, Station Control System with RTU/PLC

1.3 REFERENCE STANDARDS

A. American National Standards Institute (ANSI)
B. American Society for Testing and Materials (ASTM):

1. ASTM B3: Soft or Annealed Copper Wire.
2. ASTM B8: Soft or Annealed Copper Wire Concentric Lay Stranded Copper Conductors, Hard, Medium Hard, or Soft.

C. Insulated Cable Engineers Association, Inc. (ICEA)
D. National Electrical Manufacturers Association (NEMA):

1. NEMA WC5: Themoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
2. NEMA WC7: Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
3. NEMA WC8: Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

E. National Fire Protection Association (NFPA) 70: National Electrical Code (NEC).
F. Underwriters Laboratories, Inc. (UL): 62 Flexible Cord and Fixture Wire.
G. Rural Electrification Admission Standards (REA): PE 39.
H. Pacific Gas and Electric Company (PG&E): Engineering Standard No. 33.

1.4 SUBMITTALS

A. Submittals shall be made in accordance with provision 12-1.06 of Section 12.
B. Records of the installed length for each type of cable run.
C. Contractor's cable pulling plan, prior to pulling in cables.
D. Certified reports for insulation resistance tests of low voltage power and control wires, 15 kV cables, within one week of performing such tests, as referenced in Article 3.4, Field Quality Control, below.
E. Diagram showing any proposed variations in duct-occupancy from that shown on the Drawings, of all new and existing feeders under this Contract for approval.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Provide markings on wire and cable in accordance with applicable NEMA and NEC requirements. Label each item with UL listing approval.
B. Ship each material securely wrapped, packaged, and labeled for safe handling during shipment and storage.
C. Store wire and cable in secure and dry storage facility.

PART 2 PRODUCTS

2.1 WIRE AND CABLE

A. Low Voltage Power and Control Wires:

1. General: All low voltage power and control wires shall be rated 600 volts.
2. Single Conductor Wire:

a. Conductor Material: ICEA stranded or solid, copper meeting requirements of ASTM B 3, soft drawn.
b. Insulation Rating: 600 volts, flame and moisture resistant thermosetting dielectric.
c. Conductor Type:

1) Size 12 AWG and smaller: solid conductor for lighting fixtures and receptacles wiring, Class B stranded for control wiring.
2) Size 10 AWG and larger. Class B stranded.

d. Size 14 AWG to 1/0 AWG: NFPA 70, Type XHHW, cross-linked-thermosetting-polyethylene-insulated in accordance with NEMA WC7; or NFPA 70, Type RHH, ethylene-propylene-rubber-insulated neoprene jacketed in accordance with NEMA WC 8.
e. Size 2/0 AWG and larger: NFPA 70, Type RHH, ethylene-propylene-rubber-insulate neoprene jacketed in accordance with NEMA WC8.
f. Temperature Rating: Temperature ratings of cables shall be not less than 90 degrees C at continuous load.
g. Color Coding of Conductors:

1) 208/120 Volts:

a) A: Black.
b) B: Red.
c) C: Blue.
d) Neutral: White.
e) Ground: Green.

2) 480/277 Volts:

a) A: Brown.
b) B: Orange.
c) C: Yellow.
d) Neutral: White.
e) Ground: Green.

3) Branch circuit phase conductors No. 10 and smaller and all neutral and equipment conductors shall be solid color insulation.
4) Phase conductors having colored tracers shall have background color other than white or green.
5) Solid color coatings and tracers shall have a strongly adherent paint or dye not injurious to the insulation and which will not be obliterated by pulling into a conduit or raceway.
6) On-site coloring of ends of conductors may be permitted by the Engineer upon receipt of satisfactory evidence that the Contractor is unable to order color coded wire and cable as specified. Provide certification from the cable manufacturer that the paint or dye proposed for field application is non-injurious to the insulation.

3. Fixture Wire:

a. Provide fixture wire conforming to UL 62 and the following additional requirements:

1) Type: SF-2 silicon rubber insulated.
2) Conductor: Stranded copper conductor 16 AWG or larger as indicated.

B. Instrumentation Cables:

1. 4 to 20 mA Signal Cables: Provide cable of two conductor, single twisted pair, #16 AWG, tinned copper, 300 volt polyethylene insulated, Bedfoil aluminum polyester shield, stranded tinned copper drain wire, chrome vinyl jacket.
2. Type 1 Cable (300V Multi-Twisted, Shielded Pairs with Common Overall Shield):

a. Individual Conductors: No. 16 AWG, seven-strand copper. 15-mil thickness PVC insulation, rated for 90 degrees C (dry location), with black and white numerically printed and coded pairs.

b. Assembly: Individual conductors twisted into pairs, pairs individually covered with an aluminum-polyester shield with a tinned copper drain wire. The conductor bundle shall be tinned copper drain wire. The outer jacket shall be 40-mil minimum PVC rated 90 degrees C minimum.
c. Use only 2-, 4-, 8-, 24-, 36-, and 50-pair cable.

No. of Pairs	Max. Outside Dia. (In.)
2	0.50
4	0.60
8	0.75
16	1.05
24	1.29
36	1.48
50	1.79

d. Manufacturers: Houston Wire & Cable, Anixter, or equal.
e. All multi-conductor instrumentation cables shall be Type 1 unless noted otherwise. Conductors shall run end to end with no splices.

C. Accessories:

1. Cable Supports and Fasteners: Design for use with channel inserts. Conform to NFPA 70.
2. Conductor Bundling Straps:

a. Provide conductor bundling straps formed from self-extinguishing nylon having a temperature range of minus 65 degrees F to plus 250 degrees F.
b. Equip each strap with a locking hub or head with a stainless steel locking bath on one end and a taper on the other end.

3. Terminations:

a. Low Voltage Power and Control Wires: Provide motor connection kits consisting of heat-shrinkable, polymeric insulating material, flame-retarded per IEEE 383, to cover the connection area and a high dielectric strength mastic to seal the ends against ingress of moisture and contamination. Motor connections shall be suitable for continuous operation at conductor temperatures of 90 degrees C.

2.2 SOURCE QUALITY CONTROL

A. All wires and cables shall be factory tested to ensure that it has been manufactured in accordance with the applicable standards.

PART 3 EXECUTION

3.01 INSTALLATION

A. Low Voltage Power Cables and Wires:

1. Provide wiring systems complete as indicated. Provide ample slack wire for motor loops, service connections, and extensions.
2. Do not bend cables during installation, either permanently or temporary, to radii less than 12 times the outer diameters, except where conditions make the specified radius impracticable and shorter radii are permitted by NFPA 70 and NEMA WC 7, Appendix N.
3. Bundle cable and conductors neatly and securely with nylon straps located in branch circuit panelboards, cabinets, control boards, switchboards, and motor control centers. Use nylon bundling straps. Bundle power cables separate from control cables.

4. Install motor feeders, service connections, and extensions in accordance with the referenced codes. Install motor feeder in liquid-tight-flexible conduit of 18 inches minimum length at motor conduit box.
5. Wire Pulling: Comply with the requirements of Section 16050, Basic Electrical Materials and Methods and the following:

    a. Install wire and cable in conduit as indicated. Do not pull wiring into conduit until conduits and outlets have been thoroughly cleaned and swabbed. Do not use block and tackle or other mechanical means for pulling conductors smaller than No. 2 AWG in raceways.
    b. Provide suitable installation equipment to prevent cutting and abrasion of conduits and wire during the pulling of feeders. Use lubricant and installation procedure as recommended by the cable manufacturer.
    c. Pulling tension shall not exceed manufacturer's recommendations. For conduits runs with three or four bends, and cable size larger than 2 AWG, provide the Engineer with cable pulling calculations prior to making the pull.
    d. Provide masking or other means to prevent obliteration of cable identifications when solid coating or colored tracers are used.
    e. Pull cables installed in a single conduit together.

3.2 IDENTIFICATION

A. Low Voltage Power Cables and Wires:

1. Provide nonmetallic fiberboard or plastic identification tags or pressure-sensitive labels designed for fastening to cables, feeders and power circuits in pullboxes and manholes, and at all terminations of cable wire.
2. Stamp or print tags or labels to correspond with markings as indicated, or mark so that feeder or cable may be readily identified. ID tags for lighting and convenience outlets circuits not needed.
3. If suspended type identification tags are provided, attach the tags to slip-free plastic cable lacing units or to nylon bundling straps.

3.3 FIELD QUALITY CONTROL

A. General:

1. Insulation resistance and continuity tests shall be made by the Contractor in the presence of the Engineer after cable has been pulled in ducts and conduits, prior to connecting the new cables to existing cables or to equipment.
2. Defects in the cable installation revealed by the testers specified shall be corrected by replacement or repairs satisfactory to the Engineer, after which the Contractor shall repeat the tests until he obtains test results satisfactory to the Engineer.

SECTION 16321 DISTRIBUTION TRANSFORMERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Dry-Type power distribution transformers of the following type:

1. General purpose type.
2. Isolation type.

1.2 RELATED SECTIONS

A. Section 16050 - Basic Electrical Materials and Methods.
B. Section 16455 - Grounding and Bonding

1.3 REFERENCES

A. ANSI/IEEE C57.12.01-1989 - General Requirements for Dry-Type Distribution and Power Transformers.
B. ANSI/IEEE C57.12.91 - Test Code for Dry-Type Distribution and Power Transformers.
C. ANSI C57.12.70-1978, Terminal Markings and Connections for Distribution and Power Transformers.
D. IEEE C57.12.59-1989, Guide for Dry-Type Transformer Through-Fault Current Duration.

1.4 SUBMITTALS

A. Submit shop drawings under provision 12-1.06 of Section 12 Building Work.
B. Submit shop drawings indicating outline dimensions, connection and support points, weight, specified ratings and materials.
C. Submit product data under provision 12-1.19 of Section 12 Building Work.
D. Submit product data indicating standard model design tests and options.
E. Submit manufacturer's installation instructions.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provision 12-1.18 of Section 12 Building Work.
B. Include procedures for insulation resistance measurement and maintaining auxiliary equipment, and replacing components where applicable.

1.6 QUALITY ASSURANCE

A. Manufacturer: Company specializing in power distribution transformers with three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in factory container or provide additional heavy canvas or heavy plastic cover to protect units from dirt, water and construction debris.
B. Store and protect products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. General Electric Co.
B. Cutler-Hammer Corp.
C. Square D Co.

2.2 GENERAL PURPOSE DRY-TYPE DISTRIBUTION TRANSFORMERS

A. General Purpose Type

1. General:

a. Furnish and install single phase general purpose individually mounted dry-type transformers of the two winding type, self-cooled, with ratings and voltages as indicated on the drawings.
b. Transformers shall be designed, manufactured, and tested in accordance with all the latest applicable ANSI, NEMA and IEEE standards. All 600 volt class transformers through 750 KVA shall be UL listed and bear the UL label.
c. 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 C57.96.2.

2. Insulation System:

   a. Transformers shall be insulated as follows:

      i. 2 KVA and below - 150 degree C insulation system.
      ii. 3 through 30 KVA - 185 degree C insulation system.
      iii. 30 KVA and above - 220 degree C insulation system.

   b. Required performance shall be obtained without exceeding the above indicated temperature rise in a 40 degree C maximum ambient, with a 30 degree C average over 24 hours.
   c. All insulation materials shall be flame-retardant and shall not support combustion as defined in ASTM Standard Test Method D635.

3. Core and Coil Assemblies:

   a. 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% above the highest tap voltage. The core laminations shall be tightly clamped and compressed. Coils shall be wound of electrical grade copper with continuous wound construction.
   b. On units rated 14 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.
   c. On units rated 15 KVA and above the core and coil assembly shall be impregnated with non-hydroscopic, thermosetting varnish and cured to reduce hot spots and seal out moisture. The assembly shall be installed on a vibration-absorbing pads.

4. Enclosures:

   a. The enclosure shall be made of heavy gauge steel and shall be degreased, cleaned, primed, and finished with ANSI 61 weather-resistant light gray enamel color. 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 degrees C. The core of the transformer shall be grounded to the enclosure.
   b. On units rated 14 KVA and below with encapsulated type windings, the enclosure construction shall be totally enclosed, non-ventilated, NEMA 3R, with lifting eyes.
   c. On units rated 15 KVA and above, the enclosure construction shall be ventilated, NEMA 2, drip-proof, with lifting holes. All ventilation openings shall be protected against falling dirt. On outdoor units, provide suitable weathershields over ventilation openings.

5. Transformer sound levels shall not exceed the following ANSI and NEMA levels for self-cooled ratings:

   Up to 9 KVA 40 db
   10 to 50 KVA 45 db
   51 to 150 KVA 50 db
   151 to 300 KVA 55 db
   301 to 500 KVA 60 db
   501 to 700 KVA 62 db
   701 to 1000 KVA 64 db

6. The following tests shall be made on all transformers:

   a. Ratio tests at the rated voltage connection and at all tap connections.
   b. Polarity and phase relation tests on the rated voltage connection.

c. Applied potential tests.
d. Induced potential test.
e. No-load and excitation current at rated voltage on the rated voltage connection.
f. On ratings above 500 KVA, resistance measurements on all windings at the rated voltage connection of each unit at the tap extremes of the first unit made of a new design shall be performed in addition to the tests outlined in item A thru E above.

B. Dry-Type Isolation Transformers (with Electrostatic Shielding)

1. General:

a. Furnish and install, single phase and three phase general purpose individually mounted dry-type transformers of the two winding type, self-cooled, with ratings and voltages as indicated on the drawings.
b. Transformers shall be designed, manufactured, and tested in accordance with all the latest applicable ANSI, NEMA and IEEE standards. All 600 volt class transformers through 750 KVA shall be UL listed and bear the UL label.
c. 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.

2. Insulation Systems:

a. Transformers shall be insulated as follows:

i. 2 KVA and below: 150 degree C insulation system which superseded Class B based on 80 degree C rise.
ii. 3 through 30 KVA: 185 degree C insulation system which superseded Class F, based on 115 degree C rise.
iii. 30 KVA and above: 220 degree C insulation system which superseded Class H, based on 150 degree C rise.

b. Required performance shall be obtained without exceeding the above indicated temperature rise in 40 degree C maximum ambient.

c. All insulation materials shall be flame-retardant and shall not support combustion as defined in STM Standard Test Method D635.

3. Core and Coil Assemblies

a. Transformer core shall be constructed with high trade, 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% above the highest tap voltage. The core laminations shall be tightly clamped and compressed.
b. Transformer coils shall be wound of electrical grade aluminum conductor with continuous wound construction. An electrostatic shield consisting of a single turn of copper shall be placed between the primary and secondary winding and grounded to the transformer core.
c. On units rated 14 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.
d. On units rated 15 KVA and above the core and coil assembly shall be impregnated with non-hydroscopic, thermosetting varnish and cured to reduce hot spots and seal out moisture. The assembly shall be installed on vibration-absorbing pads.

4. Enclosures:

a. The enclosure shall be made of heavy gauge steel and shall be degreased, cleaned, primed, and finished with ANSI 61 weather-resistant light gray enamel color. 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 degrees C. The core of the transformer shall be grounded to the enclosure.
b. On units rated 14 KVA and below encapsulated windings, the enclosure construction shall be totally enclosed, non-ventilated, NEMA 3R, with lifting eyes.
c. On units rated 15 KVA and above the enclosure construction shall be ventilated, NEMA 2, drip-roof, with lifting holes. All ventilation openings shall be protected against falling dirt. On outdoor units, provide suitable weathershields over ventilation openings.

5. Transformer sound levels shall not exceed the following ANSI and NEMA levels for self-cooled ratings measured in accordance with NEMA ST20:

Up to 9 KVA 40 db
10 to 50 KVA 45 db
51 to 150 KVA 50 db
151 to 300 KVA 55 db
301 to 500 KVA 60 db
501 to 700 KVA 62 db
701 to 1000 KVA 64 db

6. The following tests shall be made on all transformers:

a. Ratio tests at the rated voltage connection and at all tap connections.
b. Polarity and phase-relation tests on the rated voltage connection.
c. Applied potential tests.
d. Induced potential test.
e. No-load and excitation current at rated voltage on the rated voltage connection.
f. On ratings above 500 KVA, resistance measurements on all windings at the rated voltage connection of each unit at the tap extremes of the first unit made of a new design shall be performed in addition to the tests outlined in item A thru E above.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that pads are ready to receive work.
B. Verify field measurements to comply with manufacturers installation drawings.
C. Verify that required utilities are available, in proper location and ready for use.
D. Beginning of installation means installer accepts conditions.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Install safety labels to NEMA 260.

3.3 FIELD QUALITY CONTROL

A. Impulse tests to ANSI/IEEE C57.98-1986, after installation and before energizing from system.
B. Test transformer to ANSI/IEEE C57.12.56-1986.
C. Test transformer to ANSI/IEEE C57.12.91-1979.

3.4 ADJUSTING

A. Adjust primary taps so that secondary voltage is within 2 percent of rated voltage.

SECTION 16455 GROUNDING AND BONDING

PART 1 GENERAL

1.1 DESCRIPTION

This Section specifies the requirements for furnishing, installing, connecting, and testing system and equipment grounding and bonding as indicated.

1.2 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM):

1. ASTM B 3: Soft or Annealed Copper Wire.
2. ASTM B 187: Copper Bus Bar, Rod, and Shapes.

B. National Fire Protection Association (NFPA) 70: National Electrical Code (NEC).
C. Underwriters Laboratories, Inc. (UL) 467: Grounding and Bonding Equipment.

1.3 SUBMITTALS

A. Submittals shall be made in accordance with provision 12-1.06 of Section 12 Building Work.
B. Shop Drawings: Show locations of ground rods, grounding connections, locations of embedded and buried grounding conductors, and locations of stubouts and pigtails for future connections to the grounding system by others. Also indicate locations of test points to measure grounding resistance.
C. Product Data: Manufacturers' data for specified, manufactured materials per provision 12-1.19 of Section 12 Building Work.
D. Test Reports: Copies of certified test reports for grounding resistance tests, including method of measurement.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Provide marking on wire and cable in accordance with applicable standards. Each item shall have the UL label.
B. Ship each material securely wrapped, packaged, and labeled for safe handling in shipment and to avoid damage.
C. Store equipment and materials in secure and dry storage facility.

PART 2 PRODUCTS

2.1 GENERAL

Conform to UL 467 and the additional requirements specified below.

2.2 GROUNDING RODS

Medium carbon steel core, copper clad by the molten weld cast process, UL-listed. Size grounding rods at 3/4-inch in diameter by 10 feet long except as otherwise indicated on the Drawings.

2.3 BARE GROUNDING CONDUCTORS

ASTM B 3, Class B stranded, annealed copper, unless otherwise indicated on the Drawings. Conductor sizes as indicated on the Drawings.

2.4 SINGLE CONDUCTOR INSULATED WIRE

As specified in Section 16120, Wires and Cables.

2.5 GROUNDING BUS BARS

ASTM B 187, with 98 percent conductivity copper.

2.6 JUMPERS

Tin-plated copper, braided, flexible jumpers.

2.7 TERMINAL LUGS

NEMA Standard 2 holes, heavy duty, high copper alloy compression type terminal lugs, with terminal lugs having twin clamping elements to secure joint against vibration and flexing. Size terminal lugs for conductors as indicated on the Drawings.

2.8 GROUND CONNECTORS

A. Cable to Box Ground Connectors: Provide high copper alloy ground connector for grounding pull boxes, enclosures, or cabinets purpose. Sizes as indicated on the Drawings.
B. Cable to Grounding Rod Ground Connectors:

1. Above Ground: High copper alloy ground connectors for joining grounding cables to grounding rods for above ground connections. Size as indicated on the Drawings.
2. Buried and Embedded: Ground connectors of exothermic weld type for buried and embedded ground connections. Size as indicated on the Drawings.

PART 3 EXECUTION

3.1 GENERAL

Install the grounding system in accordance with Article 250 of the National Electrical Code or as indicated on the Drawings.

3.2 GROUNDING RODS

The Contractor shall make earth resistivity test prior to the installation of grounding rods. Install grounding rods as indicated on the Drawings. Bury grounding rods vertically with the top of the rods at a minimum of 18 inches below grade. Interconnect grounding rods with grounding cables.

3.3 GROUNDING LOOP

A. The grounding loop outside the boundary of the building shall be installed in a minimum of 18" and a maximum of 24" outside building wall and 18" below finished grade.
B. Connect the grounding loop to the water service entrance. See Mechanical Work.
C. Main ground loop shall be sized as on Drawings with copper wire. All equipment grounding conductor size shall be in accordance with NEC 250.
D. Pull box shall be prefab concrete, as shown on details with checker plate cover.

3.4 GROUNDING BUS BARS

Included in electrical equipment.

3.5 JUMPERS

Install jumpers as indicated on the Drawings.

3.6 TERMINAL LUGS

Install terminal lugs as indicated on the Drawings.

3.7 GROUND CONNECTIONS

A. Above Ground Connections: Install compression type terminal lugs in accordance with applicable requirements specified in Section 16050, Basic Electrical Materials and Methods.
B. Buried and Embedded Ground Connections: Provide exothermic welding such as Cadweld or equivalent only. Prior to backfilling, clean and coat welded connections with a bitumastic epoxy coating. Make welds in accordance with the manufacturer's requirements. Compression-type mechanical connectors are not acceptable.
C. Grounding Conductors: Continuous grounding conductors without splices, or splice by exothermic weld only.

3.8 EQUIPMENT GROUNDING SYSTEM

A. All electrical equipment (enclosure, motors, etc.) shall be grounded. Ground buses and ground pads provided on electrical equipment shall be grounded using removable connections.
B. Conductor for equipment grounding shall be bare stranded copper. Conductors shall have green type THWN insulation when encased in conduit. Otherwise, bare stranded copper wires shall be used.
C. All structural steel shall be grounded using welded connections. Vessels, tanks, pumps and other removable equipment shall be grounded using removable connections.
D. Resistance of the Grounding System: Less than 5 ohms.
E. Enclosures: Ground enclosures of all distribution panels, small transformers, control/relay panels, in addition to the grounding conductor run with the supply cable/conductors. Connect one end of the grounding conductor run with the supply cable to the equipment, the other end to the ground bus of the power supply.
F. Motors: Ground all motors by running a separate equipment ground conductor with the phase conductors from the motor starter to the motor frame. At the motor starter, connect ground wires to the enclosure as indicated. At the MCC, connect ground wires to the ground bus as indicated.
G. Major Electrical Equipment: Provide all major electrical equipment such as distribution transformers, MCC, and switchgear with required grounding.

3.9 FIELD QUALITY CONTROL

A. Test the grounding system by the fall-of-potential method in the presence of the Engineer.
B. Demonstrate that the total ground resistance is below 5 ohms in accordance with San Francisco Electric Code, unless otherwise noted.
C. If resistance requirements is not met, bury addition ground rods or use electrolytic ground electrodes, as necessary to meet resistance requirements.
D. Test grounded equipment enclosures, raceways, conduits, exposed expansion joints, trench ducts, receptacles, light standards for continuity to the ground system.

SECTION 16473 ELECTRICAL DISTRIBUTION

PART 1 GENERAL

1.1 DESCRIPTION

This Section specifies requirements for furnishing, installing, connecting, and testing of the main switch board, circuit breakers and panelboards.

1.2 RELATED SECTIONS

A. Section 16000, General Electrical Provisions.
B. Section 16050, Basic Electrical Materials and Methods.
C. Section 16120, Wires and Cables.
D. Section 16455, Grounding and Bonding.
E. Section 15300 - Fire Protection System.

1.3 REFERENCE STANDARDS

A. American National Standards Institute (ANSI) ANSI Z55.1-76: Gray Finishes for Industrial Apparatus and Equipment.
B. American Society for Testing and Materials (ASTM) ASTM B 187: Copper Bus Bar, Rod, and Shapes.
C. National Electrical Manufacturers Association (NEMA):

1. NEMA AB 1: Molded Case Circuit Breakers and Molded Case Switches.
2. NEMA PB 1: Panelboards.

D. National Fire Protection Association NFPA 70: National Electrical Code (NEC).
E. Underwriters Laboratories, Inc. (UL):

1. UL 50: Cabinets and Boxes.
2. UL 67: Panelboards.
3. UL 489: Molded Case Circuit Breakers.
4. UL 891: Switchboards.

1.4 SUBMITTALS

A. Submittals shall be made in accordance with provision 12-1.06 of Section 12 Building Work.
B. Product Data:

1. Extent: Manufacturers' product data for specified equipment and materials.
2. Required Information for Each Item:

a. Manufacturer's model number or item identification.
b. UL listing and rating.
c. Critical dimensions and mounting arrangement.
d. Replacement parts list.

C. Shop Drawings and Wiring Diagrams:

1. Enclosures: Drawings showing materials and methods of construction, door arrangement, conduit hub and knockout locations, and identification of intended panelboard/switchboard.
2. Circuit Breakers: Drawings showing circuit for which intended, voltage ratings, insulation level, current rating, and interrupting ratings.
3. Panelboards and Switchboards: Drawings showing base material, general arrangement, location, and identification of each circuit breaker and the circuit breaker information specified above, location and identification of terminals, location of barriers, applicable UL 67 Tables A through F information, wiring diagrams, and identification of the enclosure for which intended.

D. Test Reports: Submit copies of certified reports of factory and field tests performed in accordance with the applicable referenced standards and specification requirements.

1.5 QUALITY ASSURANCE

A. Manufacturer: Select a manufacturer who has been regularly engaged in the manufacture of similar equipment and has met UL requirements.
B. Standards: Conform to NEMA AB 1 and NEMA PB 1 and NFPA 70 as applicable.
C. Interchangeability: Ensure that components of the same type, size, rating, functional characteristics, and make are interchangeable.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Marking: Provide marking on each circuit breaker and panelboard in accordance with the referenced standard. Each item shall be UL labeled.

B. Packaging: Ship each unit securely wrapped, packaged, and labeled for safe handling in shipment and to avoid damage or distortion.
C. Storage: Store switchboard, circuit breakers and panelboards in secure and dry storage facility.

PART 2 PRODUCTS

2.1 MAIN SWITCHBOARD

A. As manufactured by Cutler-Hammer, General Electric, Square D or equal; with all requirements for service equipment. Free standing front accessible, NEMA 1 Construction. Provide pull section, current transformer and metering facilities in accordance with PG&E requirements.
B. Bussing, switches and breakers rated to withstand a short circuit current of 22,000 RMS symmetrical amperes.
C. Main breaker: as shown on drawings. Provide shunt trip attachment on main circuit breaker; interlock with fire suppression system, so that electrical power is turned off to the station in the event of a fire in the electrical room.
D. Provide equipment ground bus full length of board with ground lugs on each end of connection to ground.
E. Bussing: Solid copper, tin plated.

2.2 ENCLOSED CIRCUIT BREAKERS

A. Type: NEMA AB 1, molded case, quick-make quick-break bolt-on type, with thermal-magnetic type overload trip, interchangeable unit for frame rated 125 amperes and above.
B. Parameters (as indicated on the Drawings):

1. Number of poles.
2. Rated voltage and continuous current.
3. Rated interrupting current.
4. Trip setting.

2.3 PANELBOARDS

A. Type: NEMA PB 1, UL 67.
B. Enclosure: UL 50, NEMA 12, fabricated from galvanized steel, surface-mounted unless otherwise indicated on the Drawings, and tamperproof.
C. Minimum Gutter Sizes, Main Bus Rating 225 Amperes and Below:

1. End Gutter: 6 inches.
2. Side Gutter: 5 inches.

D. Backplate: Provide interior components mounted on backplate of reinforced steel for rigid support and accurate alignment.
E. Grounding: Provide device or mechanism for enclosure grounding.
F. Trim: Galvanized steel, hinged and designed for surface or flush mounting as indicated on the Drawings, and containing a hinged door fitted with a combination latch and door lock, accommodating a master key. Provide one flat key tumbler cylinder-type, nickel-plated door lock conforming to the station masterkey system, two keys per lock. Provide nameplates or other permanent identification for each circuit breaker, mounted adjacent to the individual circuit breakers. Provide a directory frame, 8-1/2 inches by 11 inches, and mounted on the back of the door. Provide flush-mounted types with means to plumb and align the front of the panel with respect to the finished surface. Unless otherwise specified, thoroughly clean, degrease, prime with an approved galvanized primer, and then finish with ANSI Z55.1-67 enamel, Color Number 61.
G. Bus Bars:

1. Type: ASTM B187, 98 percent conductivity copper, with silver-plated contact surface.
2. Additional Requirements:

a. Neutral bus of the same rating as that of phase bus.
b. Main lugs or main circuit breaker of rating as indicated.
c. Provide a grounding bus.

H. Circuit Breakers: Provide circuit breakers conforming with the foregoing specified requirements and as indicated on the Drawings.
I. Equipment Identification Tags: Provide identification tag for panelboards as specified in Section 16050, Basic Electrical Materials and Methods.

PART 3 EXECUTION

3.1 INSTALLATION

A. Panelboard Heights: Install panelboards at locations indicated with top 6 feet, 6 inches above floor and bottom less than 12 inches above floor, unless specifically indicated otherwise on the Drawings. Use multisectional panelboards to meet these spacings if necessary. Line up tops of trims to present neat appearance.
B. Panelboard Mounting: Mount panelboards in place with front straight and plumb and in accordance with UBC requirements for Seismic Zone 4 location.
C. Feeders and Bus Taps: When a feeder serves more than one panelboard or panelboard section, install a separate junction box or provide adequate gutter area for termination of feeders and bus taps.
D. Branch Circuit Wires: Connect as indicated on the Drawings. Connect neutral wire of the branch circuit to the neutral bar in the panelboard bearing the same circuit number.
E. Conduit Connections: Make in accordance with Section 16050, Basic Electrical Materials and Methods:
F. Cable Connections: Make in accordance with Section 16120, Wires and Cables.
G. Grounding: Ground panelboards in accordance with Section 16455, Grounding and Bonding.
H. Furnish and install _" inch conduit, empty with pull rope, from hinge side of main switchboard door to telephone board for PG&E communication circuit.

3.2 DIRECTORY OF CIRCUITS

Provide each panelboad with a typewritten circuit directory located on the inside of the enclosure. Cover the directory with a clear plastic face.

3.3 FIELD TESTS

A. General Requirements: Perform the following tests in the presence of the Engineer, and submit certified test reports to the Engineer for review. Furnish equipment and instruments required to perform the tests.
B. Required Testing:

1. Test circuits for connections in accordance with the wiring diagram.
2. Test that insulation resistance to ground of nongrounded conductors is a minimum of ten megohms.
3. Test panelboard and switchboard enclosures for continuity to the grounding system.
4. Test operation of circuits and controls. When testing, operate each control a minimum of ten times and each circuit continuously for a minimum of 1/2-hour.

SECTION 16480 MOTOR CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Magnetic motor starters.
B. Solid state reduced voltage starters.
C. Motor control centers.

1.2 RELATED SECTIONS

A. Section 03300, Concrete: Housekeeping pad for motor control centers.
B. Section 16050, Basic Electrical Materials and Methods.
C. Section 16120, Wires and Cables.
D. Section 16455, Grounding and Bonding.
E. Section 13400, Station Control System with RTU/PLC

1.3 INTERFACE AND COORDINATION

A. Interface and coordinate the work of this Section with the other Division 16 Electrical Sections as required to provide a complete and operable electrical installation.
B. Interface and coordinate with work completed or in progress or to be performed under other sections of these specifications. Make indicated connections to previously completed work. Where future connections to or extensions of the work are indicated, make safe and convenient provisions for such future connections and extensions.
C. Interface and coordinate work of this section including testing with Section 13400.
D. Interface and coordinate with Divisions 11, 14, 15, Mechanical, for installation of electrical equipment furnished under Divisions 11, 14, 15.
E. The Contractor shall be responsible to coordinate with Main Pump manufacturer and Reduce voltage starter manufacturer and Standby Generator manufacturer for compatible equipment.

1.4 REFERENCE STANDARDS

A. ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
B. ANSI/UL 198E - Class R Fuses.
C. American National Standards Institute (ANSI): Z55.1-67: Gray Finishes for Industrial apparatus and Equipment.
D. American Society for Testing and Materials (ASTM):

   1. ASTM A525: General Requirements for Steel Sheet, Zinc-Coated (Galvanized by the Hot-Dip Process).
   2. ASTM B187: Copper Bus Bar, Rod, and Shapes.
   3. ASTM D2092: Practices for Preparation of Zinc-Coated Galvanized Steel Surfaces for Paint.

E. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service.
F. FS W-P-115 - Power Distribution Panel.
G. FS W-F-870 - Fuseholders (For Plug and Enclosed Cartridge Fuses).
H. FS W-S-865 - Switch, Box, Enclosed, Surface-Mounted.
I. NEMA AB 1 - Molded Case Circuit Breakers.
J. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.
K. NEMA KS 1 - Enclosed Switches.
L. NEMA PB 1 - Panelboards.
M. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
N. Underwriters Laboratories, Inc. (UL) 845: Motor Control Centers.
O. International Conference of Building Officials (ICBO): Uniform Building Code (UBC).

1.5 SUBMITTALS

A. Bureau of Engineering, Submittals shall be made in accordance with the provision 12-1.06 of Section 12 Building Work.
B. Shop drawings and electrical diagrams of equipment and layouts, including elementary/schematic control diagram per NEMA ICS-2.
C. Indicate on shop drawings, front and side views of motor control center enclosures with overall dimensions. Include conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase,

(neutral), and ground; electrical characteristics including voltage, frame size and trip ratings, withstand ratings, and time-current curves of all equipment and components.

D. Provide product data on motor starters and combination motor starters, relays, pilot devices, and switching and overcurrent protective devices.

E. Seismic calculation for motor control centers and motor control panelboards. Shop drawings shall indicate geometry, weight and orientation of each panel and materials used for anchorage.

F. All motor starter submittals shall include a copy of approved motor data for the particular mechanical equipment in which the starter and related controls are being submitted.

G. Submittals not fulfilling this requirement will be returned to the Contractor without review and all delays and costs resulting from these action shall be borne by the Contractor.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provision 12-1.18 of Section 12.

B. Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver in 60 inch maximum width shipping splits, individually wrapped for protection, and mounted on shipping skids

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to motor control center components, enclosure, and finish.

1.8 SPARE PARTS

A. Keys: Furnish 2 each to City.

B. Fuses: Furnish to City 10 spare fuses of each type and rating installed.

C. Fuse Pullers: Furnish 1 fuse puller to City.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - MOTOR CONTROLS

A. Cutler-Hammer.

B. Substitutions: Under provisions of Section 6.

2.2 MOTOR CONTROL CENTER

A. Provide motor control center conforming to UL 845 and NEMA ICS 2, Class 2, Type B, rated 480 volts, three-phase, three-wire, 60 hertz, totally enclosed, deadfront free-standing modular assembly having vertical and horizontal buses, wireways, compartments equipped with circuit breakers and starters as indicated.

B. Provide nameplate on each motor starter and control center in accordance with NEMA ICS 2, showing manufacturer's name and brand designation, the referenced standard, type, class, and rating as applicable.

C. Motor control center shall include the following appurtenances and accessories:

1. Enclosure: NEMA 2 type enclosure with drip shield, modular assembly allowing a maximum of six size one compartment units in one vertical assembly, without structural interference. Include the following:

a. Provide horizontal wireway with removable coverplate at the top and bottom for wiring between sections, incoming conduit and cable, motors and control wiring. Provide top trough separated by a barrier from the main horizontal bus.

b. Provide minimum 4 inch wide vertical wireway, with its own door, adjacent to each vertical section and front accessible.
c. Provide with adequate reinforced steel framework to form a rigid structure with smooth outer surface free from burrs, ridges, and other blemishes.
d. Provide enclosure fabricated from zinc-coated steel sheet conforming to ASTM A525, coating designation G90, minimum thickness of 14 gauge.
e. Provide painted finish for all ferrous and galvanized metal surfaces as follows: Prepare ferrous metal surfaces for painting in accordance with FS TT-C-409. Prepare galvanized metal surfaces for painting in accordance with ASTM D2092. After pretreatment, prime-paint the surfaces an approved corrosion-inhibitive metal primer for ferrous or galvanized surfaces, as applicable. Finish coat shall be a heavy-duty enamel meeting requirements of ANSI Z55.1, Color No. 61 gray.

2. Horizontal and Vertical Buses: Provide main horizontal buses at the top or center of the structure. Provide vertical buses for feeding power to each compartment in each vertical assembly and securely bolted to the main buses. Buses shall meet the following requirements:

a. Bus bar shall conform to ASTM B187, 98 percent conductivity copper, tin-plated, fully insulated by extruded sleeve or wound tape.
b. Each horizontal and vertical bus shall be rated for a minimum of 800 and 400 amperes respectively, unless the particular section requires higher rating at vertical buses due to the arrangement of the horizontal buses. Both vertical and horizontal buses shall have current density not to exceed 1000 amperes per square inch unless otherwise indicated.
c. Each bus shall be rigidly held by bus supports which have high dielectric qualities, are moisture-resistant, non-carbonizing, non-tracking, and have vertical creepage surfaces to prevent faults due to build-up of conductive dirt.
d. Both horizontal and vertical buses shall be completely isolated with bus support molding, both between phase-to-phase and phase-to-ground. Cutouts at the molding for plug-in unit stabs shall be equipped with shutter cover when the unit is in the draw-out position, to avoid accidental contact with the vertical buses.
e. Bus assembly shall be braced to withstand short-circuit rating as indicated but not less than 65,000 symmetrical amperes (rms).

3. Neutral Bus: not used.
4. Ground Bus: Provide continuous bare copper ground bus, minimum 1/4-inch by 2 inches in cross-section, the length of the control center. Equip with solderless connector for #2/0 AWG copper cable at each end. Incoming and outgoing wires and cables shall enter and leave from the top and bottom of the assembly.
5. Motor Control Center Unit:

a. Motor control center units shall be draw-out type. Provide a positive guidance system to assure proper alignment of power stabs in dead front openings to the vertical power bus which shall be isolated from the starter unit.
b. Design each section such that each unit can be easily modified to accommodate any standardized draw-out unit. Provide steel isolation barrier between compartments with rigid connection to form an effective grounding path to the steel structure.
c. Components in each draw-out unit shall be the manufacturer's standard products and readily available for repair and maintenance.
d. Make plug-in connections by self-aligning, tin plated stab type, plug-in fingers designed to tighten onto the vertical bus during high currents.
e. Provide access to each used or space unit by a separate removable hinged door, attached to the section or to the unit. Provide any unused space that is not suitable for the addition of draw-out unit with a plain bolted sheet metal cover.
f. Each unit door shall be mechanically interlocked such that the door cannot be opened unintentionally when the external disconnect operator is in the ON position, and so the external disconnect operator cannot be turned to the ON position unintentionally when the door is open. Furnish defeater means to permit trained personnel to bypass the mechanical interlock.

g. Removal of the unit shall require that the door be open and shall not leave the bus so exposed that accidental contact with it is possible.

h. Install auxiliary devices such as control power transformers, relays, instrument transformers, meters, etc., as indicated on the Drawings, in the same space unit as the starter. Acquiring additional space units by means of consolidating components is not acceptable. Mount all components in the vertical position unless specifically designed for another orientation.

i. Provide a door-mounted sign, laminated plastic with white letters on red background, on each unit in which an external voltage source will be terminated. The sign shall read: "CAUTION - THIS UNIT CONTAINS AN EXTERNAL VOLTAGE SOURCE".

j. Unit Device Panel: Provide a device panel assembly, visible from the front of the unit door, with switches and pilot lights as indicated on the Drawings. Devices shall be of the single unit, oil tight, heavy-duty type. Pilot lights shall be transformer type. The device panel may be hinged to the unit allowing the door to dispense with hinged wiring.

k. Circuit Breaker:

1) Provide a 480-volt three-pole circuit breaker for each unit in accordance with the requirements indicated. Line side of circuit breaker shall have tin-plated stab assembly for connecting to the vertical buses in unit compartment.
2) In general, main or branch circuit breaker shall be a molded case, thermal-magnetic type, with an interrupting capacity equal to that of the main bus assembly.
3) Equip circuit breaker in each compartment with mechanism and operating handle for operation at front door. Circuit breaker operating handle positions shall indicate ON, TRIPPED, and OFF. Handle shall be lockable at both ON and OFF positions. Provide method so that each unit can be padlocked in the test position with the stabs completely withdrawn from the vertical buses.
4) Circuit breaker for a combination starter shall be a motor circuit protector type. Circuit breaker operating handle shall be lockable at the OFF (OPEN) position only.

l. Motor Starter:

1) Circuit provide NEMA ICS 2 motor starter. Motor starters size 2 and smaller shall be a combination type, full voltage single speed, with non-reversible or reversible operation as indicated. Contact rating shall be 480 volts AC. Motor starter size shall be as indicated, not smaller than size 1.
2) Motor starter size 3 and larger shall be solid state, reduced voltage single speed, utilizing silicon controlled rectifiers. Reduced voltage controller shall be solid state current ramp with adjustable current limit and current ramp. See 16480-2.4.
3) Equip the motor starter unit with minimum 100 VA control power transformer or as shown on Drawings, 480 volts AC primary and 120 volts AC secondary, with two fuses at the primary side and one fuse at the secondary side. Effectively ground the unfused side of the secondary side to the frame of the draw-out unit. Wire trip-free manual reset thermal overload relay, one per phase, in the starter.
4) Provide ambient compensated bimetallic overload relays sized for the motor horsepower shown, based on 1.15 service factor, high efficiency motors according to the requirements of NFPA 70.
5.) Provide auxiliary contacts as indicated. Provide one spare normally open and one spare normally closed contact with provision for future addition of two normally open or normally closed contacts. Auxiliary contacts shall be convertible.

m. Terminal Blocks: Equip each unit with a pull-apart type terminal block and arranged such that control wiring shall be de-energized when the unit is drawn out from the compartment. At least 20 percent spare terminal blocks shall be provided. Terminal blocks for field connection of control wiring shall be suitable for #14 through #8 AWG stranded copper conductor.

n. Factory Furnished Wiring:

1) Wiring shall be NEMA Class II, Type B, with individual compartmental terminal blocks and marking as specified.

2) Minimum wire size for power circuits shall be #12 AWG. Minimum wire size for control circuits shall be #14 AWG. All wiring shall be tinned copper, utilizing Class B stranding and be UL approved and labeled.

3) Size internal wiring of combination starters to UL Standard 44. Minimum internal wiring and load side cable lugs for copper conductors shall be as follows:

Starter Size	Wire Size
1	12 AWG
2	8 AWG
3	4 AWG
4	2 AWG
5	350 KCMIL

4) Neatly bundle, secure, and protect all wiring against contact with any sharp metal edges. There shall be no spliced conductor or repaired insulation.
5) The wire and cable to be used within the equipment shall be any one of the following types of insulation: XHHW, THHN, RHW-2, SIS.
6) All wires originating from the same electrical node or point shall carry the same wire number. This wire number shall be unique for any given cubicle.
7) Both ends of each conductor (internal wiring) shall be provided with a marker with the conductor's identification. Wire numbers shall match the manufacturer's interconnection drawing. Protect identification by clear heat shrink plastic sleeves.
8) All internal wiring shall have closed ring type lugs at both ends of the wires. All lugs shall be compression type.
9) Wire all circuits and contacts for which external wiring is required or provided to terminal blocks with not more than two wires connected to any terminal point. Group these terminal blocks in the same general area and accessible without disturbing installed wiring or devices.
10) Power cable shall be of the same type and rating, color coded, and with capacity compatible with the starter or breaker rating.

o. Adhere to NFPA 70 Article 373-6 space requirements for field bending of feeder cables.
p. Nameplates: Provide laminated plastic nameplates attached by stainless steel rivets or permanent adhesive, with the following additional requirements:

1) Label each motor control center with a four inch-wide nameplate showing its function in 2-1/2 inch high, white cut-in letters on black background.
2) Label each compartment with a two inch-wide name plate showing function and number of the motor controlled in 1/2-inch high, white cut-in letters on black background, with a maximum of three lines.

6. Provide microprocessor based monitoring and protective device for main circuit breaker. The direct read meter values shall be phase current, phase voltage, power factor, watts, vars, frequency, watt demand, watthours. The device will provide alarm to RTU on loss of PG&E power. The alarm contact shall be 10 amp rated.
7. Provide strip heaters in vertical sections sized for MCC.

2.3 MANUAL MOTOR STARTERS

A. Manual Motor Starter: NEMA ICS 2; size and number of poles as indicated, AC general-purpose Class A manually operated non-reversing full-voltage controller for induction motors rated in horsepower, with overload relay, red pilot light, auxiliary contact, and toggle operator.
B. Fractional Horsepower Manual Starter: NEMA ICS 2; AC general-purpose Class A manually operated, number of poles as indicated full-voltage controller for fractional horsepower induction motors, with thermal overload unit, pilot light, and toggle operator.

C. Motor Starting Switch: NEMA ICS 2; AC general-purpose Class A manually operated 1 pole, full-voltage controller for fractional horsepower induction motors, without thermal overload unit, and toggle operator.
D. Enclosure: ANSI/NEMA ICS 6; Type as noted on drawings.

2.4 REDUCE VOLTAGE STARTERS.

A. Reduce Voltage Starters shall be UL listed and consist of an SCR based power section, logic board and paralleling bypass contactor.
B. The power section shall consists of three sets of back to back controlled power semiconductors and shall be rated for a minimum peak inverse voltage rating of 1500 PIV. Units using triacs or SCR/diode combinations shall not be acceptable. Resistor /Capacitor snubber network shall be used to prevent false firing of SCRs due to dv/dt characteristic of the system.
C. The logic board shall be mounted for ease of testing, service and replacement. It shall have quick-disconnect, plug-in connectors for current transformer inputs, line and load voltage inputs and SCR gate firing output circuits. The logic board shall be identical through all ampere ratings and voltage classes and shall be conformally coated to protect from environmental conditions.
D. The paralleling bypass contactor shall energize when the motor reaches full speed and close/open under 1-times motor current. The Contactor shall be fully rated for across the line starting duty. The Contactor shall utilize an energy balanced contact closure to limit contact bounce and an intelligent coil controller to optimize coil voltage during varying system conditions. The coil shall have a lifetime warranty.
E. The Overload protection shall be electronic and be based on an inverse time-current algorithm. Overload protection shall be adjusted via logic board. Units using bi-metal overload relays are not acceptable. Overtemperature protection (on heat sink) shall be standard.
F. The solid-state logic shall be phase sensitive and shall inhibit starting on incorrect rotation. Improper phase rotation shall be indicated on the logic board of the starter.
G. Starters shall protect against a phase loss/unbalance condition shutting down if a 35% current differential between any two phases is encountered.
H. External interface circuitry shall include 120 volt relay logic interface capability.
I. Power terminations shall consist of pressure type terminals for top or bottom entrance. Two ground lugs shall be furnished, one for incoming and one for outgoing ground connections.
J. Units shall be enclosed in the motor control center and shall be of the same manufacturer as that of the circuit breaker and motor control center manufacturer due to coordination and design issues.
K. The following logic board adjustments are required:

Ramp Time: 1-45 seconds
Current limit: 75-500% of current

2.5 CONTROLLER OVERCURRENT PROTECTION AND DISCONNECTING MEANS

A. Molded Case Thermal-Magnetic Circuit Breakers: NEMA AB 1; FS W-C-375; circuit breakers with integral thermal and instantaneous magnetic trip in each pole.
B. Motor Circuit Protector: NEMA AB 1; FS W-C-375; circuit breakers with integral instantaneous magnetic trip in each pole.
C. Non-fusible Switch Assemblies: NEMA KS 1; FS W-S-865; quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle. Provide interlock to prevent opening front cover with switch in ON position. Handle lockable in OFF position.
D. Fusible Switch Assemblies: NEMA KS 1; FS W-S-865; quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle. Provide interlock to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse Clips: FS W-F-870. Designed to accommodate Class R fuses.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install individual motor controls and motor control centers as indicated and as recommended by the equipment manufacturer, and conform to UBC requirements for Seismic Zone 4 location.
B. Install fuses in fusible switches.
C. Select and install heater elements in motor starters to match installed motor characteristics.
D. Motor Data: Provide neatly typed label inside each motor starter enclosure door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.
E. Install conduit in accordance with Section 16050, Basic Electrical Materials and Methods.
F. Connect external power cable and control wire as indicated, in accordance with Section 16120, Wires and Cables; and 16050, Basic Electrical Materials and Methods.
G. Ground motor control center in accordance with Section 16455, Grounding and Bonding.

3.2 FIELD TESTS

A. Perform the following tests and submit a certified report to the Engineer for review. Provide all equipment and instruments required to perform the tests.

1. Test circuits for connections in accordance with accepted wiring diagrams.
2. Test that insulation resistance to ground of non-grounded conductor is a minimum of ten megohms.
3. Test equipment enclosures for continuity to the grounding system.
4. Test operation of circuits and controls. When testing, operate each control a minimum of ten times and each circuit continuously for a minimum of 1/2 hours.
5. All the reduced voltage starters shall be tested under Pump motor load and shall be in agreement with the pump testing procedures required by Section 11071, Main Pumps.

B. Perform the above tests and submit the test procedure prior to testing for the Engineer review. Provide all equipment and instruments required to perform the test. This test shall be witnessed and signed off by the Contractor and the Engineer upon satisfactory completion.

SECTION 16500 LIGHTING

PART 1 GENERAL

1.1 DESCRIPTION

This Section specifies the requirements for furnishing, installing, and testing lighting fixtures, fixture mounting hardware, and lamps.

1.2 RELATED SECTIONS

A. Section 16000, General Electrical Requirements.
B. Section 16050, Basic Electrical Materials and Methods.
C. Section 16120, Wires and Cables.
D. Section 16455, Grounding and Bonding.

1.3 REFERENCE STANDARDS

A. American National Standards Institute (ANSI):

1. ANSI C 78: Series Incandescent Lamps/Electric Discharge Lamps (Fluorescent) Electric Discharge Lamps (Mercury) High-Intensity Discharge Lamps/Fluorescent Lamp Auxiliaries.
2. ANSI C 81: Series Electric Lamp Bases and Holders.
3. ANSI C 82: Series Fluorescent Lamp Ballasts.

B. American Society for Testing and Materials (ASTM):

1. ASTM A 123: Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

2. ASTM A 167: Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
3. ASTM A 366: Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.

C. Federal Specifications (FS): TT-P-641: Primer Coating, Zinc Dust-Zinc Oxide (for Galvanized Surfaces).
D. National Fire Protection Association (NFPA) 70: National Electrical Code (NEC).
E. Porcelain Enamel Institute (PEI):

1. PEI S-100: Specification for Architectural Porcelain Enamel on Steel for Exterior Use.
2. PEI LS-105: Recommended Specification for Architectural Porcelain Enamel on Aluminum for Exterior Use.

F. Underwriters Laboratories, Inc. (UL):

1. UL 57: Electric Lighting Fixtures.
2. UL 508: Ballast Lighting.
3. UL 935: Fluorescent-Lamp Ballasts.
4. UL 1029: Ballasts.

G. International Conference of Building Officials (ICBO): Uniform Building Code (UBC).

1.4 SUBMITTALS

A. Submittals shall be made in accordance with provision 12-1.06 of Section 12 Building Work.
B. Data Sheets: Lighting fixture data sheets which provides documentation indicating fixture construction, photometric performance, installation, and maintenance requirements per provision 12-1.19 Section 12 Building Work. Include the following:

1. The data sheets shall be complete with cover, title page, and table of contents. The table of contents shall provide at a glance the overall document scope and structure and, as a minimum, a heading for each fixture type with each grouping prefaced by a "general information" report sheet.
2. The data sheets shall include drawings of sufficient detail to show the following:

a. Fixture housing, hardware, and finishes.
b. Light controlling elements.
c. Electrical components, including ballast and ballast manufacturer, and provision for conduit entry.
d. Support details including foundation. Indicate weight of fixture, complete with lamps.
e. Seismic swivel hangers and written approval of luminaire manufacturer for their use.

3. Include procedures for the installation of the complete lighting fixture type in its finals service location. Dimension locations of openings and parts interfacing with remote systems, such as mounting hardware, auxiliary electrical equipment, lighting control equipment, and lamps.
4. Include operation and maintenance requirements. Include the following:

a. Materials and components clearly indicated in the parts list.
b. Relamping methods.
c. Special tools required.
d. Frequency of inspection, tightening or other service recommended for preventative maintenance.

C. Test Reports - Certified test reports of factory and field tests performed, in accordance with applicable referenced standards and Specification requirements.

1.5 DELIVERY, HANDLING, AND STORAGE

A. Handle and transport products in a manner that prevents damage.
B. Wrap and package products to avoid damage.
C. Indelibly mark each carton with minimum 1/2 inch high letters with the following information:

1. Fixture, lamp, or component type.
2. Quantity.
3. Manufacturer's name and product number.

D. Store products in a clean, dry, and secure storage area pending installation.

PART 2 PRODUCTS

2.1 LIGHTING FIXTURES

A. General:

1. Provide lighting fixtures, complete and ready for service, in accordance with UL 57, of the number, type, material, finish, electrical components and characteristics, and with the necessary hardware and auxiliary equipment, as indicated.
2. Mark fixtures clearly with manufacturer's name and catalog number, voltage, acceptable lamp type, maximum wattage, and label for intended use.
3. Fixtures shall be UL listed for the location and application indicated.

B. Materials:

1. Thicknesses, gages, and tempers of products shall be as indicated, and as recommended by the manufacturer, for the specific finish, proper forming operations and structural requirements.
2. Reflector material shall be as indicated with minimum thickness 0.032 inch, Architectural Type 1 with Class M1 anodic coating providing 83 percent reflectivity.
3. Acrylic for lenses and diffusers shall be manufactured from virgin-acrylic extrusion or injection molding pellets.
4. Stainless steel shall be Type 316 conforming to ASTM A 167.

C. Finishes:

1. Provide lighting fixtures completely factory-finished in colors to match accepted samples and in accordance with the manufacturer's recommendations for the specific application.
2. Commence no finishing operations until fabrication and forming operations have been completed.
3. Aluminum to be anodized shall be given the Aluminum Association's Architectural Class 1 anodic coating.

    a. Anodize aluminum in accordance with procedures established by alloy manufacturer to achieve color within specified range.
    b. Apply a clear organic protective coating to exposed aluminum surfaces that may experience prolonged contact with caustic material, i.e., concrete, plaster.

4. Minimum cleaning of metal before painting shall be a five-stage phosphatizing system consisting of alkali cleaner, hot water rinse, zinc phosphatizing solution with toner, water rinse at room temperature, and chromic acid rinse for neutralizing.
5. Interior fixtures with surfaces not exceeding 150 degrees F shall be painted two coats minimum, acrylic gloss enamel to a minimum total dry film thickness (DFT) of 2.5 mils.
6. Interior fixtures with surfaces exceeding a temperature of 150 degrees F, but not exceeding 300 degrees F, shall be painted with silicone-alkyd enamel, two coats minimum to a total DFT of 2.5 mils, minimum.
7. Provide fixtures specified to be painted with one coat of epoxy-polyamide at a minimum DFT of two mils and one coat of aliphatic urethane to a minimum DFT of two mils. Interior reflective surfaces specified to be painted shall be as for interior fixtures.
8. Finish fixtures specified to be porcelain enamelled, or painted fixtures with reflectors specified to be porcelain enamelled, in accordance with the requirements, of PEI S-100 or PEI LS-105.
9. Reflective surfaces not specified to be specular shall be gloss white, guaranteed non-yellowing, with a reflectance rating of not less than 88 percent.

10. Provide galvanized coating, where indicated, hot-dip galvanized according to ASTM A 123. Where painting of the galvanized surface is indicated, pretreat the surface with a spray of zinc chromate-vinyl butyryl wash primer at least 0.05 mils thick; apply an 80 percent zinc dust, 20 percent zinc oxide, alkyd resin primer conforming to FS TT-P- 641; and then apply a single-component, Type II, modified acrylic top coat.

D. Electrical Components:

1. Ballasts:

a. Supply ballast with operating characteristics in accordance with the recommendations of the lamp manufacturer. Provide ballasts suitable for the line voltage with a minimum 0.9 power factor, and maximum current crest factor of 1.7. The ballast shall provide reliable lamp starting at the minimum temperature indicated below. Provide insulation used in starters and capacitors suitable for operation in the temperature attained. Mount each ballast securely inside the fixture so as to obtain the necessary heat dissipation. High intensity discharge ballast shall comply with UL 1029. Fluorescent ballast shall be electronic ballasts consisting of rectifier, high frequency inverter, power control and regulation circuitry.
b. High pressure sodium lamps, 50 watt size or as indicated, shall provide reliable lamp starting at 20 degrees F, and allow plus or minus five percent lamp watts variation for a plus or minus ten percent input voltage variation.
c. Rapid start, 430 mA, fluorescent lamps shall be in accordance with ANSI C 82 and operated by a Class P, 430 mA, 60 hertz ballast. The ballast shall provide reliable lamp starting at 20 degrees F for fixtures located outdoors and 50 degrees F for fixtures located indoors. Ballast shall provide a sound level rating of "A". Lamp voltage variation shall not exceed plus five percent and minus ten percent.
d. All electronic ballasts shall have less than 10 percent total harmonic distortion (THD), and a third-harmonic distortion less than 10 percent.
e. Ballasts shall have a minimum ballast factor of 0.95.
f. Acceptable ballast manufacturers are:

1. MagneTek
2. EBT
3. Motorola
4. Osram
5. Advance Mark V
6. GET Sylvania

2. Fixture Wiring: As specified in Section 16120, Wires and Cables, and below:

a. Provide wires between associated operating and starting equipment with the same ampacity rating as leads from the ballast. Wiring within the fixtures shall comply with NFPA 70.
b. Tape wires at points of abrasion. Do not splice within fixtures other than as required to connect lampholders and ballast. Provide wireways and wiring channels with rounded edges or bushed holes wherever conductors pass through. Install insulated bushings at points of entrance and exit of wiring.

3. Fixture Grounding: Unless otherwise specified, provide the housing of each ballasted lighting fixture with a separate, factory-installed grounding device. Use grounding device for connecting a separate grounding conductor to the fixture housing. Refer to Section 16455, Grounding and Bonding.

E. Fixture Hardware:

1. Not used.
2. Provide bolts, nuts, washers, screws, nails, rivets, and other fastenings necessary for proper installation or assembly of work. In wet or damp locations, fasteners shall be made of 18-8 stainless steel. Fastenings within the housing shall be hot-dip galvanized steel. Nuts shall have captive externally-footed lockwashers.

3. Provide junction boxes suitable for the intended location and wiring requirements with threaded and plugged conduit entries as indicated.

2.2 CITY STANDARD STREET LIGHT

A. Luminaries 70 watts through 150 watts shall be General Electric M250R2 or American Electric Series 113 or approved equal and luminaries 200 watts and larger shall be General Electric M400R2 or American Electric Series 125 or approved equal with appropriate wattage and Type III IES distribution. Each luminaire shall be 120/240 VAC high power factor magnetic regulator ballast, reflector, glass refractor, charcoal filter and gasket and photo electric control receptacle. Provide cut off lenses and devices. The lamps for the luminaries shall be clear high pressure sodium vapor with mogul bases manufactured by General Electric, Philips, Sylvania, or equal. Align, mount and level lighting fixtures uniformly.

B. For street lights equipped with photoelectric control, the photocell shall be Type IV consisting of a photoelectric unit which plugs into an EEI-NEMA twist lock receptacle integral with the luminaire. The photoelectric controls shall be operable within a minimum voltage range between 105 and 280 VAC. All photoelectric controls shall be oriented to the north. Photoelectric controls for luminaries shall be Dark To Light Model No. D124.

C. Steel street light standards shall be hot-dip galvanized steel poles (11GA. 8.0" x 4.01" x 28'-6") with 6-foot upswept hot-dip galvanized steel bracket arm assemblies as shown on SPDPWSF #A-27,029.2 Ch.4. Steel street light standards shall be Ameron Series Catalog No. PL286, Union Metal Catalog No. 5809-B, Valmont Catalog No. DS36800A286, or approved equal. The base leveling requirements, including foundation and anchor bolts, shall conform to the requirements of SPDPWSF #A-27,029.2 Ch.4 for steel street light standards. Handhole shall be on side of pole, 90° around from luminaire arm.

2.3 FIXTURE MOUNTING HARDWARE

A. Provide fixtures with brackets, straps, canopies and stems, poles and miscellaneous hardware suitable for the mounting method specified. Pendant mounted fixtures shall have earthquake resistant swivel mountings.

B. Secure mounting brackets to housing; quantity and spacing as indicated. When exposed to public view, fabricate and finish hardware in material matching the fixture body.

C. Canopies, holders, and similar parts shall be drawn or spun in one piece with a minimum 0.026 inch finished thickness.

D. Tubing used for stems shall be seamless drawn with a minimum of 1 1/6-inch wall thickness of size and length as indicated. Stems shall be provided for pendant mounted fixtures of length as required for the specified mounting height with swivel hangers or ball aligners as required.

2.4 LAMPS

A. General: Provide each lighting fixture with the number, type, and wattage of lamps required as indicated. Lamps used in the illumination system shall be of standard manufacture, readily available, and of the highest efficiency and life consistent with other requirements of the illumination system.

B. Fluorescent Lamps: Output as indicated with cool white color, unless noted otherwise.

2.5 SOURCE QUALITY CONTROL

Provide certification of factory tests for all lighting fixtures. Test shall be certified by a nationally recognized independent testing laboratory.

PART 3 EXECUTION

3.1 INSTALLATION OF LIGHTING FIXTURES

A. Install lighting fixtures at locations indicated and in accordance with the manufacturer's instructions, complete with lamps, hangers, brackets, fittings, and accessories, ready for operation as indicated.

B. Inspect surfaces and structures to, and on, which products will be installed before the work of this Section begins, and ensure that they are capable of supporting the products. Surfaces which will be concealed by products shall be finished before products are installed.

C. Align, mount, and level lighting fixtures uniformly.
D. Install exposed parts of fixtures after construction, painting, and general clean-up in the area have been accomplished.
E. Avoid interference with, and provide clearance for, the equipment. Where the indicated locations for the lighting fixtures conflict with the locations for other equipment, change the locations for the lighting fixtures by the minimum distances necessary and as approved by the Engineer.
F. For suspended lighting fixtures, provide the indicated mounting height clearances between the bottoms of the fixtures and the finished floors.
G. Anchor lighting fixture supports to the structural slab or to structural members as indicated. Supports shall maintain the fixture positions after cleaning and relamping. Provide supports conforming to UBC requirements for Seismic Zone 4 location.
H. Surface-mounted lighting fixtures shall be bracketed rigidly from the mounting surfaces. Provide 1/4-inch clearance between surfaces when the fixture is flat-mounted against concrete surfaces. Install fixtures with a noncumulative dimensional alignment tolerance of 1/16-inch when mounted in continuous runs with one inch spacing between individual fixtures. Nipples carrying wires between fixtures shall be watertight.
I. Where aluminum is placed in contact with dissimilar materials, except galvanized steel, zinc, or stainless steel, treat contact surfaces as follows:

1. When in contact with dissimilar metals, apply a prime coat of zinc chromate primer followed by two coats of aluminum and masonry paint.
2. When in contact with concrete, masonry, and plaster, apply to aluminum contact surfaces zinc chromate primer, bituminous paint, aluminum and masonry paint, or pressure-sensitive tape.
3. When in contact with wood or other absorptive materials, apply two coats of aluminum house paint to such materials, and protect aluminum contact surfaces with bituminous paint.

3.2 INSTALLATION OF CITY STANDARD STREET LIGHT

A. Install lighting fixtures at locations indicated and in accordance with the manufacturer's instructions, complete with lamps, hangers, brackets, fittings, and accessories, ready for operation as indicated. Each street light shall have a fuse holder in its base and shall conform to SPDPWSF #49,092. The wiring for the street light shall conform to the requirements of SPDPWSF #49,092. Align, mount, and level lighting fixtures uniformly. All splices for street lighting shall be made in accordance with SPDPWSF #43,665 Ch.2.
B. Inspect luminaries, lamps, and associated hardware before and after installation to ensure that they are of the quality and type specified herein and indicated on the Drawings, and are free of defects and damage. Install new lamps not earlier than 48 hours before the date of final inspection and replace lamps that fail within 90 days after final acceptance at no extra cost to the City. Test lighting fixtures for continuity to the grounding system.

3.3 FIELD QUALITY CONTROL

A. Inspect luminaries, lamps, and associated hardware before and after installation to ensure that they are of the quality and type specified herein and indicated on the Drawings, and are free of defects and damage.
B. Whenever practicable, test lighting system at the same time that the distribution panelboard or switchboard is tested.
C. Install new lamps not earlier than 48 hours before the date of final inspection and replace lamps that fail within 90 days after final acceptance at no extra cost to the City.
D. Test lighting fixtures for continuity to the grounding system. Refer to Section 16455, Grounding and Bonding.

SECTION 16611 STATIC UNINTERRUPTIBLE POWER SUPPLY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Charger/rectifier unit.
B. Inverter unit.

C. Batteries.

1.2 REFERENCES

A. IEEE 519 - Guide for Harmonic Control and Reactive Compensation of Static Power Converters.
B. NEMA PE 1 - Uninterruptible Power Systems.
C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts).
D. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS

A. In addition to the requirements of the Standard Specifications, Bureau of Engineering, Submittals shall be make in accordance with provision 12-1.06 of Section 12 Building Work.
B. Shop Drawings: Indicate electrical characteristics and connection requirements. Provide battery rack dimensions; battery type, size, dimensions, and weight; detailed equipment outlines, weight, and dimensions; location of conduit entry and exit; single-line diagram indicating metering, control, and external wiring requirements; heat rejection and air flow requirements.
C. Product Data: Provide catalog sheets and technical data sheets to indicate physical data and electrical performance, electrical characteristics, and connection requirements.
D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product. Include equipment installation outline, connection diagram for external cabling, internal wiring diagram, and written instruction for installation per provision 12-1.19 Section 12 Building Work.
E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements, per provision 12-1.19 Section 12 Building Work.
F. Copy of maintenance service contract.
G. Copy of warranty.

1.4 OPERATION AND MAINTENANCE DATA

A. Submit under provision 12-1.18 of Section 12 Building Work.
B. Operation Data: Description of components, operating procedures, safety precautions, adjustments and troubleshooting procedures.
C. Maintenance Data: Description of servicing procedures; list of major components; recommended remedial and preventive maintenance procedures; spare parts list.

1.5 QUALIFICATION

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years experience, and with service facilities within 100 miles of Project
B. Supplier: Authorized distributor of specified manufacturer with minimum three years experience.

1.6 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.
B. Furnish Products listed and classified by Underwriters Laboratories Standard 1778.

1.7 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall identify materials and equipment delivered to site to permit check against Submittals list and shop drawings.
B. Accept Products on site in factory packing. Inspect for damage. Replace lost or damaged materials and equipment with new materials at no cost to the City.
C. Protect equipment from extreme temperature and humidity by storing in a conditioned space.

D. Protect equipment from dust and debris by wrapping unit in dusttight cover and storing away from construction activity.
E. Deliver batteries no sooner than 10 days before charging.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not store or install unless temperature is maintained between 32 degrees F (0 degrees C) and 104 degrees F (40 degrees C), at a relative humidity less than 95 percent (non-condensing).
B. Maintain conditions during and after installation of Products.

1.9 MAINTENANCE SERVICE

A. Furnish service contract with factory authorized service provider for bi-annual maintenance calls of uninterruptible power supply for two years from Date of Substantial Completion. Contract shall include documentation of service performed.
B. Include coverage of travel, labor, parts, and service.

1.10 WARRANTY

A. Provide two year warranty under provision 12-1.03 of Section 12 Building Work.
B. Warranty: Include coverage for batteries.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Best Power Technology, Inc., Wisconsin.
B. Sola, Ill.
C. Cyberex, Inc., Ohio.
D. Substitutions: Under provisions of Section 6.

2.2 UNINTERRUPTIBLE POWER SUPPLY

A. System Performance - The UPS shall supply continuous ac power to the load in a reliable manner regardless of transients on or disruptions to the primary power source. It shall provide continuity of electric power within specified tolerances without interruption upon failure or deterioration of the primary power.
B. Components:

1. Batteries shall be provided in a module within the UPS. Use sealed, maintenance free lead cadmium batteries sized to provide 100 percent UPS output for a minimum of 60 minutes.
2. Rectifier/charger to maintain battery charge and to provide input to inverter when utility power is available.
3. Inverter to provide power to load during normal operation.
4. Static switch to transfer load automatically and without disturbance between inverter and utility power.
5. Manual switch to bypass static switch for maintenance.
6. Output isolation transformers and to provide appropriate isolation and disturbance attenuation.
7. Monitors, sensors, and control circuits; including auxiliary contacts to output status: normal, battery power and low battery power to RTU.

C. Temperature Control - Size and install all elements of the UPS to adequately dissipate the heat generated within.
D. Electrical Characteristics - The electrical characteristic of each system shall be as follows:

INPUT

Voltage	208V
Frequency	57 - to 63-Hz

Power Factor	Greater than 0.80 lag at normal line and full load
	OUTPUT
Rating	5 KVA Minimum
Voltage	120V
Frequency	60-Hz, adjustable +1 percent
Harmonic Distortion	Less than 5 percent rms total harmonic distortion and less than 3 percent for any one harmonic

E. Design Standards: IEEE 519 and NEMA PE 1.

2.3 ENCLOSURE RATING AND MATERIAL

A. The enclosure for the UPS shall be NEMA 1.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.2 FIELD QUALITY CONTROL

A. Field inspection and testing shall be performed for proper alignment, proper connection, proper operation of instruments and controls, and proper equipment operation.
B. Verify specification performance criteria; measure battery discharge and recharge times; simulate fault in each system component and utility power; Operate unit at 77 degrees F (25 degrees C) for eight hours; and other tests as recommended by manufacturer.

3.3 MANUFACTURER'S FIELD SERVICES

A. Prepare and start systems under provision 12-1.19 of Section 12 Building Work.
B. Include services of technician to supervise adjustments, final connections, and system testing.

3.4 DEMONSTRATION & TRAINING

A. Demonstrate operation uninterruptible power supply by simulating an outage.
B. Provide 5 hours of instruction to one group of four CDD technicians, to be conducted at project site with manufacturer's representative. Five O & M manuals must be available at site at time of training.

SECTION 16620 PACKAGED ENGINE GENERATOR SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Packaged engine generator set, including inherent overcurrent, short circuit and overload protection, digital and analog AC metering equipment, sensor failure detection, and remote monitoring and control capability.
B. Micro-processor based control system.
C. Automatic transfer switch.
D. Battery and charger.

1.2 RELATED SECTIONS

A. Section 15200 - Vibration Isolation & Seismic Control.
B. Section 15300 - Fire Protection System.
C. Section 15480 - Diesel Fuel Supply and Engine Exhaust System.
D. Section 16000, Electrical General Provisions.
E. Section 16050, Basic Electrical Materials and Methods
F. Section 16120, Wires and Cable.
G. Section 16473, Electrical Distribution.
H. Section 16455, Grounding and Bonding.
I. Section 13400, Station Control System with RTU/PLC

1.3 REFERENCES

A. ANSI/NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
B. ANSI/NEMA MG 1 - Motors and Generators.
C. ANSI/NFPA 70 - National Electrical Code.
D. ANSI/NFPA 99 - Health Care Facilities.
E. ANSI/NEMA AB 1 - Molded Case Circuit Breakers.
F. NEMA ICS 1 - General Standards for Industrial Control and Systems.
G. NEMA ICS 2 - Standards for Industrial Control Devices, Controllers, and Assemblies.
H. NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
I. UL 1008 - Standard for Standby Generator and Automatic Transfer Switches including bypass Isolation.

1.5 SYSTEM DESCRIPTION

A. Engine generator system to provide source of standby emergency power, with RTU controlled automatic transfer switch.
B. System Capacity - 500 kW, 625 kVA at elevation of 1,000 feet above sea level, and ambient temperature between 32° and 95°F continuous rating.

1.6 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 12, Building Work, 12-1.06.
B. Submit shop drawings showing plan and elevation views with overall and interconnection point dimensions, fuel consumption rate curves at various loads, ventilation and combustion air requirements, and electrical diagrams including schematic and interconnection diagrams.
C. Submit product data showing dimensions, weights, ratings, interconnection points, and internal wiring diagrams for engine, generator, control panel, automatic transfer switch, battery, battery rack, battery charger, exhaust silencer, vibration isolators and day tank.
D. Submit automatic transfer switch catalog sheets showing voltage, switch size, ratings and size of switching and overcurrent protective devices, operating logic, short circuit ratings, dimensions, and enclosure details.
E. Manufacturer's Installation Instructions - Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.
F. Submit 6 copies of Service Contract. See 1.13 below.
G. Submit 6 copies of Warranty. See 1.12 below.

1.7 PROJECT RECORD DOCUMENTS

A. Submit record documents under provisions of Section 12, Building Work, General Requirements.
B. Accurately record location of engine generator and mechanical and electrical connections.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Section 12, Building Work, General Requirements. Minimum required is six O & M Manuals. Organized logically, starting with a complete project description, including equipment serial numbers for genset and transfer switch, description of major components; followed by safety precautions.
B. Include instructions for normal operation, routine maintenance requirements and recommended time intervals, service manuals for engine/generator, automatic transfer switch and day tank, oil sampling and analysis for engine wear, and emergency maintenance procedures.
C. System one-line diagram showing all of the system components provided by vendor or others.
D. System point to point diagram showing external power cable and control wiring between system sub components. All wire landings shall be shown with terminal block designation and location.
E. Internal control wiring diagrams showing connection of control and monitoring equipment such as PLC, relays, monitoring devices, control operators, and LEDs.
F. Copy of transfer switch manual and schematic drawings.

1.9 QUALIFICATIONS

A. Manufacturer - Company specializing in packaged engine generator system with minimum three years documented experience. Transfer switch shall be a product of engine generator manufacturer.
B. Supplier - Authorized distributor of engine generator manufacturer with service facilities within 50 miles of project site.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Section 12, Building Work, General Requirements.
B. Deliver, store, protect and handle products to site in accordance with the equipment manufacturer instruction in original shipping containers.
C. Prior to shipment, include corrosive-inhibitive vapor capsules in shipping containers, and related equipment as recommended by the capsule manufacturer.
D. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic. Provide heating in storage areas for items subject to corrosion under damp conditions.
E. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to internal components, enclosure and finish.

1.11 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.
B. Furnish products listed and classified by UL testing firm acceptable to authority having jurisdiction as suitable for purpose specified and indicated.

1.12 WARRANTY

A. The complete electrical power system (generator set, controls, automatic transfer switch and associated switches, switchgear and accessories), as provided by the single-source manufacturer, shall be warranted by said manufacturer against defects in materials and workmanship for a period of five years or 1600 hours, whichever occurs first from the Date of Substantial Completion. Said coverage shall include parts, labor, travel expenses, and labor to remove/reinstall said equipment, per the manufacturer’s standard published limited warranty. There shall be no deductibles applied to said warranty.

1.13 MAINTENANCE SERVICE

A. Furnish service contract for packaged engine generator system and automatic transfer switch for two years with quarterly maintenance calls from Date of Substantial Completion. Service contract shall be with factory authorized service provider and shall include all manufacturer recommended maintenance tasks for the set over the two years. Documentation of service work shall be required in the contract.
B. Show how to order parts: name, address, phone number.

1.14 EXTRA MATERIALS

A. Provide two additional sets of each fuel, oil, and air filter element required for the engine generator system.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Onan Corporation, model 500 DFED.
B. Kohler Power Systems.
C. Substitutions: Under provisions of Section 6.

2.2 ENGINE

A. Type - Liquid cooled in line or V-type, four stroke cycle, compression ignition, diesel internal combustion engine. Minimum displacement shall be 1150 cubic inches, with 6 cylinders. The horsepower rating of the engine at its minimum tolerance level shall be sufficient to drive the alternator and all connected accessories.
B. Rating - Sufficient to operate at 10 percent overload for one hour at specified elevation and ambient limits.
C. Fuel System - Appropriate for use of No. 2 fuel oil.
D. Engine Speed - 1800 rpm.
E. Governor - An electronic governor system shall provide automatic isochronous frequency regulation to maintain +/- 0.25% steady state frequency regulation. Equip governor with means for manual operation and adjustment.
F. Safety Devices - Engine shutdown on high water temperature low oil pressure, low oil pressure, overspeed, and engine over crank. Limits as selected by manufacturer.
G. Engine Starting - DC starting system with positive engagement, number and voltage of starter motors in accordance with manufacturer's instructions. Include remote starting control circuit, with MANUAL-OFF-REMOTE selector switch on engine-generator control panel.
H. Engine Jacket Heater - Thermal circulation type water heater with integral thermostatic control, sized to maintain engine jacket water at 90 degrees F (32 degrees C), and suitable for operation on 208 volts AC.
I. Engine Accessories - Fuel filter, lube oil filter, intake air filter, lube oil cooler, fuel transfer pump, fuel priming pump, gear-driven water pump. Include fuel pressure gage, water temperature gage, and lube oil pressure gage on engine-generator control panel.
J. Mounting - Provide unit with suitable spring-type vibration isolators and mount on structural steel base.
K. Engine mounted battery charging alternator, 45 ampere minimum and solid state regulator.
L. Cooling by Heat Exchanger.

2.3 GENERATOR

A. Generator - ANSI/NEMA MG 1; three phase, three wire, four pole, reconnectible brushless synchronous generator with brushless exciter.
B. Rating - 500 kW, 625 KVA, at 0.8 power factor, 480 volts, 60 Hz at 1800 rpm.
C. Insulation - ANSI/NEMA MG 1, Class H.
D. Enclosure - ANSI/NEMA MG 1; open drip proof.
E. Voltage Regulation - Include generator-mounted volts per Hertz exciter-regulator to match engine and generator characteristics, with voltage regulation +/- 1 percent from no load to full load. Include manual controls to adjust voltage drop +/- 5 percent voltage level, and voltage gain.

2.4 ENGINE GENERATOR ACCESSORIES

A. Not used.
B. Not used.
C. Exhaust System is specified in Section 15480.
D. Batteries: Heavy duty, diesel starting type 24V DC lead-acid storage batteries, cranking capacity sized as recommended by the generator set manufacturer. Match battery voltage to starting system. Include necessary cables and clamps.
E. Battery Tray: Plastic coated metal or wooden tray treated for electrolyte resistance, constructed to contain spillage of electrolyte.
F. Battery Charger: A UL listed/CSA certified 10 amp voltage regulated battery charger. The charger may be located in an automatic transfer switch, or may be wall mounted, at the discretion of the installer. (Installer is responsible to modify plan showing battery charger circuit conduit and wire to generator location.) Input AC voltage and DC output voltage shall be as required. Chargers shall be equipped with float, taper and equalize charge settings. Operational monitors shall provide visual output along with individual form C contacts rated at 4 amps, 120 VAC, 30VDC for remote indication of:

Loss of AC power - red light
Low battery voltage - red light
High battery voltage - red light
Power ON - green light (no relay contact)

Analog DC voltmeter and ammeter, 12 hour equalize charge timer, AC and DC fuses shall also be provided on the charger.

Current limiting type designed to float at 2.17 volts per cell and equalize at 2.33 volts per cell. Include overload protection, full wave rectifier, DC voltmeter and ammeter, and 120 volts AC fused input. Provide wall-mounted enclosure to meet ANSI/NEMA 250, Type 1 requirements.

G. Line Circuit Breaker: NEMA AB 1 molded case circuit breaker on generator output with integral thermal and instantaneous magnetic trip in each pole; 800 amps, 480 volts, 3-pole. Include battery-voltage operated shunt trip, connection to open circuit breaker on engine failure. Mount unit in enclosure to meet ANSI/NEMA 250, Type 1 requirements.
H. Engine-Generator Set Control: The generator set shall be provided with a microprocessor-based control system which is designed to provide automatic starting, monitoring, and control functions for the generator set. The control system shall also be designed to allow local monitoring and control of the generator set, and remote monitoring and control as described in this specification. The control shall be mounted on the generator set. When mounted on the generator set the control shall be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered. The control shall be UL508 labeled, CSA282-M1989 certified, and meet IEC8528 part 4. All switches, lamps and meters shall be oil-tight and dust-tight, and the enclosure door shall be gasketed. There shall be no exposed points in the control (with the door open) that operate in excess of 50 volts. The controls shall meet or exceed the requirements of Mil-Std 461C part 9, and IEC Std 801.2, 801.3., and 801.5 for susceptibility, conducted, and radiated electromagnetic emissions. The entire control shall be tested and meet the requirements of IEEE587 for voltage surge resistance. The generator set mounted control shall include the following features and functions:

1. Three position control switch labeled RUN/OFF/AUTO. In the RUN position the generator set shall automatically start, and accelerate to rated speed and voltage. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.
2. Red "mushroom-head" push-button EMERGENCY STOP switch. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting.
3. Push-button RESET switch. The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.
4. Push-button PANEL LAMP switch. Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.

5. Generator Set AC Output Metering:
The generator set shall be provided with a metering set with the following features and functions:

2.5-inch, 90 degree scale analog voltmeter, ammeter, frequency meter, and kilowatt (KW) meter. These meters shall be provided with a phase select switch and an indicating lamp for upper and lower scale on the meters. Ammeter and KW meter scales shall be color coded in the following fashion: readings from 0-90% of generator set standby rating: green; readings from 90-100% of standby rating: amber; readings in excess of 100%: red.

Digital metering set, 0.5% accuracy, to indicate generator RMS voltage and current, frequency, output current, output KW, KW-hours, and power factor. Generator output voltage shall be available in line-to-line and line-to-neutral voltages, and shall display all three phase voltages (line to neutral or line to line) simultaneously.

6. Generator Set Alarm and Status Message Display: The generator set shall be provided with alarm and status indicating lamps to indicate non-automatic generator status, and existing alarm and shutdown conditions. The lamps shall be high-intensity LED type. The lamp condition shall be clearly apparent under bright room lighting conditions. The generator set control shall indicate the existence of the following alarm and shutdown conditions on a digital display panel:

low oil pressure (alarm)
low oil pressure (shutdown)
oil pressure sender failure (alarm)
low coolant temperature (alarm)
high coolant temperature (alarm)
high coolant temperature (shutdown)
engine temperature sender failure (alarm)
low coolant level (alarm or shutdown--selectable)
fail to crank (shutdown)
overcrank (shutdown)
overspeed (shutdown)
low DC voltage (alarm)
high DC voltage (alarm)
weak battery (alarm)
low fuel base tank (alarm)
high AC voltage (shutdown)
low AC voltage (shutdown)
under frequency (shutdown)
over current (warning)
over current (shutdown)
short circuit (shutdown)
ground fault (alarm)
over load (alarm)
emergency stop (shutdown)

In addition, provisions shall be made for indication of two customer-specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions shall be of the same type and quality as the above specified conditions.

The non-automatic indicating lamp shall be red, and shall flash to indicate that the generator set is not able to automatically respond to a command to start from a remote location.

7. Engine Status Monitoring:

The following information shall be available from a digital status panel on the generator set control :

engine oil pressure (psi or kPA)
engine coolant temperature (degrees F or C)

engine oil temperature (degrees F or C)
engine speed (rpm)
number of hours of operation (hours)
number of start attempts
battery voltage (DC volts)

8. Control Functions:

The control system provided shall include a cycle cranking system, which allows for user selected crank time, rest time, and # of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15 second rest period between cranking periods.

The control system shall include an idle mode control, which allows the engine to run in idle mode in the RUN position only. In this mode, the alternator excitation system shall be disabled.

The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting.

The control system shall include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.

The control system shall include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature which is capable of discriminating between failed sender or wiring components, and an actual failure conditions.

9. Alternator Control Functions:

The generator set shall include an automatic voltage regulation system which is matched and prototype tested with the governing system provided. It shall be immune from mis-operation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below a threshold of [58-59] HZ. The voltage regulator shall include adjustments for gain, damping, and frequency roll-off. Adjustments shall be broad range, and made via digital raise-lower switches, with an alpha-numeric LED readout to indicate setting level.

The voltage regulation system shall include provisions for reactive load sharing and electronic voltage matching for paralleling applications. Motorized voltage adjust pot is not acceptable for voltage matching.

Controls shall be provided to monitor the output current of the generator set and initiate an alarm when load current exceeds 110% of the rated current of the generator set on any phase for more than 60 seconds. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator.

Controls shall be provided to monitor the KW load on the generator set, and initiate an alarm condition when total load on the generator set exceeds the generator set rating for in excess of 5 seconds.

Controls shall include a load shed control, to operate a set of dry contacts (for use in shedding customer load devices) when the generator set has been overloaded.

An AC over/under voltage monitoring system which responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds. A battery monitoring system shall be provided which initiates alarms when the DC control and starting voltage is less than 25VDC or more than 32 VDC. During engine starting, the low voltage limit shall be disabled, and if DC voltage drops to less than 14.4 volts for more than two seconds a "weak battery" alarm shall be initiated.

The control system shall include a ground fault monitoring relay. The relay shall be adjustable from 100-1200 amps, and include adjustable time delay of 0-1.0 seconds. The relay shall be for indication only, and not trip or shut down the generator set. Note bonding and grounding requirements for the generator set, and provide relay which will function correctly in system as installed.

10. Control Interfaces for Remote Monitoring:

All control and interconnection points from the generator set to remote components shall be brought to a separate connection box. No field connections shall be made in the control enclosure or in the AC power output enclosure. Provide the following features in the control system:

Form "C" dry common alarm contact set rated 2A @ 30VDC to indicate existence of any alarm or shutdown condition on the generator set.

One set of contacts rated 2A @ 30VDC to indicate generator set is ready to load. The contacts shall operate when voltage and frequency are greater than 90% of rated condition.

A fused 10 amp switched 24VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit whenever the generator set is running.

A fused 20 amp 24VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit at all times from the engine starting/control batteries.

11. Transfer switch/generator controls shall be modified such that the generator start shall be inhibited after loss of power until stated conditions in Section 13400-2.04 are met; i.e., pump call or UPS low battery. Generator shall be interlocked so that, if there is a fire alarm in the electrical room the generator shall not start no matter that conditions are met. If there is no fire alarm and the conditions above are met, then generator shall start and switching shall be accomplished when generator is ready to load.

Similarly, when pumping or battery charging has been accomplished, the load shed control shall be activated via the RTU, so the switch will disconnect the generator from the load and the generator shall go into turn off cycle. If the power outage continues, the cycle shall be repeatable. When pump call or UPS low battery condition occurs, then the RTU activates a generator start, when the generator is ready to load, the RTU turns load shed off enabling the automatic transfer switch to switch.

2.5 AUTOMATIC TRANSFER SWITCH.

A. The transfer switch unit shall be electrically operated and mechanically held. The electrical operator shall be a single-solenoid mechanism, momentarily energized. Main operators which include overcurrent disconnect devices will not be accepted. The switch shall be mechanically interlocked to ensure only one of three possible positions, normal or emergency or a neutral position when load shed is activated.
B. The switch shall be positively locked and unaffected by momentary outages so that contact pressure is maintained at a constant value and temperature rise at the contacts is minimized for maximum reliability and operating life.
C. All main contacts shall be high-pressure silver alloy composition. Switches rated 600 amperes and above shall have segmented, blow-on construction for high withstand current capability and be protected by separate arcing contacts.
D. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. A manual operating handle shall be provided for maintenance purposes. The handle shall permit the operator to manually stop the contacts at any point throughout their entire travel to inspect and service the contacts when required.
E. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof which are not intended for continuous duty, repetitive switching or transfer between two active power sources are not acceptable.
F. Neutral conductors are to be solidly connected as shown on the plans, a neutral conductor terminal plate with fully-rated AL-CU pressure connectors shall be provided.
G. All transfer switches shall be listed and labeled.
H. Service Conditions: Nema ICS 1; Temperature, 40° and Altitude, 3,300 feet.
I. Ratings:

1. Voltage - 480 volts, three phase, three wire, 60 Hz.
2. Switched Poles - 3.
3. Load Inrush Rating - Combination Electric discharge lamp, Resistive and motor loads.
4. Continuous Rating - 800 amperes.

5. Interrupting Capacity - 100 percent of continuous rating.
6. Withstand Current Rating - 22,000 rms symmetrical amperes, when used with molded case circuit breaker.

J. Enclosure shall be Nema 12 with manufacturer's standard finish.

2.6 AUTOMATIC TRANSFER SWITCH OPTIONS AND FEATURES

A. Indicating Lights - Mount in cover of enclosure to indicate NORMAL SOURCE AVAILABLE, ALTERNATE SOURCE AVAILABLE, SWITCH POSITION.
B. Test Switch - Mount in cover of enclosure to simulate failure of normal source.
C. Return to Normal Switch - Mount in cover of enclosure to initiate manual transfer from alternate to normal source.
D. Transfer Switch Auxiliary Contacts - 4 normally open; 4 normally closed.
E. Normal Source Monitor - Monitor each line of normal source voltage and frequency; initiate transfer, if conditions below, when voltage drops below 85 percent or frequency varies more than 3 Hertz from rated nominal value.

Normal Source Monitor Relay - Monitor each line of normal source voltage and frequency; when voltage drops below 85 percent or frequency varies more than 3 Hertz from rated nominal value, provide a contact closure to RTU.

Transfer switch/generator controls shall be modified such that the generator start will be inhibited until stated conditions in Section 13400-2.04 are met; i.e., pump call or UPS low battery. Then generator shall start and switching shall be accomplished when generator is ready to load. Similarly, when pumping or battery charging has been accomplished, the load shed control shall be activated via the RTU, so the switch will disconnect the generator from the load and the generator shall go into turn off cycle. If the power outage continues, the cycle shall be repeatable. When pump call or UPS low battery condition occurs, then the RTU activates a generator start, when the generator is ready to load, the RTU turns load shed off enabling the automatic transfer switch to switch.

F. Alternate Source Monitor - Monitor alternate source voltage and frequency; inhibit transfer when voltage is below 85 percent or frequency varies more than 3 Hertz from rated nominal value.
G. Load Shed Option - When a remote signal closes, the switch shall switch to a neutral position from emergency and stay there until load shed signal opens. Then the switch will go to emergency.

2.7 AUTOMATIC SEQUENCE OF OPERATION

A. Initiate Time Delay to Start Alternate Source Engine Generator - Upon initiation by normal source monitor, as modified by sub-section2.5 F above.
B. Time Delay To Start Alternate Source Engine Generator - 0 to 60 seconds, adjustable.
C. Initiate Transfer Load to Alternate Source - Upon initiation by normal source monitor and permission by alternate source monitor, as modified by 2.5 F above.
D. Time Delay Before Transfer to Alternate Power Source - 0 to 60 seconds, adjustable.
E. Initiate Retransfer Load to Normal Source - Upon permission by normal source monitor.
F. Time Delay Before Transfer to Normal Power: 0 to 5 minutes, adjustable; bypass time delay in event of alternate source failure.
G. Time Delay Before Engine Shut Down - 0 to 30 minutes, adjustable, of unloaded operation.
H. Engine Exerciser - Start engine every 7 days; run for 30 minutes before shutting down. Bypass exerciser control if normal source fails during exercising period.
I. Alternate System Exerciser - Provision to manually initiate transfer of load to alternate source during engine exercising period.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work and field dimensions are as shown on Drawings.
B. Verify that required utilities are available in proper location and ready for use.
C. Beginning of installation means installer accepts existing conditions.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions, with steel spring vibration isolators, furnished and installed with the generator set, on a concrete pad as detailed on the plans.
B. Install transfer switches in accordance with manufacturer's instructions. A manufacturer's representative shall provide periodic inspection and supervision to ensure conformance to installation drawings, schematic drawings and instructions.
C. Provide engraved plastic nameplates.

3.3 MANUFACTURER'S FIELD SERVICES

A. Prepare, start, test, and adjust systems under provisions of Section 12; Buildings; General Requirements and as follows.
B. Visual inspection of installation - generator mounting, exhaust system fuel system and cooling system; transfer switch and interconnection wiring.
C. Check out procedures for system functions - safeties, alarms and load shed.
D. On site acceptance test - The complete installation shall be tested for compliance with the specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer, with required fuel supplied by Contractor. The Engineer shall be notified five days in advance and shall witness the tests. Installation acceptance tests to be conducted on-site shall include a “cold start” test, a four hour full load test and testing with RTU/PLC control to show operation strategy has been implemented. Provide a resistive load bank and make temporary connections for full load test, if necessary. Simulate power failure, pump call, automatic starting and stopping during failure, second start under failure made to show all operations.

E. During test, record the following at 20 minute intervals:

1. Kilowatts.
2. Amperes.
3. Voltage.
4. Coolant temperature.
5. Room temperature.
6. Frequency.
7. Oil pressure.

F. Two training sessions of 4 hours each shall be conducted by the manufacturer representative for CDD personnel. Six copies of the O & M manuals shall be available during each training.

3.4 ADJUSTING

A. Adjust generator output voltage and engine speed.

3.5 CLEANING

A. Clean engine and generator surfaces. Replace oil and fuel filters.

3.6 DEMONSTRATION

A. Provide systems demonstration of complete system operation for CDD personnel.
B. Describe loads connected to emergency system and restrictions for future load additions.
C. Simulate power outage by interrupting normal source, and demonstrate that system operates to provide emergency power.