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STATE OF CALIFORNIA

DEPARTMENT OF TRANSPORTATION

NOTICE TO CONTRACTORS

AND

SPECIAL PROVISIONS

FOR BUILDING CONSTRUCTION ON STATE HIGHWAY IN

CONTRA COSTA COUNTY IN MARTINEZ FROM MOCOCO OVERHEAD TO

BENICIA-MARTINEZ BRIDGE AND OVERHEAD

DISTRICT 04, ROUTE 680

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

CONTRACT NO. 04-006044

04-CC-680-39.4/40.1

Federal Aid Project

***ACIM-680-1(054)56**

Bids Open: February 13, 2002
Dated: December 24, 2001

OSD

****

IMPORTANT SPECIAL NOTICES

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Attention is directed to Section 3, "Award and Execution of Contract," of the special provisions for special requirements for the time allowed for return of documents by the successful bidder.

Attention is directed to Section 4, "Beginning of Work, Time of Completion and Liquidated Damages," of the special provisions for special requirements for beginning of work.

ESCROW OF BID DOCUMENTATION:
The bidder's attention is directed to "Escrow of Bid Documentation" of the Special Provisions.

The bidder's attention is directed to Section 5, containing specifications for "Disputes Review Board," of the Special Provisions, regarding establishing a Disputes Review Board (DRB) for the project.

The Special Provisions for Federal-aid projects (with and without DBE goals) have been revised to incorporate changes made by new regulations governing the DBE Program (49 CFR Part 26).

Sections 2 and 5 incorporate the changes. Bidders should read these sections to become familiar with them. Attention is directed to the following significant changes:

Section 2, "Disadvantaged Business Enterprise (DBE)" revises the counting of participation by DBE primes, and the counting of trucking performed by DBE firms. The section also revises the information that must be submitted to the Department in order to receive credit for trucking.

Section 2, "Submission of DBE Information" revises the information required to be submitted to the Department to receive credit toward the DBE goal. It also revises the criteria to demonstrate good faith efforts.

Section 5, "Subcontractor and DBE Records" revises the information required to be reported at the end of the project, and information related to trucking that must be submitted throughout the project.

Section 5, "DBE Certification Status" adds new reporting requirements related to DBE certification.

Section 5, "Subcontracting" describes the efforts that must be made in the event a DBE subcontractor is terminated or fails to complete its work for any reason.

Section 5, "Prompt Progress Payment to Subcontractors" requires prompt payment to all subcontractors.

Section 5, "Prompt Payment of Withheld Funds to Subcontractors" requires the prompt payment of retention to all subcontractors.

Payment Bonds

Attention is directed to Section 5 of the Special Provisions, regarding contract bonds. The payment bond shall be in a sum not less than one hundred percent of the total amount payable by the terms of the contract.

Federal minimum wage rates for this project are no longer included in the "Proposal and Contract" book. They will be available through the California Department of Transportation's Electronic Project Document Distribution Internet Web Site at http://hqidoc1.dot.ca.gov/. See Notice to Contractors.

Attention is directed to Section 1, "Specifications and Plans," of these special provisions for Amendments To July 1999 Standard Specifications. Amendments to the various sections of the Standard Specification have been consolidated into Section 1 and dated to reflect the most recent revision.

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STANDARD PLANS LIST

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

A10A	Abbreviations
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A20A	Pavement Markers and Traffic Lines, Typical Details
A20B	Pavement Markers and Traffic Lines, Typical Details
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A77C	Metal Beam Guard Railing – Wood Post and Wood Block Details
A77D	Metal Beam Guard Railing – Typical Layouts
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RSP A77G	Metal Beam Guard Railing – End Treatment, Terminal Anchor Assembly (Type SFT)
A77H	Metal Beam Guard Railing - Anchor Cable and Anchor Plate Details
A77J	Metal Beam Guard Railing Connections to Bridge Railings, Retaining Walls and Abutments
RSP A77L	Metal Beam Guard Railing and Single Faced Barrier Railing Terminal System - End Treatments
A85	Chain Link Fence
A87	Curbs, Dikes and Driveways
D73	Drainage Inlets
D74C	Drainage Inlet Details
D77A	Grate Details
D78	Gutter Depressions
D97C	Corrugated Metal Pipe Coupling Details No. 3 - Helical and Universal Couplers
D98C	Grated Line Drain Details
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H3	Planting and Irrigation Details
H4	Planting and Irrigation Details
H5	Planting and Irrigation Details

H6	Planting and Irrigation Details
H7	Planting and Irrigation Details
H8	Planting and Irrigation Details
T1A	Temporary Crash Cushion, Sand Filled (Unidirectional)
T1B	Temporary Crash Cushion, Sand Filled (Bidirectional)
RSP T2	Temporary Crash Cushion, Sand Filled (Shoulder Installations)
T3	Temporary Railing (Type K)
RSP B0-3	Bridge Details
RSP B3-1	Retaining Wall Type 1 - H=1200 Through 9100 mm
RSP B3-2	Retaining Wall Type 1 - H=9700 Through 10 900 mm
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B11-47	Cable Railing
RS1	Roadside Signs, Typical Installation Details No. 1
RS2	Roadside Signs - Wood Post, Typical Installation Details No. 2
ES-1A	Signal, Lighting and Electrical Systems - Symbols and Abbreviations
ES-1B	Signal, Lighting and Electrical Systems - Symbols and Abbreviations
ES-3A	Signal, Lighting and Electrical Systems - Controller Cabinet Details
ES-3B	Signal, Lighting and Electrical Systems - Controller Cabinet Details
ES-3C	Signal, Lighting and Electrical Systems - Controller Cabinet Details
ES-3H	Signal, Lighting and Electrical Systems – Irrigation Controller Enclosure Cabinet
ES-4C	Signal, Lighting and Electrical Systems - Signal Heads and Mountings
ES-5A	Signal, Lighting and Electrical Systems - Detectors
ES-5B	Signal, Lighting and Electrical Systems - Detectors
ES-5E	Signal, Lighting and Electrical Systems - Detectors
RSP ES-6J	Lighting Standards - 24.4 m to 48.8 m High Mast Light Pole Foundation Details
ES-8	Signal, Lighting and Electrical Systems - Pull Box Details
ES-13A	Signal, Lighting and Electrical Systems - Splicing Details
ES-14A	Signal, Lighting and Electrical Systems - Extinguishable Message Sign, 250 mm Letters
ES-14B	Signal, Lighting and Electrical Systems - Extinguishable Message Sign, 250 mm Letters
ES-16A	Closed Circuit Television Pole Details

Federal Project with DBE Goals (12-01-99)

DEPARTMENT OF TRANSPORTATION

NOTICE TO CONTRACTORS

CONTRACT NO. 04-006044

04-CC-680-39.4/40.1

Sealed proposals for the work shown on the plans entitled:

STATE OF CALIFORNIA; DEPARTMENT OF TRANSPORTATION; PROJECT PLANS FOR BUILDING CONSTRUCTION ON STATE HIGHWAY IN CONTRA COSTA COUNTY IN MARTINEZ FROM MOCOCO OVERHEAD TO BENICIA-MARTINEZ BRIDGE AND OVERHEAD

will be received at the Department of Transportation, 1120 N Street, Room 0200, MS #26, Sacramento, CA 95814, until 2 o'clock p.m. on February 13, 2002, 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 BUILDING CONSTRUCTION ON STATE HIGHWAY IN CONTRA COSTA COUNTY IN MARTINEZ FROM MOCOCO OVERHEAD TO BENICIA-MARTINEZ BRIDGE AND OVERHEAD

General work description: Toll plaza and operations building to be constructed.

This project has a goal of 11 percent disadvantaged business enterprise (DBE) participation.
No prebid meeting is scheduled for this project.

THIS PROJECT IS SUBJECT TO THE "BUY AMERICA" PROVISIONS OF THE SURFACE TRANSPORTATION ASSISTANCE ACT OF 1982 AS AMENDED BY THE INTERMODAL SURFACE TRANSPORTATION EFFICIENCY ACT OF 1991.

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 Class B license or a combination of Class C licenses which constitutes a majority of the work.

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

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

Cross sections for this project are available at the office of the District Director of Transportation of the district in which the work is situated in paper copy format.

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

The Department of Transportation hereby notifies all bidders that it will affirmatively insure that in any contract entered into pursuant to this advertisement, disadvantaged business enterprises will be afforded full opportunity to submit bids in response to this invitation.

The U.S. Department of Transportation (DOT) provides a toll-free "hotline" service to report bid rigging activities. Bid rigging activities can be reported Mondays through Fridays, between 8:00 a.m. and 5:00 p.m., eastern time, Telephone No. 1-800-424-9071. Anyone with knowledge of possible bid rigging, bidder collusion, or other fraudulent activities should use the "hotline" to report these activities. The "hotline" is part of the DOT's continuing effort to identify and investigate highway construction contract fraud and abuse and is operated under the direction of the DOT Inspector General. All information will be treated confidentially and caller anonymity will be respected.

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. The Federal minimum wage rates for this project as predetermined by the United States Secretary of Labor are available through the California Department of Transportation's Electronic Project Document Distribution Site on the internet at http://hqidoc1.dot.ca.gov/. Addenda to modify the Federal minimum wage rates, if necessary, will be issued to holders of "Proposal and Contract" books. Future effective general prevailing wage rates which have been predetermined and are on file with the California Department of Industrial Relations are referenced but not printed in the general prevailing wage rates.

If there is a difference between the minimum wage rates predetermined by the United States Secretary of Labor and the general prevailing wage rates determined by the Director of the California Department of Industrial Relations for similar classifications of labor, the Contractor and subcontractors shall pay not less than the higher wage rate. The Department will not accept lower State wage rates not specifically included in the Federal minimum wage determinations. This includes "helper" (or other classifications based on hours of experience) or any other classification not appearing in the Federal wage determinations. Where Federal wage determinations do not contain the State wage rate determination otherwise available for use by the Contractor and subcontractors, the Contractor and subcontractors shall pay not less than the Federal minimum wage rate which most closely approximates the duties of the employees in question.

DEPARTMENT OF TRANSPORTATION

Deputy Director Transportation Engineering

Dated December 24, 2001

SW

COPY OF ENGINEER'S ESTIMATE

(NOT TO BE USED FOR BIDDING PURPOSES)

04-006044

Item	Item Code	Item	Unit of Measure	Estimated Quantity
1	070010	PROGRESS SCHEDULE (CRITICAL PATH)	LS	LUMP SUM
2	070018	TIME-RELATED OVERHEAD	WDAY	510
3	022019	ELECTRONIC MOBILE DAILY DIARY COMPUTER SYSTEM DATA DELIVERY	LS	LUMP SUM
4	022020	TEMPORARY ENTRANCE/EXITS	EA	3
5	022021	TEMPORARY CONCRETE WASHOUT FACILITY	EA	3
6	150771	REMOVE ASPHALT CONCRETE DIKE	M	120
7	150805	REMOVE CULVERT	M	14
8	153101	PLANE ASPHALT CONCRETE PAVEMENT	M2	200
9	160101	CLEARING AND GRUBBING	LS	LUMP SUM
10	190101	ROADWAY EXCAVATION	M3	830
11 (F)	192037	STRUCTURE EXCAVATION (RETAINING WALL)	M3	82
12 (F)	193013	STRUCTURE BACKFILL (RETAINING WALL)	M3	200
13 (F)	193031	PERVIOUS BACKFILL MATERIAL (RETAINING WALL)	M3	25
14	200001	HIGHWAY PLANTING	LS	LUMP SUM
15	204099	PLANT ESTABLISHMENT WORK	LS	LUMP SUM
16	208000	IRRIGATION SYSTEM	LS	LUMP SUM
17	022022	75 MM ALTERNATIVE CONDUIT	M	70
18	022023	150 MM ALTERNATIVE CONDUIT	M	4
19	208731	200 MM CORRUGATED HIGH DENSITY POLYETHYLENE PIPE CONDUIT	M	19
20	250401	CLASS 4 AGGREGATE SUBBASE	M3	650

Item	Item Code	Item	Unit of Measure	Estimated Quantity
21	260301	CLASS 3 AGGREGATE BASE	M3	660
22	390102	ASPHALT CONCRETE (TYPE A)	TONN	660
23	394001	PLACE ASPHALT CONCRETE DIKE	M	47
24	395001	LIQUID ASPHALT, SC-70 (PRIME COAT)	TONN	5
25	401000	CONCRETE PAVEMENT	M3	25
26	404092	SEAL PAVEMENT JOINT	M	40
27 (F)	510060	STRUCTURAL CONCRETE, RETAINING WALL	M3	70
28 (F)	510502	MINOR CONCRETE (MINOR STRUCTURE)	M3	11
29 (F)	520103	BAR REINFORCING STEEL (RETAINING WALL)	KG	1960
30	566011	ROADSIDE SIGN - ONE POST	EA	2
31	022024	WEATHER STATION	LS	LUMP SUM
32	620910	450 MM ALTERNATIVE PIPE CULVERT (TYPE A)	M	27
33	620911	450 MM ALTERNATIVE PIPE CULVERT (TYPE B)	M	15
34	620915	600 MM ALTERNATIVE PIPE CULVERT (TYPE B)	M	3
35	022025	100 MM PLASTIC PIPE	M	2
36	731502	MINOR CONCRETE (MISCELLANEOUS CONSTRUCTION)	M3	66
37 (F)	750001	MISCELLANEOUS IRON AND STEEL	KG	592
38	800391	CHAIN LINK FENCE (TYPE CL-1.8)	M	30
39	802592	2.4 M CHAIN LINK GATE (TYPE CL-1.8)	EA	2
40	820151	OBJECT MARKER (TYPE L-1)	EA	2

Item	Item Code	Item	Unit of Measure	Estimated Quantity
41	832003	METAL BEAM GUARD RAILING (WOOD POST)	M	180
42	839521	CABLE RAILING	M	55
43	022026	TERMINAL ANCHOR ASSEMBLY (TYPE SFT)	EA	2
44	839551	TERMINAL SECTION (TYPE B)	EA	1
45	839565	TERMINAL SYSTEM (TYPE SRT)	EA	1
46	839701	CONCRETE BARRIER (TYPE 60)	M	40
47	839704	CONCRETE BARRIER (TYPE 60D)	M	55
48	840656	PAINT TRAFFIC STRIPE (2-COAT)	M	1510
49	840666	PAINT PAVEMENT MARKING (2-COAT)	M2	33
50	842000	PARKING BUMPER (PRECAST CONCRETE)	EA	41
51	850111	PAVEMENT MARKER (RETROREFLECTIVE)	EA	78
52	994650	BUILDING WORK	LS	LUMP SUM

STATE OF CALIFORNIA

DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISIONS

Annexed to Contract No. 04-006044

SECTION 1. SPECIFICATIONS AND PLANS

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

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

AMENDMENTS TO JULY 1999 STANDARD SPECIFICATIONS

UPDATED DECEMBER 31, 2001

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

SECTION 2: PROPOSAL REQUIREMENTS AND CONDITIONS

Issue Date: December 31, 2001

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

- Where the Department has made investigations of site conditions, including subsurface conditions in areas where work is to be performed under the contract, or in other areas, some of which may constitute possible local material sources, bidders or Contractors may, upon written request, inspect the records of the Department as to those investigations subject to and upon the conditions hereinafter set forth.

SECTION 5: CONTROL OF WORK

Issue Date: December 31, 2001

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

5-1.02A Excavation Safety Plans

- The Construction Safety Orders of the Division of Occupational Safety and Health shall apply to all excavations. For all excavations 1.5 m or more in depth, the Contractor shall submit to the Engineer a detailed plan showing the design

and details of the protective systems to be provided for worker protection from the hazard of caving ground during excavation. The detailed plan shall include any tabulated data and any design calculations used in the preparation of the plan. Excavation shall not begin until the detailed plan has been reviewed and approved by the Engineer.

- Detailed plans of protective systems for which the Construction Safety Orders require design by a registered professional engineer shall be prepared and signed by an engineer who is registered as a Civil Engineer in the State of California, and shall include the soil classification, soil properties, soil design calculations that demonstrate adequate stability of the protective system, and any other design calculations used in the preparation of the plan.
- No plan shall allow the use of a protective system less effective than that required by the Construction Safety Orders.
- If the detailed plan includes designs of protective systems developed only from the allowable configurations and slopes, or Appendices, contained in the Construction Safety Orders, the plan shall be submitted at least 5 days before the Contractor intends to begin excavation. If the detailed plan includes designs of protective systems developed from tabulated data, or designs for which design by a registered professional engineer is required, the plan shall be submitted at least 3 weeks before the Contractor intends to begin excavation.
- Attention is directed to Section 7-1.01E, "Trench Safety."

SECTION 19: EARTHWORK

Issue Date: December 31, 2001

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

- In addition to the provisions in Sections 5-1.02, "Plans and Working Drawings," and 5-1.02A, "Excavation Safety Plans," detailed plans of the protective systems for excavations on or affecting railroad property will be reviewed for adequacy of protection provided for railroad facilities, property, and traffic. These plans shall be submitted at least 9 weeks before the Contractor intends to begin excavation requiring the protective systems. Approval by the Engineer of the detailed plans for the protective systems will be contingent upon the plans being satisfactory to the railroad company involved.

SECTION 42: GROOVE AND GRIND PAVEMENT

Issue Date: December 31, 2001

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

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

SECTION 49: PILING

Issue Date: December 31, 2001

Section 49-1.05, "Driving Equipment," of the Standard Specifications is amended by adding the following paragraph after the seventh paragraph:

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

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

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

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

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

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

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

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

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

SECTION 50: PRESTRESSING CONCRETE

Issue Date: December 31, 2001

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

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

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

· Prestressing steel shall be high-tensile wire conforming to the requirements in ASTM Designation: A 421, including Supplement I; high-tensile seven-wire strand conforming to the requirements in ASTM Designation: A 416; or uncoated high-strength steel bars conforming to the requirements in ASTM Designation: A 722, including all supplementary requirements. The maximum mass requirement of ASTM Designation: A 722 will not apply.

· In addition to the requirements of ASTM Designation: A 722, for deformed bars, the reduction of area shall be determined from a bar from which the deformations have been removed. The bar shall be machined no more than necessary to remove the deformations over a length of 300 mm, and reduction will be based on the area of the machined portion.

· In addition to the requirements specified herein, epoxy-coated seven-wire prestressing steel strand shall be grit impregnated and filled in conformance with the requirements in ASTM Designation: A 882/A 882M, including Supplement I, and the following:

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

♦ All visible damage to coatings caused by shipping and handling, or during installation, including cut ends, shall be repaired in conformance with the requirements in ASTM Designation: A 882/A 882M. The patching material shall be furnished by the manufacturer of the epoxy powder and shall be applied in conformance with the manufacturer's written recommendations. The patching material shall be compatible with the original epoxy coating material and shall be inert in concrete.

· All bars in any individual member shall be of the same grade, unless otherwise permitted by the Engineer.

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

· Wires shall be straightened if necessary to produce equal stress in all wires or wire groups or parallel lay cables that are to be stressed simultaneously or when necessary to ensure proper positioning in the ducts.

· Where wires are to be button-headed, the buttons shall be cold formed symmetrically about the axes of the wires. The buttons shall develop the minimum guaranteed ultimate tensile strength of the wire. No cold forming process shall be used that causes indentations in the wire. Buttonheads shall not contain wide open splits, more than 2 splits per head, or splits not parallel with the axis of the wire.

· Prestressing steel shall be protected against physical damage and rust or other results of corrosion at all times from manufacture to grouting or encasing in concrete. Prestressing steel that has sustained physical damage at any time shall be rejected. The development of visible rust or other results of corrosion shall be cause for rejection, when ordered by the Engineer.

· Epoxy-coated prestressing steel strand shall be covered with an opaque polyethylene sheeting or other suitable protective material to protect the strand from exposure to sunlight, salt spray, and weather. For stacked coils, the protective covering shall be draped around the perimeter of the stack. The covering shall be adequately secured; however, it should allow for air circulation around the strand to prevent condensation under the covering. Epoxy-coated strand shall not be stored within 300 m of ocean or tidal water for more than 2 months.

· Prestressing steel shall be packaged in containers or shipping forms for the protection of the steel against physical damage and corrosion during shipping and storage. Except for epoxy-coated strand, a corrosion inhibitor which prevents rust or other results of corrosion, shall be placed in the package or form, or shall be incorporated in a corrosion inhibitor carrier type packaging material, or when permitted by the Engineer, may be applied directly to the steel. The corrosion inhibitor shall have no deleterious effect on the steel or concrete or bond strength of steel to concrete. Packaging or forms damaged from any cause shall be immediately replaced or restored to original condition.

· The shipping package or form shall be clearly marked with a statement that the package contains high-strength prestressing steel, and the type of corrosion inhibitor used, including the date packaged.

· Prestressing steel for post-tensioning which is installed in members prior to placing and curing of the concrete, and which is not epoxy-coated, shall be continuously protected against rust or other results of corrosion, until grouted, by means of a corrosion inhibitor placed in the ducts or applied to the steel in the duct. The corrosion inhibitor shall conform to the provisions specified herein.

· When steam curing is used, prestressing steel for post-tensioning shall not be installed until the steam curing is completed.

· Water used for flushing ducts shall contain either quick lime (calcium oxide) or slaked lime (calcium hydroxide) in the amount of 0.01-kg/L. Compressed air used to blow out ducts shall be oil free.

· When prestressing steel for post-tensioning is installed in the ducts after completion of concrete curing, and if stressing and grouting are completed within 10 days after the installation of the prestressing steel, rust which may form during those 10 days will not be cause for rejection of the steel. Prestressing steel installed, tensioned, and grouted in this manner, all within 10 days, will not require the use of a corrosion inhibitor in the duct following installation of the prestressing steel. Prestressing steel installed as above but not grouted within 10 days shall be subject to all the requirements in this section pertaining to corrosion protection and rejection because of rust. The requirements in this section pertaining to tensioning and grouting within 10 days shall not apply to epoxy-coated prestressing steel strand.

· Any time prestressing steel for pretensioning is placed in the stressing bed and is exposed to the elements for more than 36 hours prior to encasement in concrete, adequate measures shall be taken by the Contractor, as approved by the Engineer, to protect the steel from contamination or corrosion.

· After final fabrication of the seven-wire prestressing steel strand, no electric welding of any form shall be performed on the prestressing steel. Whenever electric welding is performed on or near members containing prestressing steel, the welding ground shall be attached directly to the steel being welded.

· Pretensioned prestressing steel shall be cut off flush with the end of the member. For epoxy-coated prestressing steel, only abrasive saws shall be used to cut the steel. The exposed ends of the prestressing steel and a 25-mm strip of

adjoining concrete shall be cleaned and painted. Cleaning shall be by wire brushing or abrasive blast cleaning to remove all dirt and residue on the metal or concrete surfaces. Immediately after cleaning, the surfaces shall be covered with one application of unthinned zinc-rich primer (organic vehicle type) conforming to the provisions in Section 91, "Paint," except that 2 applications shall be applied to surfaces which will not be covered by concrete or mortar. Aerosol cans shall not be used. The paint shall be thoroughly mixed at the time of application and shall be worked into any voids in the prestressing tendons.

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

· Prestressing steel in pretensioned members shall not be cut or released until the concrete in the member has attained a compressive strength of not less than the value shown on the plans or 28 MPa, whichever is greater. In addition to these concrete strength requirements, when epoxy-coated prestressing steel strand is used, the steel shall not be cut or released until the temperature of the concrete surrounding the strand is less than 65°C, and falling.

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

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

For wire or bars, one 2-m long sample and for strand, one 1.5-m long sample, of each size shall be furnished for each heat or reel.

For epoxy-coated strand, one 1.5-m long sample of uncoated strand of each size shall be furnished for each reel.

If the prestressing tendon is a bar, one 2-m long sample shall be furnished and in addition, if couplers are to be used with the bar, two 1.25-m long samples of bar, equipped with one coupler and fabricated to fit the coupler, shall be furnished.

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

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

SECTION 51: CONCRETE STRUCTURES

Issue Date: December 31, 2001

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

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

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

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

· In the event that several falsework plans are submitted simultaneously, or an additional plan is submitted for review before the review of a previously submitted plan has been completed, the Contractor shall designate the sequence in which the plans are to be reviewed. In such event, the time to be provided for the review of any plan in the sequence shall be not less than the review time specified above for that plan, plus 2 weeks for each plan of higher priority which is still under

review. A falsework plan submittal shall consist of plans for a single bridge or portion thereof. For multi-frame bridges, each frame shall require a separate falsework plan submittal.

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

· If structural composite lumber is proposed for use, the falsework drawings shall clearly identify the structural composite lumber members by grade (E value), species, and type. The Contractor shall provide technical data from the manufacturer showing the tabulated working stress values of the composite lumber. The Contractor shall furnish a certificate of compliance as specified in Section 6-1.07, "Certificates of Compliance," for each delivery of structural composite lumber to the project site.

· For falsework piles with a calculated loading capacity greater than 900 kN, the falsework piles shall be designed by an engineer who is registered as either a Civil Engineer or a Geotechnical Engineer in the State of California, and the calculations shall be submitted to the Engineer.

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

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

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

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

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

· When falsework is supported on piles, the piles shall be driven and the actual bearing value assessed in conformance with the provisions in Section 49, "Piling."

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

· For falsework piles with a calculated loading capacity greater than 900 kN, the Contractor shall conduct dynamic monitoring of pile driving and conduct penetration and bearing analyses based on a wave equation analysis. These analyses shall be signed by an engineer who is registered as a Civil Engineer in the State of California and submitted to the Engineer prior to completion of falsework erection.

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

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

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

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

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

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

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

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

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

SECTION 52: REINFORCEMENT

Issue Date: December 31, 2001

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

· A Certificate of Compliance conforming to the provisions in Section 6-1.07, "Certificates of Compliance," shall also be furnished for each shipment of epoxy-coated bar reinforcement or wire reinforcement certifying that the coated reinforcement conforms to the requirements in ASTM Designation: A 775/A 775M or A 884/A 884M, respectively, and the provisions in Section 52-1.02B, "Epoxy-coated Reinforcement." The Certificate of Compliance shall include all of the certifications specified in ASTM Designation: A 775/A 775M or A 884/A 884M respectively, and a statement that the coating material has been prequalified by acceptance testing performed by the Valley Forge Laboratories, Inc., Devon, Pennsylvania.

The third paragraph in Section 52-1.08C, "Mechanical Butt Splices," of the Standard Specifications is amended to read:

· The total slip of the reinforcing bars within the splice sleeve after loading in tension to 200 MPa and relaxing to 20 MPa shall not exceed the values listed in the following table. The slip shall be measured between gage points that are clear of the splice sleeve.

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

The first paragraph in Section 52-1.08C(5), "Sleeve-Lockshear Bolt Mechanical Butt Splices," of the Standard Specifications is amended to read:

· The sleeve-lockshear bolt type of mechanical butt splices shall consist of a seamless steel sleeve, center hole with centering pin, and bolts that are tightened until the bolt heads shear off with the bolt ends left embedded in the reinforcing bars. The seamless steel sleeve shall be either formed into a V configuration or shall have 2 serrated steel strips welded to the inside of the sleeve.

Section 52-1.08F, "Nondestructive Splice Tests," of the Standard Specifications is amended by deleting the seventh paragraph.

SECTION 55: STEEL STRUCTURES

Issue Date: December 31, 2001

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

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

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

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

SECTION 56: SIGNS

Issue Date: December 31, 2001

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

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

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

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

· An alternating snugging and tensioning pattern for anchor bolts and high-strength bolted splices shall be used. Once tensioned, high-strength fastener components and direct tension indicators shall not be reused.

· For bolt diameters less than 10 mm, the diameter of the bolt hole shall be not more than 0.80-mm larger than the nominal bolt diameter. For bolt diameters greater than or equal to 10 mm, the diameter of the bolt hole shall be not more than 1.6 mm larger than the nominal bolt diameter.

· Sign structures shall be fabricated into the largest practical sections prior to galvanizing.

· Ribbed sheet metal panels for box beam closed truss sign structures shall be fastened to the truss members by cap screws or bolts as shown on the plans, or by 4.76 mm stainless steel blind rivets conforming to Industrial Fasteners Institute, Standard IFI-114, Grade 51. The outside diameter of the large flange rivet head shall be not less than 15.88 mm in diameter. Web splices in ribbed sheet metal panels may be made with similar type blind rivets of a size suitable for the thickness of material being connected.

· Spalling or chipping of concrete structures shall be repaired by the Contractor at the Contractor's expense.

· Overhead sign supports shall have an aluminum identification plate permanently attached near the base, adjacent to the traffic side on one of the vertical posts, using either stainless steel rivets or stainless steel screws. As a minimum, the information on the plate shall include the name of the manufacturer, the date of manufacture and the contract number.

SECTION 59: PAINTING

Issue Date: December 31, 2001

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

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

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

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

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

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

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

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

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

SECTION 75: MISCELLANEOUS METAL

Issue Date: December 31, 2001

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

Material	Specification
Steel bars, plates and shapes	ASTM Designation: A 36/A 36M or A 575, A 576 (AISI or M Grades 1016 through 1030 except Grade 1017)
Steel fastener components for general applications:	
Bolts and studs	ASTM Designation: A 307
Headed anchor bolts	ASTM Designation: A 307, Grade B, including S1 supplementary requirements
Nonheaded anchor bolts	ASTM Designation: A 307, Grade C, including S1 supplementary requirements and S1.6 of AASHTO Designation: M 314 supplementary requirements or AASHTO Designation: M 314, Grade 36 or 55, including S1 supplementary requirements
High-strength bolts and studs, threaded rods, and nonheaded anchor bolts	ASTM Designation: A 449, Type 1
Nuts	ASTM Designation: A 563, including Appendix X1*
Washers	ASTM Designation: F 844
Components of high-strength steel fastener assemblies for use in structural steel joints:	
Bolts	ASTM Designation: A 325, Type 1
Tension control bolts	ASTM Designation: F 1852, Type 1
Nuts	ASTM Designation: A 563, including Appendix X1*
Hardened washers	ASTM Designation: F 436, Type 1, Circular, including S1 supplementary requirements
Direct tension indicators	ASTM Designation: F 959, Type 325, zinc-coated
Stainless steel fasteners (Alloys 304 & 316) for general applications:	
Bolts, screws, studs, threaded rods, and nonheaded anchor bolts	ASTM Designation: F 593 or F 738M
Nuts	ASTM Designation: F 594 or F 836M
Washers	ASTM Designation: A 240/A 240M and ANSI B 18.22M
Carbon-steel castings	ASTM Designation: A 27/A 27M, Grade 65-35 [450-240], Class 1
Malleable iron castings	ASTM Designation: A 47, Grade 32510 or A 47M, Grade 22010
Gray iron castings	ASTM Designation: A 48, Class 30B
Ductile iron castings	ASTM Designation: A 536, Grade 65-45-12
Cast iron pipe	Commercial quality
Steel pipe	Commercial quality, welded or extruded
Other parts for general applications	Commercial quality

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

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

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

* Maximum stud diameter permitted for mechanical expansion anchors.

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

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

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

Installation Torque Values, (newton meters)

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

SECTION 86: SIGNALS, LIGHTING AND ELECTRICAL SYSTEMS

Issue Date: December 31, 2001

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

- Forms shall be true to line and grade. Tops of foundations for posts and standards, except special foundations, shall be finished to curb or sidewalk grade or as directed by the Engineer. Forms shall be rigid and securely braced in place. Conduit ends and anchor bolts shall be placed in proper position and to proper height, and anchor bolts shall be held in place

by means of rigid top and bottom templates. The bottom template shall be made of steel. The bottom template shall provide proper spacing and alignment of the anchor bolts near their bottom embedded end. The bottom template shall be installed before placing footing concrete. Anchor bolts shall not be installed more than 1:40 from vertical.

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

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

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

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

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

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

• On each lighting standard except Type 1, one rectangular stainless steel identification tag shall be permanently attached above the hand hole, near the base of the standard, using one stainless steel rivet near each corner of the identification tag. On each signal pole support, two stainless steel identification tags shall be similarly attached, one above the hand hole near the base of the vertical standard and one on the underside of the signal mast arm near the arm plate. As a minimum, the information on each stainless steel identification tag shall include the name of the manufacturer, the date of manufacture, the identification number as shown on the plans, and the contract number. The information may be either depressed or raised, and shall be legible.

• Each base plate at the bottom of poles, and each arm plate on the lower end of all luminaire and signal arms shall be marked with a unique identification code assigned by the fabricator. This code shall be traceable to a particular contract and all welds on that component, and shall be readable after the support structure is coated and installed.

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

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

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

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

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

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

Butt-welded transverse joints of tubular sections requiring CJP groove welds shall be made using a metal sleeve backing ring inside each joint. The sleeve shall be 3-mm nominal thickness, or thicker, and of steel having

the same chemical composition as the steel in the tubular sections to be joined. When the sections to be joined have different specified minimum yield strengths, the steel in the sleeve shall have the same chemical composition as the tubular section having the higher minimum yield strength. The width of the metal sleeve shall be consistent with the type of NDT chosen and shall be a minimum width of 25 mm. The sleeve shall be centered at the joint and have the same taper as the tubular sections, with the entire outer surface area of the sleeve in full contact with the adjoining inside surfaces of the tubular sections being connected.

All welds shall be continuous.

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

During fabrication, longitudinal seams on vertical tubular members of cantilevered support structures shall be centered on and along the side of the pole that the pole plate is located. Longitudinal seams on horizontal tubular members, including signal and luminaire arms, shall be within 30 degrees of the bottom of the arm.

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

Unless otherwise specified, steel members used for signal and lighting support structures shall receive NDT in conformance with AWS D1.1, AASHTO's LTS-4-"Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals" (4th edition, 2001) and the following:

Weld Location	Weld Type	Minimum Required NDT
Circumferential welds used to splice tubular sections and poles and arms	CJP groove weld with backing ring	100% UT or RT
Longitudinal seam welds	PJP groove weld	Random 25%MT
	CJP groove weld	100% UT or RT
Welds attaching base plates, flange plates, or pole or mast arm plates to poles or arm tubes	CJP groove weld with backing ring and reinforcing fillet	100% UT and MT
	External (top) fillet weld for socket-type connections	100% UT or RT

A written procedure approved by the Engineer shall be used when performing UT on material less than 8 mm thick. Contoured shoes shall be used when performing UT on round tubular sections under 1270 mm in diameter. UT of luminaire, signal arms, or pole sections that are arched or bent after welding shall be performed after bending has been performed, but before galvanizing.

When less than 100 percent of a weld is specified for NDT, and if defects are found during this inspection, additional NDT shall be performed. This additional NDT shall be performed on 25 percent of the total weld, as determined by the Quality Control Manager (QCM) unless otherwise directed by the Engineer, for all similar welds produced for signal and lighting support structures in the project. If any portion of the additional weld inspected is found defective, 100 percent of all similar welds produced for signal and lighting support structures in the project shall be tested.

One 25-mm diameter plug core sample shall be taken from each of three poles and from each of three arms for each type of signal and luminaire support to be furnished. Each plug core sample shall be taken from a different location along the poles, and arms selected for sampling. Unless otherwise directed by the Engineer, prior to coating poles the QCM shall randomly select poles and arms and the locations for taking plug core samples of longitudinal welds for each type of signal and luminaire support and submit the samples to the Engineer. Each plug core sample shall be labeled to indicate pole and arm identification codes and the location from which the plug core sample was removed. Plug core samples will not be required if other randomly selected plug core samples, representing the same types of signal and luminaire supports produced by the same manufacturer, have previously been submitted to and approved by the Engineer within the past 3 months. Repair of all plug holes will be done prior to coating, in a manner approved by the Engineer, and at the expense of the Contractor.

Prior to coating, the Contractor shall be responsible for satisfactorily repairing all holes in structures from which plug core samples were taken.

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

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

Exposed edges of the plates that make up the base assembly shall be finished to a surface roughness of 25 μm or smoother, and exposed corners of the plates shall be neatly rounded unless otherwise shown on the plans. Shafts shall be provided with slip-fitter shaft caps.

Flatness of surfaces of base plates that are to come in contact with concrete, grout, or washers and leveling nuts shall not vary more than 3 mm in any 305 mm-distance and shall not vary more than 5 mm for the length of the section. Flatness of faying surfaces of 1) plates in high-strength bolted connections, 2) plates in joints where cap screws are used to secure luminaire and signal arms, and 3) plates used for breakaway slip base assemblies shall not vary more than 2 mm in any 305 mm-distance and shall not vary more than 3 mm for the length of the section. The Engineer will prescribe the method for determining flatness.

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

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

Except for holes in base plates and flange plates, thermally cut holes made in tubular structural members of signal and lighting support structures shall initially be made a maximum of 2 mm less than the required hole diameter. The hole shall then be mechanically enlarged to the required size and shape by reaming or grinding. Edges shall have a surface roughness no greater than 6.35 mm. Round holes may be drilled to the exact final diameter. No holes shall be made in structural members unless the holes are shown on the plans or are approved in writing by the Engineer.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

SECTION 90: PORTLAND CEMENT CONCRETE

Issue Date: December 31, 2001

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

SECTION 90: PORTLAND CEMENT CONCRETE
90-1 GENERAL

90-1.01 DESCRIPTION

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

· The Contractor shall determine the mix proportions for all concrete except pavement concrete. The Engineer will determine the mix proportions for pavement concrete. Concrete for which the mix proportions are determined either by the Contractor or the Engineer shall conform to the requirements of this Section 90.

· Unless otherwise specified, cementitious material shall be a combination of cement and mineral admixture. Cementitious material shall be either:

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

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

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

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

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

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

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

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

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

· Whenever the 28-day compressive strength shown on the plans is greater than 25 MPa, the concrete shall be designated by compressive strength. If the plans show a 28-day compressive strength that is 28 MPa or greater, an additional 14 days will be allowed to obtain the specified strength. The 28-day compressive strengths shown on the plans that are 25 MPa or less are shown for design information only and are not a requirement for acceptance of the concrete.

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

· Before using concrete for which the mix proportions have been determined by the Contractor, or in advance of revising those mix proportions, the Contractor shall submit in writing to the Engineer a copy of the mix design.

· Compliance with cementitious material content requirements will be verified in conformance with procedures described in California Test 518 for cement content. For testing purposes, mineral admixture shall be considered to be cement. Batch proportions shall be adjusted as necessary to produce concrete having the specified cementitious material content.

· If any concrete has a cementitious material, portland cement, or mineral admixture content that is less than the minimum required, the concrete shall be removed. However, if the Engineer determines that the concrete is structurally adequate, the concrete may remain in place and the Contractor shall pay to the State $0.55 for each kilogram of cementitious material, portland cement, or mineral admixture that is less than the minimum required. The Department may deduct the amount from any moneys due, or that may become due, the Contractor under the contract. The deductions will not be made unless the difference between the contents required and those actually provided exceeds the batching tolerances permitted by Section 90-5, "Proportioning." No deductions will be made based on the results of California Test 518.

· The requirements of the preceding paragraph shall not apply to minor concrete or commercial quality concrete.

90-2 MATERIALS

90-2.01 CEMENT

· Unless otherwise specified, cement shall be either "Type IP (MS) Modified" cement, "Type II Modified" portland cement or Type V portland cement.

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

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

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

A. The cement shall not contain more than 0.60 percent by mass of alkalies, calculated as the percentage of Na_2O plus 0.658 times the percentage of K_2O, when determined by either direct intensity flame photometry or by the atomic absorption method. The instrument and procedure used shall be qualified as to precision and accuracy in conformance with the requirements in ASTM Designation: C 114;
B. The autoclave expansion shall not exceed 0.50 percent; and
C. Mortar, containing the cement to be used and Ottawa sand, when tested in conformance with California Test 527, shall not expand in water more than 0.010 percent and shall not contract in air more than 0.048 percent, except that when cement is to be used for precast prestressed concrete piling, precast prestressed concrete members, or steam cured concrete products, the mortar shall not contract in air more than 0.053 percent.

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

· Cement used in the manufacture of cast-in-place concrete for exposed surfaces of like elements of a structure shall be from the same cement mill.

· Cement shall be protected from exposure to moisture until used. Sacked cement shall be piled to permit access for tally, inspection, and identification of each shipment.

· Adequate facilities shall be provided to assure that cement meeting the provisions specified in this Section 90-2.01 shall be kept separate from other cement in order to prevent any but the specified cement from entering the work. Safe and suitable facilities for sampling cement shall be provided at the weigh hopper or in the feed line immediately in advance of the hopper, in conformance with California Test 125.

· If cement is used prior to sampling and testing as provided in Section 6-1.07, "Certificates of Compliance," and the cement is delivered directly to the site of the work, the Certificate of Compliance shall be signed by the cement manufacturer or supplier of the cement. If the cement is used in ready-mixed concrete or in precast concrete products purchased as such by the Contractor, the Certificate of Compliance shall be signed by the manufacturer of the concrete or product.

· Cement furnished without a Certificate of Compliance shall not be used in the work until the Engineer has had sufficient time to make appropriate tests and has approved the cement for use.

90-2.02 AGGREGATES

· Aggregates shall be free from deleterious coatings, clay balls, roots, bark, sticks, rags, and other extraneous material.

· Natural aggregates shall be thoroughly and uniformly washed before use.

· The Contractor, at the Contractor's expense, shall provide safe and suitable facilities, including necessary splitting devices for obtaining samples of aggregates, in conformance with California Test 125.

· Aggregates shall be of such character that it will be possible to produce workable concrete within the limits of water content provided in Section 90-6.06, "Amount of Water and Penetration."

· Aggregates shall have not more than 10 percent loss when tested for soundness in conformance with the requirements in California Test 214. The soundness requirement for fine aggregate will be waived, provided that the durability index, D_f, of the fine aggregate is 60, or greater, when tested for durability in conformance with California Test 229.

· If the results of any one or more of the Cleanness Value, Sand Equivalent, or aggregate grading tests do not meet the requirements specified for "Operating Range" but all meet the "Contract Compliance" requirements, the placement of concrete shall be suspended at the completion of the current pour until tests or other information indicate that the next material to be used in the work will comply with the requirements specified for "Operating Range."

· If the results of either or both the Cleanness Value and coarse aggregate grading tests do not meet the requirements specified for "Contract Compliance," the concrete that is represented by the tests shall be removed. However, if the Engineer determines that the concrete is structurally adequate, the concrete may remain in place, and the Contractor shall pay to the State $4.60 per cubic meter for paving concrete and $7.20 per cubic meter for all other concrete for the concrete represented by these tests and left in place. The Department may deduct the amount from any moneys due, or that may become due, the Contractor under the contract.

· If the results of either or both the Sand Equivalent and fine aggregate grading tests do not meet the requirements specified for "Contract Compliance," the concrete which is represented by the tests shall be removed. However, if the Engineer determines that the concrete is structurally adequate, the concrete may remain in place, and the Contractor shall pay to the State $4.60 per cubic meter for paving concrete and $7.20 per cubic meter for all other concrete for the concrete

represented by these tests and left in place. The Department may deduct the amount from any moneys due, or that may become due, the Contractor under the contract.

· The 2 preceding paragraphs apply individually to the "Contract Compliance" requirements for coarse aggregate and fine aggregate. When both coarse aggregate and fine aggregate do not conform to the "Contract Compliance" requirements, both paragraphs shall apply. The payments specified in those paragraphs shall be in addition to any payments made in conformance with the provisions in Section 90-1.01, "Description."

· No single Cleanness Value, Sand Equivalent or aggregate grading test shall represent more than 250 m^3 of concrete or one day's pour, whichever is smaller.

· Aggregates specified for freeze-thaw resistance shall pass the freezing and thawing test, California Test 528.

· The Contractor shall notify the Engineer of the proposed source of freeze-thaw resistant concrete aggregates at least 4 months before intended use. Should the Contractor later propose a different source of concrete aggregates, the Contractor shall again notify the Engineer at least 4 months before intended use. Blending of fine or coarse aggregates from untested sources with acceptable aggregates will not be permitted. Provisions for the time of submission of samples as provided in Section 40-1.015, "Cement Content," are superseded by the foregoing.

· Concurrently with notification of proposed sources of freeze-thaw resistant concrete aggregates, the Contractor shall furnish samples in the quantity ordered by the Engineer. The samples shall be secured under the direct supervision of the Engineer. Samples from existing stockpiles of processed aggregate shall be taken from washed materials and shall be visibly damp. Samples from materials in place in a material source shall be taken at depths from the existing surface that will ensure the presence of the full quantity of ground water. Excavations for the purpose of securing samples shall be made to the full depth of intended source operations. Samples shall be protected against loss of contained water until they are delivered to the Engineer.

· The Engineer will waive the above freeze-thaw test and the 4-month advance notice, required in this Section, provided aggregates are to be obtained from sources that have previously passed this test and test results are currently applicable.

· No extension of contract time will be allowed for the time required to perform the freezing and thawing test.

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

90-2.02A Coarse Aggregate

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

· Coarse aggregate shall conform to the following quality requirements:

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

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

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

90-2.02B Fine Aggregate

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

· Fine aggregate shall conform to the following quality requirements:

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

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

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

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

90-2.03 WATER

· In conventionally reinforced concrete work, the water for curing, for washing aggregates, and for mixing shall be free from oil and shall not contain more than 1000 parts per million of chlorides as Cl, when tested in conformance with California Test 422, nor more than 1300 parts per million of sulfates as SO_4, when tested in conformance with California Test 417. In prestressed concrete work, the water for curing, for washing aggregates, and for mixing shall be free from oil and shall not contain more than 650 parts per million of chlorides as Cl, when tested in conformance with California Test 422, nor more than 1300 parts per million of sulfates as SO_4, when tested in conformance with California Test 417. In no case shall the water contain an amount of impurities that will cause either: 1) a change in the setting time of cement of more than 25 percent when tested in conformance with the requirements in ASTM Designation: C 191 or ASTM Designation: C 266 or 2) a reduction in the compressive strength of mortar at 14 days of more than 5 percent, when tested in conformance with the requirements in ASTM Designation: C 109, when compared to the results obtained with distilled water or deionized water, tested in conformance with the requirements in ASTM Designation: C 109.

· In non-reinforced concrete work, the water for curing, for washing aggregates and for mixing shall be free from oil and shall not contain more than 2000 parts per million of chlorides as Cl, when tested in conformance with California Test 422, or more than 1500 parts per million of sulfates as SO_4, when tested in conformance with California Test 417.

· In addition to the above provisions, water for curing concrete shall not contain impurities in a sufficient amount to cause discoloration of the concrete or produce etching of the surface.

· Water reclaimed from mixer wash-out operations may be used in mixing concrete. The water shall not contain coloring agents or more than 300 parts per million of alkalis (Na_2O + 0.658 K_2O) as determined on the filtrate. The specific gravity of the water shall not exceed 1.03 and shall not vary more than ±0.010 during a day's operations.

90-2.04 ADMIXTURE MATERIALS

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

A. Chemical Admixtures—ASTM Designation: C 494.
B. Air-entraining Admixtures—ASTM Designation: C 260.
C. Calcium Chloride—ASTM Designation: D 98.
D. Mineral Admixtures—Coal fly ash; raw or calcined natural pozzolan as specified in ASTM Designation: C618; silica fume conforming to the requirements in ASTM Designation: C1240, with reduction of mortar expansion of 80 percent, minimum, using the cement from the proposed mix design.

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

90-3 AGGREGATE GRADINGS

90-3.01 GENERAL

· Before beginning concrete work, the Contractor shall submit in writing to the Engineer the gradation of the primary aggregate nominal sizes that the Contractor proposes to furnish. If a primary coarse aggregate or the fine aggregate is separated into 2 or more sizes, the proposed gradation shall consist of the gradation for each individual size, and the proposed proportions of each individual size, combined mathematically to indicate one proposed gradation. The proposed gradation shall meet the grading requirements shown in the table in this section, and shall show the percentage passing each of the sieve sizes used in determining the end result.

· The Engineer may waive, in writing, the gradation requirements in this Section 90-3.01 and in Sections 90-3.02, "Coarse Aggregate Grading," 90-3.03, "Fine Aggregate Grading," and 90-3.04, "Combined Aggregate Gradings," if, in the Engineer's opinion, furnishing the gradation is not necessary for the type or amount of concrete work to be constructed.

· Gradations proposed by the Contractor shall be within the following percentage passing limits:

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

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

90-3.02 COARSE AGGREGATE GRADING

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

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

· In the above table, the symbol X is the gradation that the Contractor proposes to furnish for the specific sieve size as provided in Section 90-3.01, "General."

· Coarse aggregate for the 37.5-mm, maximum, combined aggregate grading as provided in Section 90-3.04, "Combined Aggregate Gradings," shall be furnished in 2 or more primary aggregate nominal sizes. Each primary aggregate nominal size may be separated into 2 sizes and stored separately, provided that the combined material conforms to the grading requirements for that particular primary aggregate nominal size.

· When the 25-mm, maximum, combined aggregate grading as provided in Section 90-3.04, "Combined Aggregate Gradings," is to be used, the coarse aggregate may be separated into 2 sizes and stored separately, provided that the combined material shall conform to the grading requirements for the 25-mm x 4.75-mm primary aggregate nominal size.

90-3.03 FINE AGGREGATE GRADING

· Fine aggregate shall be graded within the following limits:

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

· In the above table, the symbol X is the gradation that the Contractor proposes to furnish for the specific sieve size as provided in Section 90-3.01, "General."

· In addition to the above required grading analysis, the distribution of the fine aggregate sizes shall be such that the difference between the total percentage passing the 1.18-mm sieve and the total percentage passing the 600-µm sieve shall be between 10 and 40, and the difference between the percentage passing the 600-µm and 300-µm sieves shall be between 10 and 40.

· Fine aggregate may be separated into 2 or more sizes and stored separately, provided that the combined material conforms to the grading requirements specified in this Section 90-3.03.

90-3.04 COMBINED AGGREGATE GRADINGS

· Combined aggregate grading limits shall be used only for the design of concrete mixes. Concrete mixes shall be designed so that aggregates are combined in proportions that shall produce a mixture within the grading limits for combined aggregates as specified herein. Within these limitations, the relative proportions shall be as ordered by the Engineer, except as otherwise provided in Section 90-1.01, "Description."

· The combined aggregate grading used in portland cement concrete pavement shall be the 37.5-mm, maximum grading.

· The combined aggregate grading used in concrete for structures and other concrete items, except when specified otherwise in these specifications or the special provisions, shall be either the 37.5-mm, maximum grading, or the 25-mm, maximum grading, at the option of the Contractor.

Grading Limits of Combined Aggregates

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

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

90-4 ADMIXTURES

90-4.01 GENERAL

· Admixtures used in portland cement concrete shall conform to and be used in conformance with the provisions in this Section 90-4 and the special provisions. Admixtures shall be used when specified or ordered by the Engineer and may be used at the Contractor's option as provided herein.

· Chemical admixtures and air-entraining admixtures containing chlorides as Cl in excess of one percent by mass of admixture, as determined by California Test 415, shall not be used in prestressed or reinforced concrete.

· Calcium chloride shall not be used in concrete containing steel reinforcement or other embedded metals.

· Mineral admixture used in concrete for exposed surfaces of like elements of a structure shall be from the same source and of the same percentage.

· Admixtures shall be uniform in properties throughout their use in the work. Should it be found that an admixture as furnished is not uniform in properties, its use shall be discontinued.

· If more than one admixture is used, the admixtures shall be compatible with each other so that the desirable effects of all admixtures used will be realized.

90-4.02 MATERIALS

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

90-4.03 ADMIXTURE APPROVAL

· No admixture brand shall be used in the work unless it is on the Department's current list of approved brands for the type of admixture involved.

· Admixture brands will be considered for addition to the approved list if the manufacturer of the admixture submits to the Transportation Laboratory a sample of the admixture accompanied by certified test results demonstrating that the admixture complies with the requirements in the appropriate ASTM Designation and these specifications. The sample shall be sufficient to permit performance of all required tests. Approval of admixture brands will be dependent upon a determination as to compliance with the requirements, based on the certified test results submitted, together with tests the Department may elect to perform.

· When the Contractor proposes to use an admixture of a brand and type on the current list of approved admixture brands, the Contractor shall furnish a Certificate of Compliance from the manufacturer, as provided in Section 6-1.07, "Certificates of Compliance," certifying that the admixture furnished is the same as that previously approved. If a previously approved admixture is not accompanied by a Certificate of Compliance, the admixture shall not be used in the work until the Engineer has had sufficient time to make the appropriate tests and has approved the admixture for use. The Engineer may take samples for testing at any time, whether or not the admixture has been accompanied by a Certificate of Compliance.

· If a mineral admixture is delivered directly to the site of the work, the Certificate of Compliance shall be signed by the manufacturer or supplier of the mineral admixture. If the mineral admixture is used in ready-mix concrete or in precast concrete products purchased as such by the Contractor, the Certificate of Compliance shall be signed by the manufacturer of the concrete or product.

90-4.04 REQUIRED USE OF CHEMICAL ADMIXTURES AND CALCIUM CHLORIDE

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

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

90-4.05 OPTIONAL USE OF CHEMICAL ADMIXTURES

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

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

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

90-4.06 REQUIRED USE OF AIR-ENTRAINING ADMIXTURES

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

90-4.07 OPTIONAL USE OF AIR-ENTRAINING ADMIXTURES

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

90-4.08 REQUIRED USE OF MINERAL ADMIXTURES

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

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

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

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

    1. When the calcium oxide content of a mineral admixture is equal to or less than 2 percent by mass, the amount of mineral admixture shall not be less than 15 percent by mass of the total amount of cementitious material to be used in the mix;
    2. When the calcium oxide content of a mineral admixture is greater than 2 percent, the amount of mineral admixture shall not be less than 25 percent by mass of the total amount of cementitious material to be used in the mix;
    3. When a mineral admixture that conforms to the provisions for silica fume in Section 90-2.04, "Admixture Materials," is used, the amount of mineral admixture shall not be less than 10 percent by mass of the total amount of cementitious material to be used in the mix

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

90-4.09 BLANK

90-4.10 PROPORTIONING AND DISPENSING LIQUID ADMIXTURES

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

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

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

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

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

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

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

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

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

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

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

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

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

90-5 PROPORTIONING

90-5.01 STORAGE OF AGGREGATES

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

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

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

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

90-5.02 PROPORTIONING DEVICES

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

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

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

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

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

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

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

90-5.03 PROPORTIONING

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

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

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

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

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

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

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

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

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

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

90-5.03A Proportioning for Pavement

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

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

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

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

· The discharge gate on the cement and mineral admixture hoppers or the cement plus mineral admixture hopper shall be designed to permit regulating the flow of cement, mineral admixture, or cement plus mineral admixture into the aggregate as directed by the Engineer.

· When separate weigh boxes are used for each size of aggregate, the discharge gates shall permit regulating the flow of each size of aggregate as directed by the Engineer.

· Material discharged from the several bins shall be controlled by gates or by mechanical conveyors. The means of withdrawal from the several bins, and of discharge from the weigh box, shall be interlocked so that not more than one bin can discharge at a time, and so that the weigh box cannot be tripped until the required quantity from each of the several bins has been deposited therein. Should a separate weigh box be used for each size of aggregate, all may be operated and discharged simultaneously.

· When the discharge from the several bins is controlled by gates, each gate shall be actuated automatically so that the required mass is discharged into the weigh box, after which the gate shall automatically close and lock.

· The automatic weighing system shall be designed so that all proportions required may be set on the weighing controller at the same time.

90-6 MIXING AND TRANSPORTING

90-6.01 GENERAL

· Concrete shall be mixed in mechanically operated mixers, except that when permitted by the Engineer, batches not exceeding 0.25 m^3 may be mixed by hand methods in conformance with the provisions in Section 90-6.05, "Hand-Mixing."

· Equipment having components made of aluminum or magnesium alloys that would have contact with plastic concrete during mixing, transporting, or pumping of portland cement concrete shall not be used.

· Concrete shall be homogeneous and thoroughly mixed, and there shall be no lumps or evidence of undispersed cement, mineral admixture, or cement plus mineral admixture.

· Uniformity of concrete mixtures will be determined by differences in penetration as determined by California Test 533, or slump as determined by ASTM Designation: C 143, and by variations in the proportion of coarse aggregate as determined by California Test 529.

· When the mix design specifies a penetration value, the difference in penetration, determined by comparing penetration tests on 2 samples of mixed concrete from the same batch or truck mixer load, shall not exceed 10 mm. When the mix design specifies a slump value, the difference in slump, determined by comparing slump tests on 2 samples of mixed concrete from the same batch or truck mixer load, shall not exceed the values given in the table below. Variation in the proportion of coarse aggregate will be determined by comparing the results of tests of 2 samples of mixed concrete from the same batch or truck mixer load and the difference between the 2 results shall not exceed 100 kg per cubic meter of concrete.

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

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

90-6.02 MACHINE MIXING

· Concrete mixers may be of the revolving drum or the revolving blade type, and the mixing drum or blades shall be operated uniformly at the mixing speed recommended by the manufacturer. Mixers and agitators that have an accumulation of hard concrete or mortar shall not be used.

· The temperature of mixed concrete, immediately before placing, shall be not less than 10°C or more than 32°C. Aggregates and water shall be heated or cooled as necessary to produce concrete within these temperature limits. Neither aggregates nor mixing water shall be heated to exceed 65°C. If ice is used to cool the concrete, discharge of the mixer will not be permitted until all ice is melted.

· The batch shall be so charged into the mixer that some water will enter in advance of cementitious materials and aggregates. All water shall be in the drum by the end of the first one - fourth of the specified mixing time.

· Cementitious materials shall be batched and charged into the mixer by means that will not result either in loss of cementitious materials due to the effect of wind, in accumulation of cementitious materials on surfaces of conveyors or hoppers, or in other conditions that reduce or vary the required quantity of cementitious material in the concrete mixture.

· Paving and stationary mixers shall be operated with an automatic timing device. The timing device and discharge mechanism shall be interlocked so that during normal operation no part of the batch will be discharged until the specified mixing time has elapsed.

· The total elapsed time between the intermingling of damp aggregates and all cementitious materials and the start of mixing shall not exceed 30 minutes.

· The size of batch shall not exceed the manufacturer's guaranteed capacity.

· When producing concrete for pavement or base, suitable batch counters shall be installed and maintained in good operating condition at jobsite batching plants and stationary mixers. The batch counters shall indicate the exact number of batches proportioned and mixed.

· Concrete shall be mixed and delivered to the jobsite by means of one of the following combinations of operations:

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

· Agitators may be truck mixers operating at agitating speed or truck agitators. Each mixer and agitator shall have attached thereto in a prominent place a metal plate or plates on which is plainly marked the various uses for which the equipment is designed, the manufacturer's guaranteed capacity of the drum or container in terms of the volume of mixed concrete and the speed of rotation of the mixing drum or blades.

· Truck mixers shall be equipped with electrically or mechanically actuated revolution counters by which the number of revolutions of the drum or blades may readily be verified.

· When shrink-mixed concrete is furnished, concrete that has been partially mixed at a central plant shall be transferred to a truck mixer and all requirements for transit-mixed concrete shall apply. No credit in the number of revolutions at mixing speed shall be allowed for partial mixing in a central plant.

90-6.03 TRANSPORTING MIXED CONCRETE

· Mixed concrete may be transported to the delivery point in truck agitators or truck mixers operating at the speed designated by the manufacturer of the equipment as agitating speed, or in non-agitating hauling equipment, provided the consistency and workability of the mixed concrete upon discharge at the delivery point is suitable for adequate placement and consolidation in place, and provided the mixed concrete after hauling to the delivery point conforms to the provisions in Section 90-6.01, "General."

· Truck agitators shall be loaded not to exceed the manufacturer's guaranteed capacity and shall maintain the mixed concrete in a thoroughly mixed and uniform mass during hauling.

· Bodies of non-agitating hauling equipment shall be constructed so that leakage of the concrete mix, or any part thereof, will not occur at any time.

· Concrete hauled in open-top vehicles shall be protected during hauling against rain or against exposure to the sun for more than 20 minutes when the ambient temperature exceeds 24°C.

· No additional mixing water shall be incorporated into the concrete during hauling or after arrival at the delivery point, unless authorized by the Engineer. If the Engineer authorizes additional water to be incorporated into the concrete, the drum shall be revolved not less than 30 revolutions at mixing speed after the water is added and before discharge is commenced.

· The rate of discharge of mixed concrete from truck mixer-agitators shall be controlled by the speed of rotation of the drum in the discharge direction with the discharge gate fully open.

· When a truck mixer or agitator is used for transporting concrete to the delivery point, discharge shall be completed within 1.5 hours or before 250 revolutions of the drum or blades, whichever occurs first, after the introduction of the cement to the aggregates. Under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 30°C or above, the time allowed may be less than 1.5 hours.

· When non-agitating hauling equipment is used for transporting concrete to the delivery point, discharge shall be completed within one hour after the addition of the cement to the aggregates. Under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 30°C or above, the time between the introduction of cement to the aggregates and discharge shall not exceed 45 minutes.

· Each load of concrete delivered at the jobsite shall be accompanied by a weighmaster certificate showing the mix identification number, non-repeating load number, date and time at which the materials were batched, the total amount of water added to the load, and for transit-mixed concrete, the reading of the revolution counter at the time the truck mixer is charged with cement. This weighmaster certificate shall also show the actual scale masses (kilograms) for the ingredients batched. Theoretical or target batch masses shall not be used as a substitute for actual scale masses.

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

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

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

90-6.04 TIME OR AMOUNT OF MIXING

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

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

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

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

90-6.05 HAND-MIXING

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

90-6.06 AMOUNT OF WATER AND PENETRATION

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

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

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

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

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

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

90-7 CURING CONCRETE

90-7.01 METHODS OF CURING

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

90-7.01A Water Method

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

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

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

90-7.01B Curing Compound Method

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

· Curing compounds to be used shall be as follows:

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

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

· The loss of water for each type of curing compound, when tested in conformance with the requirements in California Test 534, shall not be more than 0.15-kg/m^2 in 24 hours or more than 0.45-kg/m^2 in 72 hours.

· The curing compound to be used will be specified elsewhere in these specifications or in the special provisions.

· When the use of curing compound is required or permitted elsewhere in these specifications or in the special provisions and no specific kind is specified, any of the curing compounds listed above may be used.

· Curing compound shall be applied at a nominal rate of 3.7 m^2/L, unless otherwise specified.

· At any point, the application rate shall be within ±1.2 m^2/L of the nominal rate specified, and the average application rate shall be within ±0.5 m^2/L of the nominal rate specified when tested in conformance with the requirements in California Test 535. Runs, sags, thin areas, skips, or holidays in the applied curing compound shall be evidence that the application is not satisfactory.

· Curing compounds shall be applied using power operated spray equipment. The power operated spraying equipment shall be equipped with an operational pressure gage and a means of controlling the pressure. Hand spraying of small and irregular areas that are not reasonably accessible to mechanical spraying equipment, in the opinion of the Engineer, may be permitted.

· The curing compound shall be applied to the concrete following the surface finishing operation, immediately before the moisture sheen disappears from the surface, but before any drying shrinkage or craze cracks begin to appear. In the event of any drying or cracking of the surface, application of water with an atomizing nozzle as specified in Section 90-7.01A, "Water Method," shall be started immediately and shall be continued until application of the compound is resumed or started; however, the compound shall not be applied over any resulting freestanding water. Should the film of compound be damaged from any cause before the expiration of 7 days after the concrete is placed in the case of structures and 72 hours in the case of pavement, the damaged portion shall be repaired immediately with additional compound.

· At the time of use, compounds containing pigments shall be in a thoroughly mixed condition with the pigment uniformly dispersed throughout the vehicle. A paddle shall be used to loosen all settled pigment from the bottom of the container, and a power driven agitator shall be used to disperse the pigment uniformly throughout the vehicle.

· Agitation shall not introduce air or other foreign substance into the curing compound.

· The manufacturer shall include in the curing compound the necessary additives for control of sagging, pigment settling, leveling, de-emulsification, or other requisite qualities of a satisfactory working material. Pigmented curing compounds shall be manufactured so that the pigment does not settle badly, does not cake or thicken in the container, and does not become granular or curdled. Settlement of pigment shall be a thoroughly wetted, soft, mushy mass permitting the complete and easy vertical penetration of a paddle. Settled pigment shall be easily redispersed, with minimum resistance to the sideways manual motion of the paddle across the bottom of the container, to form a smooth uniform product of the proper consistency.

· Curing compounds shall remain sprayable at temperatures above 4°C and shall not be diluted or altered after manufacture.

· The curing compound shall be packaged in clean 210-L barrels or round 19-L containers or shall be supplied from a suitable storage tank located at the jobsite. The containers shall comply with "Title 49, Code of Federal Regulations, Hazardous Materials Regulations." The 210-L barrels shall have removable lids and airtight fasteners. The 19-L containers shall be round and have standard full open head and bail. Lids with bungholes shall not be permitted. On-site storage tanks shall be kept clean and free of contaminants. Each tank shall have a permanent system designed to completely redisperse settled material without introducing air or other foreign substances.

· Steel containers and lids shall be lined with a coating that will prevent destructive action by the compound or chemical agents in the air space above the compound. The coating shall not come off the container or lid as skins. Containers shall be filled in a manner that will prevent skinning. Plastic containers shall not react with the compound.

· Each container shall be labeled with the manufacturer's name, kind of curing compound, batch number, volume, date of manufacture, and volatile organic compound (VOC) content. The label shall also warn that the curing compound containing pigment shall be well stirred before use. Precautions concerning the handling and the application of curing compound shall be shown on the label of the curing compound containers in conformance with the Construction Safety Orders and General Industry Safety Orders of the State of California.

· Containers of curing compound shall be labeled to indicate that the contents fully comply with the rules and regulations concerning air pollution control in the State of California.

· When the curing compound is shipped in tanks or tank trucks, a shipping invoice shall accompany each load. The invoice shall contain the same information as that required herein for container labels.

· Curing compound will be sampled by the Engineer at the source of supply or at the jobsite or at both locations.

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

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

90-7.01C Waterproof Membrane Method

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

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

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

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

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

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

90-7.01D Forms-In-Place Method

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

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

90-7.02 CURING PAVEMENT

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

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

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

90-7.03 CURING STRUCTURES

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

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

· The top surface of highway bridge decks shall be cured by both the curing compound method and the water method. The curing compound shall be curing compound (1). The curing compound shall be applied progressively during the deck finishing operations immediately after finishing operations are completed on each individual portion of the deck. The water cure shall be applied not later than 4 hours after completion of deck finishing or, for portions of the decks on which finishing is completed after normal working hours, the water cure shall be applied not later than the following morning.

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

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

90-7.04 CURING PRECAST CONCRETE MEMBERS

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

A. After placement of the concrete, members shall be held for a minimum 4-hour presteaming period. If the ambient air temperature is below 10°C, steam shall be applied during the presteaming period to hold the air surrounding the member at a temperature between 10°C and 32°C.

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

90-7.05 CURING PRECAST PRESTRESSED CONCRETE PILES

· Newly placed concrete for precast prestressed concrete piles shall be cured in conformance with the provisions in Section 90-7.04, "Curing Precast Concrete Members," except that piles with a class designation ending in C (corrosion resistant) shall be cured as follows:

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

90-7.06 CURING SLOPE PROTECTION

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

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

90-7.07 CURING MISCELLANEOUS CONCRETE WORK

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

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

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

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

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

90-8 PROTECTING CONCRETE

90-8.01 GENERAL

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

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

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

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

90-8.02 PROTECTING CONCRETE STRUCTURES

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

90-8.03 PROTECTING CONCRETE PAVEMENT

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

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

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

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

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

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

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

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

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

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

90-9 COMPRESSIVE STRENGTH

90-9.01 GENERAL

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

· The compressive strength of concrete will be determined from test cylinders that have been fabricated from concrete sampled in conformance with the requirements of ASTM Designation: C 172. Test cylinders will be molded and initially

field cured in conformance with California Test 540. Test cylinders will be cured and tested after receipt at the testing laboratory in conformance with the requirements of ASTM Designation: C 39. A strength test shall consist of the average strength of 2 cylinders fabricated from material taken from a single load of concrete, except that, if any cylinder should show evidence of improper sampling, molding, or testing, that cylinder shall be discarded and the strength test shall consist of the strength of the remaining cylinder.

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

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

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

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

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

· When concrete is specified by compressive strength, prequalification of materials, mix proportions, mixing equipment, and procedures proposed for use will be required prior to placement of the concrete. Prequalification shall be accomplished by the submission of acceptable certified test data or trial batch reports by the Contractor. Prequalification data shall be based on the use of materials, mix proportions, mixing equipment, procedures, and size of batch proposed for use in the work.

· Certified test data, in order to be acceptable, shall indicate that not less than 90 percent of at least 20 consecutive tests exceed the specified strength at the maximum number of cure days specified or allowed, and none of those tests are less than 95 percent of specified strength. Strength tests included in the data shall be the most recent tests made on concrete of the proposed mix design and all shall have been made within one year of the proposed use of the concrete.

· Trial batch test reports, in order to be acceptable, shall indicate that the average compressive strength of 5 consecutive concrete cylinders, taken from a single batch, at not more than 28 days (or the maximum age allowed) after molding shall be at least 4 MPa greater than the specified 28-day compressive strength, and no individual cylinder shall have a strength less than the specified strength at the maximum age specified or allowed. Data contained in the report shall be from trial batches that were produced within one year of the proposed use of specified strength concrete in the project. Whenever air-entrainment is required, the air content of trial batches shall be equal to or greater than the air content specified for the concrete without reduction due to tolerances.

· Tests shall be performed in conformance with either the appropriate California Test methods or the comparable ASTM test methods. Equipment employed in testing shall be in good condition and shall be properly calibrated. If the tests

are performed during the life of the contract, the Engineer shall be notified sufficiently in advance of performing the tests in order to witness the test procedures.

· The certified test data and trial batch test reports shall include the following information:

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

· Certified test data and trial batch test reports shall be signed by an official of the firm that performed the tests.

· When approved by the Engineer, concrete from trial batches may be used in the work at locations where concrete of a lower quality is required and the concrete will be paid for as the type or class of concrete required at that location.

· After materials, mix proportions, mixing equipment, and procedures for concrete have been prequalified for use, additional prequalification by testing of trial batches will be required prior to making changes that, in the judgment of the Engineer, could result in a strength of concrete below that specified.

· The Contractor’s attention is directed to the time required to test trial batches and the Contractor shall be responsible for production of trial batches at a sufficiently early date so that the progress of the work is not delayed.

· When precast concrete members are manufactured at the plant of an established manufacturer of precast concrete members, the mix proportions of the concrete shall be determined by the Contractor, and a trial batch and prequalification of the materials, mix proportions, mixing equipment, and procedures will not be required.

90-10 MINOR CONCRETE

90-10.01 GENERAL

· Concrete for minor structures, slope paving, curbs, sidewalks and other concrete work, when designated as minor concrete on the plans, in the specifications, or in the contract item, shall conform to the provisions specified herein.

· The Engineer, at the Engineer's discretion, will inspect and test the facilities, materials and methods for producing the concrete to ensure that minor concrete of the quality suitable for use in the work is obtained.

90-10.02 MATERIALS

· Minor concrete shall conform to the following requirements:

90-10.02A Cementitious Material

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

90-10.02B Aggregate

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

· The Contractor shall submit to the Engineer for approval, a grading of the combined aggregate proposed for use in the minor concrete. After acceptance of the grading, aggregate furnished for minor concrete shall conform to that grading, unless a change is authorized in writing by the Engineer.

· The Engineer may require the Contractor to furnish periodic test reports of the aggregate grading furnished. The maximum size of aggregate used shall be at the option of the Contractor, but in no case shall the maximum size be larger than 37.5 mm or smaller than 19 mm.

· The Engineer may waive, in writing, the gradation requirements in this Section 90-10.02B, if, in the Engineer's opinion, the furnishing of the gradation is not necessary for the type or amount of concrete work to be constructed.

90-10.02C Water

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

90-10.02D Admixtures

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

90-10.03 PRODUCTION

· Cementitious material, water, aggregate, and admixtures shall be stored, proportioned, mixed, transported, and discharged in conformance with recognized standards of good practice that will result in concrete that is thoroughly and uniformly mixed, that is suitable for the use intended, and that conforms to requirements specified herein. Recognized standards of good practice are outlined in various industry publications such as are issued by American Concrete Institute, AASHTO, or the Department.

· The cementitious material content of minor concrete shall conform to the provisions in Section 90-1.01, "Description."

· The amount of water used shall result in a consistency of concrete conforming to the provisions in Section 90-6.06, "Amount of Water and Penetration." Additional mixing water shall not be incorporated into the concrete during hauling or after arrival at the delivery point, unless authorized by the Engineer.

· Discharge of ready-mixed concrete from the transporting vehicle shall be made while the concrete is still plastic and before stiffening occurs. An elapsed time of 1.5 hours (one hour in non-agitating hauling equipment), or more than 250 revolutions of the drum or blades, after the introduction of the cementitious material to the aggregates, or a temperature of concrete of more than 32°C will be considered conditions contributing to the quick stiffening of concrete. The Contractor shall take whatever action is necessary to eliminate quick stiffening, except that the addition of water will not be permitted.

· The required mixing time in stationary mixers shall be not less than 50 seconds or more than 5 minutes.

· The minimum required revolutions at mixing speed for transit-mixed concrete shall be not less than that recommended by the mixer manufacturer, and shall be increased, if necessary, to produce thoroughly and uniformly mixed concrete.

· Each load of ready-mixed concrete shall be accompanied by a weighmaster certificate that shall be delivered to the Engineer at the discharge location of the concrete, unless otherwise directed by the Engineer. The weighmaster certificate shall be clearly marked with the date and time of day when the load left the batching plant and, if hauled in truck mixers or agitators, the time the mixing cycle started.

· A Certificate of Compliance conforming to the provisions in Section 6–1.07, "Certificates of Compliance," shall be furnished to the Engineer, prior to placing minor concrete from a source not previously used on the contract, stating that minor concrete to be furnished meets contract requirements, including minimum cementitious material content specified.

90-10.04 CURING MINOR CONCRETE

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

90-10.05 PROTECTING MINOR CONCRETE

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

90-10.06 MEASUREMENT AND PAYMENT

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

90-11 MEASUREMENT AND PAYMENT

90-11.01 MEASUREMENT

· Portland cement concrete will be measured in conformance with the provisions specified in the various sections of these specifications covering construction requiring concrete.

· When it is provided that concrete will be measured at the mixer, the volume in cubic meters shall be computed as the total mass of the batch in kilograms divided by the density of the concrete in kilograms per cubic meter. The total mass of the batch shall be calculated as the sum of all materials, including water, entering the batch. The density of the concrete will be determined in conformance with the requirements in California Test 518.

90-11.02 PAYMENT

· Portland cement concrete will be paid for in conformance with the provisions specified in the various sections of these specifications covering construction requiring concrete.

· Full compensation for furnishing and incorporating admixtures required by these specifications or the special provisions will be considered as included in the contract prices paid for the concrete involved and no additional compensation will be allowed therefor.

· Should the Engineer order the Contractor to incorporate any admixtures in the concrete when their use is not required by these specifications or the special provisions, furnishing the admixtures and adding them to the concrete will be paid for as extra work as provided in Section 4-1.03D, "Extra Work."

· Should the Contractor use admixtures in conformance with the provisions in Section 90-4.05, "Optional Use of Chemical Admixtures," or Section 90-4.07, "Optional Use of Air-entraining Admixtures," or should the Contractor request and obtain permission to use other admixtures for the Contractor's benefit, the Contractor shall furnish those admixtures and incorporate them into the concrete at the Contractor's expense and no additional compensation will be allowed therefor.

END OF AMENDMENTS

SECTION 2. PROPOSAL REQUIREMENTS AND CONDITIONS

2-1.01 GENERAL

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

In addition to the subcontractors required to be listed in conformance with Section 2-1.054, "Required Listing of Proposed Subcontractors," of the Standard Specifications, each proposal shall have listed therein the portion of work that will be performed by each subcontractor listed.

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

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

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

The contractor, sub recipient or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR part 26 in the award and administration of DOT-assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the recipient deems appropriate. Each subcontract signed by the bidder must include this assurance.

2-1.015 FEDERAL LOBBYING RESTRICTIONS

Section 1352, Title 31, United States Code prohibits Federal funds from being expended by the recipient or any lower tier subrecipient of a Federal-aid contract to pay for any person for influencing or attempting to influence a Federal agency or Congress in connection with the awarding of any Federal-aid contract, the making of any Federal grant or loan, or the entering into of any cooperative agreement.

If any funds other than Federal funds have been paid for the same purposes in connection with this Federal-aid contract, the recipient shall submit an executed certification and, if required, submit a completed disclosure form as part of the bid documents.

A certification for Federal-aid contracts regarding payment of funds to lobby Congress or a Federal agency is included in the Proposal. Standard Form - LLL, "Disclosure of Lobbying Activities," with instructions for completion of the Standard Form is also included in the Proposal. Signing the Proposal shall constitute signature of the Certification.

The above-referenced certification and disclosure of lobbying activities shall be included in each subcontract and any lower-tier contracts exceeding $100,000. All disclosure forms, but not certifications, shall be forwarded from tier to tier until received by the Engineer.

The Contractor, subcontractors and any lower-tier contractors shall file a disclosure form at the end of each calendar quarter in which there occurs any event that requires disclosure or that materially affects the accuracy of the information contained in any disclosure form previously filed by the Contractor, subcontractors and any lower-tier contractors. An event that materially affects the accuracy of the information reported includes:

A. A cumulative increase of $25,000 or more in the amount paid or expected to be paid for influencing or attempting to influence a covered Federal action; or
B. A change in the person(s) or individual(s) influencing or attempting to influence a covered Federal action; or,
C. A change in the officer(s), employee(s), or Member(s) contacted to influence or attempt to influence a covered Federal action.

2-1.02 DISADVANTAGED BUSINESS ENTERPRISE (DBE)

This project is subject to Part 26, Title 49, Code of Federal Regulations entitled "Participation by Disadvantaged Business Enterprises in Department of Transportation Financial Assistance Programs." The Regulations in their entirety are incorporated herein by this reference.

Bidders shall be fully informed respecting the requirements of the Regulations and the Department's Disadvantaged Business Enterprise (DBE) program developed pursuant to the Regulations; particular attention is directed to the following matters:

A. A DBE must be a small business concern as defined pursuant to Section 3 of U.S. Small Business Act and relevant regulations promulgated pursuant thereto.
B. A DBE may participate as a prime contractor, subcontractor, joint venture partner with a prime or subcontractor, vendor of material or supplies, or as a trucking company.
C. A DBE bidder, not bidding as a joint venture with a non-DBE, will be required to document one or a combination of the following:

    1. The bidder will meet the goal by performing work with its own forces.
    2. The bidder will meet the goal through work performed by DBE subcontractors, suppliers or trucking companies.
    3. The bidder, prior to bidding, made adequate good faith efforts to meet the goal.

D. A DBE 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 DBE joint venture partner must share in the capital contribution, control, management, risks and profits of the joint venture. The DBE joint venturer must submit the joint venture agreement with the proposal or the DBE Information form required in the Section entitled "Submission of DBE Information" of these special provisions.
E. A DBE 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. DBEs must be certified by either the California Department of Transportation, or by a participating State of California or local agency which certifies in conformance with Title 49, Code of Federal Regulations, Part 26, as of the date of bid opening. It is the Contractor's responsibility to verify that DBEs are certified. Listings of DBEs certified by the Department are available from the following sources:

    1. The Department's DBE Directory, which is published quarterly. This Directory may be obtained from the Department of Transportation, Materiel Operations Branch, Publication Distribution Unit, 1900 Royal Oaks Drive, Sacramento, California 95815, Telephone: (916) 445-3520.
    2. The Department's Electronic Information Bulletin Board Service, which is accessible by modem and is updated weekly. The Bulletin Board may be accessed by first contacting the Department's Business Enterprise Program at Telephone: (916) 227-8937 and obtaining a user identification and password.
    3. The Department's web site at http://www.dot.ca.gov/hq/bep/index.htm.
    4. The organizations listed in the Section entitled "DBE Goal for this Project" of these special provisions.

G. Credit for materials or supplies purchased from DBEs will be as follows:

    1. If the materials or supplies are obtained from a DBE manufacturer, 100 percent of the cost of the materials or supplies will count toward the DBE goal. A DBE manufacturer is a firm that operates or maintains a factory or establishment that produces, on the premises, the materials, supplies, articles, or equipment required under the contract and of the general character described by the specifications.
    2. If the materials or supplies are purchased from a DBE regular dealer, 60 percent of the cost of the materials or supplies will count toward the DBE goal. A DBE regular dealer is a firm that owns, operates, or maintains a store, warehouse, or other establishment in which the materials, supplies, articles or equipment of the general character described by the specifications and required under the contract are bought, kept in stock, and regularly sold or leased to the public in the usual course of business. To be a DBE regular dealer, the firm must be an established, regular business that engages, as its principal business and under its own name, in the purchase and sale or lease of the products in question. A person may be a DBE regular dealer in such bulk items as petroleum products, steel, cement, gravel, stone, or asphalt without owning, operating, or maintaining a place of business as provided in this paragraph G.2. if the person both owns and operates distribution equipment for the products. Any supplementing of regular dealers' own distribution equipment shall be by a long-term lease

agreement and not on an ad hoc or contract-by-contract basis. Packagers, brokers, manufacturers' representatives, or other persons who arrange or expedite transactions are not DBE regular dealers within the meaning of this paragraph G.2.

3. Credit for materials or supplies purchased from a DBE which is neither a manufacturer nor a regular dealer will be limited to the entire amount of fees or commissions charged for assistance in the procurement of the materials and supplies, or fees or transportation charges for the delivery of materials or supplies required on a job site, provided the fees are reasonable and not excessive as compared with fees charged for similar services.

H. Credit for DBE trucking companies will be as follows:

1. The DBE must be responsible for the management and supervision of the entire trucking operation for which it is responsible on a particular contract, and there cannot be a contrived arrangement for the purpose of meeting the DBE goal.
2. The DBE must itself own and operate at least one fully licensed, insured, and operational truck used on the contract.
3. The DBE receives credit for the total value of the transportation services it provides on the contract using trucks its owns, insures, and operates using drivers it employs.
4. The DBE may lease trucks from another DBE firm, including an owner-operator who is certified as a DBE. The DBE who leases trucks from another DBE receives credit for the total value of the transportation services the lessee DBE provides on the contract.
5. The DBE may also lease trucks from a non-DBE firm, including an owner-operator. The DBE who leases trucks from a non-DBE is entitled to credit only for the fee or commission it receives as a result of the lease arrangement. The DBE does not receive credit for the total value of the transportation services provided by the lessee, since these services are not provided by a DBE.
6. For the purposes of this paragraph H, a lease must indicate that the DBE has exclusive use of and control over the truck. This does not preclude the leased truck from working for others during the term of the lease with the consent of the DBE, so long as the lease gives the DBE absolute priority for use of the leased truck. Leased trucks must display the name and identification number of the DBE.

I. Noncompliance by the Contractor with the requirements of the regulations constitutes a breach of this contract and may result in termination of the contract or other appropriate remedy for a breach of this contract.

J. Bidders are encouraged to use services offered by financial institutions owned and controlled by DBEs.

2-1.02A DBE GOAL FOR THIS PROJECT

The Department has established the following goal for Disadvantaged Business Enterprise (DBE) participation for this project:

Disadvantaged Business Enterprise (DBE): 11 percent

Bidders may use the services of the following firms to contact interested DBEs. These firms are available to assist DBEs in preparing bids for subcontracting or supplying materials.

The following firms may be contacted for projects in the following locations:

Districts 04, 05 (except San Luis Obispo and Santa Barbara Counties), 06 (except Kern County) and 10:	Districts 08, 11 and 12:
Triaxial Management Services, Inc. - Oakland 1545 Willow Street, 1st Floor Oakland, CA 94607 Telephone - (510) 286-1313 FAX No. - (510) 286-6792	Triaxial Management Services, Inc. - San Diego 2725 Congress Street, Suite 1-D San Diego, CA 92110 Telephone - (619) 543-5109 FAX No. - (619) 543-5108

Districts 07 and 08; in San Luis Obispo and Santa Barbara Counties in District 05; and in Kern County in District 06:	Districts 01, 02, 03 and 09:
Triaxial Management Services, Inc. - Los Angeles 2594 Industry Way, Suite 101 Lynwood, CA 90262 Telephone - (310) 537-6677 FAX No. - (310) 637-0128	Triaxial Management Services, Inc. - Sacramento 930 Alhambra Blvd., #205 Sacramento, CA 95816 Telephone - (916) 553-4172 FAX No. - (916) 553-4173

2-1.02B SUBMISSION OF DBE INFORMATION

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

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

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

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

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

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

The information necessary to establish the bidder's adequate good faith efforts to meet the DBE goal should include:

A. The names and dates of each publication in which a request for DBE participation for this project was placed by the bidder.

B. The names and dates of written notices sent to certified DBEs soliciting bids for this project and the dates and methods used for following up initial solicitations to determine with certainty whether the DBEs were interested.
C. The items of work which the bidder made available to DBE firms, including, where appropriate, any breaking down of the contract work items (including those items normally performed by the bidder with its own forces) into economically feasible units to facilitate DBE participation. It is the bidder's responsibility to demonstrate that sufficient work to meet the DBE goal was made available to DBE firms.
D. The names, addresses and phone numbers of rejected DBE firms, the firms selected for that work, and the reasons for the bidder's choice.
E. Efforts made to assist interested DBEs in obtaining bonding, lines of credit or insurance, and any technical assistance or information related to the plans, specifications and requirements for the work which was provided to DBEs.
F. Efforts made to assist interested DBEs in obtaining necessary equipment, supplies, materials, or related assistance or services, excluding supplies and equipment the DBE subcontractor purchases or leases from the prime contractor or its affiliate.
G. The names of agencies contacted to provide assistance in contacting, recruiting and using DBE firms.
H. Any additional data to support a demonstration of good faith efforts.

2-1.03 ESCROW OF BID DOCUMENTATION

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

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

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

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

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

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

The bid documentation shall include, but not be limited to: quantity takeoffs; rate schedules for the direct costs and the time- and nontime-related indirect costs for labor (by craft), plant and equipment ownership and operation, permanent and expendable materials, insurance and subcontracted work; estimated construction schedules, including sequence and duration and development of production rates; quotations from subcontractors and suppliers; estimates of field and home office overhead; contingency and margin for each contract item of work; and other reports, calculations and information used by the bidder to arrive at the estimate submitted with the proposal.

The Contractor shall also submit bid documentation for each subcontractor whose total subcontract exceeds $250,000. Subcontractor bid documentation shall be enclosed with the Contractor's submittal. The examination of subcontractors' bid documentation will be accomplished in the same manner as for the Contractor's bid documentation. If a subcontractor is replaced, bid documentation for the new subcontractor shall be submitted for review and escrow before authorization for the substitution will be granted. Upon request of a subcontractor, the bid documentation from that subcontractor shall be reviewed only by the subcontractor and the Department.

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

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

The first, second, and third apparent low bidders shall present the bid documentation for escrow at the District 04 Office, 111 Grand Avenue, Room 12-816, Oakland, CA 94612, on the first Monday, at 1:00 p.m., following the time indicated in the "Notice to Contractors" for the opening of bids. Other bidders need not present the bid documentation for escrow unless requested to do so by the Department.

Bid documentation shall be submitted in a sealed container, clearly marked with the bidder's name, date of submittal, project contract number and the words, "Bid Documentation for Escrow."

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

Upon submittal, the bid documentation of the apparent low bidder will be examined and inventoried by the duly designated representatives of the Contractor and the Department to ensure that the bid documentation is authentic, legible, and in accordance with the terms of this section "Escrow of Bid Documentation." The examination will not include review of, nor will it constitute approval of, proposed construction methods, estimating assumptions or interpretation of the contract.

The examination will not alter any conditions or terms of the contract. The acceptance or rejection by the Department that the submitted bid documents are in compliance with this section "Escrow of Bid Documentation" shall be completed within 48 hours of the time the bid documentation is submitted by the Contractor.

At the completion of the examination, the bid documents will be sealed and jointly deposited at an agreed commercial bank.

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

The escrowed bid documentation may be examined by the designated representatives of both the Department and the Contractor, at any time deemed necessary by either the Department or the Contractor to assist in the negotiation of price adjustments and change orders, or in the settlement of claims or disputes.

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

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

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

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

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

SECTION 3. AWARD AND EXECUTION OF CONTRACT

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

The award of the 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 DBE participation or has demonstrated, to the satisfaction of the Department, adequate good faith efforts to do so. Meeting the goal for DBE participation or demonstrating, to the satisfaction of the Department, adequate good faith efforts to do so is a condition for being eligible for award of contract.

A "Payee Data Record" form will be included in the contract documents to be executed by the successful bidder. The purpose of the form is to facilitate the collection of taxpayer identification data. The form shall be completed and returned to the Department by the successful bidder with the executed contract and contract bonds. For the purposes of the form, payee shall be deemed to mean the successful bidder. The form is not to be completed for subcontractors or suppliers. Failure to complete and return the "Payee Data Record" form to the Department as provided herein will result in the retention of 31 percent of payments due the contractor and penalties of up to $20,000. This retention of payments for failure to complete the "Payee Data Record" form is in addition to any other retention of payments due the Contractor.

Each of the two bonds specified in Section 3-1.02, "Contract Bonds," of the Standard Specifications shall be equal to 100 percent of the "Total Bid" set forth on the proposal form.

The contract shall be signed by the successful bidder and shall be received with the contract bonds by the Division of Office Engineer within 4 days, not 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, Engineering Service Center, P.O. Box 168041, Sacramento, CA 95816-8041, Attn.: Office Engineer (MS43)-Contracts.

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

Attention is directed to the provisions in Sections 8-1.03, "Beginning of Work," 8-1.06, "Time of Completion," 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.

The work (except plant establishment work) shall be diligently prosecuted to completion before the expiration of **510 WORKING DAYS** beginning on the fifth calendar day after approval of the contract.

The Contractor shall pay to the State of California the sum of $11,000 per day, for each and every calendar day's delay in finishing the work (except plant establishment 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 760 **WORKING DAYS** beginning on the fifteenth calendar day after approval of the contract.

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 $ 11,000 per day be assessed.

SECTION 5. GENERAL

SECTION 5-1. MISCELLANEOUS

5-1.01 PLANS AND WORKING DRAWINGS

When the specifications require working drawings to be submitted to the Engineer, the drawings shall be submitted to: Office of Resident Engineer (Contract No. 04-006044), 757 Arnold Drive, Suite 200, Martinez, CA 94553-6526.

5-1.011 EXAMINATION OF PLANS, SPECIFICATIONS, CONTRACT, AND SITE OF WORK

Attention is directed to "Differing Site Conditions" of these special provisions regarding physical conditions at the site which may differ from those indicated in "Materials Information," log of test borings or other geotechnical information obtained by the Department's investigation of site conditions.

5-1.012 DIFFERING SITE CONDITIONS

Attention is directed to Section 5-1.116, "Differing Site Conditions," of the Standard Specifications.

During the progress of the work, if subsurface or latent conditions are encountered at the site differing materially from those indicated in the "Materials Information," log of test borings, other geotechnical data obtained by the Department's investigation of subsurface conditions, or an examination of the conditions above ground at the site, the party discovering those conditions shall promptly notify the other party in writing of the specific differing conditions before they are disturbed and before the affected work is performed.

The Contractor will be allowed 15 days from the notification of the Engineer's determination of whether or not an adjustment of the contract is warranted, in which to file a notice of potential claim in conformance with the provisions of Section 9-1.04, "Notice of Potential Claim," of the Standard Specifications and as specified herein; otherwise the decision of the Engineer shall be deemed to have been accepted by the Contractor as correct. The notice of potential claim shall set forth in what respects the Contractor's position differs from the Engineer's determination and provide any additional information obtained by the Contractor, including but not limited to additional geotechnical data. The notice of potential claim shall be accompanied by the Contractor's certification that the following were made in preparation of the bid: a review of the contract, a review of the "Materials Information," a review of the log of test borings and other records of geotechnical data to the extent they were made available to bidders prior to the opening of bids, and an examination of the conditions above ground at the site. Supplementary information, obtained by the Contractor subsequent to the filing of the notice of potential claim, shall be submitted to the Engineer in an expeditious manner.

5-1.015 LABORATORY

When a reference is made in the specifications to the "Laboratory," the reference shall mean the Division of Materials Engineering and Testing Services and the Division of Structural Foundations of the Department of Transportation, or established laboratories of the various Districts of the Department, or other laboratories authorized by the Department to test materials and work involved in the contract. When a reference is made in the specifications to the "Transportation Laboratory," the reference shall mean the Division of Materials Engineering and Testing Services and the Division of Structural Foundations, located at 5900 Folsom Boulevard, Sacramento, CA 95819, Telephone (916) 227-7000.

5-1.017 CONTRACT BONDS

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

The payment bond shall be in a sum not less than one hundred percent of the total amount payable by the terms of the contract.

5-1.019 COST REDUCTION INCENTIVE

Attention is directed to Section 5-1.14, "Cost Reduction Incentive," of the Standard Specifications.

Prior to preparing a cost reduction proposal, the Contractor shall request a meeting with the Engineer to discuss the proposal in concept and to determine the merit of the cost reduction proposal. Items of discussion will also include permit issues, impact on other projects, impact on the project schedule, peer reviews, and review times required by the Department and other agencies.

5-1.02 LABOR NONDISCRIMINATION

Attention is directed to the following Notice that is required by Chapter 5 of Division 4 of Title 2, California Code of Regulations.

NOTICE OF REQUIREMENT FOR NONDISCRIMINATION PROGRAM

(GOV. CODE, SECTION 12990)

Your attention is called to the "Nondiscrimination Clause", set forth in Section 7-1.01A(4), "Labor Nondiscrimination," of the Standard Specifications, which is applicable to all nonexempt State contracts and subcontracts, and to the "Standard California Nondiscrimination Construction Contract Specifications" set forth therein. The specifications are applicable to all nonexempt State construction contracts and subcontracts of $5000 or more.

5-1.03 INTEREST ON PAYMENTS

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

A. Unpaid progress payments, payment after acceptance, and final payments shall begin to accrue interest 30 days after the Engineer prepares the payment estimate.
B. Unpaid extra work bills shall begin to accrue interest 30 days after preparation of the first pay estimate following receipt of a properly submitted and undisputed extra work bill. To be properly submitted, the bill must be submitted within 7 days of the performance of the extra work and in conformance with the provisions in Section 9-1.03C, "Records," and Section 9-1.06, "Partial Payments," of the Standard Specifications. An undisputed extra work bill not submitted within 7 days of performance of the extra work will begin to accrue interest 30 days after the preparation of the second pay estimate following submittal of the bill.
C. The rate of interest payable for unpaid progress payments, payments after acceptance, final payments, and extra work payments shall be 10 percent per annum.
D. The rate of interest payable on a claim, protest or dispute ultimately allowed under this contract shall be 6 percent per annum. Interest shall begin to accrue 61 days after the Contractor submits to the Engineer information in sufficient detail to enable the Engineer to ascertain the basis and amount of said claim, protest or dispute.

The rate of interest payable on any award in arbitration shall be 6 percent per annum if allowed under the provisions of Civil Code Section 3289.

5-1.031 FINAL PAYMENT AND CLAIMS

Attention is directed to Section 9-1.07B, "Final Payment and Claims," of the Standard Specifications.

If the Contractor files a timely written statement of claims in response to the proposed final estimate, the District that administers the contract will submit a claim position letter to the Contractor by hand delivery or deposit in the U.S. mail within 135 days of acceptance of the contract. The claim position letter will delineate the District's position on the Contractor's claims. If the Contractor disagrees with the claim position letter, the Contractor shall submit a written notification of its disagreement to be received by the District not later than 15 days after the Contractor's receipt of the claim position letter. The written notification of disagreement shall set forth the basis for the Contractor's disagreement and be submitted to the office designated in the claim position letter. The Contractor's failure to provide a timely, written notification of disagreement shall constitute the Contractor's acceptance and agreement with the determinations provided in the claim position letter and with final payment pursuant to the claim position letter.

If the Contractor files a timely notification of disagreement with the District claim position letter, the board of review designated by the District Director to review claims that remain in dispute will meet with the Contractor within 45 days after receipt by the District of the notification of disagreement. Attendance by the Contractor at the board of review meeting shall be mandatory.

If the District fails to submit a claim position letter to the Contractor within 135 days after the acceptance of the contract and the Contractor has claims that remain in dispute, the Contractor may request a meeting with the board of review designated by the District Director to review claims that remain in dispute. The Contractor's request for a meeting shall identify the claims that remain in dispute. If the Contractor files a request for a meeting, the board of review will meet with the Contractor within 45 days after the District receives the request for the meeting. Attendance by the Contractor at the District Director's board of review meeting shall be mandatory.

Failure of the Contractor to file a timely written statement of claims in response to the proposed final estimate, or to file a timely notification of disagreement with the District claim position letter, or to attend the District Director's board of review meeting shall constitute a failure to pursue diligently and exhaust the administrative procedures in the contract and shall be a bar to arbitration in conformance with the requirements in Section 10240.2 of the California Public Contract Code.

5-1.04 PUBLIC SAFETY

The Contractor shall provide for the safety of traffic and the public in conformance with the provisions in Section 7-1.09, "Public Safety," of the Standard Specifications and these special provisions.

The Contractor shall install temporary railing (Type K) between a lane open to public traffic and an excavation, obstacle or storage area when the following conditions exist:

A. Excavations**.—**The near edge of the excavation is 3.6 m or less from the edge of the lane, except:

1. Excavations covered with sheet steel or concrete covers of adequate thickness to prevent accidental entry by traffic or the public.
2. Excavations less than 0.3-m deep.
3. Trenches less than 0.3-m wide for irrigation pipe or electrical conduit, or excavations less than 0.3-m in diameter.
4. Excavations parallel to the lane for the purpose of pavement widening or reconstruction.
5. Excavations in side slopes, where the slope is steeper than 1:4 (vertical:horizontal).
6. Excavations protected by existing barrier or railing.

B. Temporarily Unprotected Permanent Obstacles**.—**The work includes the installation of a fixed obstacle together with a protective system, such as a sign structure together with protective railing, and the Contractor elects to install the obstacle prior to installing the protective system; or the Contractor, for the Contractor's convenience and with permission of the Engineer, removes a portion of an existing protective railing at an obstacle and does not replace such railing complete in place during the same day.

C. Storage Areas.—Material or equipment is stored within 3.6 m of the lane and the storage is not otherwise prohibited by the provisions of the Standard Specifications and these special provisions.

The approach end of temporary railing (Type K), installed in conformance with the provisions in this section "Public Safety" and in Section 7-1.09, "Public Safety," of the Standard Specifications, shall be offset a minimum of 4.6 m from the edge of the traffic lane open to public traffic. The temporary railing shall be installed on a skew toward the edge of the traffic lane of not more than 0.3-m transversely to 3 m longitudinally with respect to the edge of the traffic lane. If the 4.6-m minimum offset cannot be achieved, the temporary railing shall be installed on the 10 to 1 skew to obtain the maximum available offset between the approach end of the railing and the edge of the traffic lane, and an array of temporary crash cushion modules shall be installed at the approach end of the temporary railing.

Temporary railing (Type K) shall conform to the provisions in Section 12-3.08, "Temporary Railing (Type K)," of the Standard Specifications. Temporary railing (Type K), conforming to the details shown on 1999 Standard Plan T3, may be used. Temporary railing (Type K) fabricated prior to January 1, 1993, and conforming to 1988 Standard Plan B11-30 may be used, provided the fabrication date is printed on the required Certificate of Compliance.

Temporary crash cushion modules shall conform to the provisions in "Temporary Crash Cushion Module" of these special provisions.

Except for installing, maintaining and removing traffic control devices, whenever work is performed or equipment is operated in the following work areas, the Contractor shall close the adjacent traffic lane unless otherwise provided in the Standard Specifications and these special provisions:

Approach Speed of Public Traffic (Posted Limit) (Kilometers Per Hour)	Work Areas
Over 72 (45 Miles Per Hour)	Within 1.8 m of a traffic lane but not on a traffic lane
56 to 72 (35 to 45 Miles Per Hour)	Within 0.9-m of a traffic lane but not on a traffic lane

The lane closure provisions of this section shall not apply if the work area is protected by permanent or temporary railing or barrier.

When traffic cones or delineators are used to delineate a temporary edge of a traffic lane, the line of cones or delineators shall be considered to be the edge of the traffic lane, however, the Contractor shall not reduce the width of an existing lane to less than 3 m without written approval from the Engineer.

When work is not in progress on a trench or other excavation that required closure of an adjacent lane, the traffic cones or portable delineators used for the lane closure shall be placed off of and adjacent to the edge of the traveled way. The spacing of the cones or delineators shall be not more than the spacing used for the lane closure.

Suspended loads or equipment shall not be moved nor positioned over public traffic or pedestrians.

Full compensation for conforming to the provisions in this section "Public Safety," including furnishing and installing temporary railing (Type K) and temporary crash cushion modules, shall be considered as included in the contract prices paid for the various items of work involved and no additional compensation will be allowed therefor.

5-1.05 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, and to California Public Contract Code Section 10295.5.

Material from mining operations furnished for this project shall only come from permitted sites in compliance with California Public Contract Code Section 10295.5.

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

5-1.06 REMOVAL OF ASBESTOS AND HAZARDOUS SUBSTANCES

When the presence of asbestos or hazardous substances are not shown on the plans or indicated in the specifications and the Contractor encounters materials which the Contractor reasonably believes to be asbestos or a hazardous substance as defined in Section 25914.1 of the Health and Safety Code, and the asbestos or hazardous substance has not been rendered harmless, the Contractor may continue work in unaffected areas reasonably believed to be safe. The Contractor shall immediately cease work in the affected area and report the condition to the Engineer in writing.

In conformance with Section 25914.1 of the Health and Safety Code, removal of asbestos or hazardous substances including exploratory work to identify and determine the extent of the asbestos or hazardous substance will be performed by separate contract.

If delay of work in the area delays the current controlling operation, the delay will be considered a right of way delay and the Contractor will be compensated for the delay in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

5-1.07 YEAR 2000 COMPLIANCE

This contract is subject to Year 2000 Compliance for automated devices in the State of California.

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 shall operate accurately in the manner in which the product was intended for date operation without requiring manual intervention.

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

5-1.075 BUY AMERICA REQUIREMENTS

Attention is directed to the "Buy America" requirements of the Surface Transportation Assistance Act of 1982 (Section 165) and the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) Sections 1041(a) and 1048(a), and the regulations adopted pursuant thereto. In conformance with the law and regulations, all manufacturing processes for steel and iron materials 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 other coatings that protect or enhance the value of steel or iron materials shall be considered a manufacturing process subject to the "Buy America" 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 and iron materials. The certificates, in addition to certifying that the materials comply with the specifications, shall specifically certify that all manufacturing processes for the materials occurred in the United States, except for the above exceptions.

The requirements imposed by the law and regulations do not prevent a minimal use of foreign steel and iron materials if the total combined cost of the materials used does not exceed one-tenth of one percent (0.1 percent) of the total contract cost or $2500, whichever is greater. The Contractor shall furnish the Engineer acceptable documentation of the quantity and value of the foreign steel and iron prior to incorporating the materials into the work.

5-1.08 SUBCONTRACTOR AND DBE RECORDS

The Contractor shall maintain records showing the name and business address of each first-tier subcontractor. The records shall also show the name and business address of every DBE subcontractor, DBE vendor of materials and DBE trucking company, regardless of tier. The records shall show the date of payment and the total dollar figure paid to all of these firms. DBE prime contractors shall also show the date of work performed by their own forces along with the corresponding dollar value of the work.

Upon completion of the contract, a summary of these records shall be prepared on Form CEM-2402 (F) and certified correct by the Contractor or the Contractor's authorized representative, and shall be furnished to the Engineer. The form shall be furnished to the Engineer within 90 days from the date of contract acceptance. $10,000 will be withheld from payment until the Form CEM-2402 (F) is submitted. The amount will be returned to the Contractor when a satisfactory Form CEM-2402 (F) is submitted.

Prior to the fifteenth of each month, the Contractor shall submit documentation to the Engineer showing the amount paid to DBE trucking companies listed in the Contractor's DBE information. This monthly documentation shall indicate the portion of the revenue paid to DBE trucking companies which is claimed toward DBE participation. The Contractor shall also obtain and submit documentation to the Engineer showing the amount paid by DBE trucking companies to all firms, including owner-operators, for the leasing of trucks. The DBE who leases trucks from a non-DBE is entitled to credit only for the fee or commission it receives as a result of the lease arrangement. The records must confirm that the amount of credit claimed toward DBE participation conforms with Section 2-1.02, "Disadvantaged Business Enterprise," of these special provisions.

The Contractor shall also obtain and submit documentation to the Engineer showing the truck number, owner's name, California Highway Patrol CA number, and if applicable, the DBE certification number of the owner of the truck for all trucks used during that month for which DBE participation will be claimed. This documentation shall be submitted on Form CEM-2404 (F).

5-1.083 DBE CERTIFICATION STATUS

If a DBE subcontractor is decertified during the life of the project, the decertified subcontractor shall notify the Contractor in writing with the date of decertification. If a subcontractor becomes a certified DBE during the life of the project, the subcontractor shall notify the Contractor in writing with the date of certification. The Contractor shall furnish the written documentation to the Engineer.

Upon completion of the contract, Form CEM-2403 (F) indicating the DBE's existing certification status shall be signed and certified correct by the Contractor. The certified form shall be furnished to the Engineer within 90 days from the date of contract acceptance.

5-1.086 PERFORMANCE OF DBE SUBCONTRACTORS AND SUPPLIERS

The DBEs listed by the Contractor in response to the provisions in Section 2-1.02B, "Submission of DBE Information," and Section 3, "Award and Execution of Contract," of these special provisions, which are determined by the Department to be certified DBEs, 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 use other forces or sources of materials may be requested for the following reasons:

A. The listed DBE, after having had a reasonable opportunity to do so, fails or refuses to execute a written contract, when such written contract, based upon the general terms, conditions, plans and specifications for the project, or on the terms of such subcontractor's or supplier's written bid, is presented by the Contractor.
B. The listed DBE becomes bankrupt or insolvent.
C. The listed DBE fails or refuses to perform the subcontract or furnish the listed materials.
D. The Contractor stipulated that a bond was a condition of executing a subcontract and the listed DBE subcontractor fails or refuses to meet the bond requirements of the Contractor.

E. The work performed by the listed subcontractor is substantially unsatisfactory and is not in substantial conformance with the plans and specifications, or the subcontractor is substantially delaying or disrupting the progress of the work.
F. It would be in the best interest of the State.

The Contractor shall not be entitled to any payment for such work or material unless it is performed or supplied by the listed DBE or by other forces (including those of the Contractor) pursuant to prior written authorization of the Engineer.

5-1.09 SUBCONTRACTING

Attention is directed to the provisions in Section 8-1.01, "Subcontracting," of the Standard Specifications, and Section 2, "Proposal Requirements and Conditions," and Section 3, "Award and Execution of Contract," of these special provisions.

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/DLSE/Debar.html.

The third paragraph of Section 8-1.01, "Subcontracting," of the Standard Specifications shall not apply.

The requirement in Section 14, "FEDERAL REQUIREMENTS FOR FEDERAL-AID CONSTRUCTION PROJECTS," in these special provisions requiring the Contractor to perform 30 percent of the work with their own forces shall not apply.

Each subcontract and any lower tier subcontract that may in turn be made shall include the "Required Contract Provisions Federal-Aid Construction Contracts" in Section 14 of these special provisions. This requirement shall be enforced as follows:

A. Noncompliance shall be corrected. Payment for subcontracted work involved will be withheld from progress payments due, or to become due, until correction is made. Failure to comply may result in termination of the contract.

In conformance with the Federal DBE regulations Sections 26.53(f)(1) and 26.53(f)(2) Part 26, Title 49 CFR:

A. The Contractor shall not terminate for convenience a DBE subcontractor listed in response to Section 2-1.02B, "Submission of DBE Information," and then perform that work with its own forces, or those of an affiliate without the written consent of the Department, and
B. If a DBE subcontractor is terminated or fails to complete its work for any reason, the Contractor will be required to make good faith efforts to substitute another DBE subcontractor for the original DBE subcontractor, to the extent needed to meet the contract goal.

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

5-1.10 PROMPT PROGRESS PAYMENT TO SUBCONTRACTORS

Attention is directed to the provisions in Sections 10262 and 10262.5 of the Public Contract Code and Section 7108.5 of the Business and Professions Code concerning prompt payment to subcontractors.

5-1.102 PROMPT PAYMENT OF WITHHELD FUNDS TO SUBCONTRACTORS

The Contractor shall return all moneys withheld in retention from the subcontractor within 30 days after receiving payment for work satisfactorily completed, even if the other contract work is not completed and has not been accepted in conformance with Section 7-1.17, "Acceptance of Contract," of the Standard Specifications. This requirement shall not be construed to limit or impair any contractual, administrative, or judicial remedies otherwise available to the Contractor or subcontractor in the event of a dispute involving late payment or nonpayment by the Contractor or deficient subcontract performance or noncompliance by a subcontractor.

5-1.11 PARTNERING

The State will promote the formation of a "Partnering" relationship with the Contractor in order to effectively complete the contract to the benefit of both parties. The purpose of this relationship will be to maintain cooperative communication and mutually resolve conflicts at the lowest possible management level.

A one-day “Training in Partnering Concepts” forum will be conducted regardless of whether the Contractor requests the formation of a “Partnering” relationship. The forum will be conducted locally for the Contractor and the Engineer’s project

representatives. The Contractor shall be represented by a minimum of two representatives, one being the Contractor's authorized representative pursuant to Section 5-1.06, "Superintendence," of the Standard Specifications. If, upon the Contractor's request, "Partnering" is approved by the Engineer, "Training in Partnering Concepts" shall be conducted prior to the "Partnering" workshop. Scheduling of "Training in Partnering Concepts," selection of the Engineer's representatives to participate in "Training of Partnering Concepts," and selection of the partnering concepts trainer and site shall be as determined by the Engineer.

The Contractor may request the formation of a "Partnering" relationship by submitting a request in writing to the Engineer after approval of the contract. If the Contractor's request for "Partnering" is approved by the Engineer, scheduling of a "Partnering" workshop, selecting the "Partnering" facilitator and workshop site, and other administrative details shall be as agreed to by both parties.

The costs involved in providing a trainer and site for the "Training in Partnering Concepts" forum will be borne by the State. 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 will reimburse the Contractor for these costs as extra work in conformance with the provisions in Section 4-1.03D of the Standard Specifications. Full compensation for the wages and expenses of the Contractor's representatives, including travel costs, shall be considered as included in the contract prices paid for the various items of work and no additional compensation will be allowed therefor.

The costs involved in providing a "Partnering" 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 to the costs of "Training in Partnering Concepts" or the costs of providing a "Partnering" facilitator and workshop site. 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.

5–1.114 VALUE ANALYSIS

The Contractor may submit to the Engineer, in writing, a request for a "Value Analysis" workshop. The purpose for having a workshop is to identify value enhancing opportunities and to consider modifications to the plans and specifications that will reduce either the total cost, time of construction or traffic congestion, without impairing, in any manner, the essential functions or characteristics of the project including, but not limited to, service life, economy of operation, ease of maintenance, benefits to the travelling public, desired appearance, or design and safety standards.

To maximize the potential benefits of a workshop, the request should be submitted to the Engineer early in the project after approval of the contract. If the Contractor's request for a "Value Analysis" workshop is approved by the Engineer, scheduling of a workshop, selecting the facilitator and workshop site, and other administrative details shall be determined cooperatively by the Contractor and the Engineer.

The workshop shall be conducted in conformance with the methodology described in the Department's "Value Analysis Team Guide" available at the Department's web site at:

http://www.dot.ca.gov/hq/oppd/value/

The facilitator shall be a Certified Value Specialist (CVS) as recognized by the Society of American Value Engineers (SAVE) International, which may be contacted as follows:

SAVE International, 60 Revere Drive, Northbrook, IL 60062
Telephone 1-847-480-1730, FAX 1-847-480-9282

The Contractor may submit recommendations resulting from a "Value Analysis" workshop for approval by the Engineer as cost reduction incentive proposals in conformance with the provisions in Section 5-1.14, "Cost Reduction Incentive," of the Standard Specifications.

The costs involved in providing the "Value Analysis" facilitator and workshop site will be borne equally by the State and the Contractor. The division of cost will be made by determining the cost in providing the "Value Analysis" facilitator and workshop site in conformance with the provisions in Section 9-1.03B, "Work Performed by Special Forces or Other Special Services," of the Standard Specifications, and paying to the Contractor one-half of that cost, except no markups will be allowed.

All other costs associated with the "Value Analysis" workshop will be borne separately by the party incurring the costs, such as wages and travel expenses, and no additional compensation will be allowed therefor.

5–1.12 DISPUTE REVIEW BOARD

To assist in the resolution of disputes or potential claims arising out of the work of this project, a Dispute Review Board, hereinafter referred to as the "DRB," shall be established by the Engineer and Contractor cooperatively upon approval of the contract. The DRB is intended to assist the contract administrative claims resolution process as specified in the provisions in Section 9-1.04, "Notice of Potential Claim," and Section 9-1.07B, "Final Payment and Claims," of the Standard Specifications. The DRB shall not serve as a substitute for provisions in the specifications in regard to filing potential claims. The requirements and procedures established in this 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 project 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, 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. The State will review those claims in conformance with the provisions in Section 9-1.07B of the Standard Specifications. Following the completion of the State's administrative claims procedure, the Contractor may resort to arbitration in conformance with the provisions in Section 9-1.10, "Arbitration," of the Standard Specifications.

Disputes, as used in this section, shall include differences of opinion, properly noticed as provided hereinafter, between the State and Contractor on matters related to the work and other subjects considered by the State or Contractor, or by both, to be of concern to the DRB on this project, except matters relating to Contractor, subcontractor or supplier 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 2 members and approved by both the State and the Contractor. The third member shall act as DRB Chairperson.

The first 2 DRB members shall select a third DRB member subject to mutual approval of the parties or may mutually concur on a list of potentially acceptable third DRB members and submit the list to the parties for final selection and approval of the third member. The goal in selection of the third member is to complement the professional experience of the first 2 members and to provide leadership for the DRB's activities.

No DRB member shall have prior direct involvement in this contract. No member shall have a financial interest in this contract or the parties thereto, within a period of 6 months prior to award of this contract or during the contract, except as follows:

A. Compensation for services on this DRB.
B. Ownership interest in a party or parties, documented by the prospective DRB member, that has been reviewed and determined in writing by the State to be sufficiently insignificant to render the prospective member acceptable to the State.
C. Service as a member of other Dispute Review Boards on other contracts.
D. Retirement payments or pensions received from a party that are not tied to, dependent on or affected by the net worth of the party.
E. The above provisions apply to parties having a financial interest in this contract, including but not limited to contractors, subcontractors, suppliers, consultants, and legal and business services.

DRB members shall be especially knowledgeable in the type of construction and contract documents potentially anticipated by the contract. The members 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 conformance with the terms and conditions of the Dispute Review Board Agreement and these special provisions, within 45 days of the approval of the contract. Each party shall provide written notification to the other of the name of their selected DRB member along with the prospective member's written disclosure statement.

Before their appointments are final, the first 2 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 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 the parties involved in this

construction contract, including, but not limited to, 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 the 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 2 DRB members and to the parties prior to appointment. Either party may reject any of the 3 prospective DRB members who fail to fully comply with all required employment and financial disclosure conditions of DRB membership as described in the Dispute Review Board Agreement and herein. A copy of the Dispute 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 2 DRB members shall proceed with the selection of the third DRB member immediately upon receiving written notification from the State of their selection, and shall provide their recommendation simultaneously to the parties within 14 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 2 DRB members, or if the first 2 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 3 candidates for the third position. The parties shall select the candidates proposed under this paragraph from the current list of arbitrators certified by the Public Works Contract Arbitration Committee created by Article 7.2 (commencing with Section 10245) of the State Contract Act. The first 2 DRB members shall then select one of the 6 proposed candidates in a blind draw.

The Contractor, the State, and the 3 members of the DRB shall complete and adhere to the Dispute Review Board Agreement in administration of this DRB within 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 Dispute 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 per day if time spent per meeting, including on-site time plus one hour of travel time, is greater than 4 hours. Each DRB board member shall be compensated at an agreed rate of $600 per day if time spent per meeting, including on-site time plus one hour of travel time, is less than or equal to 4 hours. The agreed rates shall be considered full compensation for on-site time, travel expenses, transportation, lodging, time for travel and incidentals for each day, or portion thereof, that the DRB member is at an authorized DRB meeting. No additional compensation will be made for time spent by DRB members in review and research activities outside the official DRB meetings unless that time, (such as time spent evaluating and preparing recommendations on specific issues presented to the DRB), has been specifically agreed to in advance by the State and Contractor. Time away from the project, that has been specifically agreed to in advance by the parties, will be compensated at an agreed rate of $100 per hour. The agreed amount of $100 per hour shall include all incidentals including 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 Dispute Review Board Agreement state provisions for compensation and expenses of the DRB. DRB members shall be compensated at the same daily and hourly rate. The Contractor shall make direct payments to each DRB member for their participation in authorized meetings and approved hourly rate charges from invoices submitted by each DRB member. The State will reimburse the Contractor for its share of the costs. There will be no markups applied to expenses connected with the DRB, either by the DRB members or by the Contractor when requesting payment of the State's share of DRB expenses.

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

A. The State may terminate service of the State appointed member.
B. The Contractor may terminate service of the Contractor appointed member.
C. Upon the written recommendation of the State and Contractor members for the removal of the third member.
D. 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 Dispute Review Board Agreement shall be amended to reflect the change of a DRB member.

The following procedure shall be used for dispute resolution:

A. If the Contractor objects to any decision, act or order of the Engineer, the Contractor shall give written notice of potential claim in conformance with the provisions in Section 9-1.04, "Notice of Potential Claim," of the Standard Specifications, including provision of applicable cost documentation; or file written protests or notices pursuant to Section 4-1.03A, "Procedure and Protest," Section 8-1.06, "Time of Completion," Section 8-1.07, "Liquidated Damages," or Section 8-1.10, "Utility and Non-Highway Facilities," of the Standard Specifications.

B. 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.

C. 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.

D. 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.

E. 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 future claims on the matter in contention.

F. The Contractor and the State shall each be afforded an opportunity to be present and to be heard by the DRB, and to offer evidence. Either party furnishing written evidence or documentation to the DRB must furnish copies of such information to the other party a minimum of 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 evidence not furnished in conformance with the terms specified herein.

G. The DRB shall furnish a report, containing findings and recommendations as described in the Dispute Review Board Agreement, in writing to both the State and the Contractor. The DRB 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.

H. 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.

I. The DRB's recommendations, stated in the DRB's reports, are not binding on either party. Either party may seek a reconsideration of a recommendation of the DRB. The DRB shall only grant a reconsideration based upon submission of new evidence and if the request is submitted within the 30-day time limit specified for response to the DRB's written report. Each party may submit only one request for reconsideration regarding an individual DRB recommendation.

J. 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.

K. 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.

L. 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.

M. The DRB members shall have no claim against the State or the Contractor, or both, from claimed harm arising out of the parties' evaluations of the DRB's report.

DISPUTES INVOLVING SUBCONTRACTOR 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 conformance with these special provisions and in conformance with the following:

A. The Contractor shall identify clearly in submissions pursuant to this section, that portion of the dispute that involves a subcontractor claim or claims.
B. 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 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.
C. 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.
D. 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.
E. 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 conformance with the Dispute Review Board resolution specifications; (b) agree to be bound by the terms of the Dispute Review Board provisions to the extent applicable to subcontractor 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 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, subcontractor claims between the subcontractor(s) or supplier(s) and the Contractor that is not actionable by the Contractor against the Department.

A copy of the "Dispute Review Board Agreement" to be executed by the Contractor, State and the 3 DRB members after approval of the contract follows:

Form 6202 Rev (01-05-98)

DISPUTE REVIEW BOARD AGREEMENT

_____
(Contract Identification)

Contract No. _____

THIS DISPUTE REVIEW BOARD AGREEMENT, hereinafter called **"AGREEMENT",** made and entered into this _____ day of _____, _____, between the State of California, acting through the California Department of Transportation and the Director of Transportation, hereinafter called the "STATE," _____ _____ hereinafter called the "CONTRACTOR," and the Dispute Review Board, hereinafter called the "DRB" consisting of the following members:

_____ ,
(Contractor Appointee)

_____ ,
(State Appointee)

and _____
(Third Person)

WITNESSETH, that

WHEREAS, the STATE and the CONTRACTOR, hereinafter called the "parties," are now engaged in the construction on the State Highway project referenced above; and

WHEREAS, the special provisions for the above referenced contract provides for the establishment and operation of the DRB to assist in resolving disputes; and

WHEREAS, the DRB is composed of three members, one selected by the STATE, one selected by the CONTRACTOR, and the third member selected by the other two members and approved by the parties;

NOW THEREFORE, in consideration of the terms, conditions, covenants, and performance contained herein, or attached and incorporated and made a part hereof, the STATE, the CONTRACTOR, and the DRB members hereto agree as follows:

SECTION I DESCRIPTION OF WORK

To assist in the resolution of disputes between the parties, the contract provides for the establishment and the operation of the DRB. The intent of the DRB is to fairly and impartially consider disputes placed before it and provide written recommendations for resolution of these disputes to both parties. The members of this DRB shall perform the services necessary to participate in the DRB's actions as designated in Section II, Scope of Work.

SECTION II SCOPE OF WORK

The scope of work of the DRB includes, but is not limited to, the following:

A. OBJECTIVE

The principal objective of the DRB is to assist in the timely resolution of disputes between the parties arising from performance of this contract. It is not intended for either party to default on their normal responsibility to amicably and fairly settle their differences by indiscriminately assigning them to the DRB. It is intended that the mere existence of the DRB will encourage the parties to resolve disputes without resorting to this review procedure. But when a dispute 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 conformance with the requirements of the contract and the terms of this AGREEMENT. DRB recommendations, resulting from its consideration of a dispute, shall be furnished in writing to both parties. The recommendations shall be based on 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 advice or consulting services to anyone involved in the contract. The individual members shall act in a completely independent manner and while serving as members of the DRB shall have no consulting business connections with either party or its principals or attorneys or other affiliates (subcontractors, suppliers, etc.) who have a beneficial interest in the contract.

During scheduled meetings of the DRB as well as during dispute 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. Such discussions or meetings shall be disclosed to both parties. Other discussions regarding the project between the DRB members and the parties shall be in the presence of all three members and both parties. Individual DRB members shall not undertake independent investigations of any kind pertaining to disputes or potential disputes, except with the knowledge of both parties and as expressly directed by the DRB Chairperson.

C. CONSTRUCTION SITE VISITS, PROGRESS MEETINGS AND FIELD INSPECTIONS

The DRB members shall visit the project site and meet with representatives of the parties to keep abreast of construction activities and to develop familiarity with the work in progress. Scheduled progress meetings shall be held at or near the project site. The DRB shall meet at least once at the start of the project, and at least once every 6 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 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 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 electronic means. Documents and verbal statements shall be received by the DRB in conformance with acceptance standards established by the DRB. These standards need not comply with prescribed legal laws of evidence.

The third DRB member shall act as Chairperson for dispute 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 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 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 costs 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 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. DRB deliberations shall be conducted in private, with interim individual views kept strictly confidential.

After hearings are concluded, the DRB shall meet in private and reach a conclusion supported by 2 or more members. Private sessions of the DRB may be held at a location other than the job site or by electronic conferencing as deemed appropriate, in order to expedite the process.

The DRB's findings and recommendations, along with discussion of reasons therefor, shall then be submitted as a written report to both parties. Recommendations shall be based on the pertinent contract provisions, applicable laws and regulations, and facts and circumstances related to the dispute. The report shall be thorough in discussing the facts considered, the contract language, law or regulation viewed by the DRB as pertinent to the issues, and the DRB's interpretation and philosophy in arriving at its conclusions and recommendations. The DRB's report shall stand on its own, without attachments or appendices. The DRB chairman shall complete and furnish a summary report to the DRB Program Manager, Construction Program, MS 44, P.O. Box 942874, Sacramento, CA 94274.

With prior written approval of both parties, the DRB may obtain technical services necessary to adequately review the disputes presented, including audit, geotechnical, schedule analysis and other services. The parties' technical staff may supply those services as appropriate. The cost of technical services, as agreed to by the parties, shall be borne equally by the 2 parties as specified in an approved contract change order. The CONTRACTOR will not be entitled to markups for the payments made for these services.

The DRB shall resist submittal of incremental portions of information by either party, in the interest of making a fully-informed decision and recommendation.

The DRB shall make every effort to reach a unanimous decision. If this proves impossible, the dissenting member shall prepare a minority opinion, which shall be included in the DRB's report.

Although both parties should place weight upon the DRB's recommendations, they are not binding. Either party may appeal a recommendation to the DRB for reconsideration. However, reconsideration shall only be allowed when there is new evidence to present, and the DRB shall accept only one appeal from each party pertaining to an individual DRB recommendation. The DRB shall hear appeals in conformance with the terms described in the Section entitled "Dispute Review Board" in the special provisions.

E. DRB MEMBER REPLACEMENT

Should the need arise to appoint a replacement DRB member, the replacement DRB member shall be appointed in the same manner as the original DRB members were appointed. The selection of a replacement DRB member shall begin

promptly upon notification of the necessity for a replacement and shall be completed within 14 days. This AGREEMENT will be amended to indicate change in DRB membership.

SECTION III CONTRACTOR RESPONSIBILITIES

The CONTRACTOR shall furnish to each DRB member one copy of pertinent documents which are or may become necessary for the DRB to perform their function. Pertinent documents are drawings or sketches, calculations, procedures, schedules, estimates, or other documents which are used in the performance of the work or in justifying or substantiating the CONTRACTOR's position. The CONTRACTOR shall also furnish a copy of such pertinent documents to the STATE, in conformance with the terms outlined in the special provisions.

SECTION IV STATE RESPONSIBILITIES

The STATE will furnish the following services and items:

A. CONTRACT RELATED DOCUMENTS

The STATE will furnish to each DRB member one copy of Notice to Contractors and Special Provisions, Proposal and Contract, Plans, Standard Specifications, and Standard Plans, change orders, written instructions issued by the STATE to the CONTRACTOR, or other documents pertinent to any dispute that has been referred to the DRB and necessary for the DRB to perform its function.

B. COORDINATION AND SERVICES

The STATE, through the Engineer, will, in cooperation with the CONTRACTOR, coordinate the operations of the DRB. The Engineer will arrange or provide conference facilities at or near the project site and provide secretarial and copying services to the DRB without charge to the CONTRACTOR.

SECTION V TIME FOR BEGINNING AND COMPLETION

Once established, the DRB shall be in operation until the day of acceptance of the contract. The DRB members shall not begin work under the terms of this AGREEMENT until authorized in writing by the STATE.

SECTION VI PAYMENT

A. ALL INCLUSIVE RATE PAYMENT

The STATE and the CONTRACTOR shall bear the costs and expenses of the DRB equally. Each DRB board member shall be compensated at an agreed rate of $1,000 per day if time spent per meeting, including on-site time plus one hour of travel time, is greater than 4 hours. Each DRB board member shall be compensated at an agreed rate of $600 per day if time spent per meeting, including on-site time plus one hour of travel time, is less than or equal to 4 hours. The agreed rates shall be considered full compensation for on-site time, travel expenses, transportation, lodging, time for travel and incidentals for each day, or portion thereof, that the DRB member is at an authorized DRB meeting. No additional compensation will be made for time spent by DRB members in review and research activities outside the official DRB meetings unless that time has been specifically agreed to in advance by the STATE and CONTRACTOR. Time away from the project, that has been specifically agreed to in advance by the parties, will be compensated at an agreed rate of $100 per hour. The agreed amount of $100 per hour shall include all incidentals including 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

DRB members shall be compensated at the same rate. The CONTRACTOR shall make direct payments to each DRB member for their participation in authorized meetings and approved hourly rate charges from invoices submitted by each DRB member. The STATE will reimburse the CONTRACTOR for its share of the costs of the DRB.

The DRB members may submit invoices to the CONTRACTOR for partial payment for work performed and services rendered for their participation in authorized meetings not more often than once per month during the progress of the work. The invoices shall be in a format approved by the parties and accompanied by a general description of activities performed during that billing period. Payment for hourly fees, at the agreed rate, shall not be paid to a DRB member until the amount and extent of those fees are approved by the STATE and CONTRACTOR.

Invoices shall be accompanied by original supporting documents, which the CONTRACTOR shall include with the extra work billing when submitting for reimbursement of the STATE's share of cost from the STATE. The CONTRACTOR will be reimbursed for one-half of approved costs of the DRB. No markups will be added to the CONTRACTOR's payment.

C. INSPECTION OF COSTS RECORDS

The DRB members and the CONTRACTOR shall keep available for inspection by representatives of the STATE and the United States, for a period of 3 years after final payment, the cost records and accounts pertaining to this AGREEMENT. If any litigation, claim, or audit arising out of, in connection with, or related to this contract is initiated before the expiration of the 3–year period, the cost records and accounts shall be retained until such litigation, claim, or audit involving the records is completed.

SECTION VII ASSIGNMENT OF TASKS OF WORK

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

SECTION VIII TERMINATION OF 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 conformance with the terms of the contract.

SECTION IX LEGAL RELATIONS

The parties hereto mutually understand and agree that the DRB member in the performance of duties on the DRB, is acting in the capacity of an independent agent and not as an employee of either party.

No party to this AGREEMENT shall bear a greater responsibility for damages or personal injury than is normally provided by Federal or State of California Law.

Notwithstanding the provisions of this contract that require the CONTRACTOR to indemnify and hold harmless the STATE, the parties shall jointly indemnify and hold harmless the DRB members from and against all claims, damages, losses, and expenses, including but not limited to attorney's fees, arising out of and resulting from the findings and recommendations of the DRB.

SECTION X CONFIDENTIALITY

The parties hereto mutually understand and agree that all documents and records provided by the parties in reference to issues brought before the DRB, which documents and records are marked "Confidential - for use by the DRB only," shall be kept in confidence and used only for the purpose of resolution of subject disputes, and for assisting in development of DRB findings and recommendations; that such documents and records will not be utilized or revealed to others, except to officials of the parties who are authorized to act on the subject disputes, for any purposes, during the life of the DRB. Upon termination of this AGREEMENT, said confidential documents and records, and all copies thereof, shall be returned to the parties who furnished them to the DRB. However, the parties understand that such documents shall be subsequently discoverable and admissible in court or arbitration proceedings unless a protective order has been obtained by the party seeking further confidentiality.

SECTION XI DISPUTES

Disputes between the parties hereto, including disputes between the DRB members and either party or both parties, arising out of the work or other terms of this AGREEMENT, which cannot be resolved by negotiation and mutual concurrence between the parties, or through the administrative process provided in the contract, shall be resolved by arbitration as provided in Section 9-1.10, "Arbitration," of the Standard Specifications.

SECTION XII VENUE, APPLICABLE LAW, AND PERSONAL JURISDICTION

In the event that any party, including an individual member of the DRB, deems it necessary to institute arbitration proceedings to enforce any right or obligation under this AGREEMENT, the parties hereto agree that such action shall be initiated in the Office of Administrative Hearings of the State of California. The parties hereto agree that all questions shall be resolved by arbitration by application of California law and that the parties to such arbitration shall have the right of appeal from such decisions to the Superior Court in conformance with the laws of the State of California. Venue for the arbitration shall be Sacramento or any other location as agreed to by the parties.

SECTION XIII FEDERAL REVIEW AND REQUIREMENTS

On Federal-Aid contracts, the Federal Highway Administration shall have the right to review the work of the DRB in progress, except for private meetings or deliberations of the DRB.
Other Federal requirements in this agreement shall only apply to Federal-Aid contracts.

SECTION XIV CERTIFICATION OF THE CONTRACTOR, THE DRB MEMBERS, AND THE STATE

IN WITNESS WHEREOF, the parties hereto have executed this AGREEMENT as of the day and year first above written.

DRB MEMBER

By: _____

Title: _____

DRB MEMBER

By: _____

Title :_____

DRB MEMBER

By :_____

Title :_____

CONTRACTOR

By: _____

Title: _____

CALIFORNIA STATE DEPARTMENT
OF TRANSPORTATION

By: _____

Title: _____

5-1.13 FORCE ACCOUNT PAYMENT

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

Attention is directed to "Overhead" of these special provisions.

To the total of the direct costs for work performed on a force account basis, computed as provided in Sections 9-1.03A(1), "Labor," 9-1.03A(2), "Materials," and 9-1.03A(3), "Equipment Rental," of the Standard Specifications, there will be added the following markups:

Cost	Percent Markup
Labor	28
Materials	10
Equipment Rental	10

The above markups shall be applied to all work performed on a force account basis, regardless of whether the work revises the current contract completion date.

The above markups, together with payments made for time-related overhead pursuant to "Overhead" of these special provisions, shall constitute full compensation for all overhead costs for work performed on a force account basis. These overhead costs shall be deemed to include all items of expense not specifically designated as cost or equipment rental in conformance with the provisions in Sections 9-1.03A(1), "Labor," 9-1.03A(2), "Materials," and 9-1.03A(3), "Equipment Rental," of the Standard Specifications. The total payment made as provided above and in the first paragraph of Section 9-1.03A, "Work Performed by Contractor," of the Standard Specifications shall be deemed to be the actual cost of the work performed on a force account basis, and shall constitute full compensation therefor. Full compensation for all overhead costs for work performed on a force account basis, and for which no adjustment is made to the quantity of time-related overhead pursuant to “Overhead” of these special provisions, shall be considered as included in the markups specified above, and no additional compensation will be allowed therefor.

When extra work to be paid for on a force account basis is performed by a subcontractor, approved in conformance with the provisions in Section 8-1.01, “Subcontracting,” of the Standard Specifications, an additional markup of 7 percent will be

added to the total cost of that extra work including all markups specified in this section "Force Account Payment". The additional 7 percent markup shall reimburse the Contractor for additional administrative costs, and no other additional payment will be made by reason of performance of the extra work by a subcontractor.

5-1.14 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 conformance with the provisions in Section 9–1.07B, "Final Payment and Claims," of the Standard Specifications and these special provisions.

Upon the request of the Contractor, relief from maintenance and responsibility for work completed in conformance with the requirements of the contract and to the satisfaction of the Engineer may be granted in conformance with the provisions 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 final progress pay estimate showing the completed items of work. Within 30 days after receiving the final 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 for which relief of maintenance and responsibility were granted will be considered unless it was 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 conformance with the provisions in Section 9-1.10, "Arbitration," of the Standard Specifications.

5-1.15 PAYMENTS

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

For the purpose of making partial payments pursuant to Section 9-1.06, "Partial Payments," of the Standard Specifications, the amount set forth for the contract items of work hereinafter listed shall be deemed to be the maximum value of the contract item of work which will be recognized for progress payment purposes:

A. Clearing and Grubbing $5000.00

After acceptance of the contract pursuant to the provisions in Section 7-1.17, "Acceptance of Contract," of the Standard Specifications, the amount, if any, payable for a contract item of work in excess of the maximum value for progress payment purposes hereinabove listed for the item, will be included for payment in the first estimate made after acceptance of the contract.

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

A. Alternative Pipe Culvert
B. Metal Beam Guard Rail and Appurtenances
C. Bar Reinforcing Steel
D. Pipes (Irrigation System)
E. Sprinklers
F. Valves
G. Irrigation Controller
H. Irrigation Enclosure Cabinets
I. Backflow Preventers
J. Backflow Preventer Assembly Enclosures

5-1.16 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 other contract requirements. Use of the Contractor's work areas and other State-owned property shall be at the Contractor's own risk. The State shall not be held liable for damage to or loss of materials or equipment located within these areas.

The Contractor shall remove the equipment, materials, and rubbish from the work areas and other State-owned property which the Contractor occupies and shall leave the areas in a presentable condition, in conformance with the provisions in Section 4-1.02, "Final Cleaning Up," of the Standard Specifications.

The Contractor shall secure, at the Contractor's own expense, areas required for storage of plant, equipment, and materials, or for other purposes if sufficient area is not available to the Contractor within the contract limits.

5-1.17 UTILITIES

The Contractor may use electrical power, water, and compressed air from existing State outlets within the contract limits, where the utilities exist, free of charge for contract operations provided that the Contractor does not misuse these services, the utility services are in service, and the services are not required by the State for other purposes. Utilities shall be subject to the provisions in "Cooperation" of these special provisions.

The Contractor shall make arrangements to obtain additional electrical power, water or compressed air or other utilities required for the Contractor's operations and shall make and maintain the necessary service connections at the Contractor's own expense.

5-1.18 SANITARY PROVISIONS

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

5-1.19 BRIDGE TOLLS

Toll-free passage on the Benicia-Martinez Bridge will be granted only for cars, trucks and special construction equipment which are clearly marked on the exterior with the Contractor's identification and which are being operated by the Contractor exclusively for the project, and which are used for the purpose of transporting materials and workers directly to and from the project site.

The Contractor shall make application to the Engineer in advance for toll-free passage. The Contractor will be held accountable for the proper use of passes issued, and upon completion of the work, shall return unused passes to the Engineer.

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

5-1.20 ACCESS TO PROJECT SITE

Prospective bidders may make arrangements to visit the project site by contacting the Toll Bridge Program Duty Senior, telephone number (510) 286-5549, email address: Duty_Senior_ Tollbridge_ District 04@dot.ca.gov, and fax number (510) 286-4563.

5-1.21 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 conformance with the provisions in Section 55-1.02, "Drawings," of the Standard Specifications and the following:

A. Working drawings shall be submitted to the Engineer.
B. Working drawings shall not exceed 559 mm x 864 mm in size.
C. Microfilms are required of approved shop drawings and shall be only a 24x reduction.

Working drawings will be required for the Engineer. Attention is directed to Section 12-1.05, "Submittals," of these special provisions regarding items of work requiring working drawings.

SECTION 6. (BLANK)

SECTION 7. (BLANK)

SECTION 8. MATERIALS

SECTION 8-1. MISCELLANEOUS

8-1.01 SUBSTITUTION OF NON-METRIC MATERIALS AND PRODUCTS

Only materials and products conforming to the requirements of the specifications shall be incorporated in the work. When metric materials and products are not available, and when approved by the Engineer, and at no cost to the State, materials and products in the United States Standard Measures which are of equal quality and of the required properties and characteristics for the purpose intended, may be substituted for the equivalent metric materials and products, subject to the following provisions:

A. Materials and products shown on the plans or in the special provisions as being equivalent may be substituted for the metric materials and products specified or detailed on the plans.
B. Before other non-metric materials and products will be considered for use, the Contractor shall furnish, at the Contractor's expense, evidence satisfactory to the Engineer that the materials and products proposed for use are equal to or better than the materials and products specified or detailed on the plans. The burden of proof as to the quality and suitability of substitutions shall be upon the Contractor and the Contractor shall furnish necessary information as required by the Engineer. The Engineer will be the sole judge as to the quality and suitability of the substituted materials and products and the Engineer's decision will be final.
C. When the Contractor elects to substitute non-metric materials and products, including materials and products shown on the plans or in the special provisions as being equivalent, the list of sources of material specified in Section 6-1.01, "Source of Supply and Quality of Materials," of the Standard Specification shall include a list of substitutions to be made and contract items involved. In addition, for a change in design or details, the Contractor shall submit plans and working drawings in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. The plans and working drawings shall be submitted at least 7 days before the Contractor intends to begin the work involved.

Unless otherwise specified, the following substitutions of materials and products will be allowed:

SUBSTITUTION TABLE FOR SIZES OF HIGH STRENGTH STEEL FASTENERS
ASTM Designation: A 325M

METRIC SIZE SHOWN ON THE PLANS mm x thread pitch	SIZE TO BE SUBSTITUTED inch
M16 x 2	5/8
M20 x 2.5	3/4
M22 x 2.5	7/8
M24 x 3	1
M27 x 3	1-1/8
M30 x 3.5	1-1/4
M36 x 4	1-1/2

SUBSTITUTION TABLE FOR PLAIN WIRE REINFORCEMENT
ASTM Designation: A 82

METRIC SIZE SHOWN ON THE PLANS mm^2	SIZE TO BE SUBSTITUTED $inch^2$ x 100
MW9	W1.4
MW10	W1.6
MW13	W2.0
MW15	W2.3
MW19	W2.9
MW20	W3.1
MW22	W3.5
MW25	W3.9, except W3.5 in piles only
MW26	W4.0
MW30	W4.7
MW32	W5.0
MW35	W5.4
MW40	W6.2
MW45	W6.5
MW50	W7.8
MW55	W8.5, except W8.0 in piles only
MW60	W9.3
MW70	W10.9, except W11.0 in piles only
MW80	W12.4
MW90	W14.0
MW100	W15.5

SUBSTITUTION TABLE FOR BAR REINFORCEMENT

METRIC BAR DESIGNATION NUMBER[1] SHOWN ON THE PLANS	BAR DESIGNATION NUMBER[2] TO BE SUBSTITUTED
10	3
13	4
16	5
19	6
22	7
25	8
29	9
32	10
36	11
43	14
57	18

[1]Bar designation numbers approximate the number of millimeters of the nominal diameter of the bars.
[2]Bar numbers are based on the number of eighths of an inch included in the nominal diameter of the bars.
No adjustment will be required in spacing or total number of reinforcing bars due to a difference in minimum yield strength between metric and non-metric bars.

SUBSTITUTION TABLE FOR SIZES OF:

(1) STEEL FASTENERS FOR GENERAL APPLICATIONS (ASTM Designation: A 307 or AASHTO Designation: M 314, Grade 36 or 55), and

(2) HIGH STRENGTH STEEL FASTENERS (ASTM Designation: A 325 or A 449)

METRIC SIZE SHOWN ON THE PLANS mm	SIZE TO BE SUBSTITUTED inch
6 or 6.35	1/4
8 or 7.94	5/16
10 or 9.52	3/8
11 or 11.11	7/16
13 or 12.70	1/2
14 or 14.29	9/16
16 or 15.88	5/8
19 or 19.05	3/4
22 or 22.22	7/8
24, 25, or 25.40	1
29 or 28.58	1-1/8
32 or 31.75	1-1/4
35 or 34.93	1-3/8
38 or 38.10	1-1/2
44 or 44.45	1-3/4
51 or 50.80	2
57 or 57.15	2-1/4
64 or 63.50	2-1/2
70 or 69.85	2-3/4
76 or 76.20	3
83 or 82.55	3-1/4
89 or 88.90	3-1/2
95 or 95.25	3-3/4
102 or 101.60	4

SUBSTITUTION TABLE FOR NOMINAL THICKNESS OF SHEET METAL

UNCOATED HOT AND COLD ROLLED SHEETS		HOT-DIPPED ZINC COATED SHEETS (GALVANIZED)	
METRIC THICKNESS SHOWN ON THE PLANS mm	GAGE TO BE SUBSTITUTED inch	METRIC THICKNESS SHOWN ON THE PLANS mm	GAGE TO BE SUBSTITUTED inch
7.94	0.3125	4.270	0.1681
6.07	0.2391	3.891	0.1532
5.69	0.2242	3.510	0.1382
5.31	0.2092	3.132	0.1233
4.94	0.1943	2.753	0.1084
4.55	0.1793	2.372	0.0934
4.18	0.1644	1.994	0.0785
3.80	0.1495	1.803	0.0710
3.42	0.1345	1.613	0.0635
3.04	0.1196	1.461	0.0575
2.66	0.1046	1.311	0.0516
2.28	0.0897	1.158	0.0456
1.90	0.0747	1.006 or 1.016	0.0396
1.71	0.0673	0.930	0.0366
1.52	0.0598	0.853	0.0336
1.37	0.0538	0.777	0.0306
1.21	0.0478	0.701	0.0276
1.06	0.0418	0.627	0.0247
0.91	0.0359	0.551	0.0217
0.84	0.0329	0.513	0.0202
0.76	0.0299	0.475	0.0187
0.68	0.0269	--------	--------
0.61	0.0239	--------	--------
0.53	0.0209	--------	--------
0.45	0.0179	--------	--------
0.42	0.0164	--------	--------
0.38	0.0149	--------	--------

SUBSTITUTION TABLE FOR WIRE

METRIC THICKNESS SHOWN ON THE PLANS mm	WIRE THICKNESS TO BE SUBSTITUTED inch	GAGE NO.
6.20	0.244	3
5.72	0.225	4
5.26	0.207	5
4.88	0.192	6
4.50	0.177	7
4.11	0.162	8
3.76	0.148	9
3.43	0.135	10
3.05	0.120	11
2.69	0.106	12
2.34	0.092	13
2.03	0.080	14
1.83	0.072	15
1.57	0.062	16
1.37	0.054	17
1.22	0.048	18
1.04	0.041	19
0.89	0.035	20

SUBSTITUTION TABLE FOR PIPE PILES

METRIC SIZE SHOWN ON THE PLANS mm x mm	SIZE TO BE SUBSTITUTED inch x inch
PP 360 x 4.55	NPS 14 x 0.179
PP 360 x 6.35	NPS 14 x 0.250
PP 360 x 9.53	NPS 14 x 0.375
PP 360 x 11.12	NPS 14 x 0.438
PP 406 x 12.70	NPS 16 x 0.500
PP 460 x T	NPS 18 x T"
PP 508 x T	NPS 20 x T"
PP 559 x T	NPS 22 x T"
PP 610 x T	NPS 24 x T"
PP 660 x T	NPS 26 x T"
PP 711 x T	NPS 28 x T"
PP 762 x T	NPS 30 x T"
PP 813 x T	NPS 32 x T"
PP 864 x T	NPS 34 x T"
PP 914 x T	NPS 36 x T"
PP 965 x T	NPS 38 x T"
PP 1016 x T	NPS 40 x T"
PP 1067 x T	NPS 42 x T"
PP 1118 x T	NPS 44 x T"
PP 1219 x T	NPS 48 x T"
PP 1524 x T	NPS 60 x T"

The thickness in millimeters (T) represents an exact conversion of the thickness in inches (T").

SUBSTITUTION TABLE FOR STRUCTURAL TIMBER AND LUMBER

METRIC MINIMUM DRESSED DRY, SHOWN ON THE PLANS mm x mm	METRIC MINIMUM DRESSED GREEN, SHOWN ON THE PLANS mm x mm	NOMINAL SIZE TO BE SUBSTITUTED inch x inch
19x89	20x90	1x4
38x89	40x90	2x4
64x89	65x90	3x4
89x89	90x90	4x4
140x140	143x143	6x6
140x184	143x190	6x8
184x184	190x190	8x8
235x235	241x241	10x10
286x286	292x292	12x12

SUBSTITUTION TABLE FOR NAILS AND SPIKES

METRIC COMMON NAIL, SHOWN ON THE PLANS Length, mm Diameter, mm	METRIC BOX NAIL, SHOWN ON THE PLANS Length, mm Diameter, mm	METRIC SPIKE, SHOWN ON THE PLANS Length, mm Diameter, mm	SIZE TO BE SUBSTITUTED Penny-weight
50.80 2.87	50.80 2.51	_____	6d
63.50 3.33	63.50 2.87	_____	8d
76.20 3.76	76.20 3.25	76.20 4.88	10d
82.55 3.76	82.55 3.25	82.55 4.88	12d
88.90 4.11	88.90 3.43	88.90 5.26	16d
101.60 4.88	101.60 3.76	101.60 5.72	20d
114.30 5.26	114.30 3.76	114.30 6.20	30d
127.00 5.72	127.00 4.11	127.00 6.68	40d
_____	_____	139.70 7.19	50d
_____	_____	152.40 7.19	60d

SUBSTITUTION TABLE FOR IRRIGATION COMPONENTS

METRIC WATER METERS, TRUCK LOADING STANDPIPES, VALVES, BACKFLOW PREVENTERS, FLOW SENSORS, WYE STRAINERS, FILTER ASSEMBLY UNITS, PIPE SUPPLY LINES, AND PIPE IRRIGATION SUPPLY LINES SHOWN ON THE PLANS DIAMETER NOMINAL (DN) mm	NOMINAL SIZE TO BE SUBSTITUTED inch
15	1/2
20	3/4
25	1
32	1-1/4
40	1-1/2
50	2
65	2-1/2
75	3
100	4
150	6
200	8
250	10
300	12
350	14
400	16

Unless otherwise specified, substitutions of United States Standard Measures standard structural shapes corresponding to the metric designations shown on the plans and in conformance with the requirements in ASTM Designation: A 6/A 6M, Annex 2, will be allowed.

8-1.02 PREQUALIFIED AND TESTED SIGNING AND DELINEATION MATERIALS

The Department maintains the following list of Prequalified and Tested Signing and Delineation Materials. The Engineer shall not be precluded from sampling and testing products on the list of Prequalified and Tested Signing and Delineation Materials.

The manufacturer of products on the list of Prequalified and Tested Signing and Delineation Materials shall furnish the Engineer a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for each type of traffic product supplied.

For those categories of materials included in the list of Prequalified and Tested Signing and Delineation Materials, only those products shown within the listing may be used in the work. Other categories of products, not included in the list of Prequalified and Tested Signing and Delineation Materials, may be used in the work provided they conform to the requirements of the Standard Specifications.

Materials and products may be added to the list of Prequalified and Tested Signing and Delineation Materials if the manufacturer submits a New Product Information Form to the New Product Coordinator at the Transportation Laboratory. Upon a Departmental request for samples, sufficient samples shall be submitted to permit performance of required tests. Approval of materials or products will depend upon compliance with the specifications and tests the Department may elect to perform.

PAVEMENT MARKERS, PERMANENT TYPE
Retroreflective With Abrasion Resistant Surface (ARS)

A. Apex, Model 921AR (100 mm x 100 mm)
B. Ray-O-Lite, Model "AA" ARS (100 mm x 100 mm)

C. Stimsonite, Models 911 (100 mm x 100 mm) and 953 (70 mm x 114 mm)
D. 3M Series 290 (89 mm x 100 mm)

Retroreflective With Abrasion Resistant Surface (ARS)

(Used for recessed applications)

A. Stimsonite, Model 948 (58 mm x 119 mm)
B. Ray-O-Lite, Model 2002 (58 mm x 117 mm)
C. Stimsonite, Model 944SB (51 mm x 100 mm)
D. Ray-O-Lite, Model 2004 ARS (51 mm x 100 mm)*
*For use only in 114 mm wide (older) recessed slots

Non-Reflective For Use With Epoxy Adhesive, 100 mm Round

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

Non-Reflective For Use With Bitumen Adhesive, 100 mm Round

A. Alpine Products, "D-Dot" and "ANR" (ABS)
B. Apex Universal (Ceramic)
C. Apex Universal, Models 929 (ABS) and 929PP (Polypropylene)
D. Elgin Molded Plastics, "Empco-Lite" Model 900 (ABS)
E. Highway Ceramics, Inc. (Ceramic)
F. Hi-Way Safety, Inc., Models P20-2000W and 2001Y (ABS)
G. Interstate Sales, "Diamond Back" (ABS) and (Polypropylene)
H. Novabrite Models Adot-w (White) Adot-y (Yellow), (ABS)
I. Road Creations, Model RCB4NR (Acrylic)
J. Zumar Industries, "Titan TM40A" (ABS)

PAVEMENT MARKERS, TEMPORARY TYPE

Temporary Markers For Long Term Day/Night Use (6 months or less)

A. Apex Universal, Model 924 (100 mm x 100 mm)
B. Elgin Molded Plastics, "Empco-Lite" Model 901 (100 mm x 100 mm)
C. Road Creations, Model R41C (100 mm x 100 mm)
D. Vega Molded Products "Temporary Road Marker" (75 mm x 100 mm)

Temporary Markers For Short Term Day/Night Use (14 days or less)

(For seal coat or chip seal applications, clear protective covers are required)

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

STRIPING AND PAVEMENT MARKING MATERIAL

Permanent Traffic Striping and Pavement Marking Tape

A. Advanced Traffic Marking, Series 300 and 400
B. Brite-Line, Series 1000
C. Brite-Line, "DeltaLine XRP"
D. Swarco Industries, "Director 35" (For transverse application only)
E. Swarco Industries, "Director 60"
F. 3M, "Stamark" Series 380 and 5730
G. 3M, "Stamark" Series 420 (For transverse application only)

Temporary (Removable) Striping and Pavement Marking Tape (6 months or less)

A. Advanced Traffic Marking, Series 200
B. Brite-Line, Series 100
C. P.B. Laminations, Aztec, Grade 102
D. Swarco Industries, "Director-2"
E. Trelleborg Industri, R140 Series
F. 3M, Series 620 and Series A750

G. 3M, Series A145, Removable Black Line Mask
(Black Tape: for use only on Asphalt Concrete Surfaces)
H. Advanced Traffic Marking Black "Hide-A-Line"
(Black Tape: for use only on Asphalt Concrete Surfaces)
I. Brite-Line "BTR" Black Removable Tape
(Black Tape: for use only on Asphalt Concrete Surfaces)
J. Trelleborg Industri, RB-140
(Black Tape: for use only on Asphalt Concrete Surfaces)

Preformed Thermoplastic (Heated in place)

A. Flint Trading, "Premark" and "Premark 20/20 Flex"
B. Avery Dennison, "Hotape"

Removable Traffic Paint

A. Belpro, Series 250/252 and No. 93 Remover

Ceramic Surfacing Laminate, 150 mm x 150 mm

A. Safeline Industries/Highway Ceramics, Inc.

CLASS 1 DELINEATORS

One Piece Driveable Flexible Type, 1700 mm

A. Carsonite, Curve-Flex CFRM-400
B. Carsonite, Roadmarker CRM-375
C. Bunzl (Formerly Davidson Plastics), "Flexi-Guide Models 400 and 566"
D. FlexStake, Model 654 TM
E. GreenLine Models HWD1-66 and CGD1-66
F. J. Miller Industries, Model JMI-375 (with soil anchor)

Special Use Flexible Type, 1700 mm

A. Carsonite, "Survivor" (with 450 mm U-Channel base)
B. FlexStake, Model 604
C. GreenLine Models HWD and CGD (with 450 mm U-Channel base)
D. Safe-Hit with 200 mm pavement anchor (SH248-GP1)
E. Safe-Hit with 380 mm soil anchor (SH248-GP2) and with 450 mm soil anchor (SH248-GP3)

Surface Mount Flexible Type, 1200 mm

A. Bent Manufacturing Company, Masterflex Model MF-180EX-48
B. Carsonite, "Super Duck II"
C. FlexStake, Surface Mount, Models 704 and 754 TM

CHANNELIZERS

Surface Mount Type, 900 mm

A. Bent Manufacturing Company, Masterflex Models MF-360-36 (Round) and MF-180-36 (Flat)
B. Carsonite, "Super Duck" (Flat SDF-436, Round SDR-336)
C. Carsonite, "Super Duck II" Model SDCF203601MB "The Channelizer"
D. Bunzl (Formerly Davidson Plastics), Flex-Guide Models FG300LD and FG300UR
E. FlexStake, Surface Mount, Models 703 and 753 TM
F. GreenLine, Model SMD-36
G. Hi-Way Safety, Inc. "Channel Guide Channelizer" Model CGC36
H. The Line Connection, "Dura-Post" Model DP36-3 (Permanent)
I. The Line Connection, "Dura-Post" Model DP36-3C (Temporary)
J. Repo, Models 300 and 400
K. Safe-Hit, Guide Post, Model SH236SMA

CONICAL DELINEATORS, 1070 mm

(For 700 mm Traffic Cones, see Standard Specifications)
A. Bent Manufacturing Company "T-Top"

B. Plastic Safety Systems "Navigator-42"
C. Radiator Specialty Company "Enforcer"
D. Roadmaker Company "Stacker"
E. TrafFix Devices "Grabber"

OBJECT MARKERS

Type "K", 450 mm

A. Carsonite, Model SMD 615
B. FlexStake, Model 701 KM
C. Repo, Models 300 and 400
D. Safe-Hit, Model SH718SMA
E. The Line Connection, Model DP21-4K

Type "K-4" / "Q" Object Markers, 600 mm

A. Bent Manufacturing "Masterflex" Model MF-360-24
B. Carsonite, Super Duck II
C. FlexStake, Model 701KM
D. Repo, Models 300 and 400
E. Safe-Hit, Models SH8 24SMA_WA and SH8 24GP3_WA
F. The Line Connection, Model DP21-4Q

TEMPORARY RAILING (TYPE K) REFLECTORS AND CONCRETE BARRIER MARKERS

Impactable Type

A. ARTUK, "FB"
B. Bunzl (Formerly Davidson Plastics), Model PCBM-12
C. Duraflex Corp., "Flexx 2020" and "Electriflexx"
D. Hi-Way Safety, Inc., Model GMKRM100

Non-Impactable Type

A. ARTUK, JD Series
B. Stimsonite, Model 967 (with 83 mm Acrylic cube corner reflector)
C. Stimsonite, Model 967LS
D. Vega Molded Products, Models GBM and JD

THRIE BEAM BARRIER MARKERS

(For use to the left of traffic)
A. Duraflex Corp., "Railrider"
B. Bunzl (Formerly Davidson Plastics), "Mini" (75 mm x 254 mm)

CONCRETE BARRIER DELINEATORS, 400 mm

(For use to the right of traffic. When mounted on top of barrier, place top of reflective element at 1200 mm)
A. Bunzl (Formerly Davidson Plastics), Model PCBM T-16
B. Safe-Hit, Model SH216RBM
C. Sun-Lab Technology, "Safety Guide Light, Model TM," 130 mm x 130 mm x 80 mm

CONCRETE BARRIER-MOUNTED MINI-DRUM (260 mm x 360 mm x 570 mm)

A. Stinson Equipment Company "SaddleMarker"

SOUND WALL DELINEATOR

(Applied vertically. Place top of 75 mm x 300 mm reflective element at 1200 mm above roadway)
A. Bunzl (Formerly Davidson Plastics), PCBM S-36
B. Sun-Lab Technology, "Safety Guide Light, Model SM12," 130 mm x 130 mm x 80 mm

GUARD RAILING DELINEATOR

(Place top of reflective element at 1200 mm above plane of roadway)

Wood Post Type, 686 mm

A. Carsonite, Model 427
B. Bunzl (Formerly Davidson Plastics), FG 427 and FG 527
C. FlexStake, Model 102 GR
D. GreenLine GRD 27
E. J.Miller Model JMI-375G
F. Safe-Hit, Model SH227GRD

Steel Post Type

A. Carsonite, Model CFGR-327 with CFGRBK300 Mounting Bracket

RETROREFLECTIVE SHEETING

Channelizers, Barrier Markers, and Delineators

A. 3M, High Intensity
B. Reflexite, PC-1000 Metalized Polycarbonate
C. Reflexite, AC-1000 Acrylic
D. Reflexite, AP-1000 Metalized Polyester
E. Reflexite, Conformalight, AR-1000 Abrasion Resistant Coating
F. Avery Dennison T-6500 Series (Formerly Stimsonite, Series 6200) (For rigid substrate devices only)
G. Nippon Carbide, Flexible Ultralite Grade (ULG) II

Traffic Cones, 330 mm Sleeves

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

Traffic Cones, 100 mm and 150 mm Sleeves

A. 3M Series 3840
B. Reflexite Vinyl, "TR" (Semi-transparent) or "Conformalight"
C. Nippon Carbide, Flexible Ultralite Grade (ULG) II

Barrels and Drums

A. Reflexite, “Conformalight”, "Super High Intensity" or "High Impact Drum Sheeting"
B. 3M Series 3810
C. Nippon Carbide, Flexible Ultralite Grade (ULG) II
D. Avery Dennison W-6100

Barricades: Type I, Engineer Grade

A. American Decal, Adcolite
B. Avery Dennison, T-1500 and T-1600 series
C. 3M, Engineer Grade, Series 3170

Barricades: Type II, Super Engineer Grade

A. Avery Dennison, T-2500 Series
B. Kiwalite Type II
C. Nikkalite 1800 Series

Signs: Type II, Super Engineer Grade

A. Avery Dennison, T-2500 Series
B. Kiwalite, Type II
C. Nikkalite 1800 Series

Signs: Type III, High-Intensity Grade

A. 3M Series 3800
B. Nippon Carbide, Nikkalite Brand Ultralite Grade II

Signs: Type IV, High-Intensity Prismatic Grade

A. Avery Dennison T-6500 (Formerly Stimsonite Series 6200)

Signs: Type VII, High-Intensity Prismatic Grade

A. 3M Series 3900

Signs: Type VI, Roll-Up Signs

A. Reflexite, Vinyl (Orange)
B. Reflexite "SuperBright" (Fluorescent orange)
C. Reflexite "Marathon" (Fluorescent orange)
D. 3M Series RS34 (Orange) and RS20 (Fluorescent orange)

SPECIALTY SIGN (All Plastic)

A. All Sign Products, STOP Sign, 750 mm

SIGN SUBSTRATE FOR CONSTRUCTION AREA SIGNS

Aluminum

Fiberglass Reinforced Plastic (FRP)

A. Sequentia, "Polyplate"
B. Fiber-Brite

8-1.03 STATE-FURNISHED MATERIALS

Attention is directed to Section 6-1.02, "State-Furnished Materials," of the Standard Specifications and these special provisions.

The following materials will be furnished to the Contractor:

Private telephone switchboard
Intercom system for lobby transaction
Closed circuit television system for lobby transaction
Padlocks for backflow preventer assembly enclosure and irrigation controller enclosure cabinets
ATCAS equipment
Military type connectors for ATCAS equipment

ATCAS equipment will include the following:

1. Canopy devices.
2. Computer room devices
3. Toll booth terminal devices.
4. Lane devices.
5. Video transmitter data multiplexer (VTDM) network system devices.
6. Asynchronous communication devices.
7. Toll operations devices.
8. California Highway Patrol (CHP) devices

Canopy devices will include the following:

17 each patch (flat panel) antenna receiver (RX).
17 each patch (flat panel) antenna transceiver assembly
17 each yagi antenna
17 each video detection system (VDS) light and louver assembly
17 each VDS color camera/housing assembly
17 each VDS Black and white camera/housing assembly

Computer room devices will include the following:

9 each cabinets
19 each lane controllers (LCR) (two back up)
1 each computer
1 each VNS server

1 each monitor
2 each keyboard
2 each SCSI hard drive
1 each CSU/DSU (modem)
1 each VDS light relay panel
1 each VNS (Violation network server)
1 each VIP (Video image processor)
6 each VIC (Video image controller)
17 each CCP (Camera control processor)
1 each opto isolator board
6 each power supply
1 each tape drive
1 each AB switch
1 each ethernet adaptor and hub
1 each digital library
1 each plaza server
2 each fiber optic patch panel
1 each CHP optical converter

Toll booth devices will include the following:

17 each ergonomic mount and equipment
17 each control consoles “A” cabinet
17 each magnetic stripe card reader
17 each receipt printer and enclosure
17 each touch screen monitor

Lane devices will include the following:

17 each patron toll displays.
68 each light curtains with light curtain control cables.
17 each treadle frames, detectors and sensors with axle detector treadle cables.

Video transmitter data multiplexer (VTDM) network system devices will include the following:

5 each color camera with environmental enclosure and VTDM cable assemblies.
1 each video switcher.
1 each VTDM computer.
1 each VTDM monitor (305 mm).
1 each playback monitor.
1 each playback VCR.
5 each high fidelity VCR.
2 each basic rack assembly.
1 each VTDM computer stand.
System interconnect cables.

Asynchronous communication devices will include the following:

2 each servers.
2 each repeaters.

Toll operations devices will include the following:

1 each system printer.
5 each personal computers (PC).
5 each color monitor (355 mm).
4 each printers.
1 each plotter.

CHP devices will include the following:

1 each CHP antenna with CHP cable assembly.

The Contractor shall notify the Engineer not less than 48 hours before the State-furnished ATCAS equipment and military type connectors are to be picked up. The State-furnished ATCAS equipment and military type connectors will be made available to the Contractor at the San Francisco Oakland Bay Bridge Warehouse between 0800 hours and 1500 hours, Monday through Friday, excluding holidays.

8-1.04 MISCELLANEOUS METAL

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

Material	Specification
Steel bars, plates and shapes	ASTM Designation: A 36/A 36M or A 575, A 576 (AISI or M Grades 1016 through 1030 except Grade 1017)
Steel fastener components for general applications:	
Bolts and studs	ASTM Designation: A 307
Headed anchor bolts	ASTM Designation: A 307, Grade B, including S1 supplementary requirements
Nonheaded anchor bolts	ASTM Designation: A 307, Grade C, including S1 supplementary requirements and S1.6 of AASHTO Designation: M 314 supplementary requirements or AASHTO Designation: M 314, Grade 36 or 55, including S1 supplementary requirements
High-strength bolts and studs, threaded rods, and nonheaded anchor bolts	ASTM Designation: A 449, Type 1
Nuts	ASTM Designation: A 563, including Appendix X1*
Washers	ASTM Designation: F 844
Components of high-strength steel fastener assemblies for use in structural steel joints:	
Bolts	ASTM Designation: A 325, Type 1
Tension control bolts	ASTM Designation: F 1852, Type 1
Nuts	ASTM Designation: A 563, including Appendix X1*
Hardened washers	ASTM Designation: F 436, Type 1, Circular, including S1 supplementary requirements
Direct tension indicators	ASTM Designation: F 959, Type 325, zinc-coated
Stainless steel fasteners (Alloys 304 & 316) for general applications:	
Bolts, screws, studs, threaded rods, and nonheaded anchor bolts	ASTM Designation: F 593 or F 738M
Nuts	ASTM Designation: F 594 or F 836M
Washers	ASTM Designation: A 240/A 240M and ANSI B 18.22M
Carbon-steel castings	ASTM Designation: A 27/A 27M, Grade 65-35 [450-240], Class 1
Malleable iron castings	ASTM Designation: A 47, Grade 32510 or A 47M, Grade 22010
Gray iron castings	ASTM Designation: A 48, Class 30B
Ductile iron castings	ASTM Designation: A 536, Grade 65-45-12
Cast iron pipe	Commercial quality
Steel pipe	Commercial quality, welded or extruded
Other parts for general applications	Commercial quality

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

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

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

* Maximum stud diameter permitted for mechanical expansion anchors.

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

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

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

Installation Torque Values, (newton meters)

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

SECTION 8-2. CONCRETE

8-2.01 PORTLAND CEMENT CONCRETE

Portland cement concrete shall conform to the provisions in Section 90, "Portland Cement Concrete," of the Standard Specifications and these special provisions.

References to Section 90-2.01, "Portland Cement," of the Standard Specifications shall mean Section 90-2.01, "Cement," of the Standard Specifications.

Mineral admixture shall be combined with cement in conformance with the provisions in Section 90-4.08, "Required Use of Mineral Admixtures," of the Standard Specifications for the concrete materials specified in Section 56-2, "Roadside Signs," of the Standard Specifications.

The requirements of Section 90-4.08, "Required Use of Mineral Admixture," of the Standard Specifications shall not apply to Section 19-3.025C, "Soil Cement Bedding," of the Standard Specifications.

The Department maintains a list of sources of fine and coarse aggregate that have been approved for use with a reduced amount of mineral admixture in the total amount of cementitious material to be used. A source of aggregate will be considered for addition to the approved list if the producer of the aggregate submits to the Transportation Laboratory certified test results from a qualified testing laboratory that verify the aggregate complies with the requirements. Prior to starting the testing, the aggregate test shall be registered with the Department. A registration number can be obtained by calling (916) 227-7228. The registration number shall be used as the identification for the aggregate sample in correspondence with the Department. Upon request, a split of the tested sample shall be provided to the Department. Approval of aggregate will depend upon compliance with the specifications, based on the certified test results submitted, together with any replicate testing the Department may elect to perform. Approval will expire 3 years from the date the most recent registered and evaluated sample was collected from the aggregate source.

Qualified testing laboratories shall conform to the following requirements:

A. Laboratories performing ASTM Designation: C 1293 shall participate in the Cement and Concrete Reference Laboratory (CCRL) Concrete Proficiency Sample Program and shall have received a score of 3 or better on all tests of the previous 2 sets of concrete samples.
B. Laboratories performing ASTM Designation: C 1260 shall participate in the Cement and Concrete Reference Laboratory (CCRL) Pozzolan Proficiency Sample Program and shall have received a score of 3 or better on the shrinkage and soundness tests of the previous 2 sets of pozzolan samples.

Aggregates on the list shall conform to one of the following requirements:

A. When the aggregate is tested in conformance with the requirements in California Test 554 and ASTM Designation: C 1293, the average expansion at one year shall be less than or equal to 0.040 percent; or
B. When the aggregate is tested in conformance with the requirements in California Test 554 and ASTM Designation: C 1260, the average of the expansion at 16 days shall be less than or equal to 0.15 percent.

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

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

    1. When the calcium oxide content of a mineral admixture is equal to or less than 2 percent by mass, the amount of mineral admixture shall not be less than 15 percent by mass of the total amount of cementitious material to be used in the mix.
    2. When the calcium oxide content of a mineral admixture is greater than 2 percent by mass, and any of the aggregates used are not listed on the approved list as specified in these special provisions, then the amount of mineral admixture shall not be less than 25 percent by mass of the total amount of cementitious material to be used in the mix.
    3. When the calcium oxide content of a mineral admixture is greater than 2 percent by mass and the fine and coarse aggregates are listed on the approved list as specified in these special provisions, then the amount of mineral admixture shall not be less than 15 percent by mass of the total amount of cementitious material to be used in the mix.
    4. When a mineral admixture that conforms to the provisions for silica fume in Section 90-2.04, "Admixture Materials," of the Standard Specifications is used, the amount of mineral admixture shall not be less than 10 percent by mass of the total amount of cementitious material to be used in the mix.
    5. When a mineral admixture that conforms to the provisions for silica fume in Section 90-2.04, "Admixture Materials," of the Standard Specifications is used and the fine and coarse aggregates are listed on the approved list as specified in these special provisions, then the amount of mineral admixture shall not be less than 7 percent by mass of the total amount of cementitious material to be used in the mix.

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

SECTION 8-3. (BLANK)

SECTION 9. (BLANK)

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.

The Contractor shall not use the existing at-grade railroad crossing at Mococo Road and Marina Vista Road to access the job site. The Contractor shall use the relocated at-grade railroad crossing at Mococo Road/Fairview Gate and Marina Vista Road to access the job site. This relocated at-grade crossing is being constructed under Contract 04-006034. The relocated crossing is located approximately 70 meters east of the existing crossing.

Some plants required for this project may not be readily available and may have to be grown specifically for this project. Within 30 days after the contract has been approved, the Contractor shall furnish the Engineer a statement from the vendor that the order for the plants to be grown for this contract, including inspection plants and replacement plants, has been received and accepted by the vendor. The statement from the vendor shall include the names, sizes, and quantities of plants ordered and the anticipated dates of delivery. The Contractor shall notify the Engineer, in writing, when the vendor has started to grow the plants.

Not less than 60 days prior to planting the plants, the Contractor shall furnish the Engineer a statement from the vendor that the order for the plants required for this contract, including inspection plants, has been received and accepted by the vendor. The statement from the vendor shall include the names, sizes, and quantities of plants ordered and the anticipated date of delivery.

The Contractor shall place orders for replacement plants with the vendor at the appropriate time so that the roots of the replacement plants are not in a root-bound condition.

Attention is directed to "Irrigation Systems Functional Test" of these special provisions, regarding restrictions for planting operations.

Attention is directed to "Locate Existing Crossovers and Conduits" of these special provisions regarding locating existing irrigation water line crossovers and conduits shown on the plans to be incorporated in the new work. Existing irrigation water line crossovers and conduits shall be located prior to performing work on the irrigation system.

Unless otherwise shown on the plans or specified in these special provisions, conduits to be jacked or drilled or installed by the open trench method for water line crossovers and sprinkler control crossovers shall be installed prior to the installation of other pipe supply lines.

Attention is directed to "Relocate Boulders" of these special provisions regarding transporting and placing existing landscape boulders.

Clearing, grubbing, and earthwork operations shall not be performed in areas where existing irrigation facilities are to remain in place until existing irrigation facilities have been checked for proper operation in conformance with the provisions in "Highway Planting and Irrigation Systems" of these special provisions.

Attention is directed to Section 20-5.027B, "Wiring Plans and Diagrams," of the Standard Specifications regarding submittal of working drawings.

Attention is directed to "Irrigation Controller Enclosure Cabinet" of these special provisions regarding preinstalling irrigation components in the irrigation controller enclosure cabinets prior to field installation.

10-1.02 WATER POLLUTION CONTROL

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

Water pollution control work shall conform to the requirements in the "Storm Water Pollution Prevention Plan (SWPPP) and Water Pollution Control Program (WPCP) Preparation Manual" and the "Construction Site Best Management Practices (BMPs) Manual," and addenda thereto issued up to, and including, the date of advertisement of the project, hereafter referred to respectively as the "Preparation Manual" and the "Construction Site BMP Manual" and collectively as the "Manuals." Copies of the Manuals may be obtained from the Department of Transportation, Material Operations Branch, Publication Distribution Unit, 1900 Royal Oaks Drive, Sacramento, California 95815, Telephone: (916) 445-3520. Copies of the

Manuals may also be obtained from the Department's Internet Web Site at: http://www.dot.ca.gov/hq/construc/stormwater.html.

Copies of the Manuals are also available for review at 111 Grand Avenue, Oakland, California 94612. Contact the Toll Bridge Duty Senior, Telephone: (510) 286-5549 to reserve a copy at least 24 hours in advance.

The Contractor shall know and fully comply with the applicable provisions of the Manuals 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.

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 whatsoever to the Contractor or property owner 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 liabilities 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 Manuals 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 the remedies authorized by law, an amount of the money due the Contractor under the contract, as determined 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:

A. The Department will give the Contractor 30 days notice of the Department's intention to retain funds from partial payments which may become due to the Contractor prior to acceptance of the contract. Retention of funds from payments made after acceptance of the contract may be made without prior notice to the Contractor.
B. No retention of additional amounts out of partial payments will be made if the amount to be retained does not exceed the amount being withheld from partial payments pursuant to Section 9-1.06, "Partial Payments," of the Standard Specifications.
C. If the Department has retained funds and it is subsequently determined that the State is not subject to the costs and liabilities in connection with the matter for which the retention was made, the Department shall be liable for interest on the amount retained at the legal rate of interest for the period of the retention.

Conformance with the provisions in this section "Water Pollution Control" shall not relieve the Contractor from the Contractor's responsibilities as provided in Section 7, "Legal Relations and Responsibilities," of the Standard Specifications.

WATER POLLUTION CONTROL PROGRAM PREPARATION, APPROVAL AND UPDATES

As part of the water pollution control work, a Water Pollution Control Program, hereafter referred to as the "WPCP," is required for this contract. The WPCP shall conform to the provisions in Section 7-1.01G, "Water Pollution," of the Standard Specifications, the requirements in the Manuals, and these special provisions.

No work having potential to cause water pollution, as determined by the Engineer, shall be performed until the WPCP has been approved by the Engineer.

Within 30 days after the approval of the contract, the Contractor shall submit 3 copies of the WPCP to the Engineer. The Engineer will have 10 days to review the WPCP. If revisions are required, as determined by the Engineer, the Contractor shall revise and resubmit the WPCP within 10 days of receipt of the Engineer's comments. The Engineer will have 10 days to review the revisions. Upon the Engineer's approval of the WPCP, 3 additional copies of the WPCP incorporating the required changes shall be submitted to the Engineer. Minor changes or clarifications to the initial submittal may be made and attached as amendments to the WPCP. In order to allow construction activities to proceed, the Engineer may conditionally approve the WPCP while minor revisions or amendments are being completed.

The WPCP shall identify pollution sources that may adversely affect the quality of storm water discharges associated with the project and shall identify water pollution control measures, hereafter referred to as control measures, to be constructed, implemented, and maintained in order to reduce to the extent feasible pollutants in storm water discharges from the construction site during construction under this contract.

The WPCP shall incorporate control measures in the following categories:

A. Soil stabilization;
B. Sediment control;
C. Tracking control;
D. Wind erosion control;

E. Non-storm water control; and
F. Waste management and material pollution control.

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

The Contractor shall consider the objectives and minimum requirements presented in the Preparation Manual for each of the above categories. The special minimum requirements listed below supersede the minimum requirements listed in the Preparation Manual for the same category. When minimum requirements are listed for any category, the Contractor shall incorporate into the WPCP, 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 Preparation Manual and shall incorporate into the WPCP and implement on the project the control measures necessary to meet the objectives of the WPCP. The Contractor shall document the selection process in conformance with the procedure specified in the Preparation Manual. The following special minimum requirements are established:

Category	Minimum Requirement(s)
Tracking Control Practices	TC-1 Stabilized Construction Roadway
Non-Storm Water Control	NS-2 Dewatering Operations NS-3 Paving and Grinding Operations
Waste Management & Materials Pollution Control	WM-6 Hazardous Waste Management

The following contract items of work shall be incorporated into the WPCP as critical temporary control measures: Temporary Concrete Washout Facility and Temporary Entrance/Exit. The Contractor shall consider other control measures to supplement these critical temporary control measures when necessary to meet the pollution control objectives of the WPCP.

The WPCP shall include, but not be limited to, the following items as described in the Preparation Manual:

A. Project description and Contractor's certification;
B. Project information;
C. Pollution sources, control measures, and water pollution control drawings; and
D. Amendments, if any.

The Contractor shall amend the WPCP, 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 WPCP shall be amended if the WPCP has not 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 WPCP, which are required on the project to control water pollution effectively. Amendments to the WPCP shall be submitted for review and approval by the Engineer in the same manner specified for the initially approved WPCP. Amendments shall be dated and attached to the on-site WPCP document.

The Contractor shall keep a copy of the WPCP, together with updates, revisions and amendments at the project site.

WPCP IMPLEMENTATION

Upon approval of the WPCP, the Contractor shall be responsible throughout the duration of the project for installing, constructing, inspecting, and maintaining the control measures included in the WPCP 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 WPCP implementation shall continue throughout any temporary suspension of work ordered in conformance with the provisions in Section 8-1.05, "Temporary Suspension of Work," of the Standard Specifications. Requirements for installation, construction, inspection, maintenance, removal, and disposal of control measures are specified in the Manuals and these special provisions.

Soil stabilization practices and sediment control measures, including minimum requirements, shall be provided throughout the rainy season, defined as between October 1st and May 1st.

Implementation of soil stabilization practices and sediment control measures for soil-disturbed areas on the project site shall be completed, except as provided for below, not later than 20 days prior to the beginning of the rainy season or upon start of applicable construction activities for projects which begin either during or within 20 days of the rainy season.

Throughout the rainy season, the active, soil-disturbed area of the project site shall be not more than 1.9 hectares. 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 on the project site before the onset of precipitation. A quantity of soil stabilization and sediment control materials shall be maintained on site equal to 125 percent of that sufficient to protect unprotected, soil-disturbed areas on the project site. A detailed plan for the mobilization of sufficient labor and equipment shall be maintained to fully deploy control measures required to protect unprotected, soil-disturbed areas on the project site prior to the onset of precipitation. A current inventory of control measure materials and the detailed mobilization plan shall be included as part of the WPCP.

Throughout the rainy season, soil-disturbed areas on the project site shall be considered to be nonactive whenever soil disturbing activities are expected to be discontinued for a period of 20 or more days and the areas are fully protected. Areas that will become nonactive either during the rainy 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 rainy 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. 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 functioning control measures shall be deployed 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 WPCP for tracking control, wind erosion control, non-storm water control, and waste management and material pollution control.

The Engineer may order the suspension of construction operations which create water pollution if the Contractor fails to conform to the provisions in 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 WPCP. The Contractor shall identify corrective actions and time needed to address any deficient measures or reinitiate any measures that have been discontinued.

The construction site inspection checklist provided in the Preparation Manual shall be used to ensure that the necessary measures are being properly implemented, and to ensure that the control measures are functioning adequately. One copy of each site inspection record shall be submitted to the Engineer.

During the rainy season, inspections of the construction site shall be conducted by the Contractor to identify deficient measures, as follows:

A. Prior to a forecast storm;
B. After all precipitation which causes runoff capable of carrying sediment from the construction site;
C. At 24-hour intervals during extended precipitation events; and
D. Routinely, at a minimum of once every 2 weeks.

If the Contractor or the Engineer identifies a deficiency in the deployment or functioning of an identified control measure, the deficiency shall be corrected immediately. The deficiency may be corrected at 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

Full compensation for conforming to the provisions in 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.

Those control measures for which there is a contract item of work will be measured and paid for as that contract 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 provisions in this section "Water Pollution Control" as determined by the Engineer.

Retentions for failure to conform to the provisions in 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 provisions in this section will be released for payment on the next monthly estimate for partial payment following the date that a WPCP has been implemented and maintained and water pollution is adequately controlled, as determined by the Engineer.

10-1.03 DAMAGE REPAIR

Attention is directed to Section 7-1.16, "Contractor's Responsibility for the Work and Materials," and Section 7-1.165, "Damage by Storm, Flood, Tsunami or Earthquake," of the Standard Specifications and these special provisions.

When as a result of freezing conditions (as defined herein) during the plant establishment period, plants have died or, in the opinion of the Engineer, have deteriorated to a point beyond which the plants will not mature as typical examples of their species, the Engineer may direct replacement of the affected plants. The total cost of ordered plant replacement work will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications. A freezing condition, for the purpose of this specification, occurs when the temperature at or near the affected area has been officially recorded below 0°C and plants have been killed or damaged to the degree described above.

When, as a result of drought conditions (as defined herein) during the plant establishment period, plants have died or, in the opinion of the Engineer, have deteriorated to a point beyond which the plants will not mature as typical examples of their species, the Engineer may direct replacement of the affected plants. The total cost of ordered plant replacements, after water has been restricted or stopped, will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications. Restriction or shutoff of available water shall not relieve the Contractor from performing other contract work. A drought condition occurs when the Department, or its supplier, restricts or stops delivery of water to the Contractor to the degree that plants have died or deteriorated as described above.

When the provisions in Section 7-1.165, "Damage by Storm, Flood, Tsunami or Earthquake," of the Standard Specifications are applicable, the provisions above for payment of costs for repair of damage due to rain, freezing conditions and drought shall not apply.

10-1.04 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 conformance with the provisions in Section 7-1.15, "Relief From Maintenance and Responsibility," of the Standard Specifications.

10-1.05 COOPERATION

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

It is anticipated that following works by other contractors may be in progress adjacent to or within the limits of this project during progress of the work on this contract.

1. Contract No. 04-006034 --Construct Benicia/Martinez Bridge in Martinez and Benicia on Route 680 from 1.1 km north of Mococo to 1.0 km north of Contra Costa/Solano line (KP L1.0 to KP 40.1).
2. Contract No. 04-006064 --Modify Interstate 680/Interstate 780 Interchange in Benicia and Martinez on Route 680/780 from Mococo Overhead to Bayshore Road (680)/East Fifth Street (780) (KP L1.0/R1.3 to KP L1.1/R 5.3).
3. Contract No. 04-00654 --Modify Route 680/Marina Vista Road Interchange in and near Martinez on Route 680 from 0.5 km South of Mococo Overhead to Benicia-Martinez Bridge and Overhead (KP 38.5 to Kp 40.1).

The Contractor shall permit the 04-006054 contractor unimpeded access to Abutment 9 and the temporary ramp, via the Toll Plaza Access Road (PK-Line) and the Southern Parking lot.

The Contractor shall permit the 04-006064 contractor unimpeded access to south abutment of new Benicia/Martinez bridge via the Toll Plaza Access Road (PK-Line) and Northern Parking Lot.

10-1.06 PROGRESS SCHEDULE (CRITICAL PATH)

Progress schedules will be required for this contract. Progress schedules shall utilize the Critical Path Method (CPM). Attention is directed to the provisions in "COOPERATION," and "OBSTRUCTIONS" of section 10 of these special provisions. Nothing in these special provisions shall be construed as relieving the Contractor from the responsibilities specified in Section 7, "Legal Relations and Responsibility," of the Standard Specifications.

DEFINITIONS

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

A. Activity: Any task, or portion of a project, which takes time to complete.
B. Baseline Schedule: The initial CPM schedule representing the Contractor's original work plan, as accepted by the Engineer.
C. Controlling Operation: The activity considered at the time by the Engineer, within that series of activities defined as the critical path, which if delayed or prolonged, will delay the time of completion of the contract.

D. Critical Path: The series of activities, which determines the earliest completion of the contract (Forecast Completion Date). This is the longest path of activities having the least amount of float.
E. Critical Path Method: A mathematical calculation to determine the earliest completion of the contract represented by a graphic representation of the sequence of activities that shows the interrelationships and interdependencies of the elements composing a project.
F. 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.
G. Early Completion Time: The difference in time between the current contract completion date and the Contractor's scheduled early forecast completion date as shown on the accepted baseline schedule, or schedule updates and revisions.
H. Float: The amount of time between the early start date and the late start date, or the early finish date and the late finish date, of any activity or group of activities in the network.
I. Forecast Completion Date: The completion date of the last scheduled work activity identified on the critical path.
J. Fragnet: A section or fragment of the network diagram comprised of a group of activities.
K. Free Float: The amount of time an activity can be delayed before affecting a subsequent activity.
L. Hammock Activity: An activity added to the network to span an existing group of activities for summarizing purposes.
M. 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.
N. Revision: A change in the future portion of the schedule that modifies logic, adds or deletes activities, or alters activities, sequences, or durations.
O. Tabular Listing: A report showing schedule activities, their relationships, durations, scheduled and actual dates, and float.
P. Total Float: The amount of time that an activity may be delayed without affecting the total project duration of the critical path.
Q. 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.
R. Time Scaled Logic Diagram: A schematic display of the logical relationships of project activities, drawn from left to right to reflect project chronology with the positioning and length of the activity representing its duration.
S. Bar Chart (Gantt Chart): A graphic display of scheduled-related information, activities or other project elements are listed down the left side of the chart, dates are shown across the top, and activity durations are shown as date-placed horizontal bars.

PRECONSTRUCTION SCHEDULING CONFERENCE

The Engineer shall schedule and conduct a Preconstruction Scheduling Conference with the Contractor's Project Manager and Construction Scheduler within seven days after the bidder has received the contract for execution. At this meeting, the requirements of this section of the special provisions will be reviewed with the Contractor. The Contractor shall be prepared to discuss its schedule methodology, proposed sequence of operations, the activity identification system for labeling all work activities, the schedule file numbering system, and any deviations it proposes to make from the Stage Construction Plans. The Engineer shall submit a diskette of a scheduling shell project, displaying an activity code dictionary consisting of fields populated with the Caltrans Scope Breakdown Structure (SBS) Code. The SBS structure will be finalized after submittal of the accepted Baseline schedule. The Contractor shall utilize these codes, and may add other codes as necessary, to group and organize the work activities. Periodically the Engineer may request the Contractor to utilize additional filters, layouts or activity codes to be able to further group or summarize work activities.

Also, the Engineer and the Contractor shall review the requirements for all submittals applicable to the contract and discuss their respective preparation and review durations. All submittals and reviews are to be reflected on the Interim Baseline Schedule and the Baseline Schedule.

INTERIM BASELINE SCHEDULE

Within 15 days after approval of the contract, the Contractor shall submit to the Engineer an Interim Baseline Project Schedule which will serve as the progress schedule for the first 120 days of the project, or until the Baseline Schedule is accepted, whichever is sooner. The Interim Baseline Schedule shall utilize the critical path method. 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 10 days to review the schedule and to provide comments, including the Contractor's application of the supplied scope breakdown structure. The Interim Baseline Schedule does not require Caltrans acceptance but all comments are to be implemented into the Baseline Schedule. Re-submittal of the Interim Baseline Schedule is not required. Late review of the Interim Baseline Schedule shall not restrain the submittal of the Baseline Schedule.

BASELINE SCHEDULE

Within 30 days, after approval of the contract, the Contractor shall submit to the Engineer a Baseline Project Schedule including the incorporation of all comments provided to the Interim Baseline Schedule. The Baseline Schedule shall have a data date of the day prior to the first working day of the contract. The schedule shall not include any actual start dates, actual finish dates, or constraint dates (except for Contract Milestone dates.) The Baseline Schedule shall meet interim milestone dates, contract milestone dates, stage construction requirements, internal time constraints, show logical sequence of activities, and must not extend beyond the number of days originally provided for in the contract.

All task activities shall be assigned to a project calendar. Each calendar shall identify a workweek, and holidays. Use different calendars for work activities that occur on different work schedules. Activities for the preparation and the review of submittals plus fabrication are to be assigned to the same calendar.

The Contractor shall not add job inefficiencies or weather days to a project calendar without prior approval by the Engineer.

The Contractor shall not assign negative lags to any activities.

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. Each activity shall have durations 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 "total 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, the Contractor in the next monthly update or revision of the schedule shall correct it.

The Baseline Schedule shall be supplemented with resource allocations for every task activity to a level of detail that facilitates report generation based on labor craft and equipment class for the Contractor and subcontractors. The Contractor shall use average composite crews to display the labor loading of on-site construction activities. On the P3 resource dictionary, each resource should have the normal and maximum limits for the specified period of time. Based on the resource limits, 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. 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 Contractor shall not create hammock activities for the purpose of resources loading.

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, labor and equipment loading. 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 contract completion dates, and with all constraints, restraints or sequences included in the contract. The degree of detail shall include factors including, but not limited to:

A. Physical breakdown of the project;

B. Contract milestones and completion dates, substantial completion dates, constraints, restraints, sequences of work shown in the contract, the planned substantial completion date, and the final completion date;
C. Type of work to be performed, the sequences, and the major subcontractors involved;
D. All purchases, submittals, submittal reviews, manufacture, fabrication, tests, delivery, and installation activities for all major materials and equipment, including submittal of requests for audits of manufacturers and fabricators in conformance with "Manufacturing and Fabrication Qualification Audit for Materials" of these special provisions;
E. Preparation, submittal and approval of shop and working drawings and material samples, showing time, as specified elsewhere, for the Engineer's review. The same time frame shall be allowed for at least one resubmittal on all major submittals so identified in the contract documents;
F. Identification of interfaces and dependencies with preceding, concurrent and follow-on contractors, railroads, and utilities as shown on the plans or specified in the specifications;
G. Identification of each and every utility relocation and interface as a separate activity, including activity description and responsibility coding that identifies the type of utility and the name of the utility company involved;
H. Actual tests, submission of test reports, and approval of test results;
I. All start-up, testing, training, and assistance required under the Contract;
J. Punchlist and final clean-up;
K. Identification of any manpower, material, or equipment restrictions, as well as any activity requiring unusual shift work, such as double shifts, 6-day weeks, specified overtime, or work at times other than regular days or hours;
L. Identification of each and every ramp closing and opening event as a separate one-day activity, including designation by activity coding and description that it is a north-bound, south-bound, east-bound, west-bound, and entry or exit ramp activity;
M. Separate resources graphs for the Contract's labor, equipment and critical path labor, with an accompanying analysis of each and explanation for any variances (i.e., example front-end resource loading of schedules); and
N. Equipment and labor shall be differentiated by a cost account code within the resource dictionary.

The Baseline Schedule submittal shall include a 3 l/2 inch floppy diskette which contains the data files used to generate the schedule, a schedule narrative describing the critical path, narratives providing additional schedule detail as requested by the Engineer and all schedule reports.

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

PROJECT SCHEDULE REPORTS

Schedules submitted to the Engineer including Interim Baseline, Baseline, and update schedules shall include time scaled network diagrams in a layout format requested by the Engineer. The network diagrams submitted to the Engineer shall also be accompanied by four computer-generated mathematical analysis tabular reports for each activity included in the project schedule. The reports (8 1/2” x 11” size) shall include a network diagram report showing the activity columns only, a predecessor and successor report, a resource report (Interim Baseline and Baseline Schedules), and a scheduling and leveling calculation report. The network diagram report~~s~~ shall include, at a minimum, the following for each activity:

A. Activity number and description;
B. Activity codes;
C. Original, actual and remaining durations;
D. Early start date (by calendar date);
E. Early finish date (by calendar date);
F. Actual start date (by calendar date);
G. Actual finish date (by calendar date);
H. Late start date (by calendar date);
I. Late finish date (by calendar date);
J. Identify activity calendar ID;
K. Total Float and Free Float, in work days; and
L. Percentage complete.

Network diagrams shall be sorted and grouped in a format requested by the Engineer reflecting the project breakdown per the Caltrans scope breakdown structure codes. They shall show a continuous flow of information from left to right per the project sorting and grouping codes. E.g., project milestones, submittals sub-grouped by description, and the construction activities sub-grouped by the scope breakdown structure. The primary paths of criticality shall be clearly and graphically identified on the 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 the tabular reports shall be submitted to the Engineer for acceptance in the following quantities:

A. 2 sets of the Network Diagrams;
B. 2 copies of the tabular reports (8 1/2" x 11" size); and
C. 3 computer diskettes.

WEEKLY SCHEDULE MEETINGS

The Engineer and the Contractor shall hold weekly scheduling meetings to discuss the near term schedule activities, to address any long-term schedule issues, and to discuss any relevant technical issues. The Contractor shall develop a rolling 4-weeks schedule identifying the previous week worked and a 3-week look ahead. It shall provide sufficient detail to include the actual and planned activities of the Contractor and all the subcontractors for offsite and construction activities, addressing all activities to be performed and to identify issues requiring engineering action or input.

Each activity in the 4 week rolling schedule should be identified by an associated CPM schedule activity ID numbering system. This schedule should not be hand written. To create the 4 weeks rolling schedules, the Contractor should utilize the use of EXCEL spreadsheet, or Primavera scheduling software, as acceptable by the Engineer. The Engineer will provide the format of the schedule. This schedule should be electronically submitted to the Engineer one day prior to the scheduled meeting date.

MONTHLY UPDATE SCHEUDLES

The Contractor shall submit a Monthly Update Schedule to the Engineer once in each month within 5 days of the data date. The proposed update schedule prepared by the Contractor shall include all information available as of the 20th calendar day of the month, or other data date as established by the Engineer. A detailed list of all proposed schedule changes such as logic, duration, lead/lag, forecast completion date, additions and deletions shall be submitted with the update.

The monthly update of the schedule shall focus on the period from the last update to the current cut-off data date. Changes to activities or logic beyond the data date are classified as revisions and need to be addressed per the schedule revision section of this specification. Activities that have either started or finished shall be reported as they actually occurred and designated as complete, if actually completed. For activities in progress that are forecasted to complete longer than planned, the remaining durations shall be revised, not the original durations. All out of sequence activities are to be reviewed and their relationships either verified or changed.

The Monthly Update Schedule submitted to the Engineer shall be accompanied by a Schedule Narrative Report. The report shall describe the physical progress during the report period, plans for continuing the work during the forthcoming report period, actions planned to correct any negative float, and an explanation of potential delays or problems and their estimated impact on performance, milestone completion dates, forecast completion date, and the overall project completion date. In addition, alternatives for possible schedule recovery to mitigate any potential delay or cost increases shall be included for consideration by the Engineer. The report shall follow the outline set forth below:

Contractor's Schedule Narrative Report Outline:

A. Contractor's Transmittal Letter;
B. Work completed during the period;
C. Description of the current critical path;
D. Description of current problem areas;
E. Current and anticipated delays;
1. Cause of the delay;
2. Corrective action and schedule adjustments to correct the delay; and
3. Impact of the delay on other activities, milestones, and completion dates;
F. Changes in construction sequences;
G. Pending items and status thereof;
1. Permits;
2. Change Orders;
3. Time Extensions; and
4. Non-Compliance Notices;
H. Contract completion date(s) status;
1. Ahead of schedule and number of days; and
2. Behind schedule and number of days; and
I. Include updated Network Diagram and Reports.

The Contractor shall provide to the Engineer a 3 1/2” 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.

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.

On a date determined by the Engineer, the Contractor shall meet with the Engineer to review the monthly schedule update. At the monthly progress meeting, the Contractor and the Engineer shall review the updated schedule and shall discuss the content of the Narrative Report. The Engineer shall be allowed 10 days after the meeting to review and accept or reject the update schedule submitted. Rejected schedules shall be resubmitted to the Engineer within 5 days, at which time a new 5 day review period by the Engineer will begin. All efforts shall be made between the Engineer and the Contractor to complete the review and the acceptance process prior to the next update schedule data date. To expedite the process a second meeting between the Engineer and the Contractor shall be held.

SCHEDULE REVISIONS

If the Contractor desires to make a change to the accepted schedule, the Contractor shall request permission from the Engineer in writing, stating the reasons for the change, and proposed revisions to activities, logic and duration. The Contractor shall submit for acceptance an analysis showing the effect of the revisions on the entire project. The analysis shall include:

A. An updated schedule not including the revisions. The schedule shall have a data date just prior to implementing the proposed revisions and includes a project completion date;
B. A revised schedule that includes the proposed revisions. The schedule will have the same data date as the updated schedule and include a project completion date;
C. The Contractor should add resources for all new activities, also adjust resources for those activities that their remaining duration were changed;
D. A narrative explanation of the revisions and their impact to the schedule; and
E. Computer files of the updated schedule and the revised schedule sequentially numbered or renamed for archive (record) purposes.

The Engineer will provide a response within 10 days. 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 4 weeks or more behind the planned schedule, as determined by the Engineer; or
C. the Engineer determines that an approved or anticipated change will impact the critical path, milestone or completion dates, contract progress, or work by other contractors.

The Engineer shall be allowed 10 days to review and accept or reject a schedule revision. Rejected schedule revisions shall be revised and resubmitted to the Engineer within 10 days, at which time a new 10 day review period by the Engineer will begin. Only upon approval of a change by the Engineer shall it be reflected in the next schedule update submitted by the Contractor.

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 schedule update and schedule revision, both with the same data dates, demonstrating how the Contractor proposes to incorporate the Change Order or delay into the current schedule. The schedule revision shall include the sequence of activities and any revisions to the existing activities to demonstrate the influence of the delay, 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. A schedule file diskette is also to be submitted.

Acceptance or rejection of each Time Impact Analysis by the Engineer will be made within 15 days after receipt of the Time Impact Analysis, unless subsequent meetings and negotiations delay the review. A copy of the Time Impact Analysis accepted 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 acceptance.

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:

A. Complete computer system, including keyboard, mouse, 21 inch color SVGA monitor (1024x768 pixels), Intel Pentium III 850 MHz microprocessor chip, or equivalent;
B. Computer operating system software, compatible with the selected processing unit, for NT 4.0 or later or equivalent;
C. Minimum one hundred twenty eight (128) megabytes of random access memory (RAM);
D. A 6.4 gigabytes minimum hard disk drive, a 1.44 megabyte 3 1/2 inch floppy disk drive, 32x speed minimum CD-ROM drive, Ethernet card and 56k modem;
E. A color-ink-jet printer with a minimum 36 megabyte RAM, capable of 600 dots per inch color, 1200 dots per inch monochrome, or equivalent, capable of printing fully legible, time scaled charts, and network diagrams, in four colors, with a minimum size of 36inches by 48 inches (E size) and is compatible with the selected system, an HP Design Jet 1055 CM or equivalent, plotter stand, roll paper assembly and automatic paper cutter, and provide plotter paper and ink cartridges throughout the contract;
F. CPM software shall be Primavera Project Planner, the latest version for Windows 95, or later;
G. Scheduler Analyzer Pro or equivalent (a suite of programs to assist in schedule analysis) in the latest version for Windows 95, Windows NT or later; and
H. Microsoft Office Software, the latest version for Windows 95, Windows NT or later and McAfee Virus software or equivalent.

The computer hardware and software furnished shall be compatible with that used by the Contractor for the production of the CPM progress schedule required by the Contract, and shall include original instruction manuals and other documentation normally provided with the software.

The Contractor shall furnish, install, set up, maintain and repair the computer hardware and software ready for use at a location determined by the Engineer. The hardware and software shall be installed and ready for use 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. An authorized vendor of Project Primavera shall perform the training.

All computer hardware and software furnished shall remain the property of the Contractor and shall be removed by the Contractor upon acceptance of the contract when no claims involving contract progress are pending. When claims involving contract progress are pending, computer hardware or software shall not be removed until the final estimate has been submitted to the Contractor.

PAYMENT

Progress schedule (critical path) will be paid for at a lump sum price. The contract lump sum price paid for progress schedule (critical path) shall include full compensation for 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. Also for maintaining and repairing the computer hardware and training the Engineer in the use of the computer hardware and software as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Payments for progress schedule (critical path) will be made as follows:

A. Interim baseline schedule accepted, then 10 percent payment for progress schedule (critical path) will be made.
B. Baseline schedule accepted, then 10 percent payment for progress schedule (critical path) will be made.
C. Monthly update schedules accepted, then 75 percent payment for progress schedule (critical path) will be made equally for each update.
D. Final schedule update accepted, then 5 percent payment for progress schedule (critical path) will be made.

The Department will retain an amount equal to 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. Retention’s for failure to submit acceptable CPM progress schedules shall be additional to all other retention’s 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.

10-1.07 OVERHEAD

Overhead shall conform to these special provisions. The Contractor will be compensated for time-related overhead in conformance with these special provisions.

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

The provisions in Section 9-1.08, "Adjustment of Overhead Costs," of the Standard Specifications shall not apply.

Time-related overhead shall consist of those overhead costs, including field and home office overhead, that are in proportion to the time required to complete the work. Time-related overhead shall not include costs that are not related to time, including but not limited to, mobilization, licenses, permits, and any other charges incurred only once during the contract.

Field office overhead expenses include time-related costs associated with the normal and recurring operations of the construction project, and shall not include costs directly attributable to any of the work of the contract. Such time-related costs include, but are not limited to, the salaries and benefits of project managers, general superintendents, field office managers and other field office staff assigned to the project, and rent, utilities, maintenance, security, supplies and equipment costs of the project field office.

Home office overhead or general and administrative expenses refer to the fixed costs of operating the Contractor's business. These costs include, but are not limited to, general administration, insurance, personnel and subcontract administration, purchasing, accounting, and project engineering and estimating. The rate of home office overhead shall exclude expenses specifically related to other contracts or other businesses of the Contractor, equipment coordination, material deliveries, and consultant and legal fees.

The quantity of time-related overhead to be paid will be measured by the working day, as specified in the Engineer's Estimate as WDAY. The estimated amount will be based on the number of working days, excluding any days for plant establishment, as specified in "Beginning of Work, Time of Completion and Liquidated Damages" of these special provisions. In the event an early completion progress schedule, as defined in "Progress Schedule (Critical Path)" of these special provisions, is submitted by the Contractor and approved by the Engineer, the quantity of time-related overhead eligible for payment will be based on the total number of working days as specified in "Beginning of Work, Time of Completion and Liquidated Damages" of these special provisions, rather than the Contractor's early completion progress

schedule. The quantity of time-related overhead, as measured above, will be 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:

A. Suspensions of work ordered in conformance with the provisions in Section 8-1.05, "Temporary Suspension of Work," of the Standard Specifications, except:

    1. Suspensions ordered due to weather conditions being unfavorable for the suitable prosecution of the controlling operation or operations; or
    2. 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; or
    3. Any other suspensions mutually agreed upon between the Engineer and the Contractor.

B. Extensions of time granted by the State in conformance with the provisions in the fifth paragraph in Section 8-1.07, "Liquidated Damages," of the Standard Specifications; or
C. Reductions in contract time set forth in approved contract change orders, in conformance with the provisions in Section 4-1.03, "Changes," of the Standard Specifications.

In the event a cost reduction proposal is submitted by the Contractor, and is subsequently approved by the Engineer, which provides for a reduction in contract time, the contract amount of time-related overhead associated with the reduction in contract time shall be considered as a net savings in the total cost of time-related overhead. The Contractor will be paid 50 percent of the estimated net savings of the time-related overhead, in conformance with the provisions in Section 5-1.14, "Cost Reduction Incentive," of the Standard Specifications.

If the quantity of time-related overhead, measured as specified in this special provision, exceeds 149 percent of the number of working days specified in the Engineer's Estimate, the Contractor shall, within 60 days of the Engineer's written request, submit to the Engineer an audit examination and report performed by an independent Certified Public Accountant of the Contractor's actual overhead costs. The independent Certified Public Accountant's audit examination shall be performed in conformance with the requirements of the American Institute of Certified Public Accountants Attestation Standards. The audit examination and report shall depict the Contractor's project and company-wide financial records and shall specify the actual overall average daily rates for both field and home office overhead for the entire duration of the project, and whether the costs have been properly allocated. The rates of field and home office overhead shall exclude all unallowable costs as determined in the Federal Acquisition Regulations, 48 CFR, Chapter 1, Part 31. The audit examination shall determine if the rates of field and home office overhead:

A. are allowable in conformance with the requirements of the Federal Acquisition Regulations, 48 CFR, Chapter 1, Part 31;
B. are adequately supported by reliable documentation; and
C. related solely to the project under examination.

Upon the Engineer's written request, the Contractor shall make its financial records available for audit by the State for the purpose of verifying the actual rate of time-related overhead specified in the audit submitted by the Contractor. The actual rate of time-related overhead specified in the audit, submitted by the Contractor, will be subject to approval by the Engineer.

If the Engineer elects, or if requested in writing by the Contractor, contract item payments for time-related overhead, in excess of 149 percent of the number of working days designated in the Engineer's Estimate, will be adjusted to reflect the actual rate.

The cost of performing an audit examination and submitting the report, requested by the Engineer, will be borne equally by the State and the Contractor. The division of the cost will be made by determining the cost of providing an audit examination in conformance with the provisions of Section 9-1.03B, "Work performed by Special Forces or Other Special Services" of the Standard Specifications, and paying to the Contractor one-half of that cost.

The contract price paid per working day for time-related overhead shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in time-related overhead, complete in place, including all field and home office overhead costs incurred by the Contractor and by any joint venture partner, subcontractor, supplier or other party associated with the Contractor, and the Contractor's share of costs of audits of overhead costs requested by the Engineer, as specified in these special provisions, and as directed by the Engineer. The provisions in Sections 4-1.03B, "Increased or Decreased Quantities," 4-1.03C, "Changes in Character of the Work," of the Standard Specifications shall not apply to time-related overhead.

Full compensation for additional overhead costs involved in the performance of extra work at force account shall be considered as included in the markups specified in "Force Account Payment," of these special provisions.

Full compensation for additional overhead cost involved in performing additional contract item work that is not a controlling operation and for all overhead, other than the time-related overhead measured and paid for as specified in this

section "Overhead", shall be considered as included in the various items of work involved, and no additional compensation will be allowed therefor.

For the purpose of making partial payments pursuant to the provisions in Section 9-1.06, "Partial Payments," of the Standard Specifications, the number of working days to be paid for time-related overhead in each monthly partial payment will be the number of working days, specified above to be measured for payment, that occurred during that monthly estimate period. The amount earned per working day for time-related overhead shall be either the contract item price, or 20 percent of the original total contract amount divided by the number of working days specified in "Beginning of Work, Time of Completion and Liquidated Damages," of these special provisions, whichever is the lesser.

After all work has been completed, except plant establishment work, as provided in Section 20-4.08, "Plant Establishment Work," of the Standard Specifications, the amount, if any, of the total contract item price for time-related overhead not yet paid will be included for payment in the first estimate made after completion of all roadway construction work, in conformance with the provisions in Section 9-1.06, "Partial Payments," of the Standard Specifications.

10-1.08 ELECTRONIC MOBILE DAILY DIARY SYSTEM DATA DELIVERY

Attention is directed to Sections 5-1.10, "Equipment and Plants," and 7-1.01A(3), "Payroll Records," of the Standard Specifications, and these special provisions.

The Contractor shall submit to the Engineer a list of each piece of equipment and its identifying number, type, make, model and rate code in accordance with the Department of Transportation publication entitled “Labor Surcharge and Equipment Rental Rate” which is in effect on the date the work is performed, and the names, labor rates and work classifications for all field personnel employed by the Contractor and all subcontractors in connection with the public work, together with such additional information as is identified below. This information shall be updated and submitted to the Engineer weekly through the life of the project.

This personnel information will only be used for this mobile daily diary computer system and it will not relieve the Contractor and subcontractors from 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.--

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

Caltrans contract ID	Alphanumeric; up to 15 characters.
Company name.	Alphanumeric; up to 30 characters.
Federal tax ID	Alphanumeric; up to 10 characters.
State contractor license	Alphanumeric; up to 20 characters.
Company type (prime or sub)	Alphanumeric; up to 10 characters.
Address (line 1).	Alphanumeric; up to 30 characters.
Address (line 2).	Alphanumeric; up to 30 characters.
Address (city).	Alphanumeric; up to 30 chars.
Address (2-letter state code).	Alphanumeric; up to 2 characters.
Address (zip code)	Alphanumeric; up to 14 characters.
Contact First Name.	Alphanumeric; up to 15 characters
Contact Last Name	Alphanumeric; up to 20 characters
Telephone number (with area code).	Alphanumeric; up to 20 characters.
Company code: short company name.	Alphanumeric; up to 10 characters.
Type of work (Department-supplied codes)	Alphanumeric; up to 30 characters
DBE status (Department-supplied codes)	Alphanumeric; up to 20 characters.
Ethnicity for DBE status (Department-supplied codes).	Alphanumeric; up to 20 characters.
List of laborers to be used on this contract (detail specified below).	
List of equipment to be used on this contract (detail specified below).	

For example, one such set of information for a company might be:

04-072359
XYZ CONSTRUCTION, INC.
94-2991040
AL1649T
SUB
1240 9TH STREET
SUITE 600
OAKLAND
CA
94612
JOHN SMITH
(510) 834-9999
XYZ
PAVING
MBE
BLACK

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

Caltrans contract ID	Alphanumeric; up to 15 characters.
Company code (as defined above).	Alphanumeric; up to 10 characters.
Employee ID	Alphanumeric; up to 10 characters.
Last name.	Alphanumeric; up to 20 characters.
First name.	Alphanumeric; up to 15 characters.
Middle name.	Alphanumeric; up to 15 characters.
Suffix	Alphanumeric; up to 15 characters
Labor trade (Department-provided codes).	Alphanumeric; up to 10 characters.
Labor classification (Department-provided codes).	Alphanumeric; up to 10 characters.
Regular hourly rate.	Alphanumeric; up to (6,2)
Overtime hourly rate.	Alphanumeric; up to (6,2)
Double-time hourly rate	Alphanumeric; up to (6,2)
Standby hourly rate.	Alphanumeric; up to (6,2)
Ethnicity (Department-provided codes).	Alphanumeric; up to 20 characters.
Gender.	Alphanumeric; up to 1 characters.

For example, one such set of information might be:

04-072359
XYZ
1249
GONZALEZ
HECTOR
VINCENT
JR.
OPR
JNY
22.75
30.25
37.75
0.00
HISPANIC
M

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

Caltrans contract ID	Alphanumeric; up to 15 characters.
Company code (as defined above).	Alphanumeric; up to 10 characters.
Company's equipment ID number.	Alphanumeric; up to 10 characters.
Company's equipment description.	Alphanumeric; up to 60 characters.
Equipment type (from Department ratebook).	Alphanumeric; up to 60 characters.
Equipment make (from Department ratebook).	Alphanumeric; up to 60 characters.
Equipment model (from Department ratebook).	Alphanumeric; up to 60 characters.
Equipment rate code (from Department ratebook).	Alphanumeric; up to 10 characters
Regular hourly rate.	Alphanumeric; up to (6,2)
Overtime hourly rate.	Alphanumeric; up to (6,2)
Standby hourly rate	Alphanumeric; up to (6,2)
Idle hourly rate.	Alphanumeric; up to (6,2)
Rental flag.	Alphanumeric; up to 1 character.

For example, one such set of information might be:

04-072359
XYZ
B043
CAT TRACTOR D-6C

TRACC
CAT
D-6C
3645
28.08
25.27
14.04
0.00
N

Data Delivery Requirements.--

A. All data described in "Data Requirements" of this section shall be delivered to the Department electronically, on 3 1/2" floppy disks compatible with the Microsoft Windows operating system. The Contractor shall provide a weekly disk and hard copy of the required correct updated personnel and equipment information for the Contractor and all the subcontractors and verified correct by the Engineer.

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

C. The file format for all files delivered to Caltrans shall be standard comma-delimited, plain text files. This type of file (often called “CSV”) is the most standard type for interchange of formatted data; it can be created and read by all desktop spreadsheet and desktop database applications. Characteristics of this type of file are:

1. All data is in the form of plain ASCII characters.
2. Each row of data (company, person, equipment) is delimited by a carriage return character.
3. Within rows, each column (field) of data is delimited by a comma character.

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

1. Contractor info: 16 columns (fields) as specified in "Data Requirements #1", above.
2. Labor info: 15 columns (fields) as specified in "Data Requirements #2", above.
3 Equipment info: 13 columns (fields) as specified in "Data Requirements #3", above.

For 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.

E. 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:

1. All data shall be uppercase.
2. Company type shall be either “PRIME” or “SUB”.
3. Labor trade and classification codes must conform to a list of standard codes that will be supplied by Department.
4. Contractor type of work codes and DBE status codes must conform to a list of standard codes that will be supplied by Department.
5. Ethnicity codes must conform to standard codes that will be supplied by Department.
6. Data in the "gender" column must be either "M" or "F".
7. Data in the "rental equipment" column must be either "Y" or "N".
8. Equipment owner's description may not be omitted. (The description, together with the equipment number, is how the equipment will be identified in the field.) Include manufacturer, rated capacity & trade description
9. Equipment type, make, model, and ratebook code shall conform to the Department of Transportation Publication entitled “Labor Surcharge and Equipment Rental Rate”, which is in effect on the date the work is performed. If the equipment in question does not have an entry in the book then alternate, descriptive entries may be made in these fields as directed by the Engineer.

F. The name of each file must indicate its contents, e.g., "XYZlab.csv" 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 4.85 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.

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 electronic mobile daily diary computer system data delivery 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 electronic mobile daily diary computer system data have not been submitted to the Engineer. Retentions for failure to submit acceptable electronic mobile daily diary computer system data shall be additional to all other retentions provided for in the contract. The retention for failure to submit acceptable electronic mobile daily diary computer system data will be released for payment on the next monthly estimate for partial payment following the date that acceptable electronic mobile daily diary computer system data is submitted to the Engineer.

The adjustment provisions in Section 4-1.03, "Changes," of the Standard Specifications, shall not apply to the item of electronic mobile daily diary computer system data delivery. Adjustments in compensation for electronic mobile daily diary computer system data delivery will not be made for any increased or decreased work ordered by the Engineer in furnishing electronic mobile daily diary computer system data.

10-1.085 ELECTRONIC EXTRA WORK REPORT

Attention is directed to Sections 5-1.10, “Equipment and Plants,” 7-1.01A(3), “Payroll Records,” Section 9-1.03C, “Records,” and 9-1.06, “Partial Payments,” of the Standard Specifications.

All extra work reports shall be furnished to the Engineer using the department’s electronic Extra Work Billing System. The Contractor shall conform to all the requirements set forth in the “Extra Work Billing System User’s Guide.” The Guide is available from the Department, and is also found on the Internet at: http://www.dot.ca.gov/hq/esc/oe/project_ads_addenda/04/04-006044/. The Department will provide electronic Extra Work Billing System accounts to a Contractor’s representatives only after they have received training. The Department will provide system training to the Contractor’s authorized representatives within 30 days of the Contractor’s request for training.

An account, user identification assigned by the Department and password, used by the Contractor’s representative is deemed to meet the following signature requirement in Section 9-1.03C of the Standard Specifications: “Daily extra work reports shall be signed by the Contractor or the Contractor’s authorized representative.”

Extra work reports that include materials shall be substantiated by a valid copy of a vendor’s invoice as required in Section 9-1.03C, “Records,” of the Standard Specifications. Each invoice shall clearly identify the relative electronic extra work report and associated amount. In addition to postal service and parcel service, invoices may be sent via FAX or as an e-mail attachment if approved by the Engineer.

The Engineer will compare the Engineer’s records with the completed electronic daily extra work report, will reject a report that has an error that affects payment, and will indicate the necessary adjustments the Contractor must make prior to re-sending a corrected electronic extra work report. A daily extra work report that the Contractor’s representative sends to the Department using the electronic Extra Work Billing System is deemed signed by the Contractor. A daily extra work report that the Engineer approves using the electronic Extra Work Billing System is deemed signed by the Engineer.

Electronic submittals via the file transfer process shall conform to the Department’s specified format. The Contractor is responsible for maintaining the required data file format and satisfying criteria in the file transfer process. The Contractor is responsible for maintaining and operating the Contractor’s interface with the Department’s Extra Work Billing System.

There will be no additional compensation to the Contractor for furnishing daily extra work reports using the Department’s electronic Extra Work Billing System.

10-1.09 OBSTRUCTIONS

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

The Contractor shall notify the Engineer and the appropriate regional notification center for operators of subsurface installations at least 2 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

10-1.10 TEMPORARY ENTRANCE/EXITS

This work shall consist of constructing and maintaining the temporary entrance/exits as shown on the plans, as directed by the Engineer, and as specified in these special provisions. When no longer required for the work, temporary entrance/exits shall be removed as specified in these special provisions.

The type of temporary entrance/exits shall be either Type 1 or Type 2 at the option of the Contractor.

The Contractor shall use temporary entrance/exits as one of the various measures to prevent water pollution. The Water Pollution Control Program shall graphically show the use of temporary entrance/exits in relation to other water pollution control work specified elsewhere in these special provisions.

MATERIALS

Materials shall conform to the following:

Temporary Stabilization Fabric

Temporary stabilization fabric shall be manufactured from one or more of the following materials: polyester, nylon or polypropylene. Temporary stabilization fabric shall be, at the option of the Contractor, either a woven filament or nonwoven type fabric conforming to the following:

	Woven	Non-Woven
Weight, grams per Square Meter, Min. ASTM Designation: D3776	200	200
Grab Tensile Strength, Newtons (N), Min. ASTM Designation: D4632	890	650
Elongation at Break, Percent, Max. ASTM Designation: D4632	35 Max.	50 Min.

Temporary stabilization fabric shall be furnished in an appropriate protective cover, which shall protect it from ultraviolet radiation and from abrasion due to shipping and handling, and shall remain covered until installation. Temporary stabilization fabric shall be accompanied by a Certificate of Compliance conforming to the provisions in Section 6-1.07, “Certificate of Compliance,” of the Standard Specifications.

Aggregate

Aggregate shall be uniformly graded angular rock or cobble ranging in size from 76.2 mm to 180 mm, and shall be of such a nature that it can be spread and compacted to produce a stable driving surface.

Steel Ribbed Panels

Manufactured steel ribbed panels with raised bars shall be provided in individual sections. Steel plate shall be a minimum 12.7 mm thick. Bars shall be a minimum of 38.1 mm in height, approximately 12.7 mm thick at the base and tapered to 6.35 mm thick at the top of the bar, and shall be uniformly distributed 190.5 mm apart longitudinally throughout the full section of each panel. Raised bars shall be welded to the bottom plate. Each panel shall have a nominal dimension

of 3 m x 2.43 m with an approximate weight of 1454 kg for each panel. Each end of the panel shall have a slot or hooked section to facilitate coupling at the ends.

CONSTRUCTION

Temporary entrance/exits shall be installed as shown on the plans and as follows:

A. Prior to placing the temporary stabilization fabric, the areas shall be cleared of all trash and debris. Vegetation shall be removed to the ground level. Cleared trash, debris, and removed vegetation shall be disposed of outside the highway 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.
B. Temporary stabilization fabric shall be handled and placed in accordance with the manufacturer's recommendation and shall be positioned longitudinally along the alignment, pulled taut to form a tight, wrinkle-free mat. The ground to receive temporary stabilization fabric shall be graded to a uniform plane, watered and compacted, and shall be free of sharp objects that may damage the temporary stabilization fabric.
C. Adjacent borders of the fabric shall be overlapped a minimum of 450 mm.
D. Temporary stabilization fabric placed shall be covered with aggregate within 72 hours.
E. Aggregate to be placed directly over the fabric shall be spread in the direction of fabric overlaps. Stockpiling aggregate directly on the temporary stabilization fabric is not allowed. Once a sufficient working platform has been constructed, all remaining materials shall be uniformly placed and spread with 1:4 (V:H) tapers at the perimeter edges of the temporary entrance/exits where it conforms to existing roadway
F. During spreading of the aggregate, vehicles or equipment shall not be driven directly on the fabric. A sufficient thickness of aggregate shall be maintained between the fabric and the equipment to prevent damage to the fabric. Damage to the fabric resulting from the Contractor's vehicles, equipment, or operations shall be repaired at the Contractor's expense.
G. Should the fabric be damaged during placing, the damaged section shall be repaired by placing a new piece of fabric over the damaged area. The piece of fabric shall be large enough to cover the damaged area and provide a minimum 900 mm overlap on all edges.

For Type 2 temporary entrance/exits, a minimum of 3 panel sections coupled to one another is required at each temporary entrance/exit. Prior to installing panels, the ground surface shall be cleared of all debris, which may prevent uniform contact with the ground surface.

MAINTENANCE

The Contractor shall maintain temporary entrance/exits, throughout the contract period. The Contractor shall prevent displacement or migration of the aggregate surfacing or steel ribbed panels. Any significant depressions, as determined by the Engineer, which form due to settling or heavy traffic shall be repaired by the Contractor.

Temporary entrance/exits shall be maintained to minimize tracking of soil and sediment onto paved roads. If the efficiency of a temporary entrance/exit to minimize tracking of soil and sediment is compromised by the buildup of soil and sediment, or by other means, as determined by the Engineer, the Contractor shall remove and dispose of the soil and sediment in conformance with Section 19, "Earthwork," of the Standard Specifications and these special provisions. Installation of additional steel ribbed panels will be determined by the Engineer.

Pavement cleaning shall be required at all locations where construction equipment is visibly tracking sediments onto the roadway.

Pavement cleaning shall be required every day when temporary entrance/exits are in use. Soil and sediment or other extraneous material tracked onto pavement shall not be allowed to enter drainage facilities and shall be removed at least once each day.

Once the temporary entrance/exits are no longer needed, steel ribbed panels shall be removed. The aggregate and temporary stabilization fabric shall be removed and disposed of as provided for in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications. All soil and sediments shall be removed and disposed of as provided in Section 19, "Earthwork," of the Standard Specifications and these special provisions. Following removal of the temporary entrance/exits, areas shall be graded smooth and compacted to conform with adjacent areas.

PAYMENT

The quantity of the temporary entrance/exits shall be paid by each unit installed. The contract unit price paid for temporary entrance/exits shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in placing, maintaining and removing temporary entrance/exits complete in place, including transporting and disposing of soil and sediments removed from temporary entrance/exits and any incidental grading required to grade and compact areas as specified in these special provisions, and as directed by the Engineer.

10-1.11 TEMPORARY CONCRETE WASHOUT FACILITY

Temporary concrete washout facilities shall be constructed, maintained, and later removed as shown on the plans, in conformance with these special provisions and as directed by the Engineer.

Temporary concrete washout facilities shall be installed prior to beginning any placement of concrete and located a minimum of 15 m from storm drain inlets, open drainage facilities, and watercourses, unless determined infeasible by the Engineer. Each facility shall be located away from construction traffic or access areas to prevent disturbance or tracking.

Temporary concrete washout facilities shall be constructed on grade or below grade at the option of the Contractor. These facilities shall be constructed to contain all liquid and concrete waste without seepage, spillage or overflow.

MATERIALS

Materials used in the construction of temporary concrete washout facility shall conform to the following:

A. **PLASTIC SHEETING.—**Plastic sheeting shall be new and a minimum of 0.33 mm thick polyethylene sheeting and shall be free of holes, tears or other defects that compromise the impermeability of the material. Plastic sheeting shall not have seams or overlapping joints.

B. **ROCK BAG.—**Rock bag fabric shall be non-woven polypropylene, with a minimum unit weight of 250g/m^2. The fabric shall have a mullen burst strength of at least 2500 kPa, per ASTM Designation D3786 and an ultraviolet (UV) stability exceeding 70 percent at 500 hours. Rock bags shall have a length of 600 mm to 800 mm, width of 400 mm to 500 mm, thickness of 150 mm to 200 mm, and shall be filled to a weighted mass ranging from 13 kg to 22 kg. Rock bag fill material shall be non-cohesive, gravel, free from deleterious material. After filling, the opening shall be secured such that rock shall not escape from the bag.

C. **STRAW BALES.—**Straw for straw bales shall conform to the provisions in Section 20-2.06, "Straw," of the Standard Specifications.

Each straw bale shall be a minimum of 360 mm wide, 450 mm in height, 900 mm in length and shall have a minimum mass of 23 kg. The straw bale shall be composed entirely of vegetative matter, except for binding material.

Bales shall be bound by either wire, nylon or polypropylene string. Jute and cotton binding shall not be used. Wire shall be a minimum of 1.57 mm (16-gage) baling wire. Nylon or polypropylene string shall be approximately 2 mm in diameter with 360 N of breaking strength.

D. **STAKES.—**Stakes shall be 50 mm x 50 mm wood posts. Each stake shall have a minimum length of one meter. Metal stakes may be used as an alternative. The Contractor shall submit a sample of the metal stake to the Engineer for approval prior to installation. The tops of the metal stakes shall be bent over at a 90-degree angle. No additional compensation will be allowed for the use of a metal stake.

E. **STAPLES.—** Staples shall be made of 11-gage minimum steel wire and shall be U-shaped with 200-mm legs and 50-mm crown.

F. **GEOTEXTILE.—** Geotextile shall be manufactured from one or more of the following materials: polyester, nylon or polypropylene. Geotextile shall be, at the option of the Contractor, either a woven filament or nonwoven type fabric conforming to the following:

	Woven	Non-Woven
Weight, grams per Square Meter, Min. ASTM Designation: D3776	200	200
Grab Tensile Strength, Newtons (N), Min. ASTM Designation: D4632	890	650
Elongation at Break, Percent, Max. ASTM Designation: D4632	35 Max.	50 Min.

Geotextile shall be furnished in an appropriate protective cover, which shall protect it from ultraviolet radiation and from abrasion due to shipping and handling, and shall remain covered until installation. Geotextile shall be accompanied by a

Certificate of Compliance conforming to the provisions in Section 6-1.07, “Certificate of Compliance,” of the Standard Specifications.

G. **AGGREGATE BASE.—** Aggregate base shall conform to the provisions in "Aggregate Base," of these special provisions.

TEMPORARY CONCRETE WASHOUT FACILITY (TYPE ON GRADE)

Temporary concrete washout facility (type on grade) shall be constructed as shown on the plans with a minimum length of 3 m and a minimum width of 3 m. The length and width of a facility may be increased, at the Contractor’s expense, upon approval of the Engineer.

TEMPORARY CONCRETE WASHOUT FACILITY (TYPE BELOW GRADE)

Temporary concrete washout facility (type below grade) shall be constructed as shown on the plans with a minimum length of 3 m and a minimum width of 3 m. The excavated material generated from the construction of the temporary concrete washout facility shall be used to construct a berm as shown on the plans. The length and width of a facility may be increased, at the Contractor’s expense, upon approval of the Engineer.

MAINTENANCE AND REMOVAL

Temporary concrete washout facilities shall be maintained to provide adequate holding capacity with a minimum freeboard of 100 mm for on grade facilities and 300 mm for below grade facilities. Maintaining temporary concrete washout facilities shall include removing and disposing of hardened concrete and returning the facilities to a functional condition. Hardened concrete materials shall be removed and disposed of in conformance with the provisions in Section 15-3.02, "Removal Methods," of the Standard Specifications. Minor holes and tears in the plastic sheeting may be taped as long as the repair does not compromise the impermeability of the material.

When temporary concrete washout facilities are no longer required for the work, as determined by the Engineer, the hardened concrete shall be removed and disposed of in conformance with the provisions in Section 15-3.02, "Removal Methods," of the Standard Specifications. Materials used to construct temporary concrete washout facilities shall become the property of the Contractor, shall be removed from the site of the work, and shall be disposed of outside the highway right of way in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Holes, depressions or other ground disturbance caused by the removal of the temporary concrete washout facilities shall be backfilled and repaired in conformance with the provisions in Section 15-1.02, "Preservation of Property," of the Standard Specifications.

PAYMENT

The quantity of temporary concrete washout facility to be paid for shall be determined by each unit installed. If the Contractor removes the temporary concrete washout facility in order to facilitate any other work, the temporary concrete washout facility shall be replaced by the contractor at no additional cost to the State.

The contract unit price paid for temporary concrete washout facility shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in temporary concrete washout facility, complete in place, including maintaining, removing and disposing of temporary concrete washout facility; including installing, maintaining, removing and disposing of concrete washout sign, as shown on the plans, as specified in Section 15-3.02, “Removal Methods,” of the Standard Specifications and these special provisions, and as directed by the Engineer.

Temporary concrete washout facility installed below grade at the Contractor’s option, will be measured and paid for as temporary concrete washout facility installed above grade at no additional cost to the State.

10-1.12 CONSTRUCTION AREA TRAFFIC CONTROL DEVICES

Flagging, signs, and all other traffic control devices furnished, installed, maintained, and removed when no longer required shall conform to the provisions in Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications and these special provisions.

Category 1 traffic control devices are defined as those devices that are small and lightweight (less than 45 kg), and have been in common use for many years. The devices shall be known to be crashworthy by crash testing, crash testing of similar devices, or years of demonstrable safe performance. Category 1 traffic control devices include traffic cones, plastic drums, portable delineators, and channelizers.

If requested by the Engineer, the Contractor shall provide written self-certification for crashworthiness of Category 1 traffic control devices. Self-certification shall be provided by the manufacturer or Contractor and shall include the following: date, Federal Aid number (if applicable), expenditure authorization, district, county, route and kilometer post of project

limits; company name of certifying vendor, street address, city, state and zip code; printed name, signature and title of certifying person; and an indication of which Category 1 traffic control devices will be used on the project. The Contractor may obtain a standard form for self-certification from the Engineer.

Category 2 traffic control devices are defined as those items that are small and lightweight (less than 45 kg), that are not expected to produce significant vehicular velocity change, but may otherwise be potentially hazardous. Category 2 traffic control devices include: barricades and portable sign supports.

Category 2 devices purchased on or after October 1, 2000 shall be on the Federal Highway Administration (FHWA) Acceptable Crashworthy Category 2 Hardware for Work Zones list. This list is maintained by FHWA and can be located at the following internet address: http://safety.fhwa.dot.gov/fourthlevel/hardware/listing.cfm?code=workzone. The Department maintains a secondary list at the following internet address: http://www.dot.ca.gov/hq/traffops/signtech/signdel/pdffiles.htm.

Category 2 devices that have not received FHWA acceptance, and were purchased before October 1, 2000, may continue to be used until they complete their useful service life or until January 1, 2003, whichever comes first. Category 2 devices in use that have received FHWA acceptance shall be labeled with the FHWA acceptance letter number and the name of the manufacturer by the start of the project. The label shall be readable. After January 1, 2003, all Category 2 devices without a label shall not be used on the project.

If requested by the Engineer, the Contractor shall provide a written list of Category 2 devices to be used on the project at least 5 days prior to beginning any work using the devices. For each type of device, the list shall indicate the FHWA acceptance letter number and the name of the manufacturer.

Full compensation for providing self-certification for crashworthiness of Category 1 traffic control devices and for providing a list of Category 2 devices used on the project and labeling Category 2 devices as specified shall be considered as included in the prices paid for the various contract items of work requiring the use of the Category 1 or Category 2 traffic control devices and no additional compensation will be allowed therefor.

10-1.13 MAINTAINING TRAFFIC

Attention is directed to Sections 7-1.08, "Public Convenience," 7-1.09, "Public Safety," and 12, "Construction Area Traffic Control Devices," of the Standard Specifications and to the provisions in "Public Safety" of these special provisions and these special provisions. Nothing in these special provisions shall be construed as relieving the Contractor from the responsibilities specified in Section 7-1.09.

No work that would require a lane closure shall be performed.

Personal vehicles of the Contractor's employees shall not be parked on the traveled way or shoulders including any section closed to public traffic.

The Contractor shall notify Rhodia (a Private Company) of the Contractor's intent to begin work at least 5 days before work is begun. The Contractor shall cooperate with Rhodia relative to handling traffic through Mococo Road. Mococo Road is a private road with public access.

The Contractor shall not work within 7.7 m of the Rhodia Spur Track between the hours of 4:00 pm and 7:00 pm daily to allow for the safe operation of the one freight train that goes in and out of the Rhodia Company.

When working on the domestic waterline, the Contractor shall not work within 3m of the centerline of the Rhodia Spur Track.

10-1.14 TEMPORARY CRASH CUSHION MODULE

This work shall consist of furnishing, installing, and maintaining sand filled temporary crash cushion modules in groupings or arrays at each location shown on the plans, as specified in these special provisions or where designated by the Engineer. The grouping or array of sand filled modules shall form a complete sand filled temporary crash cushion in conformance with the details shown on the plans and these special provisions.

Attention is directed to "Public Safety" of these special provisions.

Whenever the work or the Contractor's operations establishes a fixed obstacle, the exposed fixed obstacle shall be protected with a sand filled temporary crash cushion. The sand filled temporary crash cushion shall be in place prior to opening the lanes adjacent to the fixed obstacle to public traffic.

Sand filled temporary crash cushions shall be maintained in place at each location, including times when work is not actively in progress. Sand filled temporary crash cushions may be removed during a work period for access to the work provided that the exposed fixed obstacle is 4.6 m or more from a lane carrying public traffic and the temporary crash cushion is reset to protect the obstacle prior to the end of the work period in which the fixed obstacle was exposed. When no longer required, as determined by the Engineer, sand filled temporary crash cushions shall be removed from the site of the work.

At the Contractor's option, the modules for use in sand filled temporary crash cushions shall be either Energite III Inertial Modules, Fitch Inertial Modules or TrafFix Sand Barrels manufactured after March 31, 1997, or equal:

A. Energite III and Fitch Inertial Modules, manufactured by Energy Absorption Systems, Inc., One East Wacker Drive, Chicago, IL 60601-2076. Telephone 1-312-467-6750, FAX 1-800-770-6755

1. Distributor (North): Traffic Control Service, Inc., 8585 Thys Court, Sacramento, CA 95828. Telephone 1-800-884-8274, FAX 1-916-387-9734
2. Distributor (South): Traffic Control Service, Inc., 1881 Betmor Lane, Anaheim, CA 92805. Telephone 1-800-222-8274, FAX 1-714-937-1070

B. TrafFix Sand Barrels, manufactured by TrafFix Devices, Inc., 220 Calle Pintoresco, San Clemente, CA 92672. Telephone 1-949 361-5663, FAX 1-949 361-9205

1. Distributor (North): United Rentals, Inc., 1533 Berger Drive, San Jose, CA 95112. Telephone 1-408 287-4303, FAX 1-408 287-1929
2. Distributor (South): Statewide Safety & Sign, Inc., P.O. Box 1440, Pismo Beach, CA 93448. Telephone 1-800-559-7080, FAX 1-805 929-5786

Modules contained in each temporary crash cushion shall be of the same type at each location. The color of the modules shall be the standard yellow color, as furnished by the vendor, with black lids. The modules shall exhibit good workmanship free from structural flaws and objectionable surface defects. The modules need not be new. Good used undamaged modules conforming to color and quality of the types specified herein may be utilized. If used Fitch modules requiring a seal are furnished, the top edge of the seal shall be securely fastened to the wall of the module by a continuous strip of heavy duty tape.

Modules shall be filled with sand in conformance with the manufacturer's directions, and to the sand capacity in kilograms for each module shown on the plans. Sand for filling the modules shall be clean washed concrete sand of commercial quality. At the time of placing in the modules, the sand shall contain not more than 7 percent water as determined by California Test 226.

Modules damaged due to the Contractor's operations shall be repaired immediately by the Contractor at the Contractor's expense. Modules damaged beyond repair, as determined by the Engineer, due to the Contractor's operations shall be removed and replaced by the Contractor at the Contractor's expense.

Temporary crash cushion modules shall be placed on movable pallets or frames conforming to the dimensions shown on the plans. The pallets or frames shall provide a full bearing base beneath the modules. The modules and supporting pallets or frames shall not be moved by sliding or skidding along the pavement or bridge deck.

A Type R or P marker panel shall be attached to the front of the crash cushion as shown on the plans, when the closest point of the crash cushion array is within 3.6 m of the traveled way. The marker panel, when required, shall be firmly fastened to the crash cushion with commercial quality hardware or by other methods determined by the Engineer.

At the completion of the project, temporary crash cushion modules, sand filling, pallets or frames, and marker panels shall become the property of the Contractor and shall be removed from the site of the work. Temporary crash cushion modules shall not be installed in the permanent work.

Temporary crash cushion modules placed in conformance with the provisions in "Public Safety" of these special provisions will not be measured nor paid for.

10-1.15 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.

RELOCATE BOULDERS

Relocate boulders shall consist of removing, transporting and placing landscape boulders from stockpile areas to proposed boulder locations as shown on the plans and as directed by the Engineer.

The quantity of boulders to be relocated is 30.

Stockpiled boulders will be state-furnished, and are between 0.8 m to 1.5 m in diameter.

The Contractor shall notify the Engineer not less than 15 days prior to the relocation of boulders from the stockpile site.

Boulders shall be protected from cracking, splitting or spalling by Contractors operations during the relocation of boulders. Damaged boulders shall be replaced in-kind at the Contractors expense.

Prior to placing boulders, the area shall be cleared as specified under “Roadside Clearing” of these special provisions. Boulders shall not be placed until the completion of the irrigation functional test.

At least 3 days prior to relocating boulders, Contractor shall mark the proposed locations for placement of the boulders within the area as shown on plans, and as directed by the Engineer.

Full compensation for relocate boulders shall be considered as included in the contract lump sum price paid for highway planting and no separate payment will be made therefor.

REMOVE ASPHALT CONCRETE DIKE

Existing asphalt concrete dike, where shown on the plans to be removed, shall be removed.

Prior to removing the dike, the outside edge of the asphalt concrete to remain in place shall be cut on a neat line to a minimum depth of 50 mm.

The dike shall be removed in such a manner that the surfacing which is to remain in place is not damaged.

The dike shall be disposed of outside the highway right of way in conformance with the provisions in Section 7-1.13 of the Standard Specifications.

REMOVE CULVERT

Existing culverts, where shown on the plans to be removed, shall be completely removed and disposed of.

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 750 mm in width and shall be operated so that no fumes or smoke will be produced. The cold planing machine shall plane 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 the road surfacing being planed. The cutting width of the blade shall be not less than 900 mm.

Heater planing operations shall not be performed at times 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 shown on the typical cross sections or as designated 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 45 mm will not be allowed 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 1:30 (vertical: horizontal) 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 loose material from the underlying surface, before placing the permanent surfacing. The removed material shall be disposed of outside the highway right of way in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Operations shall be scheduled so 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 the 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 conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications. Removal operations of planed material shall be concurrent with planing operations and follow within 15 m of the planer, unless otherwise directed by the Engineer.

Planing asphalt concrete pavement will be measured by the square meter. 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 meter for plane asphalt concrete pavement shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the 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 the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.16 CLEARING AND GRUBBING

Clearing and grubbing shall conform to the provisions in Section 16, "Clearing and Grubbing," of the Standard Specifications.

10-1.17 EARTHWORK

Earthwork shall conform to the provisions in Section 19, "Earthwork," of the Standard Specifications and these special provisions.

Surplus excavated material shall become the property of the Contractor and shall be disposed of outside the highway right of way in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Where a portion of the 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 50 mm before removing the surfacing. Full compensation for cutting the existing surfacing shall be considered as included in the contract price paid per cubic meter for roadway excavation and no additional compensation will be allowed therefor.

The portion of imported borrow placed within 1.5 m of the finished grade shall have a Resistance (R-Value) of not less than 15.

10-1.18 CONTROLLED LOW STRENGTH MATERIAL

Controlled low strength material shall consist of a workable mixture of aggregate, cementitious materials, and water and shall conform to the provisions for slurry cement backfill in Section 19-3.062, "Slurry Cement Backfill," of the Standard Specifications and these special provisions.

At the option of the Contractor, controlled low strength material may be used as structure backfill for pipe culverts, except that controlled low strength material shall not be used as structure backfill for aluminum and aluminum-coated culverts nor for culverts having a diameter or span greater than 6.1 m.

When controlled low strength material is used for structure backfill, the width of the excavation shown on the plans may be reduced so that the clear distance between the outside of the pipe and the side of the excavation, on each side of the pipe, is a minimum of 300 mm. This minimum may be reduced to 150 mm when the height of cover is less than or equal to 6.1 m or the pipe diameter or span is less than 1050 mm.

Controlled low strength material in new construction shall not be permanently placed higher than the basement soil. For trenches in existing pavements, permanent placement shall be no higher than the bottom of the existing pavement permeable drainage layer. If a drainage layer does not exist, permanent placement in existing pavements shall be no higher than 25 mm below the bottom of the existing asphalt concrete surfacing or no higher than the top of base below the existing portland cement concrete pavement. The minimum height that controlled low strength material shall be placed, relative to the culvert invert, is 0.5 diameter or 0.5 height for rigid culverts and 0.7 diameter or 0.7 height for flexible culverts.

When controlled low strength material is proposed for use, the Contractor shall submit a mix design and test data to the Engineer for approval prior to excavating the trench for which controlled low strength material is proposed for use. The test data and mix design shall provide for the following:

A. A 28-day compressive strength between 345 kPa and 690 kPa for pipe culverts having a height of cover of 6.1 m or less and a minimum 28-day compressive strength of 690 kPa for pipe culverts having a height of cover greater than 6.1 m. Compressive strength shall be determined in conformance with the requirements in ASTM Designation: D 4832.
B. When controlled low strength material is used as structure backfill for pipe culverts, the sections of pipe culvert in contact with the controlled low strength material shall conform to the requirements of Chapter 850 of the Highway Design Manual using the minimum resistivity, pH, chloride content, and sulfate content of the hardened controlled low strength material. Minimum resistivity and pH shall be determined in conformance with the requirements of California Test 643. The chloride content shall be determined in conformance with the requirements of California Test 422 and the sulfate content shall be determined in conformance with the requirements of California Test 417.
C. Cement shall be any type of portland cement conforming to the requirements in ASTM Designation: C 150; or any type of blended hydraulic cement conforming to the requirements in ASTM Designation: C 595M or the physical requirements in ASTM Designation: C 1157M. Testing of cement will not be required.
D. Admixtures may be used in conformance with the provisions in Section 90-4, "Admixtures," of the Standard Specifications. Chemical admixtures containing chlorides as Cl in excess of one percent by mass of admixture, as determined in conformance with the requirements of California Test 415, shall not be used. If an air-entraining

admixture is used, the maximum air content shall be limited to 20 percent. Mineral admixtures shall be used at the Contractor's option.

Materials for controlled low strength material shall be thoroughly machine-mixed in a pugmill, rotary drum or other approved mixer. Mixing shall continue until the cementitious material and water are thoroughly dispersed throughout the material. Controlled low strength material shall be placed in the work within 3 hours after introduction of the cement to the aggregates.

When controlled low strength material is to be placed within the traveled way or otherwise to be covered by paving or embankment materials, the material shall achieve a maximum indentation diameter of 76 mm prior to covering and opening to public traffic. Penetration resistance shall be measured in conformance with the requirements in ASTM Designation: D 6024.

Controlled low strength material used as structure backfill for pipe culverts will be considered structure backfill for compensation purposes.

10-1.19 ASBESTOS-CONTAINING MATERIAL

Asbestos-containing material, as defined in Section 1529, “Asbestos,” of the Construction Safety Orders, Title 8, of the California Code of Regulations, is present within the project limits. The City of Martinez abandoned water main to be removed, as indicated on the plans, is asbestos-containing material.

Attention is directed to Section 7-1.06, “Safety and Health Provisions,” of the Standard Specifications. Work practices and worker health and safety during any work that results in disturbance of asbestos-containing material shall conform to Section 1529, “Asbestos,” of the Construction Safety Orders, Title 8, of the California Code of Regulations. The Contractor shall obtain all certifications and registrations required to do the work and certify in writing to the Engineer that the personnel performing the work have completed a training program appropriate for the work involved. Written notification of exposure monitoring results shall be submitted to the Engineer upon completion of the monitoring. A copy of any required written certification of the adequacy of alternative work practices shall be submitted to the Engineer before performing any work.

The requirements of subsection (d), “Multi-employer work sites,” of Section 1529, “Asbestos,” of the Construction Safety Orders, Title 8, of the California Code of Regulations shall be observed during performance of the work. This shall not be construed as relieving the Contractor from the Contractor’s responsibilities as provided in Section 8-1.01, “Subcontracting,” of the Standard Specifications.

Any friable asbestos-containing material or non-friable asbestos-containing material that is damaged during the work so that it becomes friable or is in a finely divided or powdered state shall be wetted and sealed in leak-tight, non-returnable containers, such as 2 bags of 0.15 mm plastic, cartons, drums, or cans. Bulk friable asbestos-containing material that will not fit into containers without additional breaking shall be double-wrapped, sealed, and wetted. Trailers, drop-boxes, or other vehicles used for transport of bulk materials shall be lined with plastic sheeting and covered with a tarp. Each container and wrapped material shall be properly labeled, manifested and transported to a facility permitted to accept the material. The Engineer will obtain the United States Environmental Protection Agency Identification Number and sign all manifests as the Generator.

Non-friable asbestos-containing material shall be double-wrapped and transported to a facility permitted to accept the material. Any other material that has been in contact with friable, finely divided, or powdered asbestos-containing material shall be cleaned thoroughly before removal from the work area. If the Contractor chooses not to clean the material it shall be handled in accordance with the provisions for bulk friable asbestos-containing material.

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

10-1.20 IRRIGATION CROSSOVERS

Irrigation crossovers shall conform to the provisions in Section 20-5, "Irrigation Systems," of the Standard Specifications and these special provisions.

Conduits shall be placed in open trenches in conformance with the provisions in Section 20-5.03B, "Conduit for Irrigation Crossovers," of the Standard Specifications.

Conduits shall be corrugated high density polyethylene (CHDPE) pipe. Corrugated high density polyethylene pipe shall conform to the requirements in ASTM Designation: F 405 or F 667, or AASHTO Designation: M 252 or M 294 and shall be Type S. Couplings and fittings shall be as recommended by the pipe manufacturer.

Conduits shall be alternate conduits and shall be one of the following:

A. Polyvinylchloride (PVC) plastic pipe, PR(315),

Water line crossovers shall conform to the provisions in Section 20-5.03C, "Water Line Crossovers," of the Standard Specifications.

Sprinkler control crossovers shall conform to the provisions in Section 20-5.027D, "Sprinkler Control Crossovers," of the Standard Specifications.

Installation of pull boxes shall conform to the provisions in Section 20-5.027I, "Conductors, Electrical Conduit and Pull Boxes," of the Standard Specifications. When no conductors are installed in electrical conduits, pull boxes for irrigation crossovers shall be installed on a foundation of compacted soil.

10-1.21 AGGREGATE SUBBASE

Aggregate subbase shall be Class 4 and shall conform to the provisions in Section 25, "Aggregate Subbases," of the Standard Specifications and these special provisions.

The restriction that the amount of reclaimed material included in Class 4 aggregate subbase not exceed 50 percent of the total volume of the aggregate used shall not apply. Aggregate for Class 4 aggregate subbase may include reclaimed glass. Aggregate subbase incorporating reclaimed glass shall not be placed at locations where surfacing will not be placed over the aggregate subbase.

The percentage composition by mass of Class 4 aggregate subbase shall conform to the following grading requirements:

Grading Requirements (Percentage Passing)

Sieve Sizes	Operating Range	Contract Compliance
63-mm	100	100
4.75-mm	30-65	25-70
75-µm	0-15	0-18

Class 4 aggregate subbase shall also conform to the following quality requirements:

Quality Requirements

Test	Operating Range	Contract Compliance
Sand Equivalent	21 Min.	18 Min
Resistance (R-value)	----	50 Min

The provisions of the last 4 paragraphs in Section 25-1.02A, "Class 1, Class 2, and Class 3 Aggregate Subbases," of the Standard Specifications shall apply to Class 4 aggregate subbase.

At the option of the Contractor, Class 1 aggregate subbase conforming to the grading and quality requirements in Section 25-1.02A, may be used in place of Class 4 aggregate subbase. The restriction that the amount of reclaimed material included in Class 1 aggregate subbase not exceed 50 percent of the total volume of the aggregate used shall not apply. Aggregate for Class 1 aggregate subbase may include reclaimed glass. Aggregate subbase incorporating reclaimed glass shall not be placed at locations where surfacing will not be placed over the aggregate subbase. Once a class of aggregate subbase is selected, the class shall not be changed without written approval of the Engineer.

Regardless of the class of aggregate subbase supplied under the provisions of this section, payment for all aggregate subbase will be made as Class 4 aggregate subbase.

10-1.22 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 restriction that the amount of reclaimed material included in Class 3 aggregate base not exceed 50 percent of the total volume of the aggregate used shall not apply. Aggregate for Class 3 aggregate base may include reclaimed glass. Aggregate base incorporating reclaimed glass shall not be placed at locations where surfacing will not be placed over the aggregate base.

Aggregate for Class 3 aggregate base shall conform to the following requirements:

Grading Requirements (Percentage Passing)

Sieve Sizes	19 mm Maximum	
	Operating Range	Contract Compliance
50-mm	----	----
37.5-mm	----	----
25-mm	100	100
19-mm	90-100	87-100
4.75-mm	35-60	30-65
600-µm	10-30	5-35
75-µm	2-11	0-14

Grading Requirements (Percentage Passing)

Sieve Sizes	37.5 mm Maximum	
	Operating Range	Contract Compliance
50-mm	100	100
37.5-mm	90-100	87-100
25-mm	----	----
19-mm	50-85	45-90
4.75-mm	25-45	20-50
600-µm	10-25	6-29
75-µm	2-11	0-14

Quality Requirements

Tests	Operating Range	Contract Compliance
Sand Equivalent	25 Min	22 Min
Resistance (R-value)	----	78
Durability Index		35 Min

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.

10-1.23 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 amount of asphalt binder used in asphalt concrete placed in dikes, gutters, gutter flares, overside drains and aprons at the ends of drainage structures shall be increased one percent by mass of the aggregate over the amount of asphalt binder determined for use in asphalt concrete placed on the traveled way.

The aggregate for Type A asphalt concrete shall conform to the 12.5 mm maximum medium grading specified in Section 39-2.02, "Aggregate," of the Standard Specifications.

Aggregate for asphalt concrete dikes shall be in conformance with the provisions for 9.5-mm Maximum grading in Section 39-2.02, "Aggregate," of the Standard Specifications.

If the finished surface of the asphalt concrete on Toll Plaza Road and Parking Lots traffic lanes does not meet the specified surface tolerances, the surfacing 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 the 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. Ground areas shall be neat rectangular areas of uniform surface appearance. Abrasive grinding shall conform to the provisions in the first paragraph and the last 4 paragraphs in Section 42-2.02, "Construction," of the Standard Specifications.

The area to which paint binder has been applied shall be closed to public traffic. Care shall be taken to avoid tracking binder material onto existing pavement surfaces beyond the limits of construction.

10-1.24 CONCRETE PAVEMENT (WITH DOWELED TRANSVERSE WEAKENED PLANE JOINTS)

GENERAL

Portland cement concrete pavement shall conform to the provisions in Section 40, "Portland Cement Concrete Pavement," of the Standard Specifications and these special provisions.

Insert method for forming joints in pavement shall not be used.

MATERIALS

Tie Bars

Tie bars shall be deformed reinforcing steel bars conforming to the requirements of ASTM Designation: A 615/A 615M, Grade 300 or 420, and shall be epoxy-coated in conformance with the provisions in Section 52-1.02B, "Epoxy-coated Reinforcement," of the Standard Specifications, except that references made to ASTM Designation D 3963 shall be deemed to mean ASTM Designation A 934 or A 775. Epoxy-coated tie bars shall not be bent after installation.

Dowels

Dowels shall be smooth, round, epoxy-coated steel conforming to the requirements of ASTM Designation: A 615/A 615M, Grade 300 or 420, the details shown on the plans and the provisions in Section 52-1.02B, "Epoxy-coated Reinforcement," of the Standard Specifications, except that references made to ASTM Designation D 3963/D 3963M shall be deemed to mean ASTM Designation A 934/A 934M.

Dowels shall be plain, smooth, round bars. Dowels shall be free from burrs or other deformations detrimental to free movement of the bars in the concrete.

Bond Breaker

Dowels shall be lubricated with a bond breaker over the entire bar. A bond breaker application of petroleum paraffin based lubricant or white pigmented curing compound shall be used to coat the dowels completely prior to placement. Oil and asphalt based bond breakers shall not be used. Paraffin based lubricant shall be Dayton Superior DSC BB-Coat or Valvoline Tectyl 506 or an approved equal. Paraffin based lubricant shall be factory applied. White pigmented curing compound shall conform to the requirements of ASTM Designation: C309, Type 2, Class A, and shall contain 22 percent minimum nonvolatile vehicles consisting of at least 50 percent paraffin wax. Curing compound shall be applied in two separate applications. Each application of curing compound shall be applied at the approximate rate of one liter per 3.7 m^2.

Load Transfer Assemblies (Dowel Basket)

Load transfer assemblies shall be manufactured with a minimum welded wire gage number of 3/0 (9.2 mm). Assemblies shall be either a U- or a A-frame. J-frame shapes shall not be used. Assemblies shall be fabricated in conformance with the requirements of ASTM Designation: A 82. Welding of assemblies shall conform to the requirements of AWS D1.1. A broken weld will be a cause for rejection of the assembly. Assemblies shall be epoxy coated in conformance with the requirements of ASTM Designation: A 884/A 884M.

Wire for staking pins shall conform to the requirements of ASTM Designation: A 82. Staking pins shall not be less than 7 mm wire diameter.

Concrete fasteners shall be driven fasteners (concrete nails) used specifically for fastening to hardened concrete conforming to the requirements of ASTM Designation: F1667. Shank diameter shall be a minimum of 4 mm with a minimum shank length of 64 mm. Clips shall be commercial quality manufactured for use with dowel assemblies.

Surface of staking pins, concrete fasteners and clips shall be either zinc electroplated or galvanized with a minimum coating thickness of 0.005 mm.

Silicone Joint Sealant

Low modulus silicone joint sealant shall be furnished in a one-part silicone formulation. Acid cure sealants shall not be used. The compound shall be compatible with the surface to which it is applied and shall conform to the following requirements:

Specification	Test Method	Requirement
Tensile stress, 150% elongation, 7-day cure at 25°± 1°C and 45% to 55% R.H.[e]	ASTM D 412 (Die C)	310 kPa max.
Flow at 25° ± 1°C	ASTM C 639[a]	Shall not flow from channel
Extrusion Rate at 25° ± 1°C	ASTM C 603[b]	75-250 g/min.
Specific Gravity	ASTM D 792 Method A	1.01 to 1.51
Durometer Hardness, at -18°C, Shore A, cured 7 days at 25° ± 1°C	ASTM C 661	10 to 25
Ozone and Ultraviolet Resistance, after 5000 hours	ASTM C 793	No chalking, cracking or bond loss
Tack free at 25° ± 1°C and 45% to 55% R.H.[e]	ASTM C 679	Less than 75 minutes
Elongation, 7 day cure at 25° ± 1°C and 45% to 55% R.H.[e]	ASTM D 412 (Die C)	500 percent min.
Set to Touch, at 25° ± 1°C and 45% to 55% R.H.[e]	ASTM D 1640	Less than 75 minutes
Shelf Life, from date of shipment	—	6 months min.
Bond, to concrete mortar-concrete briquets, air cured 7 days at 25° ± 1°C	AASHTO T 132[c]	345 kPa min.
Movement Capability and Adhesion, 100% extension at -18°C after, air cured 7 days at 25° ± 1°C, and followed by 7 days in water at 25° ± 1°C	ASTM C 719[d]	No adhesive or cohesive failure after 5 cycles

Notes:

a. ASTM Designation: C 639 Modified (15 percent slope channel A).

b. ASTM Designation: C 603, through 3-mm opening at 345 kPa.

c. Mold briquets in conformance with AASHTO Designation: T 132, sawed in half and bonded with a 1.5 mm maximum thickness of sealant and tested in conformance with AASHTO Designation: T 132. Briquets shall be dried to constant mass at 100 ± 5° C.

d. Movement Capability and Adhesion: Prepare 305 mm x 25 mm x 75 mm concrete blocks in conformance with ASTM Designation: C 719. A sawed face shall be used for bond surface. Seal 50 mm of block leaving 12.5 mm on each end of specimen unsealed. The depth of sealant shall be 9.5 mm and the width 12.5 mm.

e. R.H. equals relative humidity.

The silicone joint sealant shall be formulated to cure rapidly enough to prevent flow after application on grades of up to 15 percent.

A Certificate of Compliance for the silicone sealant shall be furnished to the Engineer in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications. The Certificate shall also be accompanied with a certified test report of the results of the required tests performed on the sealant material within the previous 12 months prior to proposed use. The Certificate and accompanying test report shall be provided for each lot of silicone joint sealant prior to use on the project.

Backer Rods

Backer rods shall have a diameter prior to placement at least 25 percent greater than the width of the sawcut and shall be expanded, crosslinked, closed-cell polyethylene foam that is compatible with the joint sealant so that no bond or adverse reaction occurs between the rod and sealant. In no case shall the Contractor use a hot pour sealant that will melt the backer rod. The Contractor shall submit a manufacturer's data sheet verifying that the backer rod is compatible with the sealant to be used.

SUBMITTALS

Samples of the following materials used in the work shall be submitted for the Engineer's approval, 10 days prior to installation or placement of the materials:

Dowel Bars
Bond Breaker
Tie Bars
Epoxy

Load Transfer Assemblies
Staking Pins
Concrete Nails and clips
Joint Sealant
Backer Rods

INSTALLING TIE BARS

Tie bars shall be installed at longitudinal contact joints and longitudinal weakened plane joints as shown on the plans. In no case, shall any consecutive width of new portland cement concrete pavement tied together with tie bars exceed 15 meters. In no case shall tie bars be used at a joint where portland cement concrete and asphalt concrete pavements abut.

Tie bars shall be installed at longitudinal joints by the following method:

By inserting the tie bars into the plastic slipformed concrete before finishing the concrete. Inserted tie bars shall have full contact between the bar and the concrete. When tie bars are inserted through the pavement surface, the concrete over the tie bars shall be reworked and refinished to such an extent that there is no evidence on the surface of the completed pavement that there has been any insertion performed. Any loose tie bars shall be replaced by drilling and grouting into place with epoxy as described in method 1 above at the Contractor's expense.

DOWEL PLACEMENT

Dowels at transverse weakened plane joints and at transverse contact joints shall be placed as shown on the plans. Prior to placement of the dowels, the Contractor shall submit to the Engineer in writing, a daily procedure to identify the transverse weakened plane joint location relative to the middle of the dowel bars. This procedure shall be verified by either coring, or any other method that is approved by the Engineer. Sawcuts for transverse weakened plane joints that are not directly over the center of the dowel bar (tolerance ±25 mm) will be rejected and shall be corrected in conformance with "Core Drilling for Dowel Placement Alignment Assurance Testing" of these special provisions.

Dowels shall be placed by using load transfer assemblies (dowel baskets). Dowels shall be oriented parallel to the pavement lane centerline and surface of the pavement at mid slab depth. Dowel alignment shall be ±6 mm per 300 mm of dowel length in both horizontal and vertical planes.

When load transfer assemblies (dowel baskets) are used, they shall be securely anchored firmly to the base to hold all the dowel bars at the specified depth and alignment during concrete placement without displacement. For granular or non-stabilized bases, a minimum of 8 alternating, equally spaced, steel staking pins with a welded hook shall be used to anchor each 3.6 m assembly (4 per lower runner wire). Staking pins shall penetrate at least 300 mm into the granular base. For stabilized base such as cement treated base or lean concrete base, a minimum of 8 alternating, equally spaced, concrete fasteners with clips shall be used to anchor each 3.6 m assembly (4 per lower runner wire). At least 10 staking pins or concrete fasteners shall be used for assembly sections greater than 3.6 m and less than or equal to 4.9 mm. Temporary spacer wires connecting load transfer assemblies shall be cut or removed after the assemblies are anchored into position prior to concrete placement. Paving shall be suspended when approved assemblies are not in place at least 60 m in advance of the concrete placement operation. The Engineer may waive this requirement upon written request by the Contractor, in areas where access is restricted, or other construction limitations are encountered.

Approval of the initial placement of load transfer assemblies shall not constitute acceptance of the final position of the dowel bars.

LIQUID JOINT SEALANT INSTALLATION

The joint sealant detail for transverse and longitudinal joints, as shown on the plans, shall apply only to weakened plane joints. Weakened plane joints shall be constructed by the sawing method. Should grinding or grooving be required over or adjacent to any joint after sealant has been placed, the joint materials shall be completely removed and disposed of, and replaced at the Contractor's expense. Joints shall have a sealant recessed below the final finished surface as shown on the plans.

At the Contractor's option, transverse weakened plane joints shall be either Type DSC or Type SSC as shown on the plans. Longitudinal weakened plane joints shall be Type SSC only as shown on the plans.

Seven days after the concrete pavement placement and not more than 4 hours before placing backer rods and joint sealant materials, the joint walls shall be cleaned by the dry sand blast method and other means as necessary to completely remove from the joint all objectionable material such as soil, asphalt, curing compound, paint and rust. After cleaning the joint, all traces of sand, dust and loose material shall be removed from and near the joint for a distance along the pavement surfaces of at least 50 mm on each side of the joint by the use of a vacuum device. Surface moisture shall be removed at the joints by means of compressed air or moderate hot compressed air or other means approved by the Engineer. Drying procedures that leave a residue or film on the joint wall shall not be used. Sandblasting equipment shall have a maximum nozzle diameter size of 6 ± 1 mm and a minimum pressure of 0.62-MPa.

Backer rod shall be installed when the temperature of the portland cement concrete pavement is above the dew point of the air and when the air temperature is 4°C or above. Backer rod shall be installed when the joints to be sealed have been properly patched, cleaned and dried, as determined by the Engineer. Methods of placing backer rod that leave a residue or film on the joint walls, shall not be used.

Immediately after placement of the backer rod, joint sealant shall be placed in the clean, dry, prepared joints as shown on the plans. The joint sealant shall be applied by a mechanical device with a nozzle shaped to fit inside the joint to introduce the sealant from inside the joint. Adequate pressure shall be applied to the sealant to ensure that the sealant material is extruded evenly and that full continuous contact is made with the joint walls. After application of the sealant the surface of the sealant shall be recessed as shown on the plans.

Any failure of the joint material in either adhesion or cohesion of the material will be cause for rejection of the joint. The finished surface of joint sealant shall conform to the dimensions and allowable tolerances shown on the plans. Rejected joint materials or joint material whose finished surface does not conform to the dimensions shown on the plans, as determined by the Engineer, shall be repaired or replaced, at the Contractor's expense, with joint material that conforms to the requirements.

After each joint is sealed, all surplus joint sealer on the pavement surface shall be removed. Traffic shall not be permitted over the sealed joints until the sealant is tack free and set sufficiently to prevent embedment of roadway debris into the sealant.

MEASUREMENT AND PAYMENT

Sealing longitudinal and transverse weakened plane joints in portland cement concrete pavement will be measured by the meter.

The contract price paid per meter for seal pavement joint shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in sealing pavement joints complete in place, including sawing, cleaning and preparing the joints in the concrete pavement, furnishing and installing backer rod, repairing and patching spalled or raveled sawed joints, and replacing or repairing rejected joints, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for furnishing and placing epoxy-coated tie bars and lubricated epoxy- coated dowels with epoxy–coated dowel assemblies with fasteners or staking pins in portland cement concrete pavement shall be considered as included in the contract price paid per cubic meter for concrete pavement and no separate payment will be made therefor.

10-1.25 CONCRETE STRUCTURES

Portland cement concrete structures shall conform to the provisions in Section 51, "Concrete Structures," of the Standard Specifications.

10-1.26 REINFORCEMENT

Reinforcement shall conform to the provisions in Section 52, "Reinforcement," of the Standard Specifications and these special provisions.

10-1.27 ROADSIDE SIGNS

Roadside signs shall be installed at the locations shown on the plans or where designated by the Engineer and in conformance with the provisions in Section 56-2, "Roadside Signs," of the Standard Specifications and these special provisions.

Wood posts shall be pressure treated after fabrication in conformance with the provisions in Section 58, "Preservative Treatment of Lumber, Timber and Piling," of the Standard Specifications with creosote, creosote coal tar solution, creosote petroleum solution (50-50), pentachlorophenol in hydrocarbon solvent, copper naphthenate, ammoniacal copper arsenate, or ammoniacal copper zinc arsenate. In addition to the preservatives listed above, Southern yellow pine may also be pressure treated with chromated copper arsenate. When other than one of the creosote processes is used, blocks shall have a minimum retention of 6.4 kg/m^3, and need not be incised.

10-1.28 WEATHER STATION

The Contractor shall furnish and install weather station in accordance with these special provision accordance and the manufacturers' recommendations. The Contractor shall connect all individual pieces of weather station equipment so that the weather station shall be fully operational before the end of the contract. The Contractor shall be responsible for the safety of the weather station equipment until the end of the contract.

The weather station shall consist of a precipitation sensor, a datalogger, telemetric devices, power supply and a tower. The weather station shall be installed on the roof of the Operations Building located at the Benicia Martinez Bridge Toll Plaza as shown on the plans and as specified in these special provisions.

The precipitation sensor shall consist of a 200-mm diameter aluminum funnel that collects water and directs it to a tipping mechanism. The tipping mechanism shall tip and dump when 0.25 mm of water is collected. Each tip of the bucket shall cause a magnet to pass over a reed switch and effect a momentary contact closure. The tip shall also cause a second bucket to come into position below the funnel. The reed switch shall be connected to the datalogger by an appropriate interface cable.

The tipping mechanism shall be a plastic catch bucket with sapphire bearings. The tipping mechanism and the funnel shall be housed in a metallic cylinder 430 mm. high with a weight of 3.9 kg, and a gage orifice diameter of 200 mm. The gage orifice shall be protected from falling debris by a screen. The cylindrical housing shall include a bubble level and shall be mounted on a horizontal pedestal. The accuracy of the precipitation sensor shall be within 0.5 mm for a rainfall intensity of up to 25 mm/hr, and within 2 percent of total incidental precipitation for greater intensities.

The datalogger shall have a single 37-pin CPC connector which provides 8 user-configurable single-ended analog inputs, one frequency input, one switch closure input and one SDI-12 interface. The datalogger shall also have one input/output port that interfaces with MS-DOS for programming or data retrieval. It shall have 128 kilobytes of onboard memory storage, and its temperature-compensated real time clock shall not drift by more than 15 seconds per month. A 37-pin male mating connector assembly and a DB9 cable assembly shall be provided.

The datalogger shall be equipped with a 33.6 kilobaud or higher telephone modem, which shall be full duplex and its baud rate selectable from the datalogger software. The modem shall be capable of being programmed to transmit or receive data by dialing out automatically on a specified schedule or in response to an incoming call. The modem shall be powered by a 12-volt power supply and shall typically require a current of 100 mA. The modem shall also have a RJ-11 connector for connection to a standard telephone line.

A 7 ampere-hour (A·hr) rechargeable battery with a high-impact polystyrene case shall provide electrical power for the datalogger. The battery's nominal voltage shall be 12 V and it shall weigh no more than 2.72 kg. The battery shall be kept charged by two photovoltaic solar panels each weighing no more than 0.45 kg and measuring no more than 150 mm by 355 mm. Each solar panel shall be capable of supplying 100 mA at a design operating voltage of 14.5 V, and the output voltage shall be clamped at 15 V. The solar panels shall be electrically connected in parallel. All mounting hardware and connection cables for the solar panels shall be provided by the Contractor.

A NEMA Type 4 enclosure with an appropriate internal mounting plate shall house the datalogger equipment and the battery. The weather station equipment shall be mounted on a 2.74-m self-guyed tower, which shall be made of aluminum and weigh no more than 6.8 kg. All mounting hardware for the various pieces of equipment shall be provided by the Contractor.

The tower shall be mounted on a relatively flat surface with orifice horizontal. The height of the orifice above the surface on which the tower is mounted shall be not more than 2 m and not less than 1.2 m. The distance between surrounding objects and the precipitation gage shall be no closer than 2 times their height above the gage orifice.

The tower shall be mounted at a location shown on the plans. The Contractor shall wire a permanent telephone connection for the weather station, but Caltrans will arrange for the telephone service.

A complete set of manuals and software for the datalogger shall be provided to the Engineer. The software shall run on an MS-DOS or Windows platform and shall contain a library of pre-defined sensor and data processing algorithms. The software shall allow the user to create and manage custom programs that govern all aspects of the weather station's operation: reading the sensor(s), analyzing and converting the data, storage and telemetry. The software shall be capable of transferring the completed custom program to the non-volatile memory of the datalogger.

The contract lump sum price paid for weather station shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in weather station, complete in place, including providing required wiring to a standard telephone line service point and verifying operational readiness, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.29 ALTERNATIVE PIPE

Alternative pipe culverts shall conform to the provisions in Section 62, "Alternative Culverts," of the Standard Specifications and these special provisions.

REINFORCED CONCRETE PIPE

Reinforced concrete pipe shall conform to the provisions in Section 65, "Reinforced Concrete Pipe," of the Standard Specifications and these special provisions.

Where embankment will not be placed over the top of the pipe, a relative compaction of not less than 85 percent shall be required below the pipe spring line for pipe installed using Method 1 backfill in trench, as shown on Standard Plan A62D. Where the pipe is to be placed under the traveled way, a relative compaction of not less than 90 percent shall be required unless the minimum distance between the top of the pipe and the pavement surface is the greater of 1.2 m or one half of the outside diameter of the pipe.

Except as otherwise designated by classification on the plans or in the specifications, joints for culvert and drainage pipes shall conform to the plans or specifications for standard joints.

When reinforced concrete pipe is installed in conformance with the details shown on Revised Standard Plan A62DA, the fifth paragraph of Section 19-3.04, "Water Control and Foundation Treatment," of the Standard Specifications shall not apply.

When solid rock or other unyielding material is encountered at the planned elevation of the bottom of the bedding, the material below the bottom of the bedding shall be removed to a depth of 1/50 of the height of the embankment over the top of the culvert, but not less than 150 mm nor more than 300 mm. The resulting trench below the bottom of the bedding shall be backfilled with structure backfill material in conformance with the provisions in Section 19-3.06, "Structure Backfill," of the Standard Specifications.

The excavation and backfill below the planned elevation of the bottom of the bedding will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications.

The Outer Bedding shown on Revised Standard Plan A62DA shall not be compacted prior to placement of the pipe.

Reinforced concrete pipe shall be either cast or spun. Cast reinforced concrete pipe shall be manufactured by placing the concrete into stationary, vertical, cylindrical metal forms. Spun reinforced concrete pipe shall be manufactured by introducing the concrete into a rotating, horizontal, cylindrical metal form.

Special reinforced concrete pipe, having concrete cover over the steel reinforcement greater than the cover specified in AASHTO Designation: M 170M, shall conform to the provisions in Section 65-1.02, "Materials," and Section 65-1.02A, "Circular Reinforced Concrete Pipe," of the Standard Specifications, except the width of crack produced by the D-load test specified in AASHTO Designation: M 170M shall be the width determined by the following formula:

$$b = \frac{t - 3 / 8d}{t - 3 / 8d - C} \times 0.3\text{-mm}$$

Where:
b = Width of crack to be produced in lieu of the 0.3-mm crack specified in AASHTO Designation: M 170M
t = Wall thickness of pipe, mm
d = Effective depth of the section to be tested, m
C = Concrete cover over steel reinforcement in excess of cover specified in AASHTO Designation: M 170M

Reinforced concrete pipe that is to be hydrostatically tested shall be strength tested by the 3-edge bearing method to a maximum D-load of 10 percent greater than the 0.3-mm cracking D-load specified in AASHTO Designation: M 170M or to the actual D-load required to produce a 0.3-mm crack, whichever is the lesser.

CORRUGATED METAL PIPE

Corrugated steel pipe culverts shall conform to the provisions in Section 66, "Corrugated Metal Pipe," of the Standard Specifications and these special provisions.

Asphaltic mastic coating or polymeric sheet coating substituted for bituminous coating shall be placed on the outside and inside surfaces of the pipe.

Corrugated steel pipe shall be fabricated from zinc-coated steel sheet.

10-1.30 PLASTIC PIPE

Plastic pipe shall conform to the provisions in Section 64, "Plastic Pipe," of the Standard Specifications.

10-1.31 MISCELLANEOUS CONCRETE CONSTRUCTION

Minor Concrete (Miscellaneous Construction) shall conform to the provisions in Section 73, "Concrete Curbs and Sidewalks," of the Standard Specifications and these special provisions.

10-1.32 MISCELLANEOUS IRON AND STEEL

Miscellaneous iron and steel shall conform to the provisions in Section 75, "Miscellaneous Metal," of the Standard Specifications.

10-1.33 CHAIN LINK FENCE

Chain link fence shall be Type CL 1.8 and shall conform to the provisions in Section 80, "Fences," of the Standard Specifications.

10-1.34 MARKERS

Markers shall conform to the provisions in Section 82, "Markers and Delineators," of the Standard Specifications and these special provisions.

Markers on flexible posts shall conform to the provisions in "Prequalified and Tested Signing and Delineation Materials" of these special provisions. Flexible posts shall be made from a flexible white plastic which shall be resistant to impact, ultraviolet light, ozone, and hydrocarbons. Flexible posts shall resist stiffening with age and shall be free of burns, discoloration, contamination, and other objectionable marks or defects which affect appearance or serviceability.

Retroreflective sheeting for metal and flexible target plates shall be the retroreflective sheeting designated for channelizers, markers, and delineators conforming to the requirements in ASTM Designation: D 4956-95 and in conformance with the provisions in "Prequalified and Tested Signing and Delineation Materials" of these special provisions.

10-1.35 METAL BEAM GUARD RAILING

Metal beam guard railing shall be constructed in conformance with the provisions in Section 83-1, "Railings," of the Standard Specifications and these special provisions.

Line posts and blocks shall be wood.

Delete the ninth and eleventh paragraphs in Section 83-1.02B, "Metal Beam Guard Railing," of the Standard Specifications.

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

Wood posts and blocks shall be pressure treated after fabrication in conformance with the provisions in Section 58, "Preservative Treatment of Lumber, Timber and Piling," of the Standard Specifications with creosote, creosote coal tar solution, creosote petroleum solution (50-50), pentachlorophenol in hydrocarbon solvent, copper naphthenate, ammoniacal copper arsenate, or ammoniacal copper zinc arsenate. In addition to the preservatives listed above, Southern yellow pine may also be pressure treated with chromated copper arsenate. When other than one of the creosote processes is used, blocks shall have a minimum retention of 6.4 Kg/m^3, and need not be incised.

Metal beam guard railing elements and required backup plates, terminal sections, end sections, and return sections shall conform to the requirements of Type 2 W-Beam as shown in AASHTO Designation: M 180.

TERMINAL SYSTEM (TYPE SRT)

Terminal system (Type SRT) shall be furnished and installed as shown on the plans and in conformance with these special provisions.

Terminal system (Type SRT) shall be a SRT-350 Slotted Rail Terminal (8 post system) as manufactured by Trinity Industries, Inc., and shall include all the items detailed for terminal system (Type SRT) shown on the plans.

The 5 mm x 44 mm x 75 mm plate washer shown on the elevation view and in Section D-D at Wood Post No. 1 shall be omitted.

Arrangements have been made to insure that any successful bidder can obtain the SRT-350 Slotted Rail Terminal (8 post system) from the manufacturer, Trinity Industries, Inc., P.O. Box 99, 950 West 400S, Centerville, UT 84014, Telephone 1-800-772-7976. The price quoted by the manufacturer for the SRT-350 Slotted Rail Terminal (8 post system), FOB Centerville, Utah is $845.00, not including sales tax.

The above price will be firm for orders placed on or before July 31, 2002, provided delivery is accepted within 90 days after the order is placed.

The Contractor shall provide the Engineer with a Certificate of Compliance from the manufacturer in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications. The Certificate of Compliance shall certify that terminal systems (Type SRT) conform to the contract plans and specifications, conform to the prequalified design and material requirements and were manufactured in conformance with the approved quality control program.

The terminal system (Type SRT) shall be installed in conformance with the manufacturer's installation instructions and these requirements. The steel foundation tubes with soil plates attached, shall be, at the Contractor's option, either driven, with or without pilot holes, or placed in drilled holes. Space around the steel foundation tubes shall be backfilled with selected earth, free of rock, placed in layers approximately 100 mm thick and each layer shall be moistened and thoroughly compacted. Wood terminal posts shall be inserted into the steel foundation tubes by hand. Before the wood terminal posts are inserted, the inside surfaces of the steel foundation tubes to receive the wood posts shall be coated with a grease which will not melt or run at a temperature of 65°C or less. The edges of the wood terminal posts may be slightly rounded to facilitate insertion of the post into the steel foundation tubes.

Surplus excavated material remaining after the terminal system (Type SRT) has been constructed shall be disposed of in a uniform manner along the adjacent roadway where designated by the Engineer.

10-1.36 CABLE RAILING

Cable railing shall conform to the provisions in Section 83-1, "Railings," of the Standard Specifications.

10-1.37 CONCRETE BARRIER

Concrete barriers shall conform to the provisions in Section 83-2, "Barriers," of the Standard Specifications and these special provisions.

Concrete barrier markers shall conform to the provisions in "Prequalified and Tested Signing and Delineation Materials" of these special provisions. At those locations shown on the plans, concrete barrier markers shall be cemented to the barrier in conformance with the manufacturer's recommendations.

10-1.38 PAINT TRAFFIC STRIPE AND PAVEMENT MARKING

Painted traffic stripes (traffic lines) and pavement markings shall be applied in conformance with the provisions in Section 84, "Traffic Stripes and Pavement Markings," of the Standard Specifications and these special provisions.

At the option of the Contractor, permanent traffic striping and pavement marking tape conforming to the provisions in "Prequalified and Tested Signing and Delineation Materials" of these special provisions may be placed instead of the painted traffic stripes and pavement markings specified herein. Permanent tape, if used, shall be installed in conformance with the manufacturer's specifications. If permanent tape is placed instead of painted traffic stripes and pavement markings, the tape will be measured and paid for by the meter as paint traffic stripe and by the square meter as paint pavement marking of the number of coats designated in the Engineer's Estimate.

10-1.39 PARKING BUMPER

Parking bumpers shall be furnished and installed at the locations and in the manner shown on the plans.

Parking bumpers shall be precast concrete, reinforced as shown on the plans, and shall be constructed from commercial quality concrete containing not less than 280 kg of cement per cubic meter and reinforcing steel or shall be commercially available precast concrete bumpers conforming to the details shown on the plans. Minor variations in cross section dimensions will be acceptable in commercially available units.

Dowels shall be commercial quality reinforcing steel or mild steel rods.

Parking bumpers will be measured by the unit as determined from actual count in place.

The contract unit price paid for parking bumper (precast concrete) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in installing precast concrete parking bumpers, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions and as directed by the Engineer.

10-1.40 PAVEMENT MARKERS

Pavement markers shall be placed in conformance with the provisions in Section 85, "Pavement Markers," of the Standard Specifications and these special provisions.

Retroreflective pavement markers shall comply with the specific intensity provisions for reflectance after abrading the lens surface in conformance with the "Steel Wool Abrasion Procedure" specified for pavement markers placed in pavement recesses in Section 85-1.05, "Retroreflective Pavement Markers," of the Standard Specifications.

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.

When fluctuations of water pressure and water supply are encountered during normal working hours, plants shall be watered at other times, as often, and in sufficient amounts as conditions may require to keep the soil and plant roots moist during the life of the contract.

Full compensation for watering plants outside normal working hours shall be considered as included in the contract lump sum prices paid for highway planting and plant establishment work and no additional compensation will be allowed therefor.

PROGRESS INSPECTIONS

Progress inspections will be performed by the Engineer for completed highway planting and irrigation system work at designated stages during the life of the contract.

Progress inspections will not relieve the Contractor of responsibility for installation in conformance with the special provisions, plans and Standard Specifications. Work within an area shall not progress beyond each stage until the inspection

has been completed, corrective work has been performed, and the work is approved, unless otherwise permitted by the Engineer.

The requirements for progress inspections will not preclude additional inspections of work by the Engineer at other times during the life of the contract.

The Contractor shall notify the Engineer, in writing, at least 4 working days prior to completion of the work for each stage of an area and shall allow a minimum of 3 working days for the inspection.

Progress inspections will be performed at the following stages of work:

A. During pressure testing of the pipelines on the supply side of control valves.
B. During testing of low voltage conductors.
C. Before planting begins and after completion of the work specified for planting in Section 20-4.03, "Preparing Planting Areas," of the Standard Specifications.
D. Before plant establishment work begins and after completion of the work specified for planting in Section 20-4.05, "Planting," of the Standard Specifications.
E. At intervals of one month during the plant establishment period.

COST BREAK-DOWN

The Contractor shall furnish the Engineer a cost break-down for the contract lump sum items of highway planting and irrigation system. Cost break-down tables shall be submitted to the Engineer for approval within 15 working days after the contract has been approved. Cost break-down tables shall be approved, in writing, by the Engineer before any partial payment will be made for the applicable items of highway planting and irrigation system involved.

Attention is directed to "Overhead" of these special provisions regarding compensation for time-related overhead

Cost break-downs shall be completed and furnished in the format shown in the samples of the cost break-downs included in this section. Line item descriptions of work shown in the samples are the minimum to be submitted. Additional line item descriptions of work may be designated by the Contractor. If the Contractor elects to designate additional line item descriptions of work, the quantity, value and amount for those line items shall be completed in the same manner as for the unit descriptions shown in the samples. The line items 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.

The sum of the amounts for the line items of work listed in each cost break-down table for highway planting and for irrigation system work shall be equal to the contract lump sum price bid for Highway Planting and Irrigation System, respectively. Overhead and profit, except for time-related overhead, shall be included in each individual line item of work listed in a cost break-down table.

No adjustment in compensation will be made in the contract lump sum prices paid for highway planting and irrigation system due to 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.

Individual line item values in the approved cost break-down tables will be used to determine partial payments during the progress of the work and as the basis for calculating an adjustment in compensation for the contract lump sum items of highway planting and irrigation system due to changes in line items of work ordered by the Engineer. When the total of ordered changes to line items of work increases or decreases the lump sum price bid for either Highway Planting or Irrigation System by more than 25 percent, the adjustment in compensation for the applicable lump sum item will be determined in the same manner specified for increases and decreases in the total pay quantity of an item of work in Section 4-1.03B, "Increased or Decreased Quantities," of the Standard Specifications.

HIGHWAY PLANTING COST BREAK-DOWN

Contract No. 04-006044

UNIT DESCRIPTION	UNIT	APPROXIMATE QUANTITY	VALUE	AMOUNT
CULTIVATE (AND GERMINATE)	M2	1840		
RELOCATE BOULDERS	LS	LUMP SUM		
MULCH	M3	1000		
PLANT (GROUP E) (BULB)	EA	4950		
PLANT (GROUP F) FLAT-ROOTED	EA	9890		
PLANT (GROUP K) (610MM BOX)	EA	55		
PLANT (GROUP A) (NO. 1)	EA	2170		
PLANT (GROUP B) (NO. 5)	EA	310		
PLANT (GROUP U) (NO. 15)	EA	18		
IMPORTED TOPSOIL	M3	1840		
ROADSIDE CLEARING	LS	LUMP SUM		
COMMERCIAL FERTILIZER	KG	834		
SOIL AMENDMENT	M3	283		
PREPARE HOLE	EA	4280		

TOTAL _____

IRRIGATION SYSTEM COST BREAK-DOWN
Contract No. 04-006044

UNIT DESCRIPTION	UNIT	APPROXIMATE QUANTITY	VALUE	AMOUNT
CONTROL AND NEUTRAL CONDUCTORS	LS	LUMP SUM		
25MM ELECTRIC REMOTE CONTROL VALVE	EA	14		
32MM ELECTRIC REMOTE CONTROL VALVE	EA	22		
40MM ELECTRIC REMOTE CONTROL VALVE	EA	4		
65MM ELECTRIC REMOTE CONTROL VALVE	EA	1		
16 STATION IRRIGATION CONTROLLER (WALL MOUNTED)	EA	1		
32 STATION IRRIGATION CONTROLLER (WALL MOUNTED)	EA	1		
20MM PLASTIC PIPE (PR200) (SUPPLY LINE)	M	5610		
25MM PLASTIC PIPE (PR200) (SUPPLY LINE)	M	830		
32MM PLASTIC PIPE (PR200) (SUPPLY LINE)	M	930		
40MM PLASTIC PIPE (PR200) (SUPPLY LINE)	M	1350		
50MM PLASTIC PIPE (PR200) (SUPPLY LINE)	M	130		
75MM PLASTIC PIPE (PR200) (SUPPLY LINE)	M	610		
BACKFLOW PREVENTER ASSEMBLY ENCLOSURE	EA	1		
65MM BACKFLOW PREVENTER ASSEMBLY	EA	1		
SPRINKLER (TYPE B-2)	EA	730		
SPRINKLER (TYPE B-4)	EA	17		
SPRINKLER (TYPE C-2)	EA	1260		
32MM GATE VALVE	EA	5		
40MM GATE VALVE	EA	4		
50MM GATE VALVE	EA	1		
75MM GATE VALVE	EA	3		
32MM WYE STRAINER	EA	2		
40MM WYE STRAINER	EA	2		
20MM QUICK COUPLING VALVE	EA	11		

TOTAL _____

10-2.02 EXISTING HIGHWAY IRRIGATION FACILITIES

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.

Water shall be maintained in conformance with the provisions in Section 20-5.025, "Maintain Existing Water Supply," of the Standard Specifications.

LOCATE EXISTING CROSSOVERS AND CONDUITS

Existing crossovers and conduits shown on the plans to be incorporated in the new work shall be located in conformance with the provisions for locating conduits in Section 20-5.03B, "Conduit for Irrigation Crossovers," of the Standard Specifications.

Unless otherwise directed by the Engineer, existing crossovers and conduits shown on the plans to be incorporated in the new work shall be located prior to performing work on irrigation systems.

If debris is encountered in the ends of conduits, the debris shall be removed prior to performing other work in the conduits. Removal of debris within the first one meter in these conduits shall be at the Contractor's expense. If debris is encountered in the conduits more than one meter from the ends of the conduits, the additional debris shall be removed as directed by the Engineer and the removal work will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

10-2.03 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.

HIGHWAY PLANTING MATERIALS

Imported Topsoil

Imported topsoil shall conform to the provisions in Section 20-2, "Materials," and Section 20-3, "Erosion Control," of the Standard Specifications and these special provisions.

Imported topsoil shall be fertile, agricultural soil, free of impurities, plants, weeds and roots.

Topsoil shall be placed and spread to a uniform depth of 1m in all cultivated areas.

Mulch

Mulch shall be wood chips.

Commercial Fertilizer

Commercial fertilizer (slow release) shall be a pelleted or granular form, shall be slow release, and shall have within the following guaranteed chemical analysis :

Ingredient	Percentage
Nitrogen	18
Phosphoric Acid	7
Water Soluble Potash	10
Iron	1

ROADSIDE CLEARING

Prior to preparing planting areas, or commencing irrigation trenching operations for planting areas, trash and debris shall be removed from the entire highway right of way within the project limits, excluding, medians.

In addition to removing trash and debris, the project area shall be cleared as specified herein:

A. Weeds shall be killed and removed within the entire highway right of way, within the project limits, including new and existing pavement, curb, sidewalk and other surfaced areas.

After the initial roadside clearing is complete, additional roadside clearing work shall be performed 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:

A. Trash and debris shall be removed.
B. Rodents shall be controlled.
C. Weed growth shall be killed before the weeds reach the seed stage of growth or exceed 150 mm in length.
D. 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:

A. Stolon type weeds shall be killed with glyphosate.

Roadside clearing work shall not include work required to be performed as clearing and grubbing as specified in Section 16, "Clearing and Grubbing," of the Standard Specifications.

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:

Diquat
Fluazifop-butyl
Glyphosate
Isoxaben (Preemergent)
Oxadiazon - 50 percent WP (Preemergent)
Oryzalin (Preemergent)
Prodiamine (Preemergent)
Trifluralin (Preemergent)
Melfluidide (Growth regulator)

Granular preemergents may be used when applied to areas that will be covered with mulch, excluding plant basins. Granular preemergents shall be limited to the following materials:

Dichlobenil (Preemergent)
Oxadiazon (Preemergent)

Granular preemergents shall be applied prior to the application of mulch. Mulch applications shall be completed in these areas on the same working day. Photosensitive dye will not be required.

Glyphosate shall be used to kill stolon type weeds.

Oxadiazon shall be of the emulsifiable concentration or wettable powder type, except when Oxadiazon is used under mulch in conformance with these special provisions.

Prior to the application of preemergents, ground cover plants shall have been planted a minimum of 3 days and shall have been thoroughly watered.

A minimum of 100 days shall elapse between applications of preemergents.

Except for ground cover plants, preemergents shall not be applied within 450 mm of plants. Growth regulators shall not be applied within 2 m of trees, shrubs or vines.

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 15 days prior to the intended use of the other pesticides. Except for the pesticides listed in these special provisions, no pesticides shall be used or applied without prior written approval of the Engineer.

Pesticides shall not be applied within the limits of the plant basins. Pesticides shall not be applied in a manner that allows the pesticides to come in contact with the foliage and woody parts of the plants.

PREPARING PLANTING AREAS

Plants adjacent to drainage ditches shall be located so that after construction of the basins, no portion of the basin walls shall be less than the minimum distance shown on the plans for each plant involved.

PREPARE HOLES

Holes for plants shall be excavated to the minimum dimensions shown on the plans.

Backfill material for plant holes shall be a mixture of soil and other materials shown on the Plant List. Backfill material shall be thoroughly mixed and uniformly distributed throughout the entire depth of the plant hole without clods and lumps.

CULTIVATE

Areas shown on the plans to be cultivated shall be cultivated to a depth of 0.3 meters.

Immediately prior to cultivation, soil amendment, topsoil, and commercial fertilizer shall be added to the areas to be cultivated. Topsoil shall be applied at the rate shown on the plans and shall be spread to a uniform depth of one meter. Soil amendment shall be added at the rate of 5 m^3 per 100 square meters and commercial fertilizer shall be applied at the rate of 9.7 kilograms per 100 square meters. Soil amendment, topsoil, and fertilizer shall be thoroughly mixed with the soil.

After cultivation is complete and the irrigation systems have been installed, no further planting work shall be done in the cultivated areas for a period of 15 days, except the soil shall be kept sufficiently moist to germinate weeds. Weeds that germinate shall be killed.

PLANTING

Commercial fertilizer with iron sulfate shall be applied or placed at the time of planting and at the rates shown on the plans.

A granular preemergent shall be applied to areas to be covered with mulch outside of plant basins in conformance with the provisions in "Pesticides" of these special provisions.

Mulch placed in areas outside of plant basins shall be spread to a uniform depth of 25 mm in ground cover areas and 50 mm in all other areas. Planting areas adjacent to curbs or sidewalks shall be fine graded to a degree that mulch placed in these areas, at the rates required, shall not extend higher than 25 mm below top of curb or sidewalk.

Mulch shall not be placed within one meter of the center line of earthen drainage ditches, within one meter of the edge of paved ditches, and within one meter of the center line of drainage flow lines.

Attention is directed to "Irrigation Systems Functional Test" of these special provisions regarding functional tests of the irrigation systems. Planting shall not be performed in an area until the functional test has been completed for the irrigation system serving that area.

PLANT ESTABLISHMENT WORK

The plant establishment period shall be Type 2 and shall be not less than 250 working days.

Attention is directed to "Relief From Maintenance and Responsibility" in these special provisions regarding relief from maintenance and protection.

Commercial fertilizer (slow release) shall be applied to trees, shrubs, vines and ground cover during the first week of February and the last week of April. Commercial fertilizer shall be applied at the rates shown on the plans and shall be spread with a mechanical spreader wherever possible.

The center to center spacing of replacement plants for unsuitable ground cover plants shall be determined by the number of completed plant establishment working days at the time of replacement and the original spacing in conformance with the following:

ORIGINAL SPACING (Millimeters)	SPACING OF REPLACEMENT GROUND COVER PLANTS (Millimeters)		
	Number of Completed Plant Establishment Working Days		
	1-125	126-190	191-End of Plant Establishment
230	230	150	150
300	300	230	150
460	460	300	230
600	600	460	300
910	910	600	460

Weeds within plant basins, including basin walls and ground cover, shall be controlled by hand pulling.

Weeds within mulched and ground cover areas and outside of plant basins shall be controlled by killing.

Weeds within pavement, curbs, sidewalk, and other surfaced areas shall be controlled by killing.

Vines shall be trained onto fences and walls or through cored holes in walls.

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 125 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 125working days of the plant establishment period have been completed, replacement of plants, except for ground cover plants, shall be No. one size for seedlings, pot and liner size plants; No. 5 size for No. one size plants; No. 15 size for No. 5 size plants; and other plant replacement plants shall be the same size as originally specified.

One application of a preemergent pesticide conforming to the provisions in "Pesticides" of these special provisions, shall be applied between 40 and 50 working days prior to completion of the plant establishment period. This work will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

Wye strainers shall be cleaned at least 15 days prior to the completion of the plant establishment period.

The final inspection shall be performed in conformance with the provisions in Section 5-1.13, "Final Inspection," of the Standard Specifications and shall be completed a minimum of 20working days before the estimated completion of the contract.

Additional mulch conforming to the provisions in 'Mulch' of these special provisions shall be applied between 20 and 30 days prior to completion of the plant establishment period. Mulch placed in areas outside of plant basins shall be spread to a uniform depth of 25mm in ground cover areas and 50 mm in all other areas. Mulch placed in planting areas adjacent to curbs or sidewalks shall not extend higher than 25 mm below top of curb or sidewalk.

10-2.04 IRRIGATION SYSTEMS

Irrigation systems shall be furnished and installed in conformance with the provisions in Section 20-5, "Irrigation Systems," of the Standard Specifications, except materials containing asbestos fibers shall not be used.

Attention is directed to the provisions in "Obstructions" of these special provisions, regarding work over or adjacent to existing underground facilities. Excavation for proposed irrigation facilities shall not be started until the existing underground facilities have been located.

Gate valves, 75 mm and larger in size, shall be furnished with a square lug and shall be operated by use of long shank keys. Prior to acceptance of the contract, 3 long shank keys shall be delivered to the Engineer.

VALVE BOXES

Valve boxes shall conform to the provisions in Section 20-2.24, "Valve Boxes," of the Standard Specifications, except as otherwise provided herein.

Valve boxes shall be precast portland cement concrete.

Covers for concrete valve boxes shall be glass fiber reinforced plastic.

Valve boxes shall be identified on the top surface of the covers by branding the appropriate abbreviations for the irrigation facilities contained in the valve boxes as shown on the plans. Valve boxes that contain remote control valves shall be identified by the appropriate letters and numbers (controller and station numbers). The letters and numbers shall be 50 mm in height.

ELECTRIC AUTOMATIC IRRIGATION COMPONENTS

Irrigation Controllers

Irrigation controllers shall be Rainbird ESP-MC series controllers.Arrangements have been made to insure that any successful bidder can obtain the specified equipment listed below from Horizon Irrigation, 301 Broadway, Sacramento, CA 95818, telephone ((916) 492-1062.

The quoted prices and equipment are as follows:

EQUIPMENT DESCRIPTION	QUANTITY	QUOTED PRICE (EACH)*
ESP-16MC	1	$656.00
ESP-32MC	1	$1,293.00

*prices do not include sales tax

Prices are guaranteed by Horizon Irrigation until 8-31-02.

Attention is directed to the provisions in Section 12-16, "Electrical Work," of these special provisions, regarding electrical power for irrigation controllers and irrigation controller enclosure cabinets.

Electric Remote Control Valves

Electric remote control valves shall conform to the provisions in Section 20-2.23, "Control Valves," of the Standard Specifications and the following:

A. Valves shall be cast iron construction.

B. Valves shall be angle pattern (bottom inlet) or straight pattern (side inlet) as shown on the plans.
C. Electric requirements to operate the remote control valves shall not exceed 70 milliampers at 16V when waterline pressure equals 2068 kPa.

Pull Boxes

Pull box installations shall conform to the provisions in Section 20-5.027I, "Conductors, Electrical Conduits and Pull Boxes," of the Standard Specifications.

Conductors

Low voltage, as used in this section "Conductors," shall mean 36 V or less.

Low voltage control and neutral conductors in pull boxes and valve boxes, at irrigation controller terminals, and at splices shall be marked as follows:

A. Conductor terminations and splices shall be marked with adhesive backed paper markers or adhesive cloth wrap-around markers, with clear, heat-shrinkable sleeves sealed over the markers.
B. Non-spliced conductors in pull boxes and valve boxes shall be marked with clip-on, "C" shaped, white extruded polyvinyl chloride sleeves. Marker sleeves shall have black, indented legends of uniform depth with transparent overlays over the legends and "chevron" cuts for alignment of 2 or more sleeves.

Markers for the control conductors shall be identified with the appropriate number or letter designations of irrigation controllers and station numbers. Markers for neutral conductors shall be identified with the appropriate number or letter designations of the irrigation controllers.

The color of low voltage neutral and control conductor insulation, except for the striped portions, shall be homogeneous throughout the entire thickness of the insulation.

Insulation for conductors may be UL listed polyethylene conforming to UL44 test standards with a minimum insulation thickness of 1.05 mm for wire sizes 10AWG and smaller.

At the option of the Contractor, other types of splice sealing materials and methods may be used provided other materials and methods have been approved in writing by the Engineer prior to installation of the connectors.

Prior to granting relief from maintenance and responsibility, as provided in these special provisions, the functional test, in conformance with the provisions in Section 20-5.027J, "Testing," of the Standard Specifications, shall be satisfactorily completed, and instruction shall be given to the Engineer on the use and adjustment of the installed irrigation controllers.

ARMOR-CLAD CONDUCTORS

Armor-clad conductors shall be used in direct burial applications from pull boxes adjacent to irrigation controller enclosure cabinets to the remote control valves and other irrigation facilities in conformance with the details shown on the plans and these special provisions.

Armor-clad conductors shall conform to the following:

A. Conductors shall be the proper size for the application, and shall be solid, uncoated copper with a conductor size of not less than 90 percent of the AWG diameter required.
B. Conductor insulation coverings shall be manufactured of polyvinyl chloride (PVC) conforming to UL style, Type UF 60°C, 600 V. Average thickness of insulation shall be not less than 1.52 mm with a minimum thickness of 1.37 mm at any one point.
C. Armor shall be a minimum of 0.13-mm thick by 12.7 mm wide, Type 304 stainless steel tape that is helically wrapped over each conductor with a 33 percent minimum overlap.
D. Outer jacket for conductors shall be sunlight resistant PVC and shall conform to the Insulated Power Cable Engineer's Association (ICEA) S-61-402, NEMA Standard WC5, and UL Listing 1263. Nominal thickness of the outer jacket shall be 0.76-mm with a minimum thickness of 0.61 mm at any one point.

IRRIGATION SYSTEMS FUNCTIONAL TEST

Functional tests for the irrigation controllers and associated automatic irrigation systems shall conform to the provisions in Section 20-5.027J, "Testing," of the Standard Specifications and these special provisions.

Tests shall demonstrate to the Engineer, through one complete cycle of the irrigation controllers in the automatic mode, that the associated automatic components of the irrigation systems operate properly. If automatic components of the irrigation systems fail a functional test, these components shall be repaired at the Contractor's expense and the testing repeated until satisfactory operation is obtained.

Associated automatic components shall include, but not be limited to, remote control valves.

Upon completion of work on an irrigation system, including correction of deficiencies and satisfactory functional tests for the systems involved, the plants to be planted in the area watered by the irrigation system may be planted provided the planting areas have been prepared as specified in these special provisions.

PIPE

Steel Pipe

Galvanized steel pipe supply lines installed between water meters and backflow preventer assemblies shall be installed not less than 150 mm below finished grade, measured to the top of the pipe.

Plastic Pipe

Plastic pipe supply lines shall be polyvinyl chloride (PVC) 1120 or 1220 pressure rated pipe with the minimum pressure rating (PR) shown on the plans.

Plastic pipe supply lines shall have solvent cemented type joints. Primers shall be used on the solvent cemented type joints.

Plastic pipe supply lines (main) shall have a minimum cover of 0.45 m.

Plastic pipe (irrigation lines) shall be installed at the finished grade.

A nonhardening joint compound shall be used in place of the pipe thread sealant tape conforming to the provisions in Section 20-5.03E, "Pipe," of the Standard Specifications. Joint compounds shall be applied in conformance with the manufacturer's recommendations.

BACKFLOW PREVENTER ASSEMBLIES

Backflow preventers shall conform to the provisions in Section 20-2.25, "Backflow Preventers," of the Standard Specifications and these special provisions.

Pressure loss through the backflow preventers shall not exceed the following:

BACKFLOW PREVENTER SIZE (millimeters)	FLOW RATE (Liters per minute)	PRESSURE LOSS (kPa)
65	840	100

BACKFLOW PREVENTER ASSEMBLY ENCLOSURE

Enclosures shall be fabricated entirely of marine grade aluminum alloy 5052-H32 with a minimum wall thickness of 3 mm and shall be installed over backflow preventer assemblies on a portland cement concrete pad as shown on the plans and in conformance with these special provisions.

The enclosure shall be of solid sheet construction and punched on the sides with a rectangular hole pattern, except for the front panel.

The enclosure shall be a center split design having mounting lips on each side.

The locking mechanism shall be the full release type which allows for complete removal of the enclosure from its mounting base without the use of tools. The handle controlling the locking mechanism shall be concealed within the surface of the enclosure and shall provide for either a single or dual padlock Padlocks will be State-furnished. Attention is directed to "State-furnished Materials" of these special provisions.

The mounting base shall be manufactured of stainless steel and shall be galvanized, after fabrication, in conformance with the provisions in Section 75-1.05, "Galvanizing," of the Standard Specifications.

Concrete for the concrete pad shall conform to the provisions in Section 20-2.26, "Concrete," of the Standard Specifications.

The mounting base shall be set in the concrete pad a minimum of 50 mm and shall be installed when the portland cement concrete pad is still plastic. Nuts shall be hexagonal and washers shall be the lock type.

The minimum clearance between the backflow preventer assembly and the backflow preventer assembly enclosure shall be 50 mm. The concrete pad shall extend a minimum of 50 mm beyond the outer limits of the backflow preventer assembly enclosure, unless otherwise shown on the plans or specified in these special provisions.

TESTING BACKFLOW PREVENTERS

New backflow preventer installed by the Contractor shall be tested for proper operation in conformance with the provisions in Section 20-5.03J, "Check and Test Backflow Preventers," of the Standard Specifications and these special provisions.

Tests for new backflow preventer shall be satisfactorily completed after installation of the backflow preventer assembly and before operation of the irrigation systems.

Retesting of backflow preventers after satisfactory completion of the first tests will not be required.

SPRINKLERS

Sprinklers shall conform to the type, pattern, material, and operating characteristics listed in the "Sprinkler Schedule" shown on the plans. Sprinklers shall be installed at the locations as shown on the plans.

When required, risers for sprinklers shall contain a device that will automatically and instantly stop the flow of water from a riser when the riser is broken on the downstream side of the device. The device shall be installed as recommended by the manufacturer of the device.

WYE STRAINERS

Wye strainers shall be installed on the upstream side of the electric remote control valves as shown on the plans.

When garden valves are opened, discharge shall be up and out of the valve box.

FINAL IRRIGATION SYSTEM CHECK

A final check of new irrigation facilities shall be performed not more than 20 working days prior to acceptance of the contract.

The length of watering cycles using potable water measured by water meters for the final check of irrigation facilities will be determined by the Engineer.

Remote control valves connected to new irrigation controllers shall be checked for automatic performance when the controllers are in automatic mode.

Unsatisfactory performance of irrigation facilities installed or modified by the Contractor shall be repaired and rechecked at the Contractor's expense until satisfactory performance is obtained, as determined by the Engineer.

Nothing in this section "Final Irrigation System Check" shall relieve the Contractor of full responsibility for making good or repairing defective work or materials found before the formal written acceptance of the entire contract by the Director.

Full compensation for checking the irrigation systems prior to the acceptance of the contract shall be considered as included in the contract lump sum price paid for plant establishment work and no additional compensation will be allowed therefor.

SECTION 11. (BLANK)

SECTION 12. BUILDING WORK

SECTION 12-1. GENERAL REQUIREMENTS

12-1.01 SCOPE

Building 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 building work to be done consists, in general, of constructing an operations building, toll plaza, courtyard canopy, and all mechanical and electrical 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.

Toll plaza shall include toll plaza canopy, pedestrian tunnel, toll booth islands, and toll booths as shown on the plans, as specified in these special provisions and as directed by the Engineer.

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
CBC	California Building Code
CEC	California Electrical Code

CMC	California Mechanical Code
CS	Commercial Standards (US Department of Commerce)
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)
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 1997 Uniform Building Code as amended by the 1998 Title 24 California Building Standards Code.

12-1.03 GUARANTEE

The Contractor hereby unconditionally guarantees that the building work will be done in accordance with the requirements of the contract, and further guarantees the building work of the contract to be and remain free of defects in workmanship and materials for a period of one year from the date of acceptance of the contract, unless a longer guarantee period is required elsewhere in these special provisions. The Contractor hereby agrees to repair or replace any and all building work, together with any other adjacent work which may be displaced in so doing, 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.

The performance bond for the contract, or a portion thereof, in the sum equal to one-half the contract price of the building work, shall remain in full force and effect during the guarantee period.

The Contractor further agrees, that within 10 calendar days after being notified in writing by the Department of any building work not in accordance with the requirements of the contract or any defects in the building work, he shall commence and prosecute with due diligence all work necessary to fulfill the terms of this guarantee, and shall complete the work within a reasonable period of time, and, in the event he fails to comply, he does hereby authorize the Department to proceed to have such work done at the Contractor's expense and he 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.

12-1.04 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 the following work by another Contractor may be in progress adjacent to or within the limits of this project during progress of the work on this contract:

Contract No. 04-006064—Modify Interstate 680/Interstate 780 Interchange in Benicia and Martinez on Route 680/780 from Mococo Overhead to Bay Shore Road (680)/East Fifth Street (780) (KP L1.0/R1.3 to KP L1.1/R5.3).

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 of the State concerning the Benicia Martinez Toll Facility.

The Contractor shall plan his 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.

12-1.05 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 60 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.

Each submission of drawings, material lists and descriptive data shall consist of at least 6 copies. Two copies will be returned to the Contractor either approved for use or returned for correction and resubmittal.

Each separate item submitted shall bear a descriptive title, the name of the project, district, county, and contract number. Plans and detailed drawings shall be not larger than 559 mm x 864 mm.

The material list shall be complete as to name of manufacturer, catalog number, size, capacity, finish, all pertinent ratings, and identification symbols used on the plans and in the special provisions for each unit.

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, when directed by the Engineer.

12-1.06 PROGRESS SCHEDULE

A progress schedule shall be submitted in duplicate for the building work in accordance with the requirements in "Progress Schedule (Critical Path)" of these special provisions.

12-1.07 SCHEDULE OF VALUES

The Contractor shall prepare and submit to the Engineer for approval 2 copies of a Schedule of Values within 30 working days of approval of the contract covering each lump sum item for building work. Fifteen 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.

The Schedule of Values must be accurately divided into sections representing the cost of each separate building or structure. All work that is not part of a separate building or structure, such as excavation, grading, curbs, gutters, sidewalks, paving, sewer and storm drainage and utility distribution lines are to be included under a specific section as General Work and not included in the building or structure cost. Indirect costs and general condition items are to be listed as a separate line

item of work. The sections representing each building or structure must be identified as to the building or structure they represent and be broken down to show the corresponding value of each craft, trade or other significant portion of the work. A sub-total for each section shall be provided.

The Schedule of Values shall be approved by the Engineer before any partial payment estimate is prepared.

The sum of the items listed in the Schedule of Values shall equal the contract lump sum price for building work. Overhead, profit and bond premium are to be appropriately distributed across all line items of cost.

12-1.08 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.

12-1.09 UTILITY CONNECTION

The Contractor shall make all arrangements, and obtain all permits and licenses 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 State will pay all utility permits, licenses, connection charges, and excess length charges directly to the utility. Such request shall be submitted not less than 45 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 the permits and licenses shall be considered as included in the contract lump sum price paid for building work and no additional compensation will be allowed therefor.

12-1.10 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.

The Contractor shall make his own arrangements to obtain any additional electrical power and water or other utilities required for his operations and shall make and maintain the necessary service connections at his own expense.

When existing utility systems are being modified, periods of shutdown will be determined by the Engineer.

The Contractor shall provide adequate temporary lighting to perform the work and allow the Engineer to inspect the project as each portion is completed.

The Contractor shall provide and pay for telephone service he may require. State telephone facilities shall not be used.

12-1.11 REFERENCES

When reference is made to the Uniform Building Code (UBC) on the plans or in the special provisions, it shall be the 1997 Uniform Building Code as amended by the 1998 Title 24 California Building Standards Code.

12-1.12 MEASUREMENT AND PAYMENT

The contract lump sum price paid for building work shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the building 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 price paid for building work and no additional compensation will be allowed therefor.

12-1.13 FIELD ENGINEERING

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

Lines and grades.--Attention is directed to Section 5-1.07 “Lines and Grades,” of the Standard Specifications.

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

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

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

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

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

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

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

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

Survey accuracy and tolerances.--The tolerances generally applicable in setting survey stakes for foundations, slabs, and underground work shall not exceed the following:

Survey Stakes or Markers	Tolerance
Rough grading or excavation	30 mm
Trimming or preparation of subgrade for roadways	15 mm
Roadway surfacing, steel or concrete pipe	6 mm
Structures or building construction	3 mm

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

12-1.14 SUBSTITUTION OF NON-METRIC MATERIALS AND PRODUCTS

Only materials and products conforming to the requirements of the specifications shall be incorporated in the work. When metric materials and products are not available, and when approved by the Engineer, and at no cost to the State, materials and products in the inch-pound (imperial) system which are of equal quality and of the required properties and characteristics for the purpose intended, may be substituted for the equivalent metric materials and products, subject to the following requirements:

Materials and products shown on the plans or in the special provisions as being equivalent may be substituted for the metric materials and products specified or detailed on the plans.

Before other non-metric materials and products will be considered for use the Contractor shall furnish, at the Contractor's expense, evidence satisfactory to the Engineer that the materials and products proposed for use are equal to or better than the materials and products specified or detailed on the plans. The burden of proof as to the quality and suitability of substitutions shall be upon the Contractor and the Contractor shall furnish all information necessary as required to the Engineer. The Engineer will be the sole judge as to the quality and suitability of the substituted materials and products and the Engineer's decision shall be final.

When the Contractor elects to substitute non-metric materials and products, including materials and products shown on the plans or in the special provisions as being equivalent, a list of substitutions to be made shall be submitted for approval.

The following substitutions of materials and products will be allowed:

SUBSTITUTION TABLE FOR SIZES OF HIGH STRENGTH STEEL FASTENERS, ASTM Designation: A 325M	
METRIC SIZE SHOWN ON THE PLANS mm x thread pitch	IMPERIAL SIZE TO BE SUBSTITUTED inch
M16 x 2	5/8
M20 x 2.5	3/4
M22 x 2.5	7/8
M24 x 3	1
M27 x 3	1-1/8
M30 x 3.5	1-1/4
M36 x 4	1-1/2

SUBSTITUTION TABLE FOR REINFORCEMENT	
METRIC BAR DESIGNATION NUMBER AS SHOWN ON THE PLANS	IMPERIAL BAR DESIGNATION NUMBER TO BE SUBSTITUTED
10	3
13	4
16	5
19	6
22	7
25	8
29	9
32	10
36	11
43	14
57	18

SUBSTITUTION TABLE FOR WELDED PLAIN WIRE REINFORCEMENT, ASTM DESIGNATION: A 185	
	US CUSTOMARY UNITS SIZE TO BE SUBSTITUTED $inch^2$ x 100
MW9	W1.4
MW10	W1.6
MW13	W2.0
MW15	W2.3
MW19	W2.9
MW20	W3.1
MW22	W3.5
MW25	W3.9, except W3.5 in piles only
MW26	W4.0
MW30	W4.7
MW32	W5.0
MW35	W5.4
MW40	W6.2
MW45	W6.5
MW50	W7.8
MW55	W8.5, except W8.0 in piles only
MW60	W9.3
MW70	W10.9, except W11.0 in piles only
MW80	W12.4
MW90	W14.0
MW100	W15.5

The sizes in the following tables of materials and products are exact conversions of metric sizes of materials and products and are listed as acceptable equivalents:

CONVERSION TABLE FOR SIZES OF: (1) STEEL FASTENERS FOR GENERAL APPLICATIONS, ASTM Designation: A 307 or AASHTO Designation: M 314, Grade 36 or 55, and (2) HIGH STRENGTH STEEL FASTENERS, ASTM Designation: A 325 or A 449	
DIAMETER	
METRIC SIZE SHOWN ON THE PLANS mm	EQUIVALENT IMPERIAL SIZE inch
6, or 6.35	1/4
8 or 7.94	5/16
10, or 9.52	3/8
11, or 11.11	7/16
13 or 12.70	1/2
14, or 14.29	9/16
16, or 15.88	5/8
19,or 19.05	3/4
22, or 22.22	7/8
24, 25, or 25.40	1
29, or 28.58	1-1/8
32, or 31.75	1-1/4
35, or 34.93	1-3/8
38 or 38.10	1-1/2
44, or 44.45	1-3/4
51, or 50.80	2
57, or 57.15	2-1/4
64, or 63.50	2-1/2
70 or 69.85	2-3/4
76, or 76.20	3
83, or 82.55	3-1/4
89 or 88.90	3-1/2
95, or 95.25	3-3/4
102, or 101.60	4

CONVERSION TABLE FOR NOMINAL THICKNESS OF SHEET METAL			
UNCOATED HOT AND COLD ROLLED SHEETS		HOT-DIPPED ZINC COATED (GALVANIZED) SHEETS	
METRIC THICK-NESS SHOWN ON THE PLANS mm	EQUIVA-LENT US STAND-ARD GAGE inch	METRIC THICK-NESS SHOWN ON THE PLANS mm	EQUIVA-LENT GALVAN-IZED SHEET GAGE inch
7.94	0.3125		
6.07	0.2391		
5.69	0.2242		
5.31	0.2092		
4.94	0.1943		
4.55	0.1793		
4.18	0.1644	4.270	0.1681
3.80	0.1495	3.891	0.1532
3.42	0.1345	3.510	0.1382
3.04	0.1196	3.132	0.1233
2.66	0.1046	2.753	0.1084
2.28	0.0897	2.372	0.0934
1.90	0.0747	1.994	0.0785
1.71	0.0673	1.803	0.0710
1.52	0.0598	1.613	0.0635
1.37	0.0538	1.461	0.0575
1.21	0.0478	1.311	0.0516
1.06	0.0418	1.158	0.0456
0.91	0.0359	1.006 or 1.016	0.0396
0.84	0.0329	0.930	0.0366
0.76	0.0299	0.853	0.0336
0.68	0.0269	0.777	0.0306
0.61	0.0239	0.701	0.0276
0.53	0.0209	0.627	0.0247
0.45	0.0179	0.551	0.0217
0.42	0.0164	0.513	0.0202
0.38	0.0149	0.475	0.0187

CONVERSION TABLE FOR WIRE		
METRIC THICKNESS SHOWN ON THE PLANS mm	EQUIVALENT USA STEEL WIRE THICKNESS inch	GAGE NO.
6.20	0.244	3
5.72	0.225	4
5.26	0.207	5
4.88	0.192	6
4.50	0.177	7
4.11	0.162	8
3.76	0.148	9
3.43	0.135	10
3.05	0.120	11
2.69	0.106	12
2.34	0.092	13
2.03	0.080	14
1.83	0.072	15
1.57	0.062	16
1.37	0.054	17
1.22	0.048	18
1.04	0.041	19
0.89	0.035	20

CONVERSION TABLE FOR COMMON NAILS				
NAIL SIZE	METRIC mm		ENGLISH inch	
	Length	Diameter	Length	Diameter
8d	63.5	3.33	2 1/2	0.131
10d	76.2	3.76	3	0.148
16d	88.9	4.11	3 1/2	0.162

CONVERSION TABLE FOR LUMBER	
METRIC NOMINAL SURFACE DRY SIZE mm	EQUIVALENT NOMINAL SURFACE DRY U S SIZE inch
51	2
102	4
152	6
203	8
254	10
305	12

CONVERSION TABLE FOR PLYWOOD	
METRIC mm	ENGLISH inch
6.4	1/4
7.9	5/16
9.5	3/8
11.1	7/16
11.9	15/32
12.7	1/2
15.1	19/32
15.9	5/8
18.3	23/32
19.1	3/4
22.2	7/8
25.4	1
28.6	1 1/8

CONVERSION TABLE FOR INSULATION R-VALUE	
METRIC (K m^2/W)	ENGLISH (HR FT^2 F/BTU)
0.5	3
0.7	4
1.4	8
1.9	11
2.3	13
2.5	14
3.3	19
5.3	30

CONVERSION TABLE FOR VAPOR TRANSMISSION RATING	
METRIC (Perm-m)	ENGLISH (perm-inch)
0.29	0.02

CONVERSION TABLE FOR LOW PRESSURE	
METRIC (Pa)	ENGLISH (Inches of Water Column)
30	0.125
60	0.25
90	0.375
120	0.50
150	0.60
155	0.625
175	0.70
185	0.75
200	0.80
250	1.00
310	1.25

CONVERSION TABLE FOR PRESSURE	
METRIC (kPa)	ENGLISH (psi)
10	1.5
210	30
280	40
350	50
690	100
860	125
1040	150
1100	160
1210	175
1380	200
1730	250
2070	300
2170	315
2410	350
2590	375
2760	400
4830	700
5170	750
5520	800
13800	2000
17200	2500
20700	3000
27600	4000
34500	5000
137900	20000

CONVERSION TABLE FOR MIL THICKNESS	
METRIC (mm)	ENGLISH (inch/1000)
0.10	4
0.13	5
0.15	6
0.50	20
0.75	30
1.00	40

CONVERSION TABLE FOR HVAC DUCTING.	
METRIC (mm)	ENGLISH (inch)
100	4
125	5
150	6
175	7
200	8
225	9
250	10
300	12
360	14
410	16
460	18
510	20
560	22
610	24
660	26
710	28
760	30

CONVERSION TABLE FOR MECHANICAL PIPING		
METRIC (GSP, PVC, BSP, DUCTILE IRON)	METRIC (mm)	ENGLISH (inch)
NPS 1/2	15	1/2
NPS 3/4	20	3/4
NPS 1	25	1
NPS 1 1/4	32	1 1/4
NPS 1 1/2	40	1 1/2
NPS 2	50	2
NPS 2 1/2	65	2 1/2
NPS 3	75	3
NPS 4	100	4
NPS 6	150	6

CONVERSION TABLE FOR LUBRICATION PIPING TUBING WALL THICKNESS	
METRIC (mm)	ENGLISH (inch)
2.1	0.083
0.9	0.035

CONVERSION TABLE FOR HOSE/TUBING SIZES O. D.	
METRIC (mm)	ENGLISH (inch)
6	1/4
10	3/8
13	1/2
16	5/8
19	3/4
22	7/8
25	1

CONVERSION TABLE FOR DRUM SIZES			
METRIC		ENGLISH	
L	kg	gallons	pounds
205	180	55	400
60	55	16	120
19	16	5	35

CONVERSION TABLE FOR POWER	
METRIC (kW)	ENGLISH (HP)
0.037	1/20
0.075	1/10
0.18	1/4
0.25	1/3
0.37	1/2
0.55	3/4
0.75	1
1.1	1 1/2
1.5	2
2.2	3
3.7	5
5.5	7 1/2
7.5	10
11	15
15	20
18.5	25
22	30
30	40
37	50
45	60
55	75
75	100
90	120
110	150

CONVERSION TABLE FOR IMPELLER BALANCE		
SYNCHRONOUS RPM	METRIC (g mm/kg)	ENGLISH (ounce-inch/pound)
720	94	0.059
900	73	0.046
1200	54	0.034
1800	41	0.026
3600	17	0.011

CONVERSION TABLE FOR ELECTRICAL CONDUIT	
METRIC SIZE SHOWN ON THE PLANS mm	EQUIVALENT IMPERIAL SIZE inch
16	1/2
21	3/4
27	1
35	1 1/4
41	1 1/2
53	2
103	4

SECTION 12-2. SITEWORK

12-2.01 EARTHWORK FOR BUILDING WORK

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of performing earthwork for building work in accordance with the details shown on the plans and these special provisions.

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

Attention is directed to the Materials Information Handout for information regarding foundation recommendations and reports that were prepared for use during the design of this project.

Attention is directed to the requirements of "Field Engineering" in Section 12-1, "General Requirements," of these special provisions.

QUALITY ASSURANCE.--

Samples.--Samples of sand, pea gravel, or crushed stone, weighing not less than 11 kg, shall be submitted to the Engineer at the jobsite for approval.

SITE CONDITIONS.--

Existing underground piping and conduit.--The location of existing underground piping and conduit is based on the best records available. Before beginning work, the Contractor shall accurately locate the piping and conduit involved in the work. If the location of the existing piping or conduit deviates from the location shown on the plans by more than 1.5 meters, or, if no elevations are indicated and the piping or conduit is more than 0.9 meter below grade, the cost of the additional excavation, backfill, piping or conduit, and removal and replacement of concrete, if any, will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

Existing surfaced or planted areas.--Existing surfaced or planted areas that are removed, broken or damaged by the Contractor's operations shall be restored to their original condition except as otherwise shown on the plans or specified herein.

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

PART 2.- PRODUCTS

BACKFILL MATERIALS.--

Structure backfill.--

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

Sand.--

Sand shall be clean, washed sand, free from clay or organic material graded such that 100 percent passes the 6 mm sieve, 90 percent to 100 percent passes the 4.75 mm sieve and not more than 5 percent passes the 75 µm sieve size.

Pea gravel (naturally rounded).--

Pea gravel (naturally rounded) shall be clean, washed, dry density of not less than 1522 kg/m^3, free from clay or organic material and shall conform to the following grading as determined by California Test 202:

Sieve or Screen Size	Percentage Passing
19 mm	100
13 mm	90-100
9.5 mm	40-70
4.75 mm	0-15
2.36 mm	0-3

Pea gravel shall conform to the following requirements:

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

Crushed stone.--

Crushed stone shall be clean, washed, dry density of not less than 1522 kg/m^3, crushed stone or crushed gravel with an angular particle size not less than 3 mm or more than 13 mm.

Sieve or Screen Size	Percentage Passing
13 mm	100
9.5 mm	85-100
4.75 mm	10-30
2.36 mm	0-3

Crushed stone shall conform to the following requirements:

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

PART 3.- EXECUTION

PREPARATION & RESTORATION.--

Sawcutting.--Prior to excavation or trenching, existing surfacing shall be removed to saw cut lines, or to existing wood dividers or expansion joints, if any. The saw cut shall be to a neat line and have a depth not less than 25 mm.

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

STRUCTURE EXCAVATION.--

General.--Unless otherwise noted, all excavation for building work shall be classified as structure excavation.

Footing excavation.--The bottom of excavation shall not be disturbed. The contractor shall excavate by hand to the final grade. The bottom of concrete footings shall be poured against undisturbed material. Unless otherwise noted, compaction of the bottom of footing excavation is not required unless the material is disturbed. The footing depths shown on the plans shall be changed to suit field conditions when directed by the Engineer. Solid rock at or near required depths shall not be disturbed. Unsuitable material shall be excavated down to firm bearing as directed by the Engineer. Work and materials required because of excavation in excess of the depths shown on the plans, when such excavation has been ordered by the Engineer, will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

Excavate to the elevations and dimensions within a tolerance of ±12 mm. Limits of the excavation shall allow for adequate working space for installing materials and as required for safety of personnel. Such working space excavation shall be replaced in kind and compacted at the Contractor's expense.

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

At locations and to the limits shown on the plans, material below the bottom of the foundation or footing shall be removed and replaced with select backfill in accordance with the placing and compacting requirements for backfill.

Excavation for pipes and conduits.--Pipes or conduits in the same trench shall have a minimum clear distance between pipes or conduits of 150 mm. Pipes or conduits shall have not less than 0.75 meter of cover from top of pipes or conduits to finished grade unless otherwise shown on the plans or specified.

Trenching shall be of sufficient depth to permit placing a minimum depth of 100 mm of compacted sand under all pipes and conduits.

Excavation adjacent to trees shall be performed by hand methods where necessary to avoid injury to trees and roots. Roots 50 mm in diameter and larger shall be protected with heavy burlap. Roots smaller than 50 mm in diameter adjacent to trees shall be hand trimmed. Cuts through roots 13 mm in diameter and larger shall be sealed with tree trimmers' asphaltic emulsion. If trenches remain open more than 24 hours, the side of the trench adjacent to the tree shall be shaded with burlap and kept damp. Materials shall not be stockpiled within the drip line of trees.

Dewatering.--Excavations shall be kept clear of standing water. Water shall be removed by pumping if necessary. Water removed from excavation shall be carried away from the building site and disposed of in a manner that will not harm State or adjacent property.

STRUCTURE BACKFILLING.--

General.--Unless otherwise noted, all backfill for building work shall be classified as structure backfill. Backfill shall be placed and compacted in horizontal layers, not more than 150 mm thick prior to compaction, and to the lines and grades shown on the plans or to original ground.

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

Unless approved in writing by the Engineer, compaction of structure or select backfill by jetting or ponding will not be permitted.

Backfilling pipes and conduits.--Backfill placed under pipe and conduits shall be compacted sand, 100 mm minimum depth. Backfill material placed to a level 150 mm above tops of pipes and conduits shall be sand or fine earth and particles shall not exceed 13 mm in greatest dimension. For wrapped, coated, or plastic pipe or conduits, sand shall be used for backfill. Backfill material placed higher than 150 mm above tops of pipes or conduits shall consist of material free of stones or lumps exceeding 100 mm in greatest dimension except:

(a) The top 300 mm of backfill under roads, walks or paving shall consist of aggregate base material.
(b) The top 150 mm of backfill in planted areas shall consist of topsoil.

Unless otherwise shown on the plans, pipe under roads, with less than 0.75 m of cover over the top of pipe, shall be backfilled with concrete to a level 100 mm above the top of pipe. Concrete for backfill shall be commercial quality concrete containing not less than 350 kg/m^3 of cement.

COMPACTION.--

General.--Relative compaction shall be determined in accordance with California Test 216 or 231.
Unless otherwise noted below, all backfill shall be compacted to a minimum relative compaction of 90 percent.

Compact original ground.--Original ground surface under fill with surfacing of concrete and asphalt concrete shall be compacted to a relative compaction of not less than 95 percent for a minimum depth of 150 mm.

Subgrade preparation.--Preparation of subgrade material for placing aggregate base, surfacing, or slabs thereon shall include fine grading, compaction, reworking as necessary. The upper 150 mm of the subgrade shall have the same compaction as the fill to be placed over it.
The prism of backfill directly underneath the building foundation and sloping downward at 1:1 shall be compacted to 95 percent.

Structure backfill.--Structure backfill shall be compacted to not less than 95 percent relative compaction.

Select backfill.--Select backfill shall be compacted to not less than 95 percent relative compaction.
A relative compaction of not less than 95 percent shall be obtained for a minimum depth of 150 mm below the bottom of the excavation before placing select backfill.

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

DISPOSAL.--

Surplus material.--Surplus material from the excavation shall be removed and disposed of outside the right-of-way in accordance with Section 7-1.13 of the Standard Specifications.

FIELD QUALITY CONTROL.--

Inspection.--When the excavation is substantially completed to grade, the Contractor shall notify the Engineer. No concrete shall be placed until the foundation has been approved by the Engineer.

Testing.--The State will conduct compaction tests during the backfilling and compacting operations.

12-2.02 FALSEWORK

Falsework shall be designed and constructed in conformance with the requirements in Section 51-1.06, "Falsework," of the Standard Specifications and these special provisions.
The fourth and fifth sentences of the eighteenth paragraph of Section 51-1.06A, "Falsework Design and Drawings," of the Standard Specifications are deleted.
The fifth paragraph of Section 51-1.06A(1), "Design Loads," of the Standard Specifications is amended to read:

> The minimum horizontal load to be allowed for wind on heavy-duty steel shoring or steel pipe column falsework having a vertical load carrying capacity exceeding 130 kN per leg or column shall be the sum of the products of the wind impact area, shape factor, and the applicable wind pressure value for each height zone. The wind impact area is the total projected area of all the elements in the tower face or falsework bent normal to the direction of the applied wind. The shape factor shall be taken as 2.2 for heavy-duty shoring and 1.0 for pipe column falsework. Wind pressure values shall be determined from the following table:

Height Zone (Meters above ground)	Wind Pressure Value (Pa)	
	Shores or Columns Adjacent to Traffic	At Other Locations
0-9	960	720
9-15	1200	960
15-30	1440	1200
over 30	1675	1440

The first 2 sentences of the sixth paragraph of Section 51-1.06A(1), "Design Loads," of the Standard Specifications are amended to read:

The minimum horizontal load to be allowed for wind on all other types of falsework, including falsework supported on heavy-duty shoring or pipe column falsework, shall be the sum of the products of the wind impact area and the applicable wind pressure value for each height zone. The wind impact area is the gross projected area of the falsework and any unrestrained portion of the permanent structure, excluding the areas between falsework bents or towers where diagonal bracing is not used.

The last paragraph under "Timber" in the second paragraph of Section 51-1.06A(2), "Design Stresses, Loadings, and Deflections," of the Standard Specifications is amended to read:

Timber connections shall be designed in conformance with the procedures, stresses and loads permitted in the Falsework Manual as published by the Department of Transportation, Division of Structures, Office of Structure Construction.

The first entry following the third paragraph under "Steel" in the second paragraph of Section 51-1.06A(2), "Design Stresses, Loadings, and Deflections," of the Standard Specifications is amended to read:

Compression, flexural $\frac{83{,}000}{Ld/bt}$ MPa, but not to exceed 152 MPa for unidentified steel or steel conforming to ASTM Designation: A 36/A 36M nor 0.6Fy for other identified steel.

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

When falsework is supported on piles, the piles shall be driven and the actual bearing value assessed as specified in Section 49, "Piling."

12-2.03 AGGREGATE BASE

PART 1.-GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing, spreading and compacting aggregate base in accordance with the details shown on the plans and these special provisions.

PART 2.-PRODUCTS

Aggregate base.--

Aggregate base shall be commercial quality aggregates consisting of broken stone; crushed gravel; natural, clean, rough-surfaced gravel and sand; or a combination thereof.

Aggregate base shall conform to the following grading as determined by California Test 202:

Sieve or Screen Size	Percentage Passing
25 mm	100
19 mm	90 - 100
4.75 mm	35 - 60
600 µm	10 - 30
75 µm	2 - 9

Aggregate base shall also conform to the following quality requirements:

Tests	California Test No.	Test Requirements
Durability Index	229	35 Min.
Resistance (R-Value)	301	78 Min.
Sand Equivalent	217	22 Min.

PART 3.-EXECUTION

SPREADING AND COMPACTING.--

Spreading.--Aggregate base shall be placed and compacted to the lines and grades shown on the plans.

Spreading and compacting shall be performed by methods that will produce a uniform base, free from pockets of coarse or fine material.

Compaction.--Relative compaction of each layer of compacted base material shall be not less than 95 percent, as determined by California Test 216 or 231.

12-2.04 FREE DRAINING GRANULAR MATERIAL

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and placing free draining granular material beneath slabs in accordance with the details shown on the plans and these special provisions.

PART 2.- PRODUCTS

Free draining granular material.--

Free draining granular material shall be clean, hard, durable, free-draining rock. The material gradation shall be such that all passes the 25 mm screen, and not more than 10 percent passes the 4.75 mm sieve as determined by California Test 202. Granular material shall be free from organic material, clay balls or other deleterious substances.

PART 3.- EXECUTION.--

SPREADING AND CONSOLIDATING.--

General.--Free draining granular material shall be placed, spread and consolidated by tamping or vibrating.

12-2.05 VEHICLE CRASH CUSHION

GENERAL.--This work shall consist of furnishing and installing vehicle crash cushions in accordance with the details shown on the plans and these special provisions.

Vehicle crash cushions installed at the toll booth islands shall be Quadquard LMC System, as made by Energy Absorption Systems, Inc. or equal, and shall include all the items listed for "Vehicle Crash Cushion" shown on the plans.

Manufacturer	Distributor
Energy Absorption Systems, Inc. One East Wacker Drive, Suite 3000 Chicago, IL 60601-2076 Telephone (312) 467-6750	Traffic Control Service, Inc. 8585 Thys Court, Sacramento, CA 95828 Telephone (800) 884-8274 FAX (916) 387-9734

The price quoted by the distributor for the Quadquard LMC System, Part No.QS6911L, 1760 mm wide, 11-bays, FOB Origin, Energy Absorption Systems, Inc. Distribution Center in Pell City, Alabama, is $46,195.00 each, not including sales tax.

The price quoted by the distributor for the Quadquard LMC System, Part No.QS9011L, 2290 mm wide, 11-bays, FOB Origin, Energy Absorption Systems, Inc. Distribution Center in Pell City, Alabama, is $47,494.00 each, not including sales tax.

The above prices will be firm for all orders placed on or before June 30, 2002, provided order is placed within 30 days of contract award and delivery is accepted within 90 days after the order is placed.

Pipe sleeves in the backup wall and anchor bolts, nuts and washers for the front anchorage plate, shall conform to the provisions in Section 75-1.03, “Miscellaneous Bridge Metal,” of the Standard Specifications, except that high-strength bolts shall be galvanized and conform to ASTM Designation: A 325.

The Contractor shall provide the Engineer one copy of the manufacturer’s plans and parts lists for each model installed.

The Contractor shall provide the Engineer with the manufacturer’s Certificate of Compliance in accordance with the provisions of Section 6-1.07, “Certificate of Compliance,” of the Standard Specifications. Said certificate shall certify that the crash cushions comply with the contract plans and specifications, conform to the prequalified design and material requirements, and were manufactured in accordance with the approved quality control program.

12-2.06 CONTROLLED BLASTING

Project blasting shall conform to Sections 7-1.10, "Use of Explosives," and 19-2.03, "Blasting," of the Standard Specifications and the following:

The Contractor shall control project blasting effects (fly rock, ground motion, and air noise levels) within the safe limits so as not to cause damage to neighboring improvements.

The Contractor shall submit a plan to the Engineer detailing how he proposes to control fly rock, air noise level, ground motion peak particle velocity and acceleration.

No blasting operations, drilling included, shall start until the Engineer has reviewed and approved the blasting plan in accordance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. The Contractor shall provide 2 weeks for the Engineer to complete the review of the blasting plan.

In the event that additional blasting plans are required, the Contractor shall provide 2 weeks for the review of each additional plans.

Should the Engineer fail to complete his review within the time allowed, and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in blasting plan 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.

Approval of the Contractor's blasting plan or blasting procedures shall not relieve the Contractor of any of his responsibility under the contract for assuring the complete safety of his operations with respect to neighboring improvements, or for the successful completion of the work in conformance with the requirements of the plans and specifications.

The blasting plan shall provide for limiting ground motion (in any direction) to a maximum peak particle velocity of 51 mm/second and an acceleration of 2.1 m/sec.^{2}. Air noise level shall be limited to 125 dBa. Controlling fly rock, air noise level, ground motion peak particle velocity and acceleration as specified herein shall not relieve the Contractor of his responsibility for assuring the complete safety of his operation.

The blasting plan shall indicate the type and method of instrumentation proposed by the Contractor to determine air noise levels, ground motor peak particle velocities and accelerations at the nearest improvements. The blasting plan shall also provide for a preblast reconnaissance survey of all adjacent improvements.

As an alternative to monitoring peak particle velocity and acceleration, the Contractor has the option to make shot designs based on a scaled distance of 50 ft/(lb)$^{1/2}$ to the nearest improvements. The scaled distance is the ratio of the

distance, from the blast to nearest improvement, divided by the square root of the maximum explosive weight for each delay. Delays shall equal or exceed 10 milliseconds.

No blasting shall be performed within 37 meters of a structure if concrete has been placed within the previous 72 hours. No blasting shall be performed within 7.0 meters of any structure, including retaining walls once their construction begins. (See suspension of blasting operations elsewhere in this section).

The Contractor shall keep accurate records of each blast. Blasting records shall be available to the Engineer at all times and shall contain the following data as a minimum:

1. Name of Contractor.
2. Location (station interval and elevation), date and time of blast.
3. Name and signature of responsible blaster.
4. Type of material blasted.
5. Number of holes, burden and spacing.
6. Diameter and depth of holes.
7. Types of explosives used.
8. Total amount of explosives used, kilograms.
9. Maximum amount of explosives per delay period.
10. Method of firing and type of circuit.
11. Direction and distance in meters to nearest improvements, and date of reconnaissance survey.
12. Weather conditions.
13. Direction of wind.
14. Height or length of stemming.
15. Type of delay blasting caps used and delay periods used.
16. Blast identification by numerical and chronological sequence.
17. Powder factor, kilograms of explosive per cubic meters of blasted material.
18. Type and method of instrumentation.
19. Location and placement of instrumentation.
20. Instrumentation records and calculations to determine air noise levels, ground motion peak particle velocity and peak particle acceleration or calculations showing charge weight based on a scaled distance of 22.6 mm/kg$^{1/2}$.

Blasting guards in sufficient numbers to assure that people, property and improvements will not be endangered shall be stationed in the areas where blasting operations are to be performed.

Blasting operations may be suspended for any one of the following reasons:

1. Blasting plans are not approved.
2. Safety precautions are inadequate.
3. Blasting records are incomplete or not up to date.
4. Air noise, ground motion peak particle velocity or acceleration exceed the specified limits.
5. Existing neighboring improvements damaged as a result of blasting.

Suspension of the blasting operation shall in no way relieve the Contractor of his responsibilities under the terms of this contract. Blasting operations shall not resume until modifications have been made to correct the conditions that resulted in the suspension. Where rock excavation remains and explosives cannot be used within the limits of these specifications rock shall be broken using expansion chemicals such as Bristar or S-mite, or a hydraulic splitting system such as the Darda splitting system, or other non-explosive techniques.

Blasting complaints shall be accurately recorded by the Contractor as to complainant, address, date, time, nature of complaint, name of person receiving the complaint, the complaint investigation conducted, and the disposition of the complaint. Complaint records shall be available to the Engineer at all times.

Full compensation for controlling fly rock, ground motion, and air noise (record keeping included) shall be considered as included in the contract prices paid for building work, no separate payments will be made.

12-2.07 CAST-IN-DRILLED-HOLE CONCRETE PILES

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of constructing cast-in-drilled-hole concrete piles in accordance with the details shown on the plans and these special provisions.

Cast-in-drilled-hole concrete piles shall be constructed so that the excavation methods and the concrete placement procedures shall provide for placing the concrete against undisturbed material in a dry or dewatered hole.

Rock cores are available for viewing at the Transportation Laboratory.

Difficult pile installation is anticipated due to the presence of high ground water, cobbles and boulders, and the requirements of pile embedment into rock.

Cast-in-drilled-hole concrete piles 600 mm in diameter or larger may be constructed by excavation and depositing concrete under slurry.

PART 2.-PRODUCTS

Concrete and reinforcement.—

Concrete and reinforcement shall conform to the requirements specified under "Cast-In-Place Concrete" in Section 12-3, "Concrete and Reinforcement," of these special provisions.

Concrete deposited under slurry shall have a nominal penetration equal to or greater than 90 mm. Concrete shall be proportioned to prevent excessive bleed water and segregation.

Concrete deposited under slurry shall contain not less than 400 kg of cement per cubic meter.

Mineral Slurry.—

Mineral slurry shall be mixed and thoroughly hydrated in slurry tanks, and slurry shall be sampled from the slurry tanks and tested before placement in the drilled hole.

Slurry shall be recirculated or continuously agitated in the drilled hole to maintain the specified properties.

Recirculation shall include removal of drill cuttings from the slurry before discharging the slurry back into the drilled hole. When recirculation is used, the slurry shall be sampled and tested at least every 2 hours after beginning its use until tests show that the samples taken from the slurry tank and from near the bottom of the hole have consistent specified properties. Subsequently, slurry shall be sampled at least twice per shift as long as the specified properties remain consistent.

Slurry that is not recirculated in the drilled hole shall be sampled and tested at least every 2 hours after beginning its use. The slurry shall be sampled midheight and near the bottom of the hole. Slurry shall be recirculated when tests show that the samples taken from midheight and near the bottom of the hole do not have consistent specified properties.

Slurry shall also be sampled and tested prior to final cleaning of the bottom of the hole and again just prior to placing concrete. Samples shall be taken from midheight and near the bottom of the hole. Cleaning of the bottom of the hole and placement of the concrete shall not start until tests show that the samples taken from midheight and near the bottom of the hole have consistent specified properties.

Mineral slurry shall be tested for conformance to the requirements shown in the following table:

MINERAL SLURRY		
PROPERTY	REQUIREMENT	TEST
Density (kg/m^3) - before placement in the drilled hole - during drilling - prior to final cleaning - immediately prior to placing concrete	1030* to 1110* 1030* to 1200*	Mud Weight (Density) API 13B-1 Section 1
Viscosity (seconds/liter) bentonite attapulgite	29 to 53 29 to 42	Marsh Funnel and Cup API 13B-1 Section 2.2
pH	8 to 10.5	Glass Electrode pH Meter or pH Paper
Sand Content (percent) - prior to final cleaning - immediately prior to placing concrete	less than or equal to 4.0	Sand API 13B-1 Section 5
*When approved by the Engineer, slurry may be used in salt water, and the allowable densities may be increased up to 32 kg/m^3. Slurry temperature shall be at least 4 degrees Celsius when tested.		

Any caked slurry on the sides or bottom of hole shall be removed before placing reinforcement. If concrete is not placed immediately after placing reinforcement, the reinforcement shall be removed and cleaned of slurry, the sides of the drilled hole cleaned of caked slurry, and the reinforcement again placed in the hole for concrete placement.

Synthetic Slurry

Synthetic slurries shall be used in conformance with the manufacturer's recommendations and these special provisions. The following synthetic slurries may be used:

PRODUCT	MANUFACTURER
SlurryPro CDP	KB Technologies Ltd. Suite 216 735 Broad Street Chattanooga, TN 37402 (800) 525-5237
Super Mud	PDS Company c/o Champion Equipment Company 8140 East Rosecrans Ave. Paramount, CA 90723 (562) 634-8180
Shore Pac GCV	CETCO Drilling Products Group 1350 West Shure Drive Arlington Heights, IL 60004 (847) 392-5800

Inclusion of a synthetic slurry on the above list may be obtained by meeting the Department's requirements for synthetic slurries. The requirements can be obtained from the Office of Structure Design, P.O. Box 942874, Sacramento, CA 94274-0001.

Synthetic slurries listed may not be appropriate for a given site.

Synthetic slurries shall not be used in holes drilled in primarily soft or very soft cohesive soils as determined by the Engineer.

A manufacturer's representative, as approved by the Engineer, shall provide technical assistance for the use of their product, shall be at the site prior to introduction of the synthetic slurry into a drilled hole, and shall remain at the site until released by the Engineer.

Synthetic slurries shall be sampled and tested at both mid-height and near the bottom of the drilled hole. Samples shall be taken and tested during drilling as necessary to verify the control of the properties of the slurry. Samples shall be taken and tested when drilling is complete, but prior to final cleaning of the bottom of the hole. When samples are in conformance with the requirements shown in the following tables for each slurry product, the bottom of the hole shall be cleaned and any loose or settled material removed. Samples shall be obtained and tested after final cleaning with steel reinforcement in place and just prior to placing concrete.

SlurryPro CDP synthetic slurries shall be tested for conformance to the requirements shown in the following table:

SLURRYPRO CDP KB Technologies Ltd.		
PROPERTY	REQUIREMENT	TEST
Density (kg/m^3) - during drilling - prior to final cleaning - just prior to placing concrete	 less than or equal to 1075* less than or equal to 1025*	Mud Weight (Density) API 13B-1 Section 1
Viscosity (seconds/liter) - during drilling -prior to final cleaning - just prior to placing concrete	 53 to 127 less than or equal to 74	Marsh Funnel and Cup API 13B-1 Section 2.2
pH	6 to 11.5	Glass Electrode pH Meter or pH Paper
Sand Content (percent) - prior to final cleaning - just prior to placing concrete	 less than or equal to 0.5	Sand API 13B-1 Section 5
*When approved by the Engineer, slurry may be used in salt water, and the allowable densities may be increased up to 32 kg/m^3. Slurry temperature shall be at least 4 degrees Celsius when tested.		

Super Mud synthetic slurries shall be tested for conformance to the requirements shown in the following table:

SUPER MUD PDS Company		
PROPERTY	REQUIREMENT	TEST
Density (kg/m^3) - prior to final cleaning - just prior to placing concrete	less than or equal to 1025*	Mud Weight (Density) API 13B-1 Section 1
Viscosity (seconds/liter) - during drilling - prior to final cleaning - just prior to placing concrete	34 to 64 less than or equal to 64	Marsh Funnel and Cup API 13B-1 Section 2.2
pH	8 to 10.0	Glass Electrode pH Meter or pH Paper
Sand Content (percent) - prior to final cleaning -just prior to placing concrete	less than or equal to 0.5	Sand API 13B-1 Section 5
*When approved by the Engineer, slurry may be used in salt water, and the allowable densities may be increased up to 32 kg/m^3. Slurry temperature shall be at least 4 degrees Celsius when tested.		

Shore Pac GCV synthetic slurries shall be tested for conformance to the requirements shown in the following table:

Shore Pac GCV CETCO Drilling Products Group		
PROPERTY	REQUIREMENT	TEST
Density (kg/m^3) - prior to final cleaning - just prior to placing concrete	less than or equal to 1025*	Mud Weight (Density) API 13B-1 Section 1
Viscosity (seconds/liter) - during drilling - prior to final cleaning - just prior to placing concrete	35 to 78 less than or equal to 60	Marsh Funnel and Cup API 13B-1 Section 2.2
pH	8.0 to 11.0	Glass Electrode pH Meter or pH Paper
Sand Content (percent) - prior to final cleaning -just prior to placing concrete	less than or equal to 0.5	Sand API 13B-1 Section 5
*When approved by the Engineer, slurry may be used in salt water, and the allowable densities may be increased up to 32 kg/m^3. Slurry temperature shall be at least 4 degrees Celsius when tested.		

Water Slurry

At the option of the Contractor water may be used as slurry when casing is used for the entire length of the drilled hole. Water slurry shall be tested for conformance to the requirements shown in the following table:

WATER SLURRY		
PROPERTY	REQUIREMENT	TEST
Density (kg/m^3) - prior to final cleaning - just prior to placing concrete	1017 *	Mud Weight (Density) API 13B-1 Section 1
Sand Content (percent) - prior to final cleaning -just prior to placing concrete	less than or equal to 0.5	Sand API 13B-1 Section 5
*When approved by the Engineer, salt water slurry may be used, and the allowable densities may be increased up to 32 kg/m^3.		

PART 3.-EXECUTION

CONSTRUCTION.--

Drilling holes.--All holes for concrete piles shall be drilled to the tip elevations or depths shown on the plans.

Drill cuttings shall be disposed of in conformance with the provisions in Section 19-2.06, "Surplus Materials."

Except for cast-in-drilled-hole concrete piling for soundwalls and retaining walls, when cast-in-drilled-hole concrete piling is less than 600 mm in diameter, the Contractor may propose to increase the diameter and revise the pile tip elevation. The Contractor may propose to increase the diameter of -in- drilled-hole concrete piling for soundwalls and retaining walls, but the pile tip elevations shall not be revised. No additional compensation or delays will be made for the Contractor's use of increased diameter cast-in-drilled-hole concrete piling.

The axis of the hole shall not deviate from plumb more than 40 mm per 3 m of length.

Care shall be taken during excavation to prevent disturbing the foundation material surrounding the pile. Equipment or methods used for excavating holes shall not cause quick soil conditions or cause scouring or caving of the hole. After excavation is begun, the pile shall be constructed expeditiously in order to prevent deterioration of the surrounding foundation material from air slaking or from the presence of water. Deteriorated foundation material, including material that has softened, swollen or degraded, shall be removed from the sides and the bottom of the hole and shall be disposed of. The bottom of the drilled hole shall be cleaned just before placing reinforcement or concrete to remove any loose sand, gravel, dirt, and drill cuttings.

After placing reinforcement and prior to placing concrete in the drilled hole, if caving occurs or deteriorated foundation material accumulates on the bottom of the hole, as determined by the Engineer, the reinforcement shall be removed and the bottom of the drilled hole cleaned.

Water that has infiltrated the hole shall be removed before placing concrete therein. Fluvial or drainage water shall not be permitted to enter the hole.

Temporary steel casings shall be furnished and placed tight in the hole where shown on the plans and where necessary to control water or to prevent quick soil conditions or caving of the hole. Temporary casing shall be watertight and of sufficient strength to withstand the loads from installation, removal, lateral concrete pressures and earth pressures. The casing shall be non-corrugated and the surfaces shall be smooth, clean and free from hardened concrete. The casing shall be removed while the concrete is being placed. In a dewatered hole the concrete in the casing shall be maintained at a level at least 1.5 m above the bottom of the casing or at a level above the bottom of the casing adequate to prevent displacement of the concrete by material from outside the casing, whichever is greater. Casing may be vibrated or hammered when required to assist in removal of the casing from the hole, to prevent lifting of the reinforcement and to prevent concrete contamination. The withdrawal of casings shall not leave voids or cause contamination of the concrete with soil or other materials.

Portions of the holes may be enlarged, backfilled with slurry cement backfill, concrete or other material, and redrilled to the specified diameter to control caving. Backfill material at enlarged piles shall be chemically compatible with concrete and steel, shall be drillable and shall have the necessary strength required for the conditions.

Placing reinforcement.--Longitudinal reinforcing steel shall be continuous for the entire length of pile, including pile extensions.

The reinforcement shall be placed and secured symmetrically about the axis of the pile and shall be securely blocked to clear the sides of the hole.

Reinforcement for cast-in-drilled-hole concrete piling with increased diameters and revised tip elevations shall conform to the following:

The size and number of the reinforcing bars, the percentage of bars required to extend to the pile tip and the size and pitch of the spiral reinforcement shall conform to the details shown on the plans for the original piles.

The required length of the spiral reinforcement and of any reinforcing bars which do not extend to the pile tip shall be that length which would have been required for the original specified or ordered tip elevation.

The diameter of the spiral reinforcement shall either remain the same as required for the original pile or be increased to provide not less than the concrete cover required for the original pile. Positive means shall be provided to ensure that the reinforcement is centered in the pile.

Placing concrete.--The concrete filling for cast-in-drilled-hole concrete piles shall be dense and homogeneous. The methods used to place the concrete shall prevent segregation. Concrete placed in steel shells, dry drilled holes or dewatered drilled holes shall not be permitted to fall from a height greater than 2.5 m without the use of adjustable length pipes or tubes unless the flow of concrete is directed into the center of the hole using a hopper and not allowed to strike the reinforcement, reinforcement bracing and other objects in the hole.

Concrete filling for cast-in-drilled-hole concrete piles shall be vibrated in the upper 5 m of the pile.

Formed surfaces shall conform to the requirements specified under "Cast-In-Place Concrete" in Section 12-3, "Concrete and Reinforcement," of these special provisions.

Material resulting from placing concrete in piles shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," unless otherwise permitted in writing by the Engineer.

Additional placing requirements for concrete deposited under slurry.--In addition to compressive strength requirements, the consistency of the concrete to be deposited under slurry shall be verified before use by producing a batch to be tested. The test batch shall be produced and delivered to the project under conditions and in time periods similar to those expected during the placement of concrete in the piles. Concrete for the test batch shall be placed in an excavated hole or suitable container of adequate size to allow testing in conformance with California Test 533. Depositing of test batch concrete under slurry will not be required. For piles where the time required for each concrete placing operation, as submitted in the placing plan, will be 2 hours or less, the test batch shall demonstrate that the proposed concrete mix design achieves both the specified nominal penetration and a penetration of at least 50 mm after twice that time has elapsed. For piles where the time required for each concrete placing operation, as submitted in the placing plan, will be more than 2 hours, the test batch shall demonstrate that the proposed concrete mix design achieves both the specified nominal penetration and a penetration of at least 50 mm after that time plus 2 hours has elapsed. The time period shall begin at the start of placement. The concrete shall not be vibrated or agitated during the test period. Upon completion of testing, the concrete shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Concrete deposited under slurry shall not be vibrated until all temporary casing is removed and concrete contaminated with soil, slurry, or other materials is removed. Concrete deposited under slurry shall be vibrated in the upper 2 m of the pile.

The concrete deposited under slurry shall be carefully placed in a compact, monolithic mass and by a method that will prevent washing of the concrete. Placing concrete shall be a continuous operation lasting not more than the time required for each concrete placing operation at each pile, as submitted in the placing plan, unless otherwise approved in writing by the Engineer. The concrete shall be placed with concrete pumps and delivery tube system of adequate number and size to complete the placing of concrete in the time specified. The delivery tube system shall consist of one of the following:

A. A tremie tube or tubes, each of which are at least 250 mm in diameter, fed by one or more concrete pumps.
B. One or more concrete pump tubes, each fed by a single concrete pump.

The delivery tube system shall consist of watertight tubes with sufficient rigidity to keep the ends always in the mass of concrete placed. If only one delivery tube is utilized to place the concrete, the tube shall be placed near the center of the drilled hole. Multiple tubes shall be uniformly spaced in the hole. Internal bracing for the steel reinforcing cage shall accommodate the delivery tube system. Tremies shall not be used for piles without space for a 250-mm tube.

Spillage of concrete into the slurry during concrete placing operations shall not be allowed. Delivery tubes shall be capped with a water tight cap, or plugged above the slurry level with a good quality, tight fitting, moving plug that will expel the slurry from the tube as the tube is charged with concrete. The cap or plug shall be designed to be released as the tube is charged. The pump discharge or tremie tube shall extend to the bottom of the hole before charging the tube with concrete. After charging the delivery tube system with concrete, the flow of concrete through a tube shall be induced by slightly raising the discharge end. During concrete placement, the tip of the delivery tube shall be maintained to prevent reentry of the slurry into the tube. Until at least 3 m of concrete has been placed, the tip of the delivery tube shall be within 150 mm of the bottom of the drilled hole, and then the embedment of the tip shall be maintained at least 3 m below the top surface of the concrete. Rapid raising or lowering of the delivery tube shall not be permitted. If the seal is lost or the delivery tube becomes plugged and must be removed, the tube shall be withdrawn, the tube cleaned, the tip of the tube capped to prevent entrance of the slurry, and the operation restarted by pushing the capped tube 3 m into the concrete and then reinitiating the flow of concrete.

When slurry is used, a fully operational standby concrete pump, adequate to complete the work in the time specified, shall be provided at the site during concrete placement. The slurry level shall be maintained within 300 mm of the top of the drilled hole.

A log of concrete placement for each drilled hole shall be maintained by the Contractor when concrete is deposited under slurry. The log shall show the pile location, tip elevation, dates of excavation and concrete placement, total quantity of concrete deposited, length and tip elevation of any casing, and details of any hole stabilization method and materials used. The log shall include a 215 mm x 280 mm sized graph of the concrete placed versus depth of hole filled. The graph shall be plotted continuously throughout placing of concrete. The depth of drilled hole filled shall be plotted vertically with the pile tip oriented at the bottom and the quantity of concrete shall be plotted horizontally. Readings shall be made at least at each 1.5 m of pile depth, and the time of the reading shall be indicated. The graph shall be labeled with the pile location, tip elevation, cutoff elevation, and the dates of excavation and concrete placement. The log shall be delivered to the Engineer within one working day of completion of placing concrete in the pile.

After placing reinforcement and prior to placing concrete in the drilled hole, if drill cuttings settle out of slurry, the bottom of the drilled hole shall be cleaned. The Contractor shall verify that the bottom of the drilled hole is clean.

If temporary casing is used, concrete placed under slurry shall be maintained at a level at least 1.5 m above the bottom of the casing. The withdrawal of casings shall not cause contamination of the concrete with slurry.

Placing Plan.--The Contractor shall submit a placing plan to the Engineer for approval prior to producing the test batch for cast-in-drilled-hole concrete piling and at least 10 working days prior to constructing piling. The plan shall include complete description, details, and supporting calculations as listed below:

A. Requirements for all cast-in-drilled hole concrete piling:

1. Concrete mix design, certified test data, and trial batch reports.
2. Drilling or coring methods and equipment.
3. Proposed method for casing installation and removal when necessary.
4. Plan view drawing of pile showing reinforcement and inspection pipes, if required.
5. Methods for placing, positioning, and supporting bar reinforcement.
6. Methods and equipment for accurately determining the depth of concrete and actual and theoretical volume placed, including effects on volume of concrete when any casings are withdrawn.
7. Methods and equipment for verifying that the bottom of the drilled hole is clean prior to placing concrete.
8. Methods and equipment for preventing upward movement of reinforcement, including the Contractor's means of detecting and measuring upward movement during concrete placement operations.

B. Additional requirements when concrete is placed under slurry:

1. Concrete batching, delivery, and placing systems including time schedules and capacities therefor. Time schedules shall include the time required for each concrete placing operation at each pile.
2. Concrete placing rate calculations. When requested by the Engineer, calculations shall be based on the initial pump pressures or static head on the concrete and losses throughout the placing system, including anticipated head of slurry and concrete to be displaced.
3. Suppliers test reports on the physical and chemical properties of the slurry and any proposed slurry chemical additives including Material Safety Data Sheet.
4. Slurry testing equipment and procedures.
5. Removal and disposal of excavation, slurry, and contaminated concrete, including methods and rates of removal.
6. Slurry agitating, recirculating, and cleaning methods and equipment.

Acceptance Testing and Mitigation.--Vertical inspection pipes for acceptance testing shall be provided in all cast-in-drilled-hole concrete piles that are 600 mm in diameter or larger, except when the holes are dry or when the holes are dewatered without the use of temporary casing to control the groundwater.

Inspection pipes shall be Schedule 40 polyvinyl chloride pipe with a nominal inside diameter of 50 mm. Each inspection pipe shall be capped top and bottom and shall have watertight couplers to provide a clean, dry and unobstructed 50-mm diameter clear opening from 1.0 m above the pile cutoff down to the bottom of the reinforcing cage.

Inspection pipes shall be placed around the pile, inside the outermost spiral or hoop reinforcement, and 75 mm clear of the vertical reinforcement, at a uniform spacing not exceeding 840 mm measured along the circle passing through the centers of inspection pipes. A minimum of 2 inspection pipes per pile shall be used. When the vertical reinforcement is not bundled and each bar is not more than 26 mm in diameter, inspection pipes may be placed 50 mm clear of the vertical reinforcement. The inspection pipes shall be placed to provide the maximum diameter circle that passes through the centers of the inspection pipes while maintaining the clear spacing required herein. The pipes shall be installed in straight alignment, parallel to the main reinforcement, and securely fastened in place to prevent misalignment during installation of the reinforcement and placing of concrete in the hole.

The Contractor shall log the location of the inspection pipe couplers with respect to the plane of pile cut off, and these logs shall be delivered to the Engineer upon completion of the placement of concrete in the drilled hole.

After placing concrete and before requesting acceptance tests, each inspection pipe shall be tested by the Contractor in the presence of the Engineer by passing a 48.3-mm diameter rigid cylinder 610-mm long through the complete length of pipe. If the 48.3-mm diameter rigid cylinder fails to pass any of the inspection pipes, the Contractor shall attempt to pass a 32.0-mm diameter rigid cylinder 1.375 m long through the complete length of those pipes in the presence of the Engineer. If an inspection pipe fails to pass the 32.0-mm diameter cylinder, the Contractor shall immediately fill all inspection pipes in the pile with water.

The Contractor shall replace each inspection pipe that does not pass the 32.0-mm diameter cylinder with a 50.8-mm diameter hole cored through the concrete for the entire length of the pile. Cored holes shall be located as close as possible to the inspection pipes they are replacing, no more than 150 mm inside the reinforcement, and coring shall not damage the pile reinforcement. Cored holes shall be made with a double wall core barrel system utilizing a split tube type inner barrel. Coring with a solid type inner barrel will not be allowed. Coring methods and equipment shall provide intact cores for the entire length of the pile concrete. The coring operation shall be logged by an Engineering Geologist or Civil Engineer licensed in the State of California and experienced in core logging. Coring logs shall include complete descriptions of inclusions and voids encountered during coring, and shall be delivered to the Engineer upon completion. Concrete cores shall be preserved, identified with the exact location the core was recovered from within the pile, and made available for inspection by the Engineer.

Acceptance tests of the concrete will be made by the Engineer, without cost to the Contractor. Acceptance tests will evaluate the homogeneity of the placed concrete. Tests will include gamma-gamma logging. Tests may also include crosshole sonic logging and other means of inspection selected by the Engineer. The Contractor shall not conduct operations within 8.0 m of the gamma-gamma logging operations. The Contractor shall separate reinforcing steel as necessary to allow the Engineer access to the inspection pipes to perform gamma-gamma logging or other acceptance testing. After requesting acceptance tests and providing access to the piling, the Contractor shall allow 3 weeks for the Engineer to conduct these tests and make determination of acceptance if the 48.3-mm diameter cylinder passed all inspection pipes, and 4 weeks if only the 32.0-mm diameter cylinder passed all inspection pipes. Should the Engineer fail to complete these tests within the time allowance, and if in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in inspection, 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.

All inspection pipes and cored holes in a pile shall be dewatered and filled with grout after notification by the Engineer that the pile is acceptable. Placement and removal of water in the inspection pipes shall be at the Contractors expense. Grout shall conform to the provisions in Section 50-1.09, "Bonding and Grouting," of the Standard Specifications. The inspection pipes and holes shall be filled using grout tubes that extend to the bottom of the pipe or hole or into the grout already placed.

If acceptance testing performed by the Engineer determines that a pile does not meet the requirements of the specifications, then that pile will be rejected and all depositing of concrete under slurry or concrete placed using temporary casing for the purpose of controlling groundwater shall be suspended until written changes to the methods of pile construction are approved in writing by the Engineer.

The Contractor shall submit to the Engineer for approval a mitigation plan for repair, supplementation, or replacement for each rejected cast-in-drilled-hole concrete pile, and this plan shall conform to the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. Prior to submitting this mitigation plan, the Engineer will hold a repair feasibility meeting with the Contractor to discuss the feasibility of repairing rejected piling. The Engineer will consider the size of the defect, the location of the defect, and the design information and corrosion protection considerations for the pile. This information will be made available to the Contractor, if appropriate, for the development of the mitigation plan. If the Engineer determines that it is not feasible to repair the rejected pile, the Contractor shall not include repair as a means of mitigation and shall proceed with the submittal of a mitigation plan for replacement or supplementation of the rejected pile.

If the Engineer determines that a rejected pile does not require mitigation due to structural, geotechnical, or corrosion concerns, the Contractor may elect to 1) repair the pile per the approved mitigation plan, or 2) not repair anomalies found during acceptance testing of that pile. For such unrepaired piles, the Contractor shall pay to the State, $400 per cubic meter for the portion of the pile affected by the anomalies. The volume, in cubic meters, of the portion of the pile affected by the anomalies, shall be calculated as the area of the cross-section of the pile affected by each anomaly, in square meters, as determined by the Engineer, multiplied by the distance, in meters, from the top of each anomaly to the specified tip of the pile. If the volume calculated for one anomaly overlaps the volume calculated for additional anomalies within the pile, the calculated volume for the overlap shall only be counted once. In no case shall the amount of the payment to the State for any such pile be less than $400. The Department may deduct the amount from any moneys due, or that may become due the Contractor under the contract.

Pile mitigation plans shall include the following:

A. The designation and location of the pile addressed by the mitigation plan.
B. A review of the structural, geotechnical, and corrosion design requirements of the rejected pile.
C. A step by step description of the mitigation work to be performed, including drawings if necessary.
D. An assessment of how the proposed mitigation work will address the structural, geotechnical, and corrosion design requirements of the rejected pile.
E. Methods for preservation or restoration of existing earthen materials.
F. A list of affected facilities, if any, with methods and equipment for protection of these facilities during mitigation.
G. The State assigned contract number, bridge number, full name of the structure as shown on the contract plans, District-County-Route-Kilometer Post, and the Contractor's (and Subcontractor's if applicable) name on each sheet.
H. A list of materials, with quantity estimates, and personnel, with qualifications, to be used to perform the mitigation work.
I. The seal and signature of an engineer who is licensed as a Civil Engineer by the State of California.

For rejected piles to be repaired, the Contractor shall submit a pile mitigation plan that contains the following additional information:

A. An assessment of the nature and size of the anomalies in the rejected pile.
B. Provisions for access for additional pile testing if required by the Engineer.

For rejected piles to be replaced or supplemented, the Contractor shall submit a pile mitigation plan that contains the following additional information:

A. The proposed location and size of additional piling.
B. Structural details and calculations for any modification to the structure to accommodate the replacement or supplemental piling.

All provisions for cast-in-drilled-hole concrete piling shall apply to replacement piling.

The Contractor shall allow the Engineer 3 weeks to review the mitigation plan after a complete submittal has been received.

Should the Engineer fail to review the complete pile mitigation 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 pile mitigation plan, an extension of time commensurate with the delay in completion of the work thus caused will be granted in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

When repairs are performed, the Contractor shall submit a mitigation report to the Engineer within 10 days of completion of the repair. This report shall state exactly what repair work was performed and quantify the success of the repairs relative to the submitted mitigation plan. The mitigation report shall be stamped and signed by an engineer that is licensed as a Civil Engineer by the State of California. The mitigation report shall show the State assigned contract number, bridge number, full name of the structure as shown on the contract plans, District-County-Route-Kilometer Post, and the Contractor (and Subcontractor if applicable) name on each sheet. The Engineer will be the sole judge as to whether a mitigation proposal is acceptable, the mitigation efforts are successful, and to whether additional repairs, removal and replacement, or construction of a supplemental foundation is required.

12-2.09 PAINTED PAVEMENT MARKINGS

PART 1.- GENERAL.--

Scope.--This work shall consist of furnishing and applying paint for pavement markings in accordance with the details shown on the plans and these special provisions.

Pavement markings include, but are not limited to, word and symbol markings, and parking stall markings.

Alternatives.--At the option of the Contractor, striping tape may be placed instead of the painted pavement markings specified herein.

PART 2.- PRODUCTS.--

Paint.--

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

The kind of paint to be used (solvent or water borne) shall be determined by the Contractor, based on local air pollution control regulations and weather conditions.

Striping tape.--

Striping tape shall be permanent type striping tape. Striping tape shall be Brite-Line, Series 1000; Swarco Industries, Director; 3M Stamark Brand, Pliant Polymer Grade Series 5730; 3M Stamark Brand, Bisymmetric 1.75 Grade Series 5730; or equal.

PART 3.- EXECUTION.--

ALIGNMENT AND LAYOUT.--All necessary alignment and layout work shall be performed by the Contractor, in a manner that will not damage the pavement.

Unless otherwise shown on the plans, the width of parking stall markings shall be 105 mm.

EQUIPMENT AND OPERATION.--Mechanical means shall be used to paint pavement markings.

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

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

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

Rapid dry paint shall be applied only with airless type equipment.

Stencils and hand spray equipment shall be used to paint word and symbol markings. Stencils shall be furnished by the Contractor. The stencil layout shall conform to the dimensions shown on the plans.

SURFACE PREPARATION.--Surfaces which are to receive paint shall be cleaned of all dirt and loose material.

APPLICATION.--Paint shall be applied only on dry surfaces, and only during periods of favorable weather, in accordance with the manufacturer's recommendations.

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

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

Completed pavement markings shall have clean and well-defined edges, and shall conform to the dimensions shown on the plans or as specified in these special provisions.

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

If used, striping tape shall be applied in accordance with the manufacturer’s specifications.

APPLICATION RATES.--Each application of paint shall be applied at the rates recommended by the paint manufacturer for the type of surface involved.

PROTECTION.--Newly placed pavement markings shall be protected from damage by traffic or other causes until the paint is thoroughly dry.

DISABLED ACCESSIBLE PARKING STALL SYMBOL.--Each parking space reserved for persons with physical disabilities shall have a minimum 0.9 m x 0.9 m surface identification with the international symbol of accessibility. The symbol and border shall be white and the background shall be blue conforming to Federal Standard 595a, Color No. 15090.

12-2.10 GRATED LINE DRAIN

This work shall consist of furnishing and installing precast grated line drain, with necessary fittings, coupling systems, frames, grates and associated items as shown on the plans and in conformance with these special provisions.

The interior surface of the grated line drain, below the level of the frame and grate and associated connections, shall be smooth. Grated line drain channel sections shall be manufactured of monolithic polymer concrete with no side extensions.

Monolithic polymer concrete shall be made from a composition of aggregate and polyester resin or vinylester resin and shall have the following properties when tested as follows:

PROPERTY	ASTM TEST METHOD	VALUE
Tensile Strength, MPa	C 307	10 min.
Compressive Strength, MPa	C 579	80 min.
Bending Strength, MPa	C 580	20 min.
Moisture Absorption, %	C 140	0.5 max.
Chemical Resistance	C 267	Pass
Freeze/Thaw, number of cycles w/o weight loss	C 666	1600 min.

The manufacturer of the grated line drain shall furnish the Engineer a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

Grated line drain frames and grates shall be manufactured of ductile iron conforming to the provisions in Section 75-1.02, "Miscellaneous Iron and Steel," of the Standard Specifications. The frames and grates need not be galvanized or coated with asphalt paint. Bolts, nuts, frame anchors, and other connecting hardware shall conform to the provisions in Section 75-1.02, "Miscellaneous Iron and Steel," of the Standard Specifications.

Frames and grates, when installed in conformance with the manufacturer's recommendations and these special provisions, shall withstand load testing conforming to the requirements in Federal Specification RR-F-621E for "Frames, Covers, Gratings, Steps, Manhole Sump and Catch Basin." Grates shall fit into the frames without rocking.

Frames shall be secured to the surrounding concrete backfill with steel anchoring rods as shown on the plans. Other methods may be used to secure the frame to the concrete backfill or grated line drain wall provided that a minimum pullout resistance of 10 kN per meter of length of grated line drain frame is maintained.

Grates and frames shall be one piece or the grates shall be removable. Removable grates shall be held in place by locking devices that are tamper resistant. Removable grates shall provide a minimum repetitive pullout resistance of 5 kN per meter of length after completion of 1000 hours of salt spray testing in conformance with the requirements in ASTM Designation: B 117. When a combination of one piece frame and grate and removable grates are used, the locations of the removable grates shall be shown on the plans.

Except for grates installed within designated pedestrian paths of travel, grates shall accept inflow of runoff through openings. The openings shall consist of a minimum of 60 percent of the total top surface area of the grate, with individual openings or slots having a dimension not greater than 50 mm measured in the direction of the grated line drain flow line. Grates installed within designated pedestrian paths of travel shall be certified as conforming to the requirements of the "Americans with Disabilities Act."

Grated line drains shall be installed in trenches excavated to the lines and grades established by the Engineer. The bottom of the trench shall be graded and prepared to provide a firm and uniform bearing throughout the entire length of the grated line drain.

Grated line drains shall be installed and jointed in conformance with the manufacturer's recommendations.

Grated line drains shall be installed to the lines and grades with sections closely jointed and secured to ensure that no separation of the line drains occurs during backfilling.

The frame or grate of the grated line drain shall not extend above the level of the surrounding concrete backfill.

Grated line drains shall be connected to new or existing drainage facilities as shown on the plans.

Excavation and backfill shall conform to the provisions in Section 19-3, "Structure Excavation and Backfill," of the Standard Specifications.

Backfill for the grated line drains shall be either minor concrete or Class 3 concrete conforming to the provisions in Section 90, "Portland Cement Concrete," of the Standard Specifications, except that minor concrete shall contain not less than 300 kg of cement per cubic meter.

Concrete backfill shall be placed in the trench as shown on the plans. Concrete backfill shall be placed against undisturbed material at the sides and bottom of the trench and in a manner that will prevent floating or shifting of the grated line drain and voids in, or segregation of, the concrete. Foreign material which falls into the trench, prior to or during placement of the concrete, shall be immediately removed. Where necessary, earth plugs shall be constructed and compacted at the ends of the planned concrete backfill to contain the concrete within the trench.

Concrete backfill shall be finished flush with the adjacent surfacing.

The surface of the concrete shall be textured with a broom or burlap drag to produce a durable skid-resistant surface.

12-2.11 GUARD POSTS

PART 1.- GENERAL

Scope.--This work shall consist of constructing guard posts in accordance with the details shown on the plans and these special provisions.

PART 2.- PRODUCTS

Steel posts.--

Steel posts for guard posts shall be standard weight, galvanized steel pipe conforming to the details shown on the plans.

Concrete.--

Concrete for guard posts shall be commercial quality concrete, proportioned to provide a workable mix suitable for the intended use, with not less than 300 kilograms of cement per cubic meter.

PART 3.- EXECUTION

Installation.--The length and diameter of the guard posts shall conform to the details shown on the plans.

Guard posts shall be placed in holes excavated to the depth and cross section shown on the plans, and shall be installed plumb.

Guard posts shall be backfilled with concrete as shown on the plans.

Painting.--Guard posts shall be prepared and painted in accordance with the requirements specified under "Painting" in Section 12-9, "Finishes," of these special provisions.

12-2.12 BOLLARD

PART 1.- GENERAL

Scope.--This work shall consist of furnishing and installing bollards in accordance with the details shown on the plans and these special provisions.

PART 2.- PRODUCTS

Bollard.--

Bollard shall be a removable, 1 meter in height, cast aluminum or steel tubing bollard with eye bolts for chain hookups. Provide 8 mm chains. Bollard shall be Canterbury International; Model No. 1890; Maglin Furniture Systems, Ltd., Model No. MTB 400; Urbaco USA, Model Villeneuve; or equal.

PART 3.- EXECUTION

Installation.—Bollard shall be installed according to manufacturer's recommendations.
Bollard shall be backfilled with concrete as shown on the plans.

12-2.13 PARKING BUMPERS

PART 1.- GENERAL

Scope.--This work shall consist of furnishing and installing precast concrete parking bumpers in accordance with the details shown on the plans and these special provisions.

PART 2.- PRODUCTS

Parking bumpers.--

Parking bumpers shall be commercially available precast parking bumpers.

Parking bumpers shall be 1220 mm long, nominal 200 mm wide and 150 mm high with both top longitudinal corners continuously chamfered, and anchor holes 230 mm from each end.

PART 3.- EXECUTION

Layout.--Arrangement of parking bumpers shall be coordinated with the layout of parking stalls and traffic aisles, providing the proper angle to engage wheels and proper location to prevent overtravel of vehicles.

Parking bumpers shall be anchored with two 19 mm diameter reinforcing bars 380 mm in length. The reinforcing bars shall be installed such that the top of the bars is flush with the top of the parking bumper.

12-2.14 ACCESSIBLE PARKING AND AUTHORIZATION SIGNS

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing accessible parking and authorization signs in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data and sign fastening details shall be submitted for approval.

PART 2.- PRODUCTS

Accessible parking stall identification sign.--

Accessible parking stall identification sign shall be a metal sign with baked enamel finish and the international symbol of accessibility. Sign background shall be blue and shall conform to Federal Standard 595a, Color No. 15090. Symbol, lettering and border shall be white and shall conform to Federal Standard 595a, Color No. 17886.

Van accessible sign.--

Van accessible sign shall be a metal sign with baked enamel finish and the international symbol of accessibility. Sign background shall be blue and shall conform to Federal Standard 595a, Color No. 15090. Lettering and border shall be white and shall conform to Federal Standard 595a, Color No. 17886.

Unauthorized vehicles parking sign.--

Unauthorized vehicles parking sign shall be a metal sign with baked enamel finish. Sign background shall be blue and shall conform to Federal Standard 595a, Color No. 15090. Lettering and border shall be white and shall conform to Federal Standard 595a, Color No. 17886. Lettering shall be not less than 25 mm in height and shall read as shown on the plans.

Support post.--

Support post shall be commercial quality, standard weight, galvanized steel pipe. Pipe diameter shall be 35 mm.

Fastening hardware.--

Fastening hardware shall be galvanized or cadmium plated.

Concrete.--

Concrete for support posts shall be commercial quality concrete, proportioned to provide a workable mix suitable for the intended use, with not less than 300 kilograms of cement per cubic meter.

PART 3.- EXECUTION

Installation.--Support posts shall be placed in holes excavated to the depth and cross-section shown on the plans. Posts shall be set vertical and shall be firmly embedded in concrete backfill. The top of the concrete backfill around the post shall be crowned to drain water.

Support posts shall be fitted with a rainproof top.

Sign shall be fastened rigidly and securely to the support post.

The Engineer will provide the Contractor with the necessary information for the disabled authorization sign.

SECTION 12-3. CONCRETE AND REINFORCEMENT

12-3.01 CAST-IN-PLACE CONCRETE

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of constructing cast-in-place concrete facilities in accordance with the details shown on the plans and these special provisions.

Whenever the 28-day compressive strength shown on the plans is 25 MPa or greater, the concrete shall be considered to be designated by compressive strength. The 28-day compressive strengths shown on the plans which are less than 25 MPa, are shown for design information and are not to be considered a requirement for acceptance of the concrete.

Related work.--Compressive strength concrete shall conform to the requirements in Section 90-9, “Compressive Strength,” of the Standard Specifications.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data for admixtures, expansion joint material, vapor barrier, hardener, and sealer shall be submitted for approval.

Descriptive data shall be delivered to the Engineer at the jobsite.

QUALITY ASSURANCE.--

Certificates of Compliance.--Certificates of Compliance shall be furnished for cement, reinforcement, admixtures, freeze-thaw aggregates and epoxy products in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

PART 2.- PRODUCTS

CONCRETE MIXES.--

Concrete (structural work).--

Commercial quality concrete shall be proportioned to provide a workable mix suitable for the intended use; shall have not less than 350 kg/m^3 of cement; 0 to 50 mm penetration, inclusive, as determined by California Test 533.

Concrete (minor work).--

Commercial quality concrete for concrete curbs, sidewalks, driveways, gutter depressions, new door openings, and collars shall be proportioned to provide a workable mix suitable for the intended use; shall have not less than 300 kg/m^3 of cement; 0 to 50 mm penetration, inclusive, as determined by California Test 533.

Concrete (sewer structures).--

Commercial quality concrete for sewer structures shall be proportioned to provide a workable mix suitable for the intended use; shall have not less than 400 kg/m^3 of a mixture of Type II cement and 15 percent by weight of a mineral admixture or Type IP (MS) Modified cement; 0 to 50 mm penetration, inclusive, as determined by California Test 533.

CONCRETE MATERIALS.--

Cement.--

Cement shall conform to ASTM Designation: C 150, Types II, or III portland cement; or Type IP (MS) Modified cement. Type IP (MS) Modified shall conform to ASTM Designation: C 595 and shall be comprised of an intimate mixture of Type II Modified cement and not more than 20 percent of a pozzolanic material.

Aggregates.--

Aggregates shall be free from deleterious coatings, clay balls and other extraneous materials.

Admixtures.--

Admixtures used in portland cement concrete shall be included on the Department's current list of approved admixtures, and shall conform to ASTM Designation: C 494, Types A, B, D, F or G for chemical admixtures; ASTM Designation: C 260 for air-entraining admixtures; and ASTM Designation: C 618 for mineral admixtures, except loss on ignition shall not exceed 4 percent. Properties of admixtures shall be uniform in each lot.

FORM MATERIALS.--

Forms for exposed finish concrete.--

Forms for exposed surfaces shall be plywood, metal or other panel type materials. Plywood shall be not less than 16 mm thick and without scars, dents, and delaminations. Forms shall be furnished in largest practical pieces to minimize number of joints.

Plywood shall conform to the requirements of U. S. Product Standard PS-1 for Exterior B-B (Concrete Form) Class I.

Forms for edges of slabs shall be nominal 50 mm solid stock lumber, plywood, or metal forms.

Forms for unexposed finish concrete.--

Forms for unexposed finish concrete surfaces shall be plywood, lumber, metal or other acceptable material.

Forms for cylindrical columns or supports.--

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

Form ties.--

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

Form oil.--

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

REINFORCING MATERIALS.--

Bar reinforcement.--

Bar reinforcement shall conform to ASTM Designation: A 615/A 615M, Grade 60 [420], or ASTM Designation: A 706/A 706M.

Bar supports.--

Bar supports for reinforcement shall be precast mortar blocks or ferrous metal chairs, spacers, metal hangers, supporting wires, and other approved devices of sufficient strength to resist crushing under applied loads.

EPOXY.--

General.--Epoxy shall be furnished as 2 components which shall be mixed together at the site of the work.

Epoxy resin adhesive.--

Epoxy resin adhesive shall conform to State of California Specification No. 8040-21M-08 or other epoxy suitable for bonding new concrete to old.

Epoxy mortars.--

Epoxy mortar and epoxy mortar surface treatment shall consist of a commercial quality, trowelable mixture consisting of epoxy and sand. Epoxy shall have a pull-off strength of not less than 6895 MPa and a 90-percent cure in 24 hours. Epoxy shall be of the type that requires no primer as a bonding agent.

Sand.--

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

Sand for epoxy mortar surface treatment shall be graded such that 100-percent passes the 150 µm sieve.

RELATED MATERIALS.--

Anchor bolts, nuts, and washers.--

Nonheaded anchor bolts shall conform to ASTM Designation: A 36/A 36M, with a minimum hook length of 6.2 diameters.

Headed anchor bolts shall conform to ASTM Designation: A 307.

Nuts shall conform to ASTM Designation: A 563M, Grade A.

Washers for anchor bolts shall be commercial quality.
Exposed anchor bolts, nuts, and washers shall be hot dipped galvanized.

Expansion joint material.--

Expansion joint material shall be commercial quality asphalt impregnated pressed fiber sheets, 13 mm minimum thickness.

Vapor barrier.--

Vapor barrier shall be commercial quality polyethylene sheets not less than 0.15 mm thick.

Bond breaker.--

Bond breaker shall be Type I asphalt saturated organic felt or such other material approved by the Engineer.

Type A control joints.--

Type A control joints shall be commercial quality, preformed, T-shaped plastic strips with detachable top flange.

Keyed construction joint forms.--

Keyed construction joint forms shall be commercial quality, galvanized metal, factory fabricated construction joint forms. Forms shall produce a rabbeted key type joint.

Divider and edger strips.--

Divider and edger strips shall be foundation grade redwood.

Mortar.--

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

Curing compound.--

Curing compound shall be a non-pigmented curing compound with fugitive dye conforming to the requirements of ASTM Designation: C 309, Type 1-D, Class A.

Concrete hardener.--

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

Concrete sealer.--

Concrete sealer shall be commercial quality VOC-compliant, silane type sealer with hydrophobic and oleophobic properties. Concrete sealer shall be ProSoCo, Inc., Standoff Tile and Masonry Protector (TMP); Tamms Industries, Hey'Di H.O.S.; Textured Coatings of America, Inc., Rainstopper 1750W-Clear; or equal.

Splash block.--

Splash blocks shall be precast concrete splash blocks with depressed runoff trough. Splash blocks shall be 305 mm x 610 mm x 89 mm in size unless otherwise shown on the plans.

ADMIXTURES.--

General.--Admixtures shall be used when specified or ordered by the Engineer and may be used at the Contractor's option to conserve cement or to facilitate any construction operation.

Calcium chloride shall not be used in any concrete.

Admixtures shall be combined with concrete materials by methods that produce uniform properties throughout the concrete.

If more than one admixture is used, said admixtures shall be compatible with each other so that the desirable effects of all admixtures will be realized.

Mineral admixtures may be used to replace up to 15 percent of Type II portland cement provided the weight of mineral admixture used is not less than the weight of cement replaced. Mineral admixtures shall not be used to replace Type IP (MS) Modified or Type III cements. Chemical admixtures may be used to reduce up to 5 percent of the portland cement except that the cement content shall not be less than 300 kg/m^3. When both chemical and mineral admixtures are used with Type II cement, the weight of cement replaced by mineral admixture may be considered as cement in determining the resulting cement content.

Mineral admixtures will be required in the manufacture of concrete containing aggregates that are determined to be "deleterious" or "potentially deleterious" when tested in accordance with ASTM Designation: C 289. The use of mineral admixture in such concrete shall conform to the requirements in this section except that the use of set retarding admixtures will not be permitted.

When the use of a chemical admixture is specified or is ordered by the Engineer, the admixture shall be used at the rate specified or ordered. If no rate is specified or ordered, or if the Contractor uses a chemical admixture for his own convenience, the admixture shall be used at the dosage normally recommended by the admixture manufacturer.

When air-entrainment is specified or is ordered by the Engineer, the air-entraining admixture shall be used in amounts to produce concrete having the specified or ordered air content as determined by California Test 504. If the Contractor uses air-entrainment for his own convenience, the average air content shall not exceed 4 percent and no single test shall exceed 5 1/2 percent.

Chemical admixtures and air-entraining admixtures shall be dispensed in liquid form. Dispensers shall have sufficient capacity to measure at one time the total quantity required for each batch. If more than one liquid admixture is used in the concrete, a separate measuring unit shall be provided for each liquid admixture and dispensing shall be such that the admixtures are not mixed at high concentrations. When air-entraining admixtures are used with other liquid admixtures, the air-entraining admixtures shall be the first to be incorporated into the mix. Unless liquid admixtures are added to premeasured water for the batch, they shall be discharged to flow into the stream of water so that the admixtures are well dispersed throughout the batch.

BAR REINFORCING STEEL.--

Bending.--Reinforcing steel bars shall accurately conform to the dimensions shown on the plans.

Bars shall be bent or straightened in a manner that will not crack or break the material. Bars with kinks or improper bends shall not be used.

Hooks, bends and splices shall conform to the provisions of the Building Code Requirements for Reinforced Concrete of the American Concrete Institute.

MIXING AND TRANSPORTING CONCRETE.--

General.--When a truck mixer or agitator is used for transporting concrete to the delivery point, discharge shall be complete within 1 1/2 hours, or before 250 revolutions of the drum or blades, whichever comes first, after the introduction of cement to the aggregates.

Truck mixers or agitator shall be equipped with electrically or mechanically actuated revolution counters by which the number of revolutions of the drum or blades may readily be verified. The counters shall be of the continuous-registering type, which accurately register the number of revolutions and shall be mounted on the truck so that the Engineer may safely and conveniently inspect them from alongside the truck. Under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 30°C or above, a time less than 1 1/2 hours may be required.

When non-agitating hauling equipment is used for transporting concrete to the delivery point, discharge shall be complete within one hour after the introduction of cement to the aggregates. Under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 30°C, or above, the time between the introduction of cement to the aggregates and discharge shall not exceed 45 minutes.

Each load of concrete for the work shall be accompanied by a trip ticket, a copy of which shall be delivered to the Engineer at the jobsite. The trip ticket shall show volume of concrete, weight of cement and aggregates, quantity of each admixture, quantity of water including water added at the jobsite, time of day the concrete is batched, and revolution counter readings on transit mix trucks at the times the truck is charged and unloaded.

PART 3.- EXECUTION

PREPARATION.--

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

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

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

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

Forms for exposed surfaces shall be constructed with triangular fillets not less than 19 mm x 19 mm attached so as to prevent mortar runs and to produce smooth straight chamfers at all sharp edges of the concrete.

Form fasteners shall be removable without chipping, spalling, heating or otherwise damaging the concrete surface. Form ties shall be removed to a depth of at least 25 mm below the surface of the concrete.

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

Soffit forms and supports shall not be released or removed until at least 10 days after placing concrete. Other forms shall not be stripped until at least 40 hours after placing concrete.

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

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

Redwood dividers shall have 4 mm x 89 mm galvanized nails partially driven into both vertical faces at 450 mm on centers.

Vapor barrier.--Vapor barrier shall be lapped 150 mm and securely taped at splices. Vapor barrier shall be protected with a 75 mm layer of clean uncompacted sand cover.

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

Placing reinforcing steel.--Reinforcing steel bars shall be accurately placed to the dimensions shown on the plans.

Bar reinforcement conforming to ASTM Designation: A 615/A 615M, Grade 420, or A 706//A 706M shall be lapped at least 45 diameters.

Bars shall be firmly and securely held in position by means of wiring and approved bar supports. The spacing of supports and ties shall prevent displacement of the reinforcing or crushing of supports.

Tie wire shall be clear of concrete formwork and concrete surfaces.

All reinforcing steel shall be in place and inspected before concrete placement begins. Placing of bars on fresh layers of concrete will not be permitted.

Ground bar.--A continuous reinforcing steel bar shall be installed in the building foundation at the location indicated on the plans for the electrical ground bar. The use of epoxy coated reinforcing bar is not permitted. The end of the ground bar shall extend beyond the concrete surface and shall be protected from damage by construction operations.

PLACING CONCRETE.--

General.--Concrete shall be placed and consolidated by means of internal vibrators to form dense, homogeneous concrete free of voids and rock pockets.

Forms and subgrade shall be thoroughly moistened with water immediately before placing concrete.

Concrete shall be placed as nearly as possible to its final location and the use of vibrators for extensive shifting of the concrete will not be permitted.

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

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

FINISHING CONCRETE SURFACES.--

Finishing unformed surfaces.--Slabs shall be placed full thickness to finish elevation and leveled to screeds by use of long straightedges. The screeds shall be set to grade at approximately 1.8 meter centers. After leveling, screeds shall be removed and the surface shall be floated with wooden floats.

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

The floated surface shall be trowelled with steel trowels. Troweling shall form a dense, smooth and true finish. Walkways, pedestrian ramps, stairs and outdoor slabs for pedestrian traffic shall be given a non-slip broom finish unless a different finish is called for on the plans or in these special provisions.

The application of cement dust coat will not be permitted.

Steel trowel finish and broom finish will not be required for slabs to be covered with ceramic tile.

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

Finished surfaces of floor slabs shall not deviate more than 3 mm from the lower edge of a 3-meter long straight edge.

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

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

CURING CONCRETE.--

General.--Freshly placed concrete shall be protected from premature drying and excessive cold or hot temperatures.

Initial curing of floor slabs shall start as soon as free water has disappeared from the concrete surface. The concrete shall be kept continuously moist for not less than 7 days after the concrete has been placed.

Cotton mats, rugs, carpets, or sand blankets may be used as a curing medium to retain the moisture during the curing period. Curing materials that will stain or discolor concrete shall not be used on surfaces exposed to view.

Prior to placing the curing medium, the entire surface of the concrete shall be kept damp by applying water with a nozzle that so atomizes the flow that a mist and not a spray is formed, until the surface of the concrete is covered with the curing medium. At the expiration of the curing period, the concrete surfaces shall be cleared of all curing mediums.

Concrete surfaces, other than floor slabs, shall be kept moist for a period of at least 5 days by leaving the forms in place or by covering the exposed surfaces using moist rugs, cotton mats or other curing materials approved by the Engineer.

Concrete curbs, sidewalks, collars, and gutter depressions may be cured with a curing compound.

PROTECTING CONCRETE.--

General.--Concrete shall not be placed on frozen or frost covered surfaces.

Concrete shall be protected from damage due to rain, freezing or inclement weather, and shall be maintained at a temperature of not less than 4°C for 72 hours. When required by the Engineer, the Contractor shall provide a written outline of his proposed methods of protecting concrete.

Vehicles, equipment, or concentrated loads weighing more than 140 kg individually and material stockpiles weighing more than 240 kg/m^2 will not be permitted on the concrete within 10 calendar days after placing.

SPECIAL TREATMENTS.--

Concrete hardener.--Chemical concrete hardener shall be applied to the floor surfaces shown on the plans, prior to the application of concrete sealer. Surfaces shall be clean and dry before the application of hardener.

The solution shall be applied in accordance with the manufacturer's instructions.

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

Concrete sealer.--Concrete sealer shall be applied to the concrete surfaces designated on the plans in accordance with the manufacturer's instructions for heavy duty use. The sealer shall be applied to dry concrete surfaces.

Epoxy resin adhesive.--Epoxy resin adhesive shall be applied to concrete surfaces shown on the plans. Epoxy resin adhesive shall be mixed and applied in accordance with the manufacturer's recommendations.

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

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

12-3.02 COMPRESSIVE STRENGTH CONCRETE

PART 1.- GENERAL

SUMMARY.--

Scope.--This work consist of furnishing and testing compressive strength portland cement concrete in accordance with the details shown on the plans and these special provision.

Whenever the 28-day design strength shown on the plans is 25 MPa or greater, the concrete shall be considered to be designated by compressive strength.

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

Related work.--The requirements of this special provision are in addition to the applicable requirements for concrete (structural work) in "Cast-in-Place Concrete," of these special provisions.

SUBMITTALS.--

Mix design.--Before using compressive strength concrete, the Contractor shall submit in writing to the Engineer a copy of the mix design.

Quality control submittals.--When concrete is specified by compressive strength, prequalification of materials, mix proportions, mixing equipment, and procedures proposed for use, will be required prior to the placement of such 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.

The certified test data and trial batch test reports shall include the following information:

A. Date of mixing.
B. Mixing equipment and procedures used.
C. The size of batch in cubic meters and weight, type and source of all ingredient 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 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.

Certified test data.--Certified test data, in order to be acceptable, must indicate that not less than 90 percent of at least 20 consecutive 28-day tests exceed the specified strength, and none of said tests are less than 95 percent of the specified strength. Strength tests included in such 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 reports.--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 after molding shall be at least 4 MPa greater than the specified 28-day compressive strength, and no individual cylinder shall have a strength less than the specified strength.

Data contained in the report shall be from trial batches which were produced within one year of the proposed use of the 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 test 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.

PART 2.- PRODUCTS (not applicable)

PART 3.- EXECUTION

FIELD QUALITY CONTROL.--

Testing.--The Contractor shall engage an independent testing agency to conduct field quality control testing in accordance with these special provisions.

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 shall be molded and initial field cured in accordance with California Test 540. Test cylinders shall 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, said cylinder shall be discarded and the strength test shall consist of the strength of the remaining cylinder.

When the concrete is designated by 28-day compressive strength rather than by cement content, the concrete strength to be used as a basis for acceptance will be determined from cylinders cured in accordance with Method 1 of California Test 540. If the result of a single 28-day compressive strength is below the specified strength but is 95 percent or more of the specified strength, the Contractor shall, at his expense, make corrective changes, subject to approval of the Engineer, in the mixing proportions or in the concrete fabrication procedures, before placing additional concrete, and shall pay to the State $14.00 for each in-place cubic meter of concrete represented by the deficient test. If the result of a single 28-day test is below 95 percent of the specified strength but is 85 percent or more of the specified strength, the Contractor shall make the aforementioned corrections and pay to the State $20.00 for each in place cubic meter of concrete represented by the deficient test. In addition, such corrective changes shall be made when the compressive strength of the concrete tested at 7 days indicates, in the judgment of the Engineer, that the concrete will not attain the required compressive strength at 28 days. All such concrete represented by a single test which indicates a compressive strength of less than 85 percent of the specified 28-day compressive strength shall be removed in accordance with the provisions in Section 2-1.10, "Removal of Rejected or Unauthorized Work," of the General Conditions.

If the test result indicates a 28-day strength 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 his expense obtains and submits sufficient evidence acceptable to the Engineer that the strength of the concrete placed in the work meets or exceeds the specified strength 28-day compressive strength. If the test result indicates a 28-day compressive strength below 85 percent, the concrete represented by such test will be rejected, unless the Contractor, at his expense, obtains and submits evidence acceptable to the Engineer that the strength and quality of the concrete placed in the work are acceptable. If such evidence consists of cores taken from the work, the cores shall be obtained and tested in accordance with specifications of ASTM Designation: C 42.

No single 28-day strength test shall represent more than 230 m^3.

12-3.03 LIGHTWEIGHT PORTLAND CEMENT CONCRETE

Scope

Lightweight concrete shall be composed of portland cement, lightweight coarse and fine aggregates, admixtures if used, and water, proportioned and mixed as specified in these special provisions.

Concrete for composite metal decking shall be lightweight concrete.

PRODUCTS.—

Lightweight portland cement concrete

The fine aggregate portion of the lightweight concrete mix shall consist of lightweight fine aggregate, natural sand or manufactured sand fine aggregate, or a combination thereof, as required to comply with the air-dry unit mass requirements of these special provisions.

Lightweight aggregates shall conform to the requirements in ASTM Designation: C 330, and the following requirements:

A. Lightweight aggregates shall be rotary kiln expanded shale or clay having a surface sealed by firing. The coarse aggregate shall not be crushed after firing except that aggregate that is 19 mm in size and smaller may be crushed to the extent necessary to produce the required coarse aggregate grading. The final coarse aggregate size shall not exceed 19 mm.
B. The splitting tensile strength and the drying shrinkage requirements of ASTM Designation: C 330 shall not apply.
C. The shrinkage characteristics of lightweight aggregates shall be such that the drying shrinkage of lightweight concrete produced therefrom, when tested in conformance with the requirements in California Test 537, shall be not more than 0.040-percent after 14 days of drying.
D. Lightweight aggregates shall have not more than 5 percent loss when tested for soundness in conformance with the requirements in California Test 214.
E. Natural sand and manufactured sand fine aggregates, portland cement, water, and admixtures shall conform to the provisions in Section 90, "Portland Cement Concrete," of the Standard Specifications.

Proportioning of lightweight concrete shall conform to the provisions in Section 90-5, "Proportioning," of the Standard Specifications and to these special provisions.
Lightweight concrete shall have good workability and other properties such that proper placement, consolidation, and finishing are obtained.

The aggregates shall be uniformly pre-wetted or presaturated in such a manner that uniform penetration of the concrete will be maintained. Presaturation by thermal, vacuum, or equivalent methods will be required for lightweight aggregate in concrete which is to be pumped.

Portland cement, aggregates, water, and admixtures shall be proportioned to produce lightweight concrete containing not less than 350 kg nor more than 500 kg of cement per cubic meter

CONSTRUCTION.--Lightweight portland cement concrete shall conform to the requirements under Cast-in-Place Concrete, elsewhere in these special provisions.

12-3.04 PRE-CAST CONCRETE STAIRS

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of constructing, furnishing and installing pre-cast concrete stairs with stair nosing in accordance with the details shown on the plans and these special provisions.

The requirements of this special provision are in addition to the applicable requirements for concrete (structural work) and bar reinforcing steel in "Cast-in-Place Concrete," elsewhere in this Section 12-3.

SUBMITTALS.--

Product data.--Manufacturer’s descriptive data for pre-cast concrete stairs and stair nosing shall be submitted for approval.

Shop drawings.--Complete shop drawings showing dimensions, additional reinforcement required for lifting and bracing devices, construction loads and other pertinent information shall be submitted for approval.

Samples.--One sample of pre-cast stair with stair nosing shall be submitted for approval.

PART 2.- PRODUCTS

Pre-cast concrete stair.--

Pre-cast concrete stair shall be manufactured in accordance with the requirements under Structural Concrete in Section 12-3 “Concrete and Reinforcement,” of these special provisions.

Stair nosing.--

Stair nosing shall be heat treated 6063-T6 aluminum alloy base. Stair nosing shall meet OSHA requirements for anti-slip safety on stairs. The abrasive filler shall consist of a mixture of aluminum oxide and silicon carbide granules in an epoxy matrix locked into the extruded channels of the base. The abrasive ribs shall project a minimum of 1/16 inch above the extruded channels. Nosing shall be cast into the pre-cast concrete stair and shall terminate not more than 3" from end of steps.

Reinforcing steel and inserts.--Reinforcing steel shall be placed as for other concrete work. Anchorages, inserts and other cast-in-place items shall be located and firmly secured in position.

ERECTION AND INSTALLATION.--

General.--Erection equipment shall be used with care to prevent damage to pre-cast concrete stairs. Any damage shall be repaired prior to completion of the work.

12-3.05 TROWELED CONCRETE OVERLAY

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of placing a troweled concrete overlay in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data and materials safety data sheets shall be submitted for approval.

Samples.--Two samples 610 mm x 610 mm of each color and architectural finish shall be submitted for approval.

PART 2.- PRODUCTS

Troweled concrete overlay.--

Troweled concrete overlay shall be a high performance colored flooring compound intended to be used as a decorative coating. Troweled concrete overlay may be a polymer based product or portland cement admixture suitable for the use intended. Troweled concrete overlay shall be Cementics, Milsestone Hybridized Portland Cement; Elitecrete Systems, Inc., Polymer Cement Overlays; Concrete Soultions, Inc., Ultra Surface Concrete Polymer; or equal.

INSTALLATION

The troweled concrete overlay shall be placed by a trained contractor and the contractor shall posses a current trained contractor certificate from the specific product used. The product shall be applied to the thickness recommended by the manufacturer.

The troweled concrete overlay shall be installed on substrate that has been cleaned in accordance with the manufacturer's recommendations.

The troweled concrete overlay shall be placed when ambient air and surface temperature is a minimum of 7 ˚C and a maximum of 43 ˚C and shall remain so for at least 24 hours. All materials shall be stored in a dry location, out of direct sunlight and protected from weather and other damage in accordance with material safety data sheets.

SECTION 12-4. MASONRY

12-4.01 CONCRETE MASONRY UNITS

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of constructing reinforced hollow concrete masonry units in accordance with the details shown on the plans and these special provisions.

Related work.--Water repellent coating shall be applied in accordance with the requirements specified under "Water Repellent Coating" in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

PERFORMANCE REQUIREMENTS.--

Unit Strength.--Provide masonry units that develop the following installed compressive strengths (f'm) at 28 days:

Based on net area f'm = 13.8 MPa

SUBMITTALS.--

Product data.--Manufacturer's descriptive data for each type of masonry unit, accessory, and other manufactured products shall be submitted for approval.

Samples.--Two samples of masonry units of each color and architectural finish shall be submitted for approval.

QUALITY ASSURANCE.--

Masonry preconstruction testing service.--The Contractor shall employ and pay all costs for the services of a testing laboratory acceptable to the Engineer and experienced in performing preconstruction masonry tests. The testing laboratory shall comply with the requirements of ASTM Designation: E 329.

Preconstruction tests shall be performed on the following materials by the Unit Test Method as defined by Section 2105, "Quality Assurance," of the Uniform Building Code:

Concrete masonry units shall be tested in accordance with ASTM Designation: C 140.

Grout shall be tested in accordance with ASTM Designation: C 1019.

In addition:

Mortar shall be tested in accordance with Uniform Building Code Standard: 21-16.

Test results shall be reported in writing to the Engineer and the Contractor on the same day the tests are made.

Single source responsibility.--Exposed masonry units of uniform color and texture shall be obtained from one manufacturer for each different product required for each continuous surface or visually related surfaces.

Mortar ingredients of uniform quality, including color for exposed masonry, shall be obtained from one manufacturer for each cementitious component and from one source and producer for each aggregate.

Certificates of Compliance.--Certificate of Compliance shall be furnished for masonry units, aggregate for grout and transit mixed grout in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

DELIVERY, HANDLING AND STORAGE.--

Delivery.--Masonry materials shall be delivered to the project in an undamaged condition.

Storage and handling.--Masonry units shall be stored and handled in order to prevent deterioration or damage due to moisture, temperature changes, contamination, corrosion or other causes.

PART 2.- PRODUCTS

CONCRETE MASONRY UNITS.--

Concrete masonry units.--

Concrete masonry units shall be nominal size, color and architectural finish as shown on plans; hollow load bearing, medium weight, Grade N, Type II, conforming to ASTM Designation: C 90; standard or open ended masonry units.

Special shapes shall be provided where required for lintels, corners, jambs, sash, control joints, headers, bonding and other special conditions.

MORTAR AND GROUT MATERIALS.--

Cement.--

Cement for mortar shall be Type II, low alkali portland cement conforming to ASTM Designation: C 150; or masonry cement conforming to ASTM Designation: C 91.

Cement for grout shall be Type II portland cement conforming to ASTM Designation: C 150 with maximum 15 percent Class N, F, or C mineral admixture conforming to ASTM Designation: C 618 except that the loss on ignition shall not exceed 4 percent; or Type IP(MS) blended hydraulic cement conforming to ASTM Designation: C 595.

Aggregate.--

Aggregate for mortar shall conform to ASTM Designation: C 144, except not more than 10 percent shall pass the No. 100 sieve.

Aggregate for grout shall conform to ASTM Designation: C 404, except 100 percent of the coarse aggregate shall pass the 9.5 mm sieve. Soundness loss shall not exceed 10 percent as determined by California Test 214.

Coloring for mortar.--

Coloring for mortar shall be chemically inert, fade resistant mineral oxide or synthetic type.

Lime.--

Lime shall conform to ASTM Designation: C 207, Type S.

Premixed mortar or grout.--

A premixed packaged blend of cement, lime, and sand, with or without color, that requires only water to prepare for use as masonry mortar or grout may be furnished. Packages of premix shall bear the manufacturer's name, brand, contents, weight, and color identification.

Transit mixed grout.--

Transit mixed grout shall conform to ASTM Designation: C 94, except aggregate shall be as specified herein for aggregate for grout. The minimum compressive strength shall be 17236 kPa at 28 days when tested in accordance with ASTM Designation: C 39. Admixtures, if used, shall conform to ASTM Designation: C 494, Types A, E or F and shall not contain chlorides.

REINFORCEMENT, TIES AND ANCHORING DEVICES.--

Bar reinforcement.--

Bar reinforcement shall conform to ASTM Designation: A 615/A 615 M, Grade 60 [420], or ASTM Designation: A 706/A 706 M.

Anchor bolts.--

Anchor bolts shall conform to ASTM Designation: A 307, and shall be 12 mm diameter unless otherwise shown on the plans.

Anchors, ties, angles, and metal lath.--

Anchors, ties, angles, and metal lath shall be commercial quality, and shall be galvanized.

Dry pack.--

Dry pack to set items into masonry shall be one part portland cement to not over 3 parts of clean sand and with a minimum amount of water for hydration and packing.

PROPORTIONING MORTAR AND GROUT.--

General.--Mortar shall be proportioned by loose volume and shall have one part cement, one quarter part of hydrated lime and 2 1/4 to 3 parts aggregate. Mortar shall be tinted with coloring to match the masonry units.

Grout, except transit mixed and packaged premix grout, shall be proportioned by loose volume and shall have one part cement, not more than 1/10 part hydrated lime, 2 1/4 to 3 parts sand aggregate, and not more than 2 parts gravel aggregate.

Aggregate shall be measured in a damp loose condition.

Grout shall be mixed with sufficient water to produce a mix consistency suitable for pumping without segregation. Slump shall not exceed 229 mm.

PART 3.- EXECUTION

CONSTRUCTION.--

General.--Masonry units shall be laid in running bond, except as otherwise shown on the plans.

Surfaces of metal, glass, wood, completed masonry, and other such materials exposed to view shall be protected from spillage, splatters and other deposits of cementitious materials from masonry construction. All such deposits shall be removed without damage to the materials or exposed surfaces.

Construction will comply with Section 2104 Construction of the Uniform Building Code. Tolerances specified in Section 2104 shall be in affect unless otherwise shown on the plans.

Where fresh masonry joins concrete or masonry, the contact surfaces of existing material shall be roughened, cleaned and lightly wetted. The roughened surface shall be no smoother than a wood troweled surface. Cleaning shall remove laitance, curing compounds, debris, dirt and any substance which decreases bond to the fresh masonry.

Masonry shall not be erected when the ambient air temperature is below 5° C.

Surfaces of masonry erected when the ambient air temperature exceeds 38° C. shall be kept moist with water for a period of not less than 24 hours. Water shall be uniformly applied with a fog spray at the intervals required to keep the surfaces moist but not to exceed 3 hours unless otherwise approved by the Engineer.

All anchors, bolts, dowels, reglets and other miscellaneous items to be cast into the wall, shall be firmly secured in place before grout is poured.

Shoring for concrete masonry lintels shall remain in place a minimum of 15 days after the wall has been completed.

Laying masonry units.--Concrete masonry units shall be laid dry.

During laying of units all cells shall be kept dry in inclement weather by suitably covering incomplete walls. Wooden boards and planks shall not be used as covering materials. The covering shall extend down each side of masonry walls approximately 600 mm.

Chases shall be kept free from debris and mortar.

Bond beam units with an opening at each cross web shall be used at all horizontal reinforcing bars.

Where masonry unit cutting is necessary, all cuts shall be made with a masonry saw to neat and true lines. Blocks with excessive cracking or chipping of the finished surfaces exposed to view will not be acceptable.

Lintels.--Masonry lintels shall be as shown on the plans. Lintels shall be formed using U-shaped lintel units with reinforcing bars placed as shown on the plans. Formed-in-place lintels shall be temporarily supported.

Bar reinforcement.--Bar reinforcement shall be accurately positioned in the center of the cell and securely held in position with either wire ties or spacing devices near the ends of bars and at intervals not exceeding 192 bar diameters. Wire shall be 16-gage or heavier. Wooden, aluminum, or plastic spacing devices shall not be used. Tolerances for the placement of vertical reinforcement in walls and flexural elements shall be ± 12 mm. Tolerance for longitudinal reinforcement in walls shall be ±50 mm.

The minimum spacing for splices in vertical reinforcement for masonry walls shall be 1220 mm plus lap.

Bar reinforcement shall not be placed in the plane of mortar joints.

Mortar.--Mortar joints shall be approximately 9.5 mm wide. Units shall be laid with all head and bed joints filled solidly with mortar for the full width of masonry unit shell. Head joints shall be shoved tight. Exposed joints shall be concave, tooled smooth, unless otherwise shown on the plans.

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

Mortar placed in joints shall preserve the unobstructed vertical continuity of the concrete filling. Any overhanging mortar projecting more than 12 mm, or other obstruction or debris shall be removed from the inside of such cells.

GROUTING.--

General.--All cells shall be filled solidly with grout. All grout in the cells shall be consolidated at the time of placement by vibrating and reconsolidated after excess moisture has been absorbed but before plasticity is lost. Slicing with a trowel is not acceptable.

Masonry units may be placed full height of the masonry work before grouting, or they may be placed in increments for individual grout pours.

Cleanouts shall be provided for all grout pours over 1524 mm in height. Such cleanouts shall be provided in the bottom course at every cell containing vertical reinforcement. After cell inspection, the cleanouts shall be sealed before filling with grout.

Masonry units shall be placed full height of the grout pour. Grout shall be placed in a continuous pour in grout lifts not exceeding 1828 mm. The interruption between placing successive lifts of grout shall be not more than one hour.

Between grout pours, a horizontal construction joint shall be formed by stopping the grout a minimum of 38 mm below the top of the last course, except if the joint is at a bond beam, it shall be 12 mm below the top of the bond beam unit, or at the top of the wall.

CLEANING AND PROTECTING MASONRY.--

General.--Splashes, stains or spots on the faces of the masonry exposed to view shall be removed.

Completed masonry shall be protected from freezing for a period of at least 5 days.

FIELD QUALITY CONTROL.--

General.-- The Contractor shall employ, at his own expense, a special inspector and testing laboratory to perform structural tests and inspections of masonry to verify that the construction conforms to the Uniform Building Code in accordance with the requirements in Section 1701, “Special Inspections,” and Section 2105, “Quality Assurance,” of the Uniform Building Code. The contractor shall submit a written Field Quality Control Plan that identifies the inspector, the lab, and the procedures used. The Field Quality Control Plan shall conform to these specifications and the 1997 Uniform Building Code. The contractor's Field Quality Control Plan shall be submitted to the Engineer for approval. The Engineer shall have three weeks to approve the plan.

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

The QCM shall be the sole individual responsible to the Contractor for submitting, receiving, and approving all correspondence, required submittals, and reports to and from the Engineer.

The QCM shall not be employed or compensated by any subcontractor, or 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.

Masonry special inspection personnel or testing firms to be used in the work shall not be employed or compensated by any subcontractor, or by other persons or entities hired by subcontractors, who will provide other services or materials for the project, except for the following conditions:

Special Inspector.--The special inspector shall be, as a minimum, an International Conference of Building Officials (ICBO) certified Special Masonry Inspector. The special masonry inspector shall perform the inspections required under Section 1701.5.7., "Structural masonry" of the Uniform Building Code. The special inspector shall prepare a "Daily Field Report" providing information regarding the specific operations witnessed, including placing of masonry units and bar reinforcing, grouting, fabrication of test specimens, and other observations of importance to the work. A "Daily Field Report" is required for each day that the Special Inspector is on the jobsite. A copy of these reports shall be delivered to the Engineer on the day following the preparation. The special inspector shall submit a final signed report to the Engineer and Contractor stating whether the work requiring special inspection was, to the best of the inspector's knowledge, in conformance with the approved plans, specifications, and the applicable workmanship provisions of these specifications and the Uniform Building Code.

Testing.-- The testing laboratory shall comply with the requirements of ASTM Designation: E 329. Test results shall be reported in writing to the Engineer and the Contractor on the same day the tests are made. Testing shall be done in accordance with Section 2105.3,"Compliance with f'm" of the UBC. The contractor can establish f'm by either sections 2105.3.2, 2105.3.3, or 2105.3.3. A set of tests shall be done for each 465 m^2 of wall area, but not less than one test per project. Tests shall be performed on the following materials by the Unit Test Method as defined:

Concrete masonry units shall be tested in accordance with ASTM Designation: C 140.
Grout shall be tested in accordance with ASTM Designation: C 1019.
In addition:

Mortar shall be tested in accordance with Uniform Building Code Standard: 21-16.

Any work not meeting the requirements of section 2105 shall be redone and retested. Sampling, inspecting, reworking and retesting of material will be done at the contractor's expense.

12-4.02 GLASS MASONRY UNITS

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of constructing reinforced glass block masonry units in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data and installation instructions shall be submitted for approval.

Samples.--Two samples of glass block units of each type, color, design and architectural finish specified shall be submitted for approval.

Samples for verification.--Sample panel consisting of 4 glass blocks with mortar joints indicated or as selected by Engineer shall be submitted for approval.

QUALITY ASSURANCE.--

Certificates of Compliance.--Certificate of Compliance shall be furnished for glass block units in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

Single source responsibility.--Materials for glass unit masonry shall be from a single source for each type of material required.

DELIVERY, STORAGE AND HANDLING.--

Storage of Materials.--Unopened cartons of glass block shall be stored in a clean, cool, dry area.
Opened cartons of glass block shall be protected from rain or water run-off with tarpaulins or plastic covers.

PART 2.- PRODUCTS

MATERIALS.--

Glass block units.--

Hollow glass block shall be non-load bearing made by fusing together 2 halves of clean, colorless pressed glass to produce a partial vacuum. Manufacturer's standard white coating shall be factory-applied on edge surfaces. Transparent pattern shall have smooth outer and inner faces.

Solid glass block shall be semi-transparent blocks with smooth outer faces, made by fusing together 2 solid slabs of clear, colorless glass, with manufacturer's standard white coating factory-applied on edge surfaces, 76 mm thick by 190 mm square actual size.

Mortar materials.--

Portland cement shall conform to ASTM Designation: C 150, Type I, or Type II, white or gray cement.

Color pigmented mortar shall be factory prepackaged consisting of white or gray cement combined with color-fast mineral pigments to produce color indicated, or if not indicated, shall be as selected from the manufacturer's standard formulations.

Hydrated lime shall conform to ASTM Designation: C 207, Type S.

Aggregate for mortar shall be commercially produced for masonry work and be free of organic impurities and lumps of clay or shale, and conform to ASTM Designation: C 144.

Water for mortar shall be clean and potable.

Water repellent admixture shall be the manufacturer's standard dry mixture of stearic water repellent compounds, water reducing agent and fine aggregates intended to reduce capillarity in mortar.

Glass unit masonry accessories.--

Panel (joint) reinforcing shall be prefabricated ladder-type welded wire units with deformed continuous side rods and plain cross rods, each 4 mm in diameter, not less than 0.25 meter long and as follows:

Hot-dip galvanized wire shall conform to ASTM Designation: A 82 for uncoated wire and ASTM Designation: A 153, Class B2, for zinc coating applied to hot-dip process after fabrication and assembly.

Spacing of side rods shall be 50 mm center to center, unless otherwise indicated.

Panel anchors shall be the glass block manufacturer's standard perforated steel strips, one mm uncoated thickness by 45 mm wide by 610 mm, hot-dip galvanized after perforating to comply with ASTM Designation: A 153, Class B2.

Sealant shall be a non-staining, waterproof mastic, silicone type.

Backer rod shall be polyethylene foam, neoprene, oakum or equal as approved by the sealant manufacturer.

Mortar mixes.--

Mortar mixes shall conform to ASTM Designation: C 270, "Proportion Specification," for Type S portland cement-lime mortar. Use of masonry cement shall not be permitted.

Mortar for exterior panels shall include a waterproofing admixture in mortar mix in accordance with the manufacturer's instruction.

Pigments for color pigmented mortar shall be selected and proportioned with other ingredients to produce mortar of the required color. Pigment to cement ratio shall not exceed 1 to 10 by weight.

Mortar shall be mixed in a mechanical batch mixer to produce a stiff but workable consistency which is drier than mortar for ordinary unit masonry; mortar shall not be retempered after it has taken an initial set.

PART 3.- EXECUTION

INSTALLATION.--

Setting masonry units.--First and succeeding courses of glass unit masonry shall be set with completely filled bed and head joints, with no furrowing. Glass unit masonry shall be laid up with courses accurately spaced and coordinated with other construction; maintain 10 mm joint width unless otherwise indicated.

Exposed joints shall be tooled slightly concave using a jointer larger than the joint width; tooling shall be done while mortar is still plastic and before it takes a final set.

Installing panel reinforcing,--Panel reinforcing shall be installed in horizontal joints at the spacing indicated, running continuously from end to end of panels. Panel reinforcing shall be spaced vertically as follows:

For all panels, every other course starting with the first course above the sill.

Panel reinforcing shall be placed in joints immediately above and below all opening within glass unit masonry panels.

Panel reinforcing shall be lapped not less than 153 mm where more than one length is necessary.

Installing panel anchors.--Panel anchors shall be installed at locations indicated and in the same horizontal joints where panel reinforcing occurs. Extend panel anchors at least 310 mm into joint and bend within expansion joints at edges of panels. Panel anchors shall be attached as shown on the plans.

CLEANING.--

Surplus mortar.--Surplus mortar shall be removed from face of glass blocks at time joints are tooled and while still plastic.

Glass unit masonry shall be cleaned after mortar has attained final set but before it has dried on block surfaces by use of scrub brush with stiff fiber bristles and damp cloth. Abrasive cleaners, steel wool or wire brush shall not be used.

SECTION 12-5. METALS

12-5.01 STRUCTURAL STEEL FOR BUILDINGS

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of fabricating, assembling, furnishing and erecting structural steel in accordance with the details shown on the plans and these special provisions.

Structural steel consists of:

Wide flage beams and columns, channels, tube steel, angles, pipe, metal cladding.

Source quality control.--Materials and fabrication procedures are subject to inspection and tests in mill, shop and field, conducted by the Engineer or a qualified inspection agency. The Contractor or fabricator shall provide access to the Engineer or testing agency to places where the structural steel work is being fabricated or produced so that the required inspection and testing can be accomplished. Such inspections and tests will not relieve the Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements. The testing agency may inspect the structural steel at the plant before shipment; however, the Engineer reserves the right, at any time before final acceptance to reject the material that does not conform to the contract requirements.

REFERENCES.--

General.--Structural steel shall be fabricated, assembled and erected in accordance with American Institute of Steel Construction (AISC), "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings."

Welding shall be in accordance with American Welding Society (AWS) D1.1, "Structural Welding Code - Steel."

Dimensional details and workmanship for welded joints in tubular and pipe connections shall conform to Part C, Structural Details; Part D, Special Provision for Welding Tubular Joints; and Part E, Workmanship, in Section 10 of AWS D1.1.

SUBMITTALS.--

Product data.--Product data for items to be incorporated into the work, including structural steel, high strength bolts, nuts and washers and alternative connectors, shall be submitted for approval.

Working drawings.--Working drawings and calculations shall be submitted for approval.

Working drawings shall show any changes proposed in the work, details of connections and joints exposed to the weather, details for connections not dimensioned on the plans, the sequence of shop and field assembly and erection, welding sequences and procedures. If required, the location of butt welded splices on a layout drawing of the entire structure, and the location and details of any temporary supports that are to be used.

Calculations and working drawings for falsework to be used for the erection of structural steel shall be submitted for approval. The falsework shall be designed and constructed to provide the necessary rigidity and to support loads which will be applied. Working drawings and design calculations shall be stamped and signed by an engineer who is registered as a Civil or Structural Engineer in the State of California. The expiration date of the registration shall be shown.

CLOSEOUT SUBMITTALS.--

Final drawings.--At the completion of each building on the contract, one set of reduced prints on 27 kg (minimum) bond paper, 280 mm x 432 mm in size, of the corrected original tracings of all approved drawings for each building shall be furnished to the Engineer. An index prepared specifically for the drawings for each building containing sheet numbers and titles shall be included on the first reduced print in the set for each building. Reduced prints for each building 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.

QUALITY ASSURANCE.--

Qualifications for welding.--A certified copy of qualification test record for welders shall be submitted to the Engineer at the jobsite. Descriptive data for equipment for field welding structural steel, including type and electric power requirements, shall be submitted for approval.

Certificates of Compliance.--Certificate of Compliance shall be furnished for structural steel products in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications. Certificate of Compliance shall include mill test certificates for each heat number used in the work.

DELIVERY, HANDLING AND STORAGE.--

Structural materials shall be loaded, transported, unloaded and stored so that it is kept clean and undamaged. Material shall be stored above ground on platforms, skids, or other supports. Covers and protection shall be provided to protect the materials from corrosion.

Anchorages and anchor bolts, which are to be embedded in concrete or masonry, shall be delivered in ample time to not delay the work.

PART 2.- PRODUCTS

MATERIALS.--

Steel bars, plates and shapes.--

Steel bars, plates and shapes shall conform to ASTM Designation: A 572/A 572M, Grade 50 [345].

Pipe.--

Pipe shall conform to ASTM Designation: A 53, standard weight, unless otherwise shown on the plans.

Steel tubing.--

Steel tubing shall conform to ASTM Designation: A 500, Grade B, or A 501.

Stud connectors.--

Stud connectors shall conform to ASTM Designation: A 108, Grades 1018 through 1020, cold drawn, either semi- or fully killed.

Anchor bolts, nuts and washers.--

Nonheaded anchor bolts shall conform to ASTM Designation: A 36/A 36M, with a minimum hook length of 6.2 diameters.

Headed anchor bolts shall conform to ASTM Designation: A 307.

Nuts shall conform to ASTM Designation: A 563M, Grade A.

Washers for anchor bolts shall be commercial quality.

Machine bolts, nuts and washers.--

Machine bolts and nuts shall conform to ASTM Designation: A 307.

Washers for machine bolts shall be commercial quality.

High strength (HS) bolts, nuts and washers.--

High strength (HS) bolts, nuts and washers shall conform to ASTM Designation: A 325M.

Direct tension indicators.--

Direct tension indicators shall conform to ASTM Designation: F 959.

Tension control fasteners.--

Tension control bolts shall have a splined end extending beyond the threaded portion of the bolt and which shears off when the specified bolt tension is attained.

Inorganic zinc primer.--

Inorganic zinc primer shall be a waterborne inorganic zinc primer conforming to the requirements of AASHTO Designation: M 300-92 I, Type II. Inorganic zinc primer shall be listed on the qualified products list which may be obtained from the Transportation Laboratory, (916) 227-7000.

Mortar.--

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

FABRICATION.--

Shop fabrication and assembly.--Workmanship and finish shall be equal to the best general practice in modern shops.

Cuts shall not deviate more than 2 mm from the intended line. Roughness, notches or gouges shall be removed.

Bearing stiffeners at points of loading shall be square with the web and shall have at least 75 percent of the stiffener in contact with the flanges.

Finished members shall be true to line, shall have square corners and smooth bends and shall be free from twists, kinks, warps, dents and open joints.

Exposed edges and ends of metal shall be dressed smooth, with no sharp edges and with corners slightly rounded.

Stud connectors.--Steel surfaces shall be prepared as recommended by the manufacturer of the stud connectors. Stud connectors shall be welded to the flanges of beams or girders as shown on the plans. Automatic end welding of headed stud connectors shall be in accordance with the manufacturer's instructions.

Connections.--Abutting surfaces at connections shall be clean.

Cutting and welding at the jobsite will not be allowed except as shown on the approved drawings or specifically approved by the Engineer.

Finished holes for bolts shall be cylindrical and perpendicular to the plane of the connection. Subpunched and subdrilled holes shall be 6 mm smaller in diameter than the diameter specified for the finished hole.

Bolted Connections.--Bolts for connecting steel to steel shall be machine bolts conforming to ASTM Designation: A 307 or high-strength bolts conforming to ASTM Designation: A 325M as shown on the plans.

High-strength structural steel bolts, or equivalent fasteners, other bolts attached to structural steel, nuts, and washers shall be galvanized by mechanically deposited coating.

Holes for other work.--Holes for securing other work to structural steel and passage of other work through steel framing members shall be as shown on the approved drawings.

Threaded nuts or specialty items for securing other work to steel members shall be as shown on the approved drawings.

Holes shall be cut, drilled or punched perpendicular to metal surfaces. Holes shall not be flame cut or enlarged by burning. Holes are to be drilled in bearing plates.

SHOP PAINTING.--

General.--Structural steel members, except those to receive sprayed-fireproofing, shall be painted.

Surface preparation.--Surfaces of structural steel to be receive inorganic zinc primer shall be blast cleaned in accordance with Steel Structures Painting Council, SSPC-SP 10, "Near-White Blast Cleaning."

Bolted connections.--Contact surfaces of high strength bolted connections and ungalvanized anchor bolt assemblies shall be blast cleaned and coated with waterborne inorganic zinc primer before assembly. The total thickness of primer on each surface shall be between 0.025 mm to 0.076 mm and may be applied in one application.

Painting.--Immediately after surface preparation, surfaces of structural steel shall receive an undercoat of waterborne inorganic zinc primer. Color shall essentially match Federal Standard 595B, No. 36373.

The manufacturer's published mixing and application instructions for inorganic zinc primer shall be followed.

PART 3.- EXECUTION

ERECTION AND ASSEMBLY.--

Field splices.--Field splices shall be made only at the locations shown on approved working drawings.

The parts shall be accurately assembled in their final position as shown on the plans and in true alignment with related and adjoining work before final fastening.

All parts shall be supported adequately and at locations to provide a vibration free, rigid, and secure installation.

Bolted connections.--All high strength bolted connections shall be made with high strength bolts installed with direct tension indicator washers or tension control fasteners.

When used, one mechanically galvanized direct tension washer shall be installed with each high strength bolt. Bolts shall be tightened until a direct tension indicator washer gap is 0.13 mm or less. A zero gap will not be cause for rejection.

During installation of tension control bolts, the torque required to turn the nut on the tension control bolt shall be counterbalanced by the torsion shear resistance of the splined end of the bolt.

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

Nuts shall be on side of member least exposed to view.

Setting bases and bearing plates.--Concrete and masonry surfaces shall be cleaned and roughened to improve bond. Bottom of base and bearing plates shall be clean.

Base plates and bearing plates for structural members shall be set on wedges or other adjusting devices.

Anchor bolts shall be wrench tightened after supported members have been positioned and plumbed.

Mortar shall be solidly packed between bearing surfaces and base or bearing plates to ensure that no voids remain. Exposed surfaces shall be finished and allowed to cure.

FIELD PAINTING.--

Touch-up painting.--After erection, the Contractor shall clean field welds, bolted connections, and abraded areas of shop paint and apply the same materials as applied for shop painting.

Surfaces that are scheduled to receive finish coats shall be painted with an additional prime coat and finish coats in accordance with the requirements specified for shop primed steel under "Painting" in Section 12-9.

QUALITY CONTROL.--

Testing and inspection.--Ultrasonic examination shall be performed by the Contractor on at least 50 percent of all full penetration butt-welded splices in accordance with the requirements of AWS D1.1 and these special provisions.

Welding procedures and methods shall be subject to inspection for conformance with AWS D1.1.

Butt welds shall be tested in accordance with AWS D1.1, Chapter 6, Part C, Ultrasonic Testing of Groove Welds.

Examination, reporting and disposition of tests shall be in accordance with the provisions of 6.12, AWS D1.1.

In addition to ultrasonic examinations by the Contractor, welds may be subject to inspection or non-destructive testing by the Engineer.

When additional inspection or non-destructive testing is required 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 such inspection and testing.

The Contractor shall correct all deficiencies in the structural steel work which inspections and laboratory test reports have indicated to be not in compliance with these special provisions. Additional tests shall be performed by the Contractor at his expense to reconfirm any non-compliance of original work, and to show compliance of the corrected work.

12-5.02 METAL ROOF AND FLOOR DECKING

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing metal roof and floor decking in accordance with the details shown on the plans and these special provisions.

Metal roof and floor decking includes ribbed sheet steel decking units, bent plates, accessories, fasteners and such other components, not mentioned, but required for a rigid, secure and complete installation.

REFERENCES.--

General.--The design, fabrication and erection of metal roof and floor decking shall conform to the applicable requirements of the American Iron and Steel Institute (AISI) publication, "Specifications for the Design of Light Gauge Cold Formed Steel Structural Members," and the applicable Steel Deck Institute Design Manual and these special provisions. The roof shall have an Underwriters Laboratories Class 60 wind uplift classification.

Welding shall be in accordance with American Welding Society (AWS) D1.3, "Structural Welding Code - Sheet Steel."

SUBMITTALS.--

Product data.--Manufacturer's descriptive data for each type of deck and accessories shall be submitted for approval.

Working drawings.--Working drawings showing complete erection layouts, details, dimensions, deck section properties shall be submitted for approval. Drawings shall show types and gages, fastening methods, including the location, type and sequence of connections, sump pans, cut openings, surface finishes and temporary supports or bracing.

The metal roof and floor decking supplier shall submit a fastening schedule and calculations stamped by an engineer who is registered as a Civil or Structural Engineer in the State of California showing that the metal panels, clips, and fasteners conform to the span and design loads shown on the plans and the wind uplift requirements of the Uniform Building Code as amended by Title 24, Part 2, California Code of Regulations.

QUALITY ASSURANCE.--

Qualification of field welding.--Welding processes and welding operators shall be qualified in accordance with "Welder Qualification," procedures in American Welding Society (AWS) D1.1, "Structural Welding Code - Steel."

Welding decking in place is subject to inspection and testing. Defective work shall be removed and replaced with acceptable work.

Certificates of Compliance.--Certificates of Compliance shall be furnished for the metal decking in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

DELIVERY, HANDLING AND STORAGE.--

General.-- Metal roof and floor decking units and accessories shall be transported, stored and erected in a manner that will prevent corrosion, distortion or other damage.

Deck units shall be stored off the ground with one end elevated to provide drainage.

PART 2.- PRODUCTS

MANUFACTURERS.--Acceptable manufacturers shall be; Verco Manufacturing Co.; BHP Co.; or equal.

MATERIALS.--

Deck units.--

Deck units, closures and plates shall be fabricated from galvanized sheet steel conforming to ASTM Designation: A 446/A 446M. Minimum yield strength shall be not less than 228 MPa.

Galvanizing shall conform to the requirements of ASTM Designation: A 525M, coating class G60.

Miscellaneous steel shapes.--

Miscellaneous steel shapes shall conform to ASTM Designation: A 36/A 36M.

Anchor clips, vent clips, flashing, saddle plates, flexible closure strips and other accessories.--

Anchor clips, vent clips, flashing, saddle plates, flexible closure strips and other accessories shall be as recommended by the decking manufacturer.

FABRICATION.--

General.--Deck units shall be formed to span 3 or more supports, with flush, telescoped or nested 50 mm laps at ends and interlocking or nested side laps unless otherwise shown on the plans.

Deck units shall conform to the configurations, metal thickness, depth and width and section properties shown on the plans.

End bearing shall be not less than 38 mm.

Metal closure strips.--Metal closure strips for opening between deck units and other construction shall be fabricated from the same gage and material as the adjacent deck units. Strips shall be formed to provide tight-fitting closures at end of cells or flutes and sides of decking.

Roof sump pans.--Sump pans shall be fabricated from single piece of galvanized sheet steel with level bottoms and sloping sides to direct water flow to drain. Sump pans shall be of adequate size to receive roof drains and with bearing flanges not less than 75 mm wide. Pans shall be recessed not less than 40 mm below roof deck surface unless otherwise shown or required by deck configuration. Holes for drains shall be cut in the field.

Cleaning.--When spray-on fireproofing is specified, the decking manufacturer shall supply decking free of amounts of oil or lubricants which would significantly impair the adhesion of the spray-on fireproofing.

PART 3.- EXECUTION

INSTALLATION.--

General.--Deck units and accessories shall be installed in accordance with the manufacturer's recommendations and approved drawings and these special provisions.

Units shall be placed on supporting steel framework, adjusted in place and properly aligned before being permanently fastened. Ends of units shall have positive bearing over structural supports.

Cutting and fitting shall present a neat and true appearance with exposed burrs removed. Openings through the decking shall be cut square and shall be reinforced as recommended by the decking manufacturer.

The metal roof and floor decking shall not be used as a working platform before deck units are fastened in place. Supplies, equipment or other loads shall not be stored on the deck. Mechanical equipment or other loads shall not be hung from metal roof decking.

Welding.--Welding shall conform to AWS requirements (D1.1 and D1.3) and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.

Welding washers shall be used where recommended by the manufacturer.

Fastening metal roof and floor decking units.--Roof deck units shall be fastened to supporting steel members as shown on the approved working drawings.

Fastening side laps.--Side laps of adjacent deck units shall be fastened as shown n the plans.

Field painting:--Immediately following erection, field welds, bolted connections and abraded areas shall be cleaned with a wire brush.

Galvanized surfaces shall be touched-up with galvanizing repair paint recommended by the manufacturer.

12-5.03 WELDING STEEL SPECIAL MOMENT-RESISTING FRAMES

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of fabricating, assembling, and erecting Steel Special Moment-Resisting Frames (SMRF) in accordance with the details shown on the plans and these special provisions.

Related Work.--Material descriptions for steel and other related items can be found in "Structural Steel for Building" listed elsewhere in these special provisions.

Requirements for the contractor's welding inspection program can be found under "Welding Quality Control" elsewhere in these special provisions.

REFERENCES.--

General.--AWS (American Welding Society) shall refer to the latest edition, unless otherwise noted.

SYSTEM DESCRIPTION.—

The contractor shall provide Welding Procedure Specification (WPS) and a detailed sequence of welding sketch for review and approval by the design engineer prior to starting of fabrication.

All welding procedures shall be prequalifed or qualified by test per AWS D1.1-98. A pre-construction meeting between the engineer of record, the fabricator, the erector, the contractor, and the inspector shall take place to discuss the Welding Procedure Specification (WPS). The welding electrode manufacturer's specification should be attached to the WPS on all jobs. All welders and inspectors will be informed of and must adhere to the WPS and shall retain a copy.

All welding shall be continuously inspected by an inspector.

Welders shall be qualified for the work they will be doing and shall have certifications current.

Welding shall be by Flux Core Arc Welding (FCAW) process using E71T-8 low hydrogen electrodes in conformance with the AWS, 1998 Uniform Building Code with 1995 Title IVXX amendments.

All welds, used in primary members, shall have a filler metal with a notch toughness of 1.37 N/m (20 ft/lbs) average at minus 18 degrees Celsius (zero degrees Fahrenheit) as determined by manufacture certification or AWS classification. Unless noted otherwise, all steel shown on the "ST " plan sheets shall be deemed primary members.

SUBMITTALS.--

Product data.--Product data for items to be incorporated into the work, including structural steel, high strength bolts, nuts and washers and alternative connectors, shall be submitted for approval as described in "Structural Steel for Buildings" elsewhere in these special provisions.

Welding Submittals.--

Field Welding Sequence.--Provisions for welding heat effects: A sequence for field welding shall be planned to minimize locked in stresses and distortions and shall be submitted to the engineer at the time of shop drawing submittal. Any proposed deviations from the details shown on the drawings shall be approved by the engineer. The procedures and the details used shall result in completed connections, which are in full compliance with the intent of the details shown on the drawings and specifications. The sequence of field welding, both in the joints and frames as a whole shall be performed prior to the engineer's approval.

Welding Procedure Specification (WPS).--A written "Welding Procedure Specification "(WPS)" per AWS D1.1-98 shall be developed by the fabricator/erector and reviewed and approved by the contractor's Welding Quality Control Manager (WQCM). All welded joints shall be pre-qualified per AWS D1.1-98. Non pre-qualified welded joints shall be qualified by test and procedure qualification test record included per AWS D1.1-98. The WPS shall include the welding parameters recommended by the electrode manufacturer. The WPS shall include:

1 The written WPS shall contain all the necessary information required by the code, this specification, and any other information necessary to produce welds that are in compliance with these requirements.

2 The WPS shall list the applicable base metal types and thicknesses.

3 The WPS shall list the welding joint details, including joint type, weld type, joint geometry, and applicable dimensions. Individual weld passes shall be identified in the sketch and numbered to identify the sequence of the their deposition. The sketch shall identify the maximum layer thickness and bead widths. In no case shall the layer thickness exceed 6.4 mm, nor shall the maximum bead width exceed 15.9 mm.

4 The WPS shall list the applicable welding process.

5 The WPS shall indicate the position of welding.

6 The WPS shall list the filler metal per AWS D1.1-98 and electrode specification and classification, as well as details regarding shielding material used.

7 The WPS shall indicate the minimum pre-heat requirements and interpass temperatures. The minimum specified pre-heat shall meet the requirements of AWS D1.1-98, Table 3.2.

8 The WPS shall list all applicable electrical characteristics for the process employed. The WPS shall clearly indicate the specific values required for each welding pass. These electrical characteristics shall include at a minimum the following:

i Electrode diameter.
ii Type of current, and acceptable ranges of current measured in age. For wire feed processes, at the contractor's option, wire feed speed may be listed in lieu of a specific current.
iii Voltage (For all process).
iv Travel Speed (range).
v Electrode extension (stick out) for wire feed processes.

2.10 All electrodes listed in the WAS shall be low hydrogen types.
2.11 A copy of electrode manufacturer's technical information shall be attached to the WAS or its I.D. No. listed.

Field welding sequence and WAS shall be submitted for approval.

QUALITY ASSURANCE.--

Qualifications for welding.--Shall be as described in “Welding Quality Control” listed elsewhere in these special provisions.

PART 2.- PRODUCTS (Blank)

PART 3.- EXECUTION

INSTALLATION.—

Provisions for welding Beam-Columns.--The following provisions apply to all welding at beam-column moment connections:

A. Minimum initial pre-heat to be 107.2 °C measured one foot from the weld joint. Maximum interpass temperature of 315.6 °C to be monitored on the column flange. Maintain pre-heat temperature when welding is interrupted.
B. Use stringer passes only, no weaving. Lay passes in horizontal layers. Each pass shall be thoroughly de-slagged and cleaned by wire brushing.
C. The root pass shall begin in the center of the joint in the areas of the weld access hole, reaching past the beams web through the cope hole when near the end of welding. After the arc is initiated, travel shall progress toward the edge of both flanges, and the weld shall be terminated on the weld run off tab.
D. Peen each pass, except first and last, immediately after de-slagging, and clean using a power slagging gun with a blunt tool. Keep gun at right angles to weld and make 4-5 passes the length of the weld with no nicks, cuts or deep indentations being evident.
E. The start of the weld in the weld access hole area shall be visually inspected to ensure fusion, soundness, freedom from slag inclusions and excessive porosity. The resulting bead profile shall be suitable for obtaining good fusion by the subsequent pass to be initiated on the opposite side of the beam web. If the profiles is not conducive to good fusion, the start of the first root pass shall be ground, gouged, chipped, or otherwise prepared to ensure adequate fusion.
F. The second half of the weld joint shall have the root pass applied before any other weld passes are performed. The arc shall be initiated in the area of the start of the first root pass, and travel shall progress to the end of the joint, terminating on the weld tab.
G. Each weld layer shall be completed on both sides of the joint before a new layer is deposited.

H. Remove back up bars and weld tabs and test and inspect the weld root for imperfections. Back gouge the weld root to sound material and clean by grinding if backgouged by air arc.

I. Re-weld the backgouged area and provide an additional fillet weld to reinforce the joint. The size of the reinforcing fillet weld shall be equal to 1/4 the beam flange thickness, but not less than 6.4 mm, nor more than 9.5 mm per note J of figure 3.4 of D1.1-98. Re-weld backgouged area and provide an additional fillet weld to reinforce the joint. The size of the reinforcing fillet weld shall be equal to 1/4 the beam flange thickness, bot not less that 6.35 mm nor more than 9.53 mm per note J of Figure 3.4 of D1.1-98.

J. Stress relieve post heat treatment:

1. Start post-heat immediately after frame joint welding is completed at the pre-heat temperature of 107.2 °C. Raise temperature to 304.4 °C (+10), at 93.3 °C (per hour maximum.
2. Post heat temp= Min. 304.4 °C (+10)
   Max 315.6 °C
3. Soak time shall be 1 hour per inch at 304.4 °C. Thicker element of the joint governs.
4. Ramp down to ambient at 37.8 °C per hour maximum in no less than 6 hours.
5. If the gradual cooling process is not done to the inspector's satisfaction, the area in question shall be reheated to 315.6 °C and cooling process repeated per notes 3 and 4 above.

Clean groove preparation thermal cuts by grinding.

Welds shall be terminated at the end of a joint in a manner that will ensure sound welds. Whenever necessary, this shall be done by use of extension bars and run off tabs. Run off tabs used art beam flange connections shall be removed and the welds finished to a smooth contour (25 mm radius) per 3.12.3 of AWS D1.1-98. No 25 mm dams are allowed.

FIELD QUALITY CONTROL.--

Testing and inspection.--The Contractor's Quality Control (QC) personnel shall, as a minimum, perform the following shop and field testing of materials, welds, and bolts as follows:

1. Ultrasonic testing is required for all (100%) complete penetration welds. Test groove welding on continuity plates by ultrasonic testing after beam flange weld connection is completed. Testing shall be performed no sooner than 48 hours after completion of welding.
2. All welds shall be visually inspected and periodically measured (15%)
3. Check by calibrated torque wrench a minimum of one (1) high strength bolt at each shear connection.
4. Check a minimum of 10% of fillet weld by magnetic particle (ASTM 109 Method). Check a minimum of 25% of continuity plate fillet welds and beam fillet welds (100% in moment zones) by magnetic particle.
5. In progress visual inspection per ASW D1.1-98 is required for all welding (cut outs, clean up, root passes, fill in passes, etc). Magnetic particle testing is required after clean up of all surfaces to be welded. Ultrasonic testing is required for all complete penetration welds. In addition, magnetic particle testing is required for fillet welds 9.53 mm or larger. Re-test groove welding on continuity plates by ultrasonic testing after beam flange welding connection.
6. To assure the proper amperage and voltage of the welding process, the use of a hand held calibrated amp and volt meter shall be used by the contractor and measured at the arc with this equipment. Travel speed and electrode stick out shall be verified to be in compliance with the electrode manufacturer's recommendation.

Weld acceptance shall be made based on the acceptance criteria of AWS D1.1-98 chapter 6, section C.

The Contractor shall correct all deficiencies in the structural steel work which inspections and laboratory test reports have indicated to be not in compliance with these special provisions. Additional tests shall be performed by the Contractor at his expense to reconfirm any non-compliance of original work, and to show compliance of the corrected work.

12-5.04 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 welding is performed for the following work:

A. Special Moment Resisting Frames (SMRF)

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	1998

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.

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

The QCM shall not be employed or compensated by any subcontractor, or by other persons or entities hired by subcontractors, who will provide other services or materials for the project. The QCM may be an employee of the Contractor.

Welding inspection personnel or nondestructive testing (NDT) firms to be used in the work shall not be employed or compensated by any subcontractor, or by other persons or entities hired by subcontractors, who will provide other services or materials for the project, except for the following conditions:

A. The welding is performed at a permanent fabrication facility which is certified under the AISC Quality Certification Program, Category Cbr, Major Steel Bridges.
B. The welding is performed at a permanent fabrication facility which is certified under the AISC Quality Certification Program, Category Sbd, Conventional Steel Building Structures.

For welding performed at such certified facilities, the inspection personnel or NDT firms may be employed or compensated by the fabrication facility performing the welding.

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

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

A. The name of the welding firm and the NDT firm to be used;
B. 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;
C. 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;
D. An organizational chart showing all QC personnel and their assigned QC responsibilities;
E. The methods and frequencies for performing all required quality control procedures, including QC inspection forms to be used, as required by the specifications including:

    1. all visual inspections;
    2. all NDT including radiographic geometry, penetrameter and shim selection, film quality, film processing, radiograph identification and marking system, and film interpretation and reports; and
    3. calibration procedures and calibration frequency for all NDT equipment;

F. 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, 2) placing all identification and tracking information on each radiograph and 3) a method of reporting nonconforming welds to the Engineer;
G. 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;

H. 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;
I. 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
J. 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.
K. Example forms to be used for Certificates of Compliance, daily production logs, and daily reports.

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

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

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

It is expressly understood that the Engineer's approval of the Contractor's WQCP 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 WQCP.

A daily production log for welding shall be kept by the QCM for each day that welding is performed. The log shall clearly indicate the locations of all welding, 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.

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:

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

All radiographic envelopes shall have clearly written on the outside of the envelope the following information: name of the QCM, name of the nondestructive testing firm, name of the radiographer, date, contract number, complete part description, and all included weld numbers or a report number, as detailed in the WQCP. In addition, all innerleaves shall have clearly written on them the part description and all included weld numbers, as detailed in the WQCP.

All reports regarding NDT, including radiographs, shall be signed by both the NDT technician and the person that performed the review, and then submitted directly to the QCM for review and signature prior to submittal to the Engineer. Corresponding names shall be clearly printed or typewritten next to all signatures.

The Engineer will review the Welding Report to determine if the Contractor is in conformance with the WQCP. 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 WQCP, 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 in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

Sections 6.1.2 through 6.1.4.3 of AWS D 1.1are 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, elsewhere in these special provisions, 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 conformance with the requirements in 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 conformance with the requirements in 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 6.14.6, "Personnel Qualification," of AWS D 1.1is replaced with the following:

Personnel performing NDT shall be qualified in conformance with the requirements in 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. The Written Practice of the NDT firm shall meet or exceed the requirements of the current edition of the ASNT Recommended Practice No. SNT-TC-1A. 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 is replaced with the following:

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 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 WQCP, 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 5working 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 in conformance with the provisions 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.

Section 6.6.5, "Nonspecified Nondestructive Testing Other Than Visual," of AWS D 1.1 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 as provided in Section 4-1.03D 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 conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for each item of work for which welding was performed. The certificate shall state that all of the materials and workmanship incorporated in the work, and all required tests and inspections of this work, have been performed in conformance with the details shown on the plans and the provisions of the Standard Specifications and these special provisions.

12-5.05 STEEL DECK

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing steel deck in accordance with the details shown on the plans and these special provisions.

Steel deck includes ribbed sheet steel decking units, bent plates, accessories, fasteners and such other components, not mentioned, but required for a rigid, secure and complete installation.

REFERENCES.--

General.--The design, fabrication and erection of steel deck shall conform to the applicable requirements of the American Iron and Steel Institute (AISI) publication, "Specifications for the Design of Light Gauge Cold Formed Steel Structural Members," and the applicable Steel Deck Institute Design Manual and these special provisions.

Welding shall be in accordance with American Welding Society (AWS) D1.3, "Structural Welding Code - Sheet Steel."

SUBMITTALS.--

Product data.--Manufacturer's descriptive data for each type of deck and accessories shall be submitted for approval.

Working drawings.--Working drawings showing complete erection layouts, details, dimensions, deck section properties shall be submitted for approval. Drawings shall show types and gages, fastening methods, including the location, type and sequence of connections, sump pans, cut openings, surface finishes and temporary supports or bracing.

The steel deck supplier shall submit a fastening schedule and calculations stamped by an engineer who is registered as a Civil or Structural Engineer in the State of California showing that the metal roof panels, clips, and fasteners conform to the span and design loads shown on the plans and the wind uplift requirements of the Uniform Building Code as amended by Title 24, Part 2, California Code of Regulations.

QUALITY ASSURANCE.--

Qualification of field welding.--Welding processes and welding operators shall be qualified in accordance with "Welder Qualification," procedures in American Welding Society (AWS) D1.1, "Structural Welding Code - Steel."

Welding decking in place is subject to inspection and testing. Defective work shall be removed and replaced with acceptable work.

Certificates of Compliance.--Certificates of Compliance shall be furnished for the metal decking in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

DELIVERY, HANDLING AND STORAGE.--

General.--Steel deck units and accessories shall be transported, stored and erected in a manner that will prevent corrosion, distortion or other damage.

Deck units shall be stored off the ground with one end elevated to provide drainage.

PART 2.- PRODUCTS

MANUFACTURERS.--Acceptable manufacturers shall be; Verco Manufacturing Co.; BHP Co.; or equal.

MATERIALS.--

Deck units.--

Deck units, closures and plates shall be fabricated from galvanized sheet steel conforming to ASTM Designation: A 446/A 446M. Minimum yield strength shall be not less than 228 MPa.

Galvanizing shall conform to the requirements of ASTM Designation: A 525M, coating class G60.

Miscellaneous steel shapes.--

Miscellaneous steel shapes shall conform to ASTM Designation: A 572/A 572M, Grade 50.

Anchor clips, vent clips, flashing, saddle plates, flexible closure strips and other accessories.--

Anchor clips, vent clips, flashing, saddle plates, flexible closure strips and other accessories shall be as recommended by the decking manufacturer.

FABRICATION.--

General.--Deck units shall be formed to span 3 or more supports, with flush, telescoped or nested 50 mm laps at ends and interlocking or nested side laps unless otherwise shown on the plans.

Deck units shall conform to the configurations, metal thickness, depth and width and section properties shown on the plans.

End bearing shall be not less than 38 mm.

Metal closure strips.--Metal closure strips for opening between deck units and other construction shall be fabricated from the same gage and material as the adjacent deck units. Strips shall be formed to provide tight-fitting closures at end of cells or flutes and sides of decking.

Roof sump pans.--Sump pans shall be fabricated from single piece of galvanized sheet steel with level bottoms and sloping sides to direct water flow to drain. Sump pans shall be of adequate size to receive roof drains and with bearing flanges not less than 75 mm wide. Pans shall be recessed not less than 40 mm below roof deck surface unless otherwise shown or required by deck configuration. Holes for drains shall be cut in the field.

Cleaning.--When spray-on fireproofing is specified, the decking manufacturer shall supply decking free of amounts of oil or lubricants which would significantly impair the adhesion of the spray-on fireproofing.

PART 3.- EXECUTION

INSTALLATION.--

General.--Deck units and accessories shall be installed in accordance with the manufacturer's recommendations and approved drawings and these special provisions.

Units shall be placed on supporting steel framework, adjusted in place and properly aligned before being permanently fastened. Ends of units shall have positive bearing over structural supports.

Cutting and fitting shall present a neat and true appearance with exposed burrs removed. Openings through the decking shall be cut square and shall be reinforced as recommended by the decking manufacturer.

The metal roof deck shall not be used as a working platform before deck units are fastened in place. Supplies, equipment or other loads shall not be stored on the deck. Mechanical equipment or other loads shall not be hung from metal roof decking.

Welding.--Welding shall conform to AWS requirements (D1.1 and D1.3) and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.

Welding washers shall be used where recommended by the manufacturer.

Fastening roof deck units.--Roof deck units shall be fastened to supporting steel members as shown on the structural plans.

Fastening side laps.--Side laps of adjacent deck units shall be fastened as shown n the plans.

Roof sump pans.--Roof sump pans shall be placed over openings provided in roof and welded to top decking surface. Welds are to be spaced at not more than 305 mm with at least one weld in each corner. Cut opening in sump bottom to accommodate drain size indicated.

Field painting:--Immediately following erection, field welds, bolted connections and abraded areas shall be cleaned with a wire brush.

Galvanized surfaces shall be touched-up with galvanizing repair paint recommended by the manufacturer.

12-5.06 COMPOSITE METAL DECKING

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing composite metal decking in accordance with the details shown on the plans and these special provisions.

Composite metal decking includes ribbed sheet steel decking units, bent plates, lightweight portland cement concrete, accessories, fasteners and such other components, not mentioned, but required for a rigid, secure and complete installation.

PART 2.- PRODUCTS

Metal decking.--

Metal decking shall conform to the requirements of Section 12-5, "Steel Deck, " in these special provisions.

Lightweight portland cement concrete.--

Lightweight portland cement concrete shall conform to the requirements of under "Lightweight Portland Cement Concrete," in Section 12-3, "Lightweight Portland Cement Concrete, " in these special provisions.

PART 3.- EXECUTION

Metal decking.--Metal decking shall be installed in accordance with the requirements of Section 12-5, Metal Decking," in these special provisions.

Lightweight portland cement concrete.—Lightweight portland cement concrete shall be placed in accordance with the requirements of Section 12-3, "Concrete and Reinforcement, " in these special provisions.

12-5.07 COLD FORMED METAL FRAMING

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing cold formed metal framing, including load-bearing and non-bearing steel studs, and "C"-shaped steel joists and rafters, in accordance with the details shown on the plans and these special provisions.

SYSTEM DESCRIPTION.--

Loadings.--Components shall be sized to withstand the design loads shown on the plans.

Wall system shall be designed to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclical day/night temperature range.

Wall system design shall accommodate construction tolerance, deflection of building structural members, and clearances of intended openings.

REFERENCES.--

Component design.--Structural properties of studs and joists shall be computed in accordance with American Iron and Steel Institute (AISI), "Specification for Designing of Cold-Formed Steel Structural Members."

Welding.--Welding shall be in accordance with American Welding Society (AWS) D1.3, "Structural Welding Code - Sheet Steel."

Welders shall be qualified in accordance with "Welder Qualification," procedures of AWS D1.1, "Structural Welding Code-Steel."

SUBMITTALS.--

Product data.--Manufacturer's descriptive data and installation instructions for each item of cold-formed metal framing and accessories shall be submitted for approval.

Installation instructions shall include instructions for securing studs to tracks and other framing connections.

Working drawings.--Working drawings and calculations for cold formed metal framing components not fully dimensioned in manufacturer's descriptive data shall be submitted for approval.

Working drawings shall include framing members showing size and gage designations, number, type, location and spacing. Working drawings shall include supplemental strapping, bracing, splices, bridging, accessories, and details required for proper installation.

The cold formed metal framing supplier shall submit drawings and calculations stamped by an Engineer who is registered as a Civil or Structural Engineer in the State of California showing that the metal framing and fasteners comply with seismic and wind uplift requirements of the Uniform Building Code as amended by Title 24, Part 2, California Code of Regulations.

QUALITY ASSURANCE.--

Fire-rated assemblies.--Where cold formed metal framing units are components of assemblies indicated to be fire-rated, provide units which have been approved for the rating indicated on the plans.

DELIVERY, STORAGE AND HANDLING.--

General.--Cold formed metal framing components shall be protected from rusting and damage. Components shall be delivered to the jobsite in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade. Components shall be stored off ground in a dry ventilated space.

PART 2.- PRODUCTS

COLD FORMED METAL FRAMING.--

Steel studs, joists and rafters.--

Load-bearing studs shall be formed to channel shape, punched web, and knurled faces, conforming to ASTM Designation: A 653M, Grade 340 (50). Studs shall be 1.52 mm (16-gage) minimum thickness and size as shown on the drawings.

Joists, rafters, and other framing components, 1.21 mm (18-gage) or lighter, shall be fabricated of commercial quality galvanized steel sheets; conforming to ASTM Designation: A 653M, Grade 230 (33).

Steel Track.--

Track shall be formed steel, channel shape, and same width as studs; solid web; not less than 1.21 mm (18-gage) thickness.

ACCESSORIES.--

Fasteners.--

Fasteners shall be hot-dipped galvanized, self-drilling, self-tapping screws, or bolts, nuts and washers.

Anchorages.--

Anchorages shall be ICBO approved for the purpose intended, integral stud type, powder driven or drilled expansion bolts.

FINISHES.--

Studs, track and headers.--

Studs, tracks and headers shall be hot-dipped galvanized to conform to ASTM Designation: A 653M, G60.

Miscellaneous metal parts.--

Miscellaneous parts, including, bracing, furring, plates, gussets, and bridging, shall be hot dipped galvanized to not less than 381 kilograms per square meter.

FABRICATION.--

General.--Cold formed metal framing components shall be fabricated in place or prefabricated into panels to the maximum extent possible prior to erection. Panels shall be fabricated plumb, square, true to line and braced against racking with joints welded. Lifting of prefabricated panels shall be performed in a manner to prevent damage or distortion.

Panels shall be fabricated in jig or templates to hold members in proper alignment and position to assure accurate placement.

Fastenings.--Components shall be fastened by shop welding, bolting or screw fasteners as shown on the approved drawings.

PART 3.- EXECUTION

INSTALLATION.--

Studs.--Studs shall be erected plumb, except as needed for diagonal bracing or similar requirements. Channel tracks shall be aligned accurately to the wall layout at both floor and ceiling. Tracks shall be secured to floor and ceiling with fasteners spaced at not more than 406 mm intervals. Fasteners shall be provided at corners and ends of track.

Studs shall extend from floor to underside of floor or roof structure above. Each stud shall be secured to tracks at both top and bottom by bolting or screw fastening at both inside and outside flanges. Field welding shall not be permitted. A 12 mm clearance shall be provided at the top shoes. Door openings shall have double studs continuous across head and from floor to ceiling on each jamb.

Studs at openings shall be fastened solidly and securely to floor clips. Floor clips shall be fastened to the floor with 2 anchors unless otherwise shown on the plans.

Supplemental framing, blocking and bracing shall be installed in steel stud system wherever walls or partitions are to support fixtures, equipment, services, casework, heavy trim and furnishings, wall mounted door stop, toilet, grab bar and similar work requiring attachment to the wall or partition.

One continuous, horizontal 19 mm channel reinforcement shall be placed approximately 152 mm above all wall openings. The reinforcement shall pass through the web openings in the studs and shall extend through the first stud located beyond the double studs at either side of the opening and shall be saddle tied to each stud it passes through.

Joists and rafters.--Joists and rafters shall be installed directly over bearing studs or a load distribution member shall be installed at the top track.

Web stiffeners shall be provided at reaction points where shown on the plans.

Ends of joists shall be reinforced with end clips, steel hangers, steel angle clips, steel stud section, or as otherwise recommended by the manufacturer.

Joists shall be secured to interior support systems to prevent lateral movement of bottom flanges.

12-5.08 MISCELLANEOUS STAINLESS STEEL SHEET METAL

PART 1.- GENERAL

Scope.-- This work shall consist of fabricating, furnishing and installing miscellaneous stainless steel sheet metal in accordance with the details shown on the plans and these special provisions.

Miscellaneous stainless steel sheet metal shall consist of:

Stainless steel cabinets, flashing and cover plates

Working Drawings.--Working drawings for all fabricated items shall be submitted for approval.

PART 2.- PRODUCTS

MATERIALS.--

General.--Sheet metal materials shall be flat, smooth and free from surface blemishes where exposed to view in the finished units. Materials which exhibit pitting or discolorations shall not be used.

Stainless steel plate, sheet and strip.--

Stainless steel plate, sheet and strip shall conform to the requirements of ASTM Designation: A240/A 240M, Type 304. Stainless steel material shall have a No. 4 satin finish.

Fasteners.--

Fasteners shall be stainless steel.

FABRICATION.--

General.--Fabrication of sheet metal items shall conform to the requirements indicated for quality, thickness and finish as well as dimensions and details.

Stainless steel sheet metal shall be accurately dieformed and assembled in jigs. Units shall be square and rigid. Flat or plane surfaces shall be free of heat of other types of distortions.

All free edges shall be hemmed.

Rounded corners shall be true and straight and shall be formed on a constant radius.

All welded seams shall be continuous welds.

Fabrication and installation shall conform to the recommendation in SMACNA publications.

Sheet metal items shall be formed in the maximum lengths and keep joints to a minimum.

PART 3.- EXECUTION

Installation.--Sheet metal items shall be set plumb, level and in alignment with adjacent work.

Only concealed fasteners and anchorages where possible.

Joints shall be fitted tight with exposed connections accurately fitted together.

12-5.09 STEEL PAN STAIR

PART 1.- GENERAL

Scope.-- This work shall consist of fabricating, furnishing and installing steel pan stair in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Working Drawings.--Working drawings for all fabricated items shall be submitted for approval. Submittals for the steel pan stair shall indicate the location of each stair, profile, connections, attachments, anchorages, size and type of fasteners and accessories including details and design data of steel pan stair. The steel pan stair supplier shall submit calculations stamped by an engineer who is registered as a Civil or Structural Engineer in the State of California showing that showing that the steel pan stair, clips, and fasteners conform to the span and design loads shown on the plans.

PART 2.- PRODUCTS

MATERIALS.--

Steel pan stair.--

Steel pan for stairs shall be American stair, cast-in-place tread; Sharon Companies (C-F) concrete fill; or equal.

Steel pan stair nosing.--

Stair nosing shall be heat treated 6063-T6 aluminum alloy base. Stair nosing shall meet OSHA requirements for anti-slip safety on stairs. The abrasive filler shall consist of a mixture of aluminum oxide and silicon carbide granules in an epoxy matrix locked into the extruded channels of the base. The abrasive ribs shall project a minimum of 1/16 inch above the extruded channels. Nosing shall be cast into the steel pan stair and shall terminate not more than 3" from end of steps.

Steel pan stair nosing shall be ACL Industries, Inc. Model No. 630-2; American Safety Tread Co., Model No. FA-411D; Wooster Products Inc., Model Number WP2J; or equal.

PART 3.- EXECUTION

INSTALLATION.--Steel pan stair shall be installed in accordance with the manufacturer's recommendations.

12-5.10 BUILDING MISCELLANEOUS METAL

PART 1.- GENERAL

Scope.--This work shall consist of fabricating, furnishing and installing building miscellaneous metal in accordance with the details shown on the plans and these special provisions.

Building miscellaneous metal shall consist of the following:

Galvanized metal partition-gate, toll booth steel plate, angle trench drain, steel plate cover, outdoor lightings shroud, pipe down spouts and drains

including all anchors, fastenings, hardware, accessories and other supplementary parts necessary to complete the work.

REFERENCES.--

Codes and standards.--Welding of steel shall be in accordance with American Welding Society (AWS) D 1.1, "Structural Welding Code-Steel" and D 1.3, “Structural Welding Code-Sheet Steel.”

SUBMITTALS.--

Product data.--Submit manufacturer's specifications, anchor details and installation instructions for products used in miscellaneous metal fabrications.

Working drawings.--Working drawings of fabricated items shall be submitted for approval.

QUALITY ASSURANCE.--

Shop assembly.--Preassemble items in shop to the greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark all units for reassembly and installation.

Inspection and tests.--Materials and fabrication procedures shall be subject to inspection and tests by the Engineer, in mill, shop and field. Such tests will not relieve the Contractor of responsibility of providing materials and fabrication procedures in compliance with specified requirements.

PART 2.- PRODUCTS

MATERIALS.--

Steel bars, plates and hot-rolled shapes.--

Steel bars, plates and hot-rolled shapes shall conform to ASTM Designation: A 36/A 36M.

Galvanized sheet steel.--

Galvanized sheet steel shall conform to ASTM Designation: A 446M having a minimum yield strength of 228 MPa. Galvanizing shall be G60.

Checkered floor plates.--

Checkered floor plates shall be commercial quality steel with standard raised pattern.

Pipe.--

Pipe shall be commercial quality standard steel pipe.

Steel tubing.--

Steel tubing shall conform to ASTM Designation: A 500, Grade B, or A 501.

Bolts, studs, threaded rods, nuts and washers.--

Bolts, studs, threaded rods, and nuts for general application shall conform to ASTM Designation: A 307.

Washers shall be commercial quality.

Fittings.--

Brackets, bolt, threaded studs, nuts, washers, and other fittings for railings and handrailings shall be commercial quality pipe and fittings.

Expansion anchors.--

Expansion anchors shall be ICBO approved for the purpose intended, integral stud type anchor or internally threaded type with independent stud, hex nut and washer.

Powder driven anchors.--

Powder driven anchors shall be plated, spring steel alloy drive pin or threaded stud type anchors for use in concrete or steel. Spring steel shall conform to ASTM Designation: A 227M, Class 1. The diameter, length and type of shank and the number and type of washer shall be as recommended by the manufacturer for the types and thickness of material being anchored or fastened.

Resin capsule anchors.--

Stud anchors for resin capsule anchors shall conform to ASTM Designation: A 307 threaded steel rod with hex nut and washer and sealed glass capsule or cartridge containing an adhesive composed of unsaturated polyester resin and benzol peroxide coated quartz sand. Resin capsule shall be Hilti; Molly; or equal.

Drainage grates.--

Drainage grates shall be fabricated from steel bars as specified herein; ductile iron castings conforming to ASTM Designation: A 536, Grade 65-45-12; or carbon steel castings conforming to ASTM Designation: A 27M, Grade 65-35.

Mortar.--

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

FABRICATION.--

Workmanship and finish.--Workmanship and finish shall be equal to the best general practice in modern shops.

Miscellaneous metal shall be clean and free from loose mill scale, flake rust and rust pitting, and shall be well formed and finished to shape and size with sharp lines and angles. Bends from shearing or punching shall be straightened.

The thickness of metal and details of assembly and support shall give ample strength and stiffness.

Built-up parts shall be true to line and without sharp bends, twists and kinks. Exposed ends and edges of metal shall be milled or ground smooth, with corners slightly rounded.

Joints exposed to the weather shall be made up to exclude water.

Galvanizing.--Items indicated on the plans to be galvanized shall be hot-dip galvanized after fabrication. The weight of galvanized coating shall be at least 460 grams per square meter of surface area, except drainage grates shall have at least 610 grams per square meter of surface area.

Painting.--Building miscellaneous metal items not galvanized shall be cleaned and prime painted prior to erection in accordance with the requirements specified for steel and other ferrous metals under "Painting" in Section 12-9, "Finishes," of these special provisions.

Loose bearing and leveling plates.--Loose bearing and leveling plates shall be furnished for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area. Plates shall be drilled to receive anchor bolts. Galvanize after fabrication.

Drainage pipes, frames and grates.--Drain piping shall have connections sealed watertight.

Drainage grates shall have end bars of the same cross section as support bars. Connections between end bars and support bars of structural steel shall be welded all around.

Drainage frames shall be angles and plates as shown on the plans.

Drainage grates and frames shall be match marked.

Steel pipe railings and handrailings.--Pipe handrailing shall consist of handrailing elements supported by metal brackets (wall type) or handrailing elements supported by tubular steel posts (post type).

Ends of railing pipe shall be closed, except for a 3 mm diameter weep hole at the low point.

All corners on railings shall be rounded. Simple and compound curves shall be formed by bending pipe in jigs to produce uniform curvature; maintain cylindrical cross-section of pipe throughout the bend without buckling, twisting or otherwise deforming exposed surfaces of the pipe.

Wall brackets, end closures, flanges, miscellaneous fitting and anchors shall be provided for interconnections of pipe and attachment of railings and handrails to other work. Inserts and other anchorage devices shall be furnished for connecting railings and handrails to concrete or masonry.

Steel railing shall be galvanized after fabrication. After galvanizing, all elements of the railing shall be free of fins, abrasions, rough or sharp edges, and other surface defects and shall not be kinked, twisted or bent.

PART 3.- EXECUTION

GENERAL.--

Anchorages.--Anchorage devices and fasteners shall be provided for securing miscellaneous metal in-place construction; including threaded fasteners for concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws and other connectors.

Cutting, drilling and fitting shall be performed as required for installation of miscellaneous metal fabrications. Work is to set accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels.

Loose leveling and bearing plates.--Plates shall be set on wedges or other adjustable devices. Anchor bolts shall be wrench tightened after the plates have been positioned and plumbed. Mortar shall be packed solidly between bearing surfaces and plates to ensure that no voids remain.

Steel pipe railings and handrailings.--Railings shall be adjusted prior to anchoring to ensure matching alignment at abutting joints. Secure posts and railing ends to building construction as shown on the plans.

Resin capsule anchors shall not to be used for anchoring railings and handrailings.

Powder driven anchors.--Powder driven anchors shall be installed with low velocity powder actuated equipment in accordance with the manufacturer's instructions and State and Federal OSHA regulations.

Resin capsule anchors.--Resin capsule anchors shall be installed in accordance with the manufacturer's instructions.

DAMAGED SURFACES.--

General.--Galvanized surfaces that are abraded or damaged at any time after the application of the zinc coating shall be repaired by thoroughly wire brushing the damaged areas and removing all loose and cracked coating, after which the clean areas shall be painted with 2 applications of unthinned zinc-rich primer (organic vehicle type). Aerosol cans shall not be used.

12-5.11 PRE-ENGINEERED STEEL STAIRS

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing pre-engineered steel stairs in accordance with the details shown on the plans and these special provisions.

Steel stairs shall consist of treads, risers, and stringers, and other accessories and components, not mentioned, which are required for a complete, securely fastened installation.

SYSTEM DESCRIPTION.--

Design Requirements.-- The steel stairs shall conform to the design requirements as shown on the plans.

REFERENCES.--

Codes and standards.--Welding of steel shall be in accordance with American Welding Society (AWS) D 1.1, "Structural Welding Code-Steel" and D 1.3, “Structural Welding Code-Sheet Steel.”

SUBMITTALS.--

Product Data.--Manufacturer's technical product data, installation instructions, and recommendations shall be submitted for approval.

Product data shall include the manufacturer's name and a complete material description of all components of the stair system.

Samples.--Material samples shall include a 150 mm x 150 mm sample of the stair tread.

Working Drawings.--Working drawings showing the layout and details of the stairs shall be submitted for approval.

Working drawings shall show the shape, size, thickness, steel grades, and method of attachment for each component used in the work; the layout and spacing of fasteners; and details of connections.

Design calculations for the stair system shall be submitted to verify compliance with the design requirements.

Working drawings and design calculations shall be stamped and signed by an engineer who is registered as a Civil or Structural Engineer in the State of California. The expiration date of the registration shall be shown. The Engineer’s signature shall be original.

QUALITY ASSURANCE.--

Certificates of Compliance.--Certificates of compliance shall be furnished for the stair system in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

PART 2.- PRODUCTS

MATERIALS.--

Base metal.--

Base metal shall be as required to meet the design requirements and as shown on the plans.

Configuration.--

Configuration of components shall be as shown on the plans. The size of the components shown on the plans are minimum.

Stair treads.--

Stair treads shall be checkered plate with raised medium pattern.

METAL FINISHES.--

Galvanizing-Pre-engineered steel stairs shall be hot-dip galvanized after fabrication conforming to ASTM Designation: A 123.

Painting.--Pre-engineered steel stairs shall be cleaned and painted in accordance with the requirements for galvanized metal under "Painting" in Section 12-9, "Finishes," of these special provisions.

FABRICATION.--

General.—Steel stairs shall be factory fabricated.

Stair treads and risers shall be factory-welded to the stringers

PART 3.- EXECUTION.--

INSTALLATION.--

General.--The steel stairs shall be installed and fastened in accordance with the details shown on the plans and the approved working drawings.

The steel stairs shall be adjusted in place and properly aligned for the detailed conditions before fastening. Stairs shall not be warped, bowed or twisted.

CLEAN UP AND CLOSE OUT.--

Clean up.--Adjacent surfaces shall be protected during the installation and sealant work. Excess sealant shall be removed as the installation progresses.

Roof panels, and other prefinished metal surfaces shall be cleaned after installation as recommended by the manufacturer. Exposed cuts shall be touched-up with a matching durable primer and paint as recommended by the canopy system manufacturer.

Damaged surfaces.— Galvanized surfaces that are abraded or damaged at any time after the application of the zinc coating shall be repaired by thoroughly wire brushing the damaged areas and removing all loose and cracked coating, after which the clean areas shall be painted with 2 applications of unthinned zinc-rich primer (organic vehicle type). Aerosol cans shall not be used.

12-5.12 ALUMINUM HANDRAIL AND RAILINGS

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of fabricating, furnishing and installing aluminum handrails and railing systems in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data for products and processes used in handrails and railing systems shall be submitted for approval.

Working drawings.--Working drawings of handrails and railings shall be submitted for approval.

Working drawings shall show fabrication and installation for each type of handrail and railing system required including plans, elevations, sections, profiles of rails, fittings, connections and anchors.

Samples.--Two 150 mm long samples of each distinctly different railing member, including handrails, top rails, posts and balusters, shall be submitted for approval.

QUALITY ASSURANCE.--

Single source responsibility.--Handrails and railing systems of each type and material shall be obtained from a single manufacturer.

DELIVERY, STORAGE AND HANDLING.--

Storage.--Handrails and railing systems shall be stored in clean, dry location, away from uncured concrete and masonry, protected from damage of any kind. Handrails and railing systems shall be covered with waterproof paper, tarpaulin, or polyethylene sheeting. Allow for air circulation.

PART 2.- PRODUCTS

MATERIALS.--

Railing elements.--

Railing elements shall conform to ASTM Designation: B 429, Type 6061-T6 aluminum alloy pipe, 4 mm wall thickness and 38 mm diameter.

Brackets, flanges, fittings and anchors.--

Brackets, flanges, fittings and anchors shall be the manufacturer's standard for interconnection of handrail and railing members to other work.

Fasteners.--

Fasteners shall be the same basic metal as the fastened metal. Corrosive metals and metals that are incompatible with the metals joined shall not be used.

Concealed fasteners shall be used for interconnections of handrail and railing components and for their attachments to other work except where exposed fasteners are unavoidable or are the standard fastening method for handrail and railing systems indicated.

Exposed fasteners shall be Phillips flat head screws unless otherwise noted on the plans.

FABRICATION.--

General.--Handrails and railing systems shall be fabricated to the dimensions and details shown on the plans.

Items shall be preassembled in the shop to the greatest extent possible to minimize field splicing and assembly. Units shall be disassembled only as necessary for shipping and handling.

Returns shall be made at free ends of handrailing to bring the pipe to within 6 mm of the wall. Ends of railing elements shall be capped. Concealed weeps shall be provided at low points.

Expansion joints shall have pipe sleeves.

Changes in direction of railing members shall be formed by bending members, insertion of prefabricated elbow fittings, radius bends, or by mitering. Elbow bends shall be by using mitered joints.

Welding shall be by the tungsten inert gas arc welding method or the consumable electrode inert gas method. Welding processes that require the use of flux will not be permitted.

All welds shall conform to the requirements of Section 8.15, "Quality of Welds," of the American Welding Society publication No. AWS D 1.1, "Structural Welding Code."

Exposed welds shall be ground smooth and flush.

FINISHES.--

Anodizing.--After fabrication, exposed surfaces of aluminum shall be given a clear anodic oxide coating conforming to the requirements of ASTM Designation: B 580, Type B, Architectural Class I. Surfaces to be coated shall be free of scratches, porosity, inclusions, roll and die marks, cold-shuts, and cracks that will adversely affect the appearance and performance of the anodic coatings.

PART 3.- EXECUTION

INSTALLATION.--

General.--The handrailing shall be erected to line and grade without welding in the field. Installation shall be in accordance with the manufacturer's recommendations. Posts shall be within 3 mm of vertical.

Exposed connections shall be accurately fitted to form tight, hairline joints.

The location of expansion joints shall be in accordance with the manufacturer's recommendation except that joints shall be spaced not closer than 4.6 meter apart and shall be coordinated with joint locations in the support structure.

Corrosion protections.--Aluminum surfaces to be in contact with grout or concrete materials shall be given a heavy coat of alkali-resistant bituminous paint or zinc chromate primer.

An isolation coating shall be provided on aluminum surfaces in contact with dissimilar metals.

Railing connections.--Railing ends shall be anchored to concrete or masonry with manufacturer’s standard fittings designed for this purpose, unless otherwise shown on the plans.

Handrails shall be secured to walls with the manufacturer’s standard wall brackets and fittings, unless otherwise shown on the plans.

CLEANING.--

General.--Paint, dirt, stains and grout shall be removed without marring or scratching the aluminum surfaces. Solvents and cleaning compounds shall be chemically compatible with the anodic coating and aluminum.

PROTECTION.--

General.--Finishes of railing systems and handrails shall be protected from damage during constructions by use of temporary protective coverings. Coverings are to be removed upon completion of the work.

Finishes damaged during installation and construction shall be restored so that no evidence remains of construction work.

12-5.13 ACOUSTICAL METAL CEILING PANEL

PART 1.- GENERAL

SUMMARY.--

Scope.-- This work shall consist of furnishing and installing acoustical metal panels in accordance with the details shown on the plans and these special provisions.

Acoustical metal panels shall consist of acoustical insulation and perforated metal panels.

SUBMITTALS

Manufacturer's descriptive data, standard color palette, and installation instructions shall be submitted for approval. The color shall be selected by the Engineer after the award of the contract.

PART 2.- PRODUCTS

Panels.--

Acoustical metal panel shall be not less than 0.70 mm (24-gage) thick galvanized sheet steel, with G60 [Z180] coating, conforming to ASTM Designation: A 653/A 653M, Grade 33 [230]. Panels shall be 9 mm overall depth, with 16 mm wide grooves at 38 mm intervals, electrostatically painted and oven dried.

Acoustical insulation.--

Acoustical insulation shall be 25 mm thickness glass fiber with noise reduction coefficient not less than 0.75.

Furring strips.--

Furring strips shall be light gage galvanized metal as recommended by the manufacturer.

EXECUTION

Acoustical panels shall be installed as recommended by the manufacturer.

Perforated metal panel shall be one piece without joints, and shall be fastened to furring strips with stainless steel screws spaced at not more than 152 mm along edges and 457 mm at intermediate furring strips.

12-5.14 STAINLESS STEEL SPECIALTIES

PART 1.- GENERAL.--

This work shall consist of furnishing, fabricating, and installing stainless steel specialties which include; stainless steel piano hinges, framing tubes, angles, cabinets and all fasteners as shown on the plans and these special provisions.

SUBMITTALS.--

Manufacturer's descriptive data and fabricator's shop drawings shall be submitted for approval.

Working drawings.--Working drawings of stainless steel specialties shall be submitted for approval.

Working drawings shall show fabrication and installation for each type fabricated item required including plans, elevations, sections, profiles, fittings, connections and anchors.

PART 2.- PRODUCTS.--

Stainless steel piano hinges, framing tubes, angles, and cabinets.—

Items listed above shall be fabricated from the stainless steel sheet conforming to ASTM Designation: A 666, Type 304 stretcher leveled with standard flatness with thickness shown on the plans.

Stainless steel sheet.—

Stainless steel sheet shall conform to ASTM Designation: A 666, Type 304 stretcher leveled with standard flatness with thickness shown on the plans.

Fasteners.--

Stainless steel fasteners.

PART 3.- EXECUTION.--

FABRICATION.--

Stainless steel sheet metal shall be accurately die formed and assembled in jigs. The cabinets shall be of one-piece welded constructions.

The cabinet shall have mitered and welded corners. Exposed welds shall be ground smooth. Exposed butt welds shall be ground flush. All corners shall be rounded to 3 mm radius unless noted otherwise on the plans.

Fasteners shall be concealed.

INSTALLATION.--

Stainless steel items shall be installed rigid and secure. Stainless steel sheet metal shall be free of mars and scratches and shall be clean of dirt, grease, coatings, and other discoloring stains.

FINISHES.--

Remove tool and die marks and stretch lines or blend into finish.

Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

Bright, Directional Polish: No. 4 finish.

When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PROTECTION.--

General.--Finishes of stainless steel shall be protected from damage during construction. Coverings are to be removed upon completion of the work.

Finishes damaged during installation and construction shall be restored so that no evidence remains of construction work.

SECTION 12-6. WOOD AND PLASTICS

12-6.01 ROUGH CARPENTRY

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing materials and performing rough carpentry work including wood framing, furring, and sheathing in accordance with the details shown on the plans and these special provisions.

Rough carpentry includes carpentry work not specified as part of other sections and which is generally not exposed.

SUBMITTALS.--

Product Data.--Manufacturer's material data and installation instructions shall be submitted for gypsum sheathing, framing hardware and underlayments.

Wood treatment data.--Chemical treatment manufacturer's instructions shall be submitted for the handling, sorting, installation, and finishing of treated materials.

For each type of preservative treatment used, certification by treating plant shall include type of preservative solution and pressure process used, net amount of preservative retained and conformance with the applicable standards of the American Wood Preservers Association.

For each type of fire-retardant treatment, include certification by treating plant that the treated material complies with the applicable standards and other requirements.

DELIVERY, HANDLING AND STORAGE.--

Delivery and storage.--Materials shall be kept under cover and dry. All materials shall be protected from exposure to weather and contact with damp or wet surfaces with blocking and stickers. All lumber, plywood and other panels shall be stacked in such a manner to provide air circulation within and around the stacks.

PART 2.- PRODUCTS

LUMBER.--

General.--Lumber shall be manufactured to comply with PS 20, "American Softwood Lumber Standard," and with applicable grading rules of inspection.

Softwood lumber shall be quality grade stamped or shall be accompanied by a certificate of inspection. Inspection certificates or grade stamps shall indicate compliance with the grading requirements of WWPA, WCLIB, RIS, or other approved lumber inspection agencies.

All lumber used shall be nominal sized and dressed S4S unless otherwise specified in these special provisions.

Framing lumber shall be solid stock lumber, Douglas Fir-Larch, and the grades indicated under WCLIB or WWPA rules. Moisture content shall not exceed 19 percent and shall be grade stamped "S-Dry."

DIMENSION LUMBER.--

Except as otherwise shown on the plans, lumber shall have the following grades.

Vertical framing lumber.--

Vertical framing lumber, nominal 51 mm x 51 mm through 102 mm x 102 mm, shall be Construction grade or better.

Vertical framing lumber, nominal 51 mm x 152 mm through 102 mm x 152 mm shall be No. 2 or better.

Horizontal framing lumber.--

Horizontal framing lumber, nominal 51 mm x 102 mm and wider, including joists and rafters, shall be No. 2 or better.

Horizontal framing lumber, nominal 102 mm x 102 mm and wider, including joist and rafters, shall be No. 1 or better.

Exposed framing lumber.--

Exposed framing lumber which is not concealed and is to receive a stain or natural finish shall be the same grade and species as indicated for structural framing and hand selected for appearance.

Miscellaneous lumber.--

Miscellaneous lumber for support or attachment of other work including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping and similar members shall be not less than No. 2 or better.

Lumber in contact with concrete or masonry construction shall be pressure treated Douglas Fir-Larch.

TIMBERS.--

Timbers (nominal 127 mm or thicker).--

Timbers shall be No. 1 or better.

PLYWOOD PANELS.--

General.—Plywood panels shall comply with Voluntary Product Standard PS1, "U. S. Product Standard for Construction and Industrial Plywood."

Plywood panels shall be Group 1 unless otherwise noted.

Each plywood panel shall be factory marked with APA or other trademark evidencing compliance with grade requirements.

Plywood backing panels.--

Plywood backing panels for mounting electrical or telephone equipment shall be 19 mm plywood panels APA C-D PLUGGED, Exposure 1, touch-sanded.

Plywood cricket.--

Plywood cricket shall be APA RATED STURD-I-FLOOR, Exposure 1, with tongue-and-groove edges. Span rating and thickness shall be as shown on the plans.

MISCELLANEOUS MATERIALS.--

Rough Carpentry Hardware.--

Steel plates and rolled sections shall be mild, weldable steel, conforming to AISI grades 1016 through 1030 except 1017.

Nails, screws, bolts, nuts, washers shall be commercial quality. Exposed fasteners shall be hot dipped galvanized or stainless steel.

Joist hangers, clips and other standard framing hardware shall be ICBO approved, commercial quality, galvanized sheet steel or hot dipped galvanized, of the size shown on the plans.

Expansion anchors and powder driven anchors shall be as specified under "Building Miscellaneous Metal," in Section 12-5, "Metals," of these special provisions.

Nails.--

Nails shall conform to ASTM F 1667-95. "Common" nails shall conform to the following table:

Nail Size	Length (mm)	Diameter (mm)
8d	63.5	3.33
10d	76.2	3.76
16d	88.9	4.11

Building paper.--

Building paper shall be kraft type waterproofing building paper, Type I (No. 15) asphalt saturated roofing felt or high density, bonded polyethylene fiber building paper.

Adhesive.--

Adhesive for plywood glue-nailed systems shall conform to APA Specification: AFG-01.

WOOD TREATMENT BY PRESSURE PROCESS.--

Preservative treatment.--

Preservative treatment shall be copper napthenate, pentachlorophenol or water-borne arsenicals (ACA, CCA or ACZA).

The following items shall be treated:

Wood cants, nailers, curbs, equipment support bases, blocking, stripping and similar members in connection with roofing, flashing, vapor barriers and waterproofing.
Wood sills, sleepers, blocking, furring and other similar members in contact with concrete or masonry.

All holes, daps and cut ends of treated lumber shall be thoroughly swabbed with 2 applications of copper napthenate.

Fire retardant treatment.--

Fire retardant treatment shall be paintable, odorless fire retardant preservative applied by pressure treating methods.

PART 3.- EXECUTION

INSTALLATION.--

Wood framing.--Wood framing shall be in accordance with Chapter 23 of the California Building Code.

Framing members shall be of sizes and spacing shown on the plans. Unless otherwise shown on the plans, structural members shall not be spliced between supports.

Wood framing shall be accurately cut and assembled to provide closely fitted members. Framing shall be erected true to the lines and grades shown on the plans and shall be rigidly secured in place as shown and as required by recognized standards. Bracing shall be placed wherever necessary to support all loads on the structure during erection.

The size and spacing of fasteners and the edge distance for nails shall be as shown on the plans.

Nailing schedule shall be as shown on the plans and shall comply with the California Building Code.

Wall coverings exposed to the weather shall have a backing of building paper applied weatherboard fashion to the framing or sheathing. Backing shall be lapped 50 mm at horizontal joints, 152 mm at vertical joints and 305 mm at building corners.

Stair framing.--Stair framing members shall be of the size and spacing shown on the plans.

Stringers shall be notched to receive treads, risers and supports. Effective depth remaining shall be not less than 89 mm.

Plywood panels.--Plywood panels shall be attached to the framing as shown on the plans and these special provisions. All structural plywood sheathing (both roof and wall) shall be nailed with "Common" nails.

Plywood decking shall be glued and nailed to the framing system.

Plywood sheathing shall be nailed to the framing system and shall be continuous over 2 or more supports. Roof and floor panels shall be installed with the long dimension across the supports, with end joints staggered 1.22 m. Wall sheathing shall have all edges blocked. Spacing between panels shall be 3 mm.

12-6.02 FINISH CARPENTRY

PART 1.- GENERAL

SUMMARY.--

Scope.--This work consists of furnishing and installing materials and performing finish carpentry, including exterior and interior trim, plywood soffits and panels and plywood and softwood paneling, as shown on the plans and these special provisions.

Finish carpentry includes carpentry work not specified as part of other sections and which is generally exposed to view.

SUBMITTALS.--

Product data.--Manufacturer's specifications and installation instructions for each item of factory-fabricated siding and paneling.

Samples.--One sample shall be submitted to the Engineer at the jobsite for each species and cut or pattern of finish carpentry as shown below:

Exterior standing and running trim - 610 mm long x full board or molding width, finished on one side and one edge.

Interior standing and running trim - 610 mm long by full board or molding width, finished on one side and one edge.

Siding - 610 mm long, finished on one side and one edge.

Exterior plywood for transparent finish - 610 mm long x panel width, finish shall be applied to upper half of each piece.

Plywood paneling - 610 mm long x full panel width, finished on one side.

QUALITY ASSURANCE.--

Factory marks.--Each piece of lumber and plywood shall be marked with type, grade, mill and grading agency identification. Marks shall be omitted from surfaces to receive transparent finish. A mill certificate stating that material has been inspected and graded in accordance with requirements shall be furnished if marks cannot be placed on concealed surfaces.

PRODUCT DELIVERY, STORAGE AND HANDLING.--

Delivery.--Carpentry materials shall be delivered after painting, wet work and similar operations have been completed.

Protection.--Finish carpentry materials shall be protected during transit, delivery, storage and handling to prevent damage, soiling and deterioration.

PART 2.- PRODUCTS

WOOD PRODUCT QUALITY STANDARDS.--

Softwood lumber.--Softwood lumber shall conform to the requirements of PS 20, "American Softwood Lumber Standard," with applicable grading rules of inspection.

Plywood.--Plywood shall conform to the requirements of Voluntary Products Standard PS-1, "U. S. Product Standard for Construction and Industrial Plywood."

Hardwood lumber.--Hardwood lumber shall conform to the requirements of the National Hardwood Lumber Association (NHLA) rules.

Woodworking.--Woodworking shall conform to the requirements of Woodwork Institute of California (WIC), "Manual of Millwork."

MATERIALS.--

General.--Lumber sizes indicated shall be nominal sizes except as indicated by detailed dimensions. Lumber which is to be dressed or worked and dressed shall be manufactured to the actual sizes as required by PS 20.

Lumber that is to receive a transparent finish (stained or clear) shall be made of solid lumber stock.

Lumber that is to be painted may be solid or glued-up lumber at the contractor's option.

Glued-up lumber for exterior finish work shall comply with PS 56 for "wet use" and be so certified by the inspection agency.

Exterior standing and running trim.--

Standing and running trim in the form of boards or worked products shall be clear, all heart Redwood.

Trim to be painted shall be finished smooth.

Trim which is to be exposed to view and to receive transparent finish (stained or clear) shall be saw textured.

Plywood siding for transparent finish.--

Plywood for transparent finish shall be 16 mm, redwood, APA RATED SIDING 303-6-W, EXT with exterior glue, rough sawn Texture 1-11. Siding shall be factory treated with the manufacturer's standard water repellent preservative.

Plywood paneling and wainscotting.--

Plywood paneling and wainscotting shall be APA Interior Grade A-C, Group 1, Exposure 1 plywood. Thickness shall be as shown on the plans.

Interior standing and running trim.--

Standing and running trim to be painted shall be paint-grade pine, solid stock or finger jointed.

Standing and running trim to have transparent finish shall be solid hardwood, species to be shown on the plans.

Open shelving.--

Open shelving shall be 19 mm Grade A-C fir plywood with veneer core and 13 mm thick solid stock pine edge banding glued and nailed.

Miscellaneous Materials.--

Nails, screws and other anchoring devices of the type, size, material and finish required shall be provided for secure attachment, concealed where possible.

Fasteners and anchorages for exterior use shall be hot dip galvanized.

Screens for soffit vents shall be 4 x 4 or 8 x 8 mesh, galvanized screen. Open area shall be not less than 50 percent.

Preservative treatment.--

Preservative treatment shall be copper napthenate, pentachlorophenol or water-borne arsenicals (ACA, CCA or ACZA).

Wood members, except those of redwood, in contact with mortar setting beds, concrete block walls, slab on grade and other concrete work, and wood used for roofing cant and curbs shall be pressure treated with leach resistant preservative. Each piece of pressure treated lumber shall bear the AWPA label.

All holes, daps, or cuts made after treating shall be thoroughly swabbed with copper napthenate

Fire retardant treatment.--

Fire retardant treatment shall be paintable, odorless fire retardant preservative applied by pressure treating methods.

PART 3.- EXECUTION

INSTALLATION.--

General.--All work shall be installed plumb, level and true with no distortions.

Standing and running trim.--Standing and running trim shall be installed with minimum number of joints possible, using full length pieces to the greatest extent possible.

Exterior joints shall be made water-resistant by careful fitting.

Anchor finish carpentry.--Finish carpentry shall be anchored to framing or blocking built in or attached directly to the substrate.

Interior carpentry shall be attached to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing where required for complete installation. Fine finish nails shall be used for exposed nailing, countersunk and filled flush with finished surface and matching final finish where transparent finish is indicated.

Finish exterior siding shall be fastened with corrosion resistant nails. The size and spacing of the siding fasteners shall be as shown on the plans. Nails shall be driven flush with the surrounding surfaces, not countersunk. Nails shall be located in the grooves of grooved siding whenever possible.

ADJUSTMENT, CLEANING, FINISHING AND PROTECTION.--

General.--Damaged and defective finish carpentry work shall be repaired or replaced.

All exposed or semi-exposed surfaces shall be cleaned.

Finish carpentry shall be finished in accordance with the requirements specified under "Painting" in Section 12-9, "Finishes," of these special provisions.

12-6.03 CABINETS

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing a swinging gate, wood cabinets and plastic laminate tops, splashes and returns as shown on the plans and in these special provisions.

SUBMITTALS.--

Product data.--Manufacturer's product data for plastic laminates and cabinet hardware shall be submitted for approval.

Samples.--Three samples shall be submitted for each of the items shown below:

Lumber with or for transparent finish: 152 mm x 19 mm x 457 mm, finished on one side and one edge.

Wood veneer faced panel products, with or for transparent finish, finished, 203 mm x 254 mm.

Plastic laminate, 203 mm x 254 mm for each type, color, pattern and surface finish.

Working drawings.--Working drawings for cabinets showing location of cabinets, dimensioned plans and elevations, attachment devices and other components shall be submitted for approval. Working drawings shall bear the "WIC Certified Compliance Label" on the first sheet of the drawings.

QUALITY ASSURANCE.--

Codes and standards.--Cabinets and swinging gate shall be manufactured and installed in accordance with the Manual of Millwork of the Woodwork Institute of California (WIC) requirements for the custom grade work.

Certificates of Compliance.--Prior to delivery to the jobsite, the cabinet manufacturer shall issue a WIC Certified Compliance Certificate indicating that the products he will furnish for this job and certifying that they will fully meet all the requirements of the grade or grades specified.

WIC Certified Compliance Label shall be stamped on all cabinet work and swinging gate.

Each plastic laminate top shall bear the WIC Certified Compliance Label.

Prior to completion of the contract, a WIC Certified Compliance Certificate for Installation shall be delivered to the Engineer.

DELIVERY, STORAGE AND HANDLING.--

Protection.--Cabinets shall be protected during transit, delivery, storage and handling to prevent damage, soiling and deterioration.

PART 2.- PRODUCTS

ACCEPTABLE MANUFACTURERS.--

Manufacturers.--Subject to compliance with these specifications, high pressure decorative laminates shall be Consoweld Corp.; Formica Corp.; Nevamar Corp.; or equal.

MANUFACTURED UNITS.--

General.--Cabinets shall be fabricated to the dimensions, profiles, and details shown on the plans with openings and mortises precut, where possible to receive hardware and other items and work.

Fabrication, assembly, finishing, hardware application, and other work shall be completed to the maximum extent possible prior to shipment to the jobsite.

Laminate clad cabinets.--

Laminate clad cabinets shall be custom grade, flush overlay construction.

Laminate cladding shall be high pressure decorative laminate complying with NEMA LD 3. Color, pattern and finish shall be as shown on the plans. Laminate surface and grade shall be as follows:

Horizontal and vertical surfaces other than tops shall conform to GP-50 (1.27 mm nominal thickness).

Postformed surfaces shall conform to PF-42 (1.07 mm nominal thickness).

Laminated counter tops and splashes.--

Laminated counter tops and splashes shall be WIC custom grade.

Surface material shall be high pressure laminated plastic conforming to NEMA LD-3, 1.27 mm thickness.

Unless otherwise shown on the plans, splashes shall be 102 mm high from the surface of the deck. Back splashes shall be continuous formed and coved. Side splashes shall be top set.

Laminated counter tops self edged, counter tops to receive sinks or plumbing fixtures shall have a bullnose.

The underside of tops and backsides of splashes shall be covered with an approved backing sheet.

Butcher block workbench tops and splashes.--

Butcher block workbench tops and splashes shall be maple with industrial protective finish surface.

Swinging gate.--

Swinging gate shall conform to the requirements for WIC "Custom" grade, solid core wood door. Faces shall be plastic laminate.

CABINET HARDWARE AND ACCESSORY MATERIALS.--

General.--Cabinet hardware and accessory materials shall be provided for cabinets.
Hardware shall be provided with standard US 26D metal plated finish.

Drawer slides.--

Drawer slides shall be side mounting full extension with fully enclosed rolling balls and rollers. Concealed slides and bearings, and positive stop. Capacity shall be not less than 35 kg, except capacity shall be not less than 45 kg for heavy duty drawers.

Door guides.--

Sliding door guides shall be continuous, dual channel, metal guides, top and bottom. Bottom guide shall have crowned track.

Shelf supports.--

Shelf supports shall be adjustable, semi-recessed, chrome finished pressed metal, heavy duty standards and support clip, with one inch adjustment increments.

Cabinet hinges.--

Cabinet hinges shall be steel. Length of jamb leaf shall be 64 mm.

Cabinet hinge manufacturers shall be Stanley, Hager, McKinney, or equal.

Cabinet catches.--

Cabinet catches shall be self aligning magnetic type in aluminum case with zinc plated steel strike.

Cabinet catch manufacturers shall be Stanley, Hager, McKinney, or equal.

Cabinet pulls.--

Cabinet pulls shall be 8 mm diameter rod, with 33 mm projection and 75 mm center to center fastening.

Cabinet pull manufacturers shall be Stanley, Hager, McKinney, or equal.

Swinging gate hardware.--

Swinging gate hardware shall consist of spring pivot, bolt type latch, and wall bumper.

Spring pivot shall be mortise ball bearing pivot with adjustable spring tension and flat jamb gate brackets.

Wall bumper shall be not less than 64 mm in diameter with a 25 mm projection.

FABRICATION.--

Shop assembly.--Nails shall be countersunk and the holes filled, molds shall be neatly mitered and all joints shall be tight and true.

As far as practicable, work shall be assembled at the mill and delivered to the building ready to be set in place. Parts shall be smoothly dressed and interior work shall be belt sanded at the mill and hand sanded at the building. After assembly, work shall be cleaned and made ready for the specified finish.

Veneer sequence matching shall be maintained of cabinets with transparent finish.

All work shall be prepared to receive finish hardware. Finish hardware shall be accurately fitted and securely fastened as recommended by the manufacturer. Finish hardware shall not be fastened with adhesives.

Drawers shall be fitted with dust covers of 6 mm plywood or hardboard above compartments and drawers except where located directly under tops.

Precut openings.--Openings for hardware, appliances, plumbing fixtures, and similar items shall be precut where possible. Openings shall be accurately located and templates used for proper size and shape. Edges of cutouts shall be smoothed and edges sealed with a water-resistant coating.

PART 3.- EXECUTION

INSTALLATION.--

Cabinets.--Cabinets shall be installed without distortion so that doors and drawers fit openings properly and are accurately aligned. Hardware shall be adjusted to center doors and drawers in openings and to provide unencumbered operation. Installation of hardware and accessory items shall be completed as indicated on the approved drawings.

Laminate tops.--Laminate tops shall be securely fastened to base units and other support systems as indicated on the approved drawings.

Cabinet hardware.--Doors for cabinets shall be equipped with one pair of hinges and one catch per leaf, unless otherwise shown on the plans. Each door leaf shall be equipped with one pullknob.

Drawers up to 610 mm wide shall have one pull knob and drawers over 610 mm wide shall have two pull knobs.

12-6.04 SET-UP TABLES

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of fabricating and furnishing set-up tables as shown on the plans and in these special provisions.

SUBMITTALS.--

Samples.--Three samples, 203 mm x 254 mm of non-porous solid surface table top shall be submitted.

Working drawings.--Working drawings for set-up tables showing dimensioned plans and elevations, attachment devices and other components shall be submitted for approval. Working drawings shall bear the "WIC Certified Compliance Label" on the first sheet of the drawings.

QUALITY ASSURANCE.--

Codes and standards.—Set-up table shall be manufactured in accordance with the Manual of Millwork of the Woodwork Institute of California (WIC) requirements for custom grade work.

Certificates of Compliance.--Prior to delivery to the jobsite, the set-up table manufacturer shall issue a WIC Certified Compliance Certificate indicating that the products he will furnish for this job and certifying that they will fully meet all the requirements of the grade or grades specified.

WIC Certified Compliance Label shall be stamped on all table work.

DELIVERY, STORAGE AND HANDLING.--

Protection.—Set-up tables shall be protected during transit, delivery, storage and handling to prevent damage, soiling and deterioration.

PART 2.- PRODUCTS

ACCEPTABLE MANUFACTURERS.--

Manufacturers.--Subject to compliance with these specifications, non-porous solid surfacing table top shall be Corian.; Swanstone; Transolid; or equal.

MANUFACTURED UNITS.--

General.—Set-up tables shall be fabricated to the dimensions, profiles, and details shown on the plans with openings and mortises precut, where possible to receive hardware and other items and work.

Fabrication, assembly, finishing, hardware application, and other work shall be completed to the maximum extent possible prior to shipment to the jobsite.

Laminate cladding for base shall be high pressure decorative laminate complying with NEMA LD 3. Color, pattern and finish shall be as shown on the plans. Laminate surface and grade shall be as follows:

Horizontal and vertical surfaces other than tops shall conform to GP-50 (1.27 mm nominal thickness).

Postformed surfaces shall conform to PF-42 (1.07 mm nominal thickness).

FABRICATION.--

Shop assembly.--Nails shall be countersunk and the holes filled, molds shall be neatly mitered and all joints shall be tight and true.

As far as practicable, work shall be assembled at the mill and delivered to the building ready to be set in place. Parts shall be smoothly dressed and interior work shall be belt sanded at the mill and hand sanded at the building.

Solid surfacing table tops.—Solid surfacing table tops shall be securely fastened to base units and other support systems as indicated on the approved drawings.

SECTION 12-7. THERMAL AND MOISTURE PROTECTION

12-7.01 BITUMINOUS WATERPROOFING

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and applying a bituminous waterproofing membrane in accordance with the details shown on the plans and these special provisions.

Bituminous waterproofing membrane shall consist of a coating of primer, a bonded, continuous membrane composed of 2 layers of asphalt saturated glass fabric and 3 moppings of waterproofing asphalt.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data, installation instructions and recommendations for each waterproofing material shall be submitted for approval.

QUALITY ASSURANCE.--

General.--The Contractor shall obtain primary materials from a single manufacturer. Secondary materials shall be only as recommended by the primary manufacturer.

Labels.--Materials shall be furnished which have factory applied labels affixed to each container or roll of material certifying compliance with ASTM standards specified.

PART 2.- PRODUCTS

Asphalt primer.--

Asphalt primer shall be cut-back type conforming to ASTM Designation: D 41.

Waterproofing asphalt.--

Waterproofing asphalt shall conform to ASTM Designation: D 449, Type I, suitable for vertical surfaces below grade.

Glass fiber fabric.--

Glass fiber fabric shall conform to ASTM Designation: D 1668, Type I, for woven glass fabric treated with asphalt and weighs about 0.73 kg per 10 square meters.

Plastic cement.--

Plastic cement shall be suitable for use with bituminous materials.

Protection board.--

Protection board shall be organic fiberboard treated for resistance to fungus and insects, asphalt impregnated and asphalt coated on both faces; 513 mm thick unless otherwise noted.

PART 3.- EXECUTION

PREPARATION.--

Protection.--Liquid or mastic compounds shall not be permitted to enter or clog drains and conductors. Spillage or migration onto other surfaces of work shall be prevented by masking or otherwise protect adjoining work.

Surface Preparation.--All concrete surfaces which are to be waterproofed shall be reasonably smooth and free from holes and projections which might puncture the membrane. The surface shall be dry and thoroughly cleaned of dust and loose materials.

The primer shall be applied to the surface and allowed to dry before applying asphalt.

INSTALLATION.--

General.--Installation shall comply with manufacturer's instructions, except where more stringent requirements are shown or specified, and except where proper conditions require extra precautions or provisions to ensure satisfactory performance of work.

Application.--No primer or asphalt shall be applied in wet weather, nor when the temperature is below 18°C. Heating shall be in accordance with the manufacturer's instructions.

Multiply-courses of bitumen and felts or fabrics shall be installed in individual courses, unless manufacturer recommends shingle-fashion courses. Courses shall be laid in direction or directions recommended.

Membrane shall be extended as flashing at edges, openings and projections, so as to complete waterproof enclosure as required for leakproof installation.

Protection board.--Protection board shall be set into last course of asphalt before it cools.

12-7.02 INSULATION (GENERAL)

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing insulation in accordance with the details shown on the plans and these special provisions.

Insulation materials shall be as specified in these special provisions, and shall be compatible with existing or new materials incorporated in the building.

SUBMITTALS.--

Product data.--A list of materials, manufacturer's descriptive data, location schedule, and time schedule shall be submitted for approval.

The list of materials to be used shall include the trade name, manufacturer's name, smoke developed and flame spread classification, resistance rating and thickness for the insulation materials and accessories.

Schedules.--A location schedule and time schedule shall be submitted for approval.

The location schedule shall show where each material is to be installed.

The Contractor shall provide the Engineer at the jobsite with an accurate time schedule of the areas of the building to be insulated each day. The time schedule shall be submitted 3 working days in advance of the work.

Samples --Samples of insulation material shall be submitted to the Engineer at the jobsite.

QUALITY ASSURANCE.--

Codes and standards.--All insulating materials shall be certified to comply with the California Quality Standards for Insulating Materials and shall be listed in the Department of Consumer Affairs publication "Consumer Guide and Directory of Certified Insulation Material."

DELIVERY, STORAGE AND HANDLING.--

General.--Insulating materials shall be delivered to the jobsite and stored in a safe dry location with labels intact and legible.

Insulating materials shall be protected from physical damage and from becoming wet or soiled.

In the event of damage, materials shall be repaired or replaced as necessary to comply with these specifications.

PART 2.- PRODUCTS (Not applicable.)

PART 3.- EXECUTION (Not applicable.)

12-7.03 BATT AND BLANKET INSULATION

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing batt or blanket insulation in accordance with the details shown on the plans and these special provisions.

Batt insulation shall include faced and unfaced batts in walls and ceilings, acoustical batts for sound control and exposed batt or blanket insulation for ceilings and walls.

QUALITY ASSURANCE.--

Laminator's qualifications.--Laminator for bonding polyethylene vapor-retarder to insulating batts shall be approved by the insulation manufacturer.

The name of the laminator shall be submitted with the Product Data.

Codes and standards.--All batt or blanket insulation, including facings such as vapor barriers, shall have a flame-spread rating not to exceed 25 and a smoke density not to exceed 450 when tested in accordance with UBC Standard No. 8-1.

The flame-spread and smoke density limitations do not apply to facings on batt insulation installed between ceiling joists, or in roof-ceiling or wall cavities, provided the facing is installed in substantial contact with the surface of the ceiling or wall finish.

PART 2.- PRODUCTS

INSULATING MATERIALS.--

General.--Fiberglass batts shall be thermal insulation produced by combining glass fibers with thermosetting resins to comply with ASTM Designation: C 665.

Exterior wall insulation.--

Exterior wall insulation shall be R-3.3 K• m^2/W fiberglass batts with paper-laminate vapor-retarder membrane on one face. Insulation shall conform to ASTM Designation: C 665, Type II, Class C.

Acoustical insulation.--

Acoustical insulation shall be 89 mm, unfaced fiberglass insulation batts. Insulation shall conform to ASTM Designation: C 665, Type I.

VAPOR-RETARDERS.--

Paper-laminate vapor-retarder.--

Paper-laminate vapor-retarder shall be kraft paper sheets laminated together with asphalt or other vapor retarding compounds, scrim reinforced at edges of sheets.

Foil-paper vapor-retarder.--

Foil-paper vapor-retarder shall be 0.0076 mm reflective aluminum foil laminated with scrim reinforcing to plastic-coated kraft paper**.**

Polyethylene vapor-retarder.--

Polyethylene vapor-retarder shall be factory-applied, 0.076 mm, white polyethylene film, a blend of fiberglass and polyester yarn reinforcement, and metallized polyester film laminated with a flame resistant adhesive, and a Class I flame-spread classification.

AUXILIARY INSULATION MATERIALS.--

Insulation tape.--

Insulation tape shall be as recommended by the insulation manufacturer.

Insulation adhesive.--

Insulation adhesive shall be the type recommended by the insulation manufacturer and complying with the requirements for fire resistance.

FABRICATION--

General.--Polyethylene shall be factory laminated to fiberglass batts or blankets by an applicator approved by the manufacturer of the batts or blankets.

PART 3.- EXECUTION

INSTALLATION.--

General.--The vapor retarder on faced batts shall be toward the interior and shall be fastened to provide a sealed retarder. Punctures and holes in the retarder shall be repaired.

Unless otherwise shown on the plans or specified elsewhere in these special provisions, insulation shall be kept 75 mm to 100 mm clear of lighting fixtures and heat producing electrical appliances and equipment.

Installing batt type insulation.--Insulation batts shall be installed to completely fill the space between framing members. Apply a single layer of insulation of required thickness, unless otherwise shown on the plans or required to make up total thickness. Installation shall conform to the manufacturer's recommendations and these special provisions.

Installing exposed insulation.--Exposed insulation shall be installed on impaling pins adhered to the substrate at 406 mm centers each direction with a minimum distance of 102 mm to the edge of the batt. Retainer clips shall be placed onto the pins so that the batt is slightly compressed. Pins shall be cut within 13 mm of the retaining clips and protective rubber caps placed on the ends of the pins.

When line wire is shown on the plans, blankets shall be supported with line wire spaced at 405 mm on center.

Joints in exposed insulation shall be sealed by lapping not less than 100 mm. Exposed insulation shall be fastened to framing at top, end and bottom, at perimeter of wall openings and at lap joints.

Overlapping joints shall be sealed with insulation adhesives as recommended by vapor retarder manufacturer's printed directions. Butt joints and fastener penetrations shall be sealed with insulation tape of the type recommended by the vapor retarder manufacturer. Joints at pipes, conduits, electrical boxes and similar items penetrating the vapor retarder shall be sealed.

12-7.04 RIGID FOAM ROOF INSULATION

PART 1.- GENERAL

Scope.--This work shall consist of furnishing and installing rigid foam roof insulation system in accordance with the details shown on the plans and these special provisions.

Rigid foam insulation system shall include tapered rigid insulation, wood nailers, overlayment, fasteners and such other materials, not mentioned, which are required for the complete installation of the rigid insulation system

Codes and standards.--All rigid foam insulation shall have a flame-spread rating not to exceed 75 and a smoke density not to exceed 450 when tested in accordance with UBC Standard No. 8-1.

Shop drawings.-- Shop drawings for the layout and installation of the rigid insulation and overlayment shall b submitted for approval.

PART 2.- PRODUCTS

Rigid cellular polystyrene insulation.--.--

Rigid cellular polystyrene insulation shall be a rigid board formed by the expansion of polystyrene resin beads or granules in a closed mold. The insulation shall be 3.3-K• m^2/W have a minimum density of 24 kg/m^3. The insulation shall have a minimum starting thickness of 38 mm and shall be tapered to provide the slope shown on the plans. The insulation shall conform to ASTM Designation: C 578.

Bitumen.--

Bitumen shall conform to ASTM Designation: D 312, for Type III roofing asphalt.

Joint tape.--

Joint tape shall be as recommended by the manufacturer.

Wood nailers.--

Wood nailers shall be Douglas fir, hem-fir or equivalent western softwood pressure treated after fabrication. Wood preservatives shall be waterborne type.

FABRICATION--

General.--The insulation board shall be factory-cut and labeled. The overlayment shall be factory laminated to the insulation board.

PART 3.- EXECUTION

INSTALLATION.--

General.--The vapor retarder on faced batts shall be toward the interior and shall be fastened to provide a sealed retarder. Punctures and holes in the retarder shall be repaired.

Preparation.--The preparation of the deck surfaces shall conform to the manufacturer's recommendations and these special provisions.

The deck surface shall be made smooth and level.

Installation.--Insulation shall be installed in accordance with the approved shop drawings.

Insulation shall be secured with a solid uniform application of hot bitumen applied to the roof deck at the rate of not less than 12 kilograms per 10 square meters. The hot asphalt shall be allowed to cool to approximately 107° C to 121° C before placing the insulation on the deck.

Joints between panels shall be tightly butted and covered with minimum 100 mm wide joint tape.

The complete installation shall be smooth, and suitable for the proper bedding of succeeding layers of roofing material.

Insulation panel joints shall be covered with tape the same day or otherwise protected for the weather.

Insulation panels with broken or crushed corners edges shall be trimmed free of such defects or shall be discarded. Replacement panels less than 305 mm wide shall not be used.

Damaged insulation in the completed work shall be removed and replaced. Insulation that has been wet or is wet shall be considered damaged.

12-7.05 SPRAY-ON INSULATION

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing spray-on insulation in accordance with the details shown on the plans and these special provisions.

Product data.--A list of materials, manufacturer's descriptive data, and location schedule shall be submitted for approval.

PART 2.- PRODUCTS

Spray-on insulation.—

Spray-on insulation shall be R-3.3 K• m^2/W, and shall meet ASTM Designation: E 84 (fire hazard) and ASTM Designation: E-736 (adhesion/cohesion). Spray-on insulation shall have a maximum flame spread rating of 10, and smoke development of 0. Spray-on insulation shall be International Cellulose Corporation, K-13 Spray-on System; Monoglass, Inc., Spray-on Insulation; Icynene, Inc., Icynene Insulation System; or equal.

PART 3.- INSTALLATION

Installing spray-on insulation.—Spray-on insulation shall be installed according to manufacturer’s recommendations.

12-7.06 SPRAYED-ON FIREPROOFING

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and applying a cementitious, sprayed-on fireproofing to structural members in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data and application instructions shall be submitted for approval.

Descriptive data shall include trade names, manufacturers' names, complete information on the materials to be applied, the material thickness for columns and beams for the required fire resistance ratings, and the manufacturer's printed instructions for application.

QUALITY ASSURANCE.--

Codes and standards.--Sprayed-on fireproofing shall have a maximum flame spread rating of 10, and smoke development of 0 in accordance with ASTM Designation: E 84.

Single source responsibility.--Fireproofing materials shall be purchased from a single supplier.

Certificates of Compliance.--Certificates of Compliance shall be furnished for sprayed-on fireproofing materials in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

DELIVERY, STORAGE AND HANDLING.--

General.--Materials to be applied shall be delivered in original unopened packages. Packages shall be identified by the manufacturer's label and shall bear proper UL or FM labels for fire resistance classification.

Materials shall be stored above ground, under cover, and in a dry location until ready for use. Packages which have been exposed to moisture before use shall be discarded.

PART 2.- PRODUCTS

Fireproofing.--

Fireproofing shall be sprayed on cementitious or mineral fiber fireproofing conforming to ASTM Designation: E 119. Fireproofing shall be Grace, Monokote; ALBI, Duraspray; or equal.

Fireproofing primer and adhesive.--

Fireproofing primer and adhesive shall be as recommended by the fireproofing manufacturer.

PART 3.- EXECUTION

Preparation.--Surfaces to be fireproofed shall be clean and dry, and shall be free from rust, grease, dust, and other deleterious materials which could impair the bond of the fireproofing.

Prior to applying fireproofing, clips, hangers, support sleeves and other attachments required to penetrate the fireproofing shall be in place.

Ducts, piping, equipment or other suspended matter which would interfere with the application of fireproofing materials shall not be positioned until fireproofing work is completed.

Surfaces not to receive sprayed on fireproofing shall be protected from the overspray of the fireproofing materials.

Application.--Equipment and application procedure shall be as recommended by the fireproofing manufacturer.

The primer and fireproofing materials shall be applied in accordance with the fireproofing manufacturer's application instructions.

The final wet film thickness of sprayed on fireproofing materials shall be as required to achieve the fireproofing manufacturer's specified resistance rating.

The material thickness shall be measured on the basis of the wet film thickness and shall be determined by random measurements during application.

Patching and repairing of sprayed on fireproofing shall be done by spraying or hand troweling.

Clean-up.--Work areas shall be maintained in an orderly condition. Upon completion of the installation, all debris and equipment shall be removed from the job site.

12-7.07 THROUGH-PENETRATION FIRESTOPPING

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing firestopping materials at penetrations in fire-rated walls, floors, and ceilings in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--

Product data.--A list of materials, manufacturer's descriptive data, and location schedule shall be submitted for approval.

Descriptive data shall include trade names, manufacturers' names, complete information on the materials to be applied, California State Fire Marshal Listing, the material thickness for the required fire resistance ratings, and the manufacturer's printed instructions for installation. Manufacturer's assembly shall be California State Fire Marshal approved.

QUALITY ASSURANCE.--

Certificates of Compliance.--Certificates of Compliance shall be furnished with each shipment of firestopping materials in accordance with Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

DELIVERY, STORAGE AND HANDLING.--

Delivery.--Materials to be applied shall be delivered in original unopened packages. Packages shall be identified by the manufacturer's label and shall bear proper labels for fire resistance classification.

Storage.--Materials shall be stored above ground, under cover, and in a dry location until ready for use. Packages which have been exposed to moisture before use shall be discarded.

PART 2.- PRODUCTS

Fire-rated caulk.--

Fire-rated caulk shall conform to ASTM Designation: E 814 and shall be rated for use in 2 and 3-hour fire-rated assemblies. Fire-rated caulk shall be 3M Brand, Fire Barrier Caulk; Dow Corning, Fire Stop Sealant; Standard Oil, Fyre Putty; or equal.

Wrap strip.--

Wrap strip shall be nominal 6 mm thick intumescent elastomeric material in 50 mm wide strips, faced one side with aluminum foil, and rated for use in 1-hour and 2-hour fire-rated systems.

Packing material.--

Packing material shall be polyethylene backer rod or nominal one inch thickness of tightly packed ceramic (alumina silica) fiber blanket, mineral-wool batt or glass fiber insulation material.

Fire-rated mortar.--

Fire-rated mortar shall be non-asbestos, 753 to 913 kilograms per cubic meter air dried density portland cement fly ash through-penetration firestopping mortar. Fire-rated mortar shall conform to ASTM Designation: E 814 and shall be rated for use in 3-hour fire-rated systems at 75 mm minimum thickness.

Fire safing insulation.--

Fire safing insulation shall be inorganic 56 kilograms per cubic meter minimum density, non-combustible fiber insulation conforming to Federal Specifications HH-1-521F, when tested in accordance with ASTM Designation: E 119 and ASTM Designation: E 136 for 3 hour fire resistance.

PART 3.-EXECUTION.--

Installation.--Firestopping materials shall be installed to conform to the requirements of the California State Fire Marshal Listing and the manufacturer's recommendations.

12-7.08 TORCH APPLIED ROOFING

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing a torch applied roof covering system in accordance with the details shown on the plans and these special provisions.

Torch applied roofing system shall have a granular surfacing, and shall include all materials for constructing the roofing system complete and in place.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data and installation instructions for torch applied roofing system shall be submitted for approval.

QUALITY ASSURANCE.--

Codes and standards.--Roofing materials shall conform to the rules for control of volatile organic emissions adopted by the local air pollution control district having jurisdiction in the area.

Field samples.--Materials shall be delivered to the jobsite in labeled containers or wrappings sufficiently ahead of their intended use to allow sampling and testing by the Engineer.

DELIVERY AND HANDLING.--

Storage.--Stored or stockpiled roof roofing shall be set on end and shall be protected from the elements. Roofing rolls compressed into oval cross section shall not be used

PART 2.- PRODUCTS

Torch applied roofing and flashing.--

Torch applied roofing shall be Class A or B fire retardant plastic bituminous roofing membrane. Plasticized bituminous compound, consisting of distilled asphalt mixed with polyproylene and petrochemical woven around a nonwoven polyester core.

Flashing rolls shall be properly sized for the application intended.

Top surface shall be embedded with slate flakes or mineral granules as follows:

4 mm smooth---	For torch applied roofing on curved surfaces.
4.5mm granular----	For torch applied roofing on flat surfaces.

Primer.--

Primer for torch applied roofing shall be a water-based asphalt primer application for metal surfaces.

PART 3.- EXECUTION

PREPARATION.--

General.--Surfaces to be covered shall be smooth, hard, dry and shall be free from high spots, depressions, frost or defects from frost, dust loosened material or other debris.

Openings, holes or crevices shall be filled or covered before any roofing materials are applied.

INSTALLATION.--

Application.--Torch applied roofing shall be installed to provide a watertight, non-leaking roof covering in accordance with the manufacturer's recommendations.

Torch applied roofing work and work of other trades shall be coordinated and scheduled to minimize interference and to eliminate traffic on the completed roof.

Torch applied roofing and roofing materials shall not be applied in wet weather or when ambient temperature is below 50° F. All drainage fixtures shall be set at the proper level to permit the free flow of water.

Primer shall be applied in a thin, continuous, uniform coating without skips or dry spots.

Flashing.--Flashings shall be installed as the roofing progresses to protect new facilities from damage resulting from rain, wind and storms. Any damage resulting from rain, wind or storms shall be corrected at the Contractors expense.

Torch applied flashings shall be placed after roofing is placed unless otherwise shown on the plans.

Torch applied flashings shall be one layer of flashing applied to metal substrate free of voids, fish mouths and wrinkles. No splices will be permitted.

CLEANUP.--

General.--Upon completion of the work, the Contractor shall clean all exposed surfaces that are subject to spillage, over run and marking by torch applied roofing. Clean up methods and materials shall be as recommended by the manufacturer.

Cleanup methods shall not damage, discolor or otherwise affect the exposed surfaces.

12-7.09 ALUMINUM COMPOSITE PANELS

PART 1.- GENERAL

SUMMARY.--

This work shall consist of designing, fabricating, furnishing and installing a water tight Rout and Return Dry panel aluminum composite panel system on the toll plaza structure as shown on the plans and these special provisions. The Rout and Return Dry panel system must consist of a dry gasket interlocking system. The panel system shall consist of dry gasketed perimeter extrusions, extruded stiffeners, gaskets, fasteners, related flashings, sealants between jamb panels and previously installed adjacent construction, and other miscellaneous accessories required for a complete watertight installation. Assembly shall be water and airtight without reliance on a secondary backup membrane.

QUALITY ASSURANCE.—

Fabrication History: Fabricator shall assume undivided responsibility for all components of the panel work and shall demonstrate no less than five years successful experience of metal panel work similar in scope and size to this project.

Performance Requirements: Work shall conform with all applicable codes and regulations.

Design Criteria: Make allowances for free and noiseless vertical and horizontal thermal movement due to the contraction and expansion of component parts, for ambient temperature range of 20 F to 180 F. Buckling, opening of joints, undue stress on fasteners, failure of sealants or any other detrimental effects due to thermal movement of component parts

will not be permitted. Fabrication, assembly and erection procedure shall take into account the ambient temperature range at the time of the operation.

Wind Loads: Assemblies shall be designed for flexural, shear and torsional stresses for the following positive and negative wind pressures acting normal to the place of the assemblies. Loading design shall be as specified on the drawings.

Pressure and Load: Normal to the plane of the wall between structural supports, deflection of the connected perimeter framing members shall not exceed 1/175 of span length or 19 mm, whichever is less.

At connection points of framing members to anchors, anchor deflection is any direction shall not exceed 1.5 mm. Where connection points are not clearly defined, maximum anchor deflection shall not exceed 1.5 mm.

Stresses must take into account interaction and in no case shall allowable values exceed the yield stress.

At 1.5 times design pressure, permanent deflections of framing members must not exceed 1/1000 of the span length, and components must not experience failure or gross permanent distortion. Art connection points of framing members to anchors, permanent set shall not exceed 1.5 mm.

Flatness Criteria: Maximum 13 mm in 15 on panel in any direction for assembled units. (Not accumulative)

General Approval: Composite panel manufacturer shall have an ICBO research report.

TESTS

Wall system: Walls furnished shall have been tested. If such tests are not available, mockups shall be constructed and tests performed. In either case, an independent laboratory approved by the Engineer shall conduct tests. Test results shall meet or exceed the following:

Air infiltration: When tested in accordance with STM E283-84, air infiltration at 6.245 psf must not exceed 0.06 cfm per square foot of wall area.

Static Water Infiltration: Water infiltration is defined as the appearance of uncontrolled water on the wall. Design shall provide drainage to the exterior face of the wall, any leakage of water occurring at joints and/or any condensation taking place within the construction. No water infiltration under static pressure with ASTM E331-86 at a differential static pressure of 15 psf, after 15 minutes.

Structural Performance: Shall be tested in accordance with ASTM E330-84 at design pressure. After initial test, test at 150 % of design pressure. No permanent deformation exceeding 1/1000 or failure to structural members allowed.

Seismic Racking: There shall be no failure or deterioration of the system when the unit is laterally racked to 19 mm in both directions and repeated for three cycles.

Bond Integrity Test: When in accordance with ASTM D1781-76 for bond integrity, simulating resistance to delamination.

Peel Strength:

Fire Performance: ASTM E84-79 maximum value flame spread 0, smoke developed 0.

UBC 26-3 No flame spread along interior face or penetration through the wall assembly.

ASTM 162: No surface flaming.

SUBMITTALS.--

Working Drawings.--Working drawings, engineering calculations five panel anchorage system samples, catalog cuts, descriptive data, and installation instructions shall be submitted for approval.

Samples: Submit (5) 203 mm x 203 mm sample of panel system in specified finish complete with factory edge treatment, fabricated into units representative of the actual calculations.

Working drawings shall show the shape, size, thickness, and method of attachment for each component used in the work; the layout and spacing of fasteners; details of connections and closures; and details for expansion joints and weathertight joints.

Design calculations for the fastening system with the substrate shown on the plans shall be submitted to verify compliance with the design requirements.

Working drawings and design calculations shall be stamped and signed by an engineer who is registered as a Civil or Structural Engineer in the State of California. The expiration date of the registration shall be shown. The Engineer's signature shall be original.

The engineering calculations for the design of the metal panel system shall include applied loads, load combinations, panel stresses and deflections, fastener loads and stresses and provisions for accommodating the canopy deflections.

Mock up: Construct full size mock-up per that outlined on the drawings. Mock-up must be approved prior to ordering materials and release of panels for fabrication.

Acceptable fabricator's.--The following are acceptable fabricator's providing they meet all of the criteria for this specification; Elward Systems Corporation, CSP Wall Systems, Center Glass Company, Universe Corporation, or equal.

DELIVERY, HANDLING AND STORAGE.--

Delivery and handling.--Panels shall be protected against damage and discoloration.

Storage.--Panels shall be stored above ground, with one end elevated for drainage and protected against standing water and condensation between adjacent surfaces.

PART 2.- PRODUCTS

MATERIALS.--

SHEET MATERIAL.--

Aluminum composite material.--

Panels shall match the color shown on the plans and the following:

1. Composite metal panel shall consist of two exterior sheets of 0.50 mm thick AA5005 aluminum alloy or AA3105 and a core of extruded thermoplastic. The exterior sheets and core shall be bonded together with no glues or adhesives. The panels shall be integrated into a 41 mm maximum depth extruded aluminum edge grip system. The edge grip system shall be of 6063-T5 aluminum alloy.

2. The maximum allowable fabrication tolerances for the panels shall be as follows:

Panel Bow	Maximum of 0.2 percent of length or width panel dimension
Width	3 mm
Length	3 mm
Camber	0.8 mm
End Squareness	0.25 percent of panel width

3. All panel surfaces shall be free of seams, warp, and buckling. The panel lines, breaks and angles shall be sharp and true.
4. The metal panel system shall have an internal drainage system to catch condensation and any other accumulations of moisture and direct it to discharge weeps.
5. Attachment clips, fasteners, furring, shims, brackets and miscellaneous hardware shall be stainless steel and shall be as recommended by the metal panel manufacturer. All fasteners shall be concealed.
6. Acceptable products are Alucobond, Reynobond, Alpolic, or equal.

Sealants and gaskets.--

Sealant shall be one-part, low modulus, weatherproofing silicone, Dow Corning Corporation, 795 Silicone Building Sealant; General Electric Company, Silpruf Sealant; or equal and shall be as recommended by the metal panel manufacturer. Gaskets shall be Sanopreme, EPDM, or equal. Sealant and gaskets shall be black in color.

Edge trim.--

Edge trim shall be extruded aluminum with integral weather-stripping as detailed on the plans so as to provide the following features:

Rout and return of the composite aluminum sheet on all perimeters. "Continuous Edge Grip" is not acceptable.

Exposed edge of composite aluminum sheet shall be protected inside an extruded aluminum pocket.

Maximum overall panel thickness shall not exceed 51 mm.

The composite aluminum sheet shall be mechanically attached to all perimeter extrusions.

Color shall be black painted silicone modified polyester.

Stiffeners.--

Extruded aluminum sections secured to edge trim and bonded to rear face of composite aluminum sheet with silicone, and of sufficient size and strength to maintain flatness of the panel within the specified tolerances. Stffeners shall have a mill finish.

Panel coating.--

Panel coating shall be factory applied, oven baked multiple coat fluoropolymer based coating system containing polyvinylidene fluoropolymer resin (Kynar 500) for use on aluminum substrates. The minimum dry film thickness of the completed multiple coat system shall be 0.04 mm. The coating system shall be applied and oven baked in accordance with the manufacturer's instructions. The coating system shall not be field applied. The color of the panel coating shall be as shown on the plans.

Flashings.--

Fabricate flashing from 1.5 mm thickness aluminum sheet; where exposed to view finish to match adjacent panels. Provide lap strip under flashing at abutted conditions, with lapped surfaces sealed with full bed of non-hardening sealant.

PART 3. -EXECUTION

The metal panel system shall be installed rigidly and securely in accordance with the manufacturer's recommendations.

Extreme care shall be exercised in handling, storing, moving and installation the metal panels to avoid twisting, racking, scratching, denting, chipping, staining or any other type of damage or distortion. Panels damaged in handling or installing shall be replaced by the Contractor at his expense.

Fabricate panels so that the panel thickness at the joinery is 44 mm.

Panels shall be accurately positioned to maintain the straight joint lines between panels as shown on the plans. Joints shall be kept uniform throughout the installation and shall be of sufficient width to accommodate the deflections of the frame and the expansion and contraction of the panels but shall not exceed 12 mm in width.

Adjoining panels shall be aligned and matched to one another at the joints. The surfaces at the edges of each panel shall be flush with the surfaces at the edges of the adjacent panels.

Neoprene isolation material shall be provided to separate adjoining incompatible metals. Nylon washers shall be used to separate canopy members, fasteners, clips, and brackets of ferrous metal (except stainless steel) from aluminum.

Openings through the panels for penetrations shall be cut square to present a neat and true appearance with exposed burrs, removed. Openings shall be reinforced and sealed as recommended by the panel manufacturer.

A dry gasket shall be the primary method to seal joints. The dry gasket shall be compatible with silicone sealant.

Other surfaces necessary to use sealant, shall be clean and shall be free of dust, dirt oil, moisture and other deleterious matter which might adversely affect the adhesion of the sealant. Primer shall be applied in accordance with the sealant manufacturer's instructions. Application of backing materials and sealant shall be in accordance with the panel

manufacture's working drawings and the sealant manufacturer's instructions, all as specified under Submittals," in these special provisions.

Joints to be sealed shall be inspected for construction defects which would adversely affect the execution of the work. Unsatisfactory conditions shall be corrected before the joint sealant is applied.

The installation metal panel system shall be weathertight.

The metal panel system shall be thoroughly cleaned after installation to remove excess sealant, tapes, dirt, grease or other unsightly materials. Cleaning shall be in accordance with the panel and sealant manufacturer's instructions.

12-7.10 MODIFIED BITUMEN ASPHALT ROOFING SYSTEM

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing a minimum 4-ply asphalt modified bitumen built-up roof covering system in accordance with the details shown on the plans and these special provisions.

Built-up roofing shall be three plies of asphalt/glass-fiber felt roof system with one ply of smooth surface SBS/SIS rubber modified membrane. Surfacing shall be ASTM Designation: 1863 aggregate (NAGA_BUR).

Wood nailers, and curbs shall conform to the requirements under "Rough Carpentry" in Section 12-6, "Wood and Plastics," of these special provisions.

Sheet metal flashing and counter-flashing shall conform to the requirements under "Sheet Metal Flashing" elsewhere in this Section 12-7.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data and applicable roofing specifications shall be submitted for approval.

Descriptive data shall include flash point temperature and finish blowing temperature for bitumen. Descriptive data shall include modified membrane tensile and tear strengths, elongation characteristics, rubber content, and low temperature flexibility.

Roofing specifications shall include materials to be used, details and methods of application of the various materials for the complete roofing system proposed for use by the roofing manufacturer.

Samples.--A color sample of roofing gravel, approximately 2.25 kilograms in weight, shall be submitted to the Engineer at the job site for approval.

Sample of rubber modified membrane, approximately 305 mm x 305 mm, shall be submitted for approval.

QUALITY ASSURANCE.--

Manufacturer's qualifications.--Primary products, including each type of roofing felt, bitumen, composition flashing and modified membrane shall be from a single manufacturer, or approved by the warranteeing manufacturer, who has produced that type of product successfully for not less than 5 years. Secondary products shall only be used when recommended by the roofing manufacturer.

Field supervision.--The roofing installer shall provide full-time supervision at the jobsite when roofing work is in progress. The supervisor shall have not less than 5 years experience in roofing work similar in nature and scope to the roofing work specified.

Codes and standards.--Roofing materials shall conform to the rules for control of volatile organic emissions adopted by the air pollution control district that has jurisdiction.

Roofing products shall have been tested and listed as Class A by the Underwriters Laboratory, Factory Mutual, or other recognized testing agency, and shall bear those labels.

Certificates of Compliance.--Products or product containers shall be labeled to indicate compliance with ASTM specifications or shall be accompanied by Certificates of Compliance certifying that the materials comply with ASTM

Designations or these special provisions. Certificates of Compliance shall be in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

Certificate of Compliance for bulk bituminous materials shall be submitted indicating that the materials comply with the required standards, and shall indicate flash point (FP), finished blowing temperature (FBT), softening point (SP), and equiviscous temperature (EVT).

Field samples.--Materials shall be delivered to the project in labeled containers or wrappings sufficiently ahead of their intended use to allow for sampling and testing by the State. Bitumen shall not be heated before sampling.

Pre-installation conference.--Approximately 2 weeks prior to the start of roofing work, the Contractor shall convene a pre-installation conference. The Contractor shall require attendance of all parties directly affecting the installation of the modified bitumen asphalt roofing system including the roofing installer and materials supplier.

The Contractor shall notify the Engineer, in writing, not less than 5 working days prior to the pre-installation conference.

Agenda items shall include preparatory work by other trades, review roofing system requirements, construction schedule and tentative starting date, and procedures for unfavorable weather conditions, including temporary roofing.

DELIVERY, STORAGE AND HANDLING.--

Delivery.--Materials shall be delivered to the jobsite with labels in place.

Storage.--Stored or stockpiled roll roofing shall be set on end, stored on pallets or other raised surfaces, and shall be protected from the elements. Felt rolls compressed into an oval cross section shall not be used. Felts damaged from exposure to sunlight and felts that are torn or cut shall not be used.

Roofing products that are wet or have been wet will be considered damaged. Damaged products shall not be used.

PROJECT CONDITIONS.--

Weather condition limitations.--The Contractor shall proceed with the roofing work only when existing and forecasted weather conditions will permit work to be performed in accordance with the manufacturer's recommendations and warranty requirements.

Modified bitumen asphalt roofing shall not be applied in wet weather or when ambient air temperature is below 10°C. All drainage fixtures shall be set at the proper level to permit free flow of water.

Temporary roofing.--At the option of the Contractor and when adverse job conditions or weather conditions prevent permanent roofing from being installed in accordance with the contract requirements, a temporary roof may be installed and removed prior to proceeding with the permanent roofing work. Temporary roofing shall be furnished, applied, and removed at no cost to the State.

WARRANTY.--

Manufacturer's warranty.--The Contractor shall submit the roofing manufacturer's standard 30 years limited warranty.

Modified bitumen asphalt roofing and related flashing installations, including related metal work, shall be guaranteed against defective materials and workmanship and against leakage due to faulty or inferior materials, inept or careless installation work, inadequate installation supervision, and inadequate protection of the completed work.

Any such defects or leakage occurring during the period of the warranty shall be promptly and completely corrected, including all affected work or damaged substrate, at no additional cost to the State. Bulging or wrinkling of modified bitumen asphalt roofing shall be interpreted as defects requiring correction.

Such warranty shall be in effect from the date of acceptance of the contract and shall be signed by an agent of the manufacturer and countersigned by the Contractor, and shall be submitted to the Engineer prior to the completion of the work.

PART 2.- PRODUCTS

SHEET MATERIALS.--

Ply felts.--

Ply felts shall be asphalt impregnated, glass-fiber roofing felts conforming to ASTM Designation: D 2178, Type IV.

SURFACING SHEETS.--

Smooth surface field modified membrane.--

Field modified membrane: Modified field sheet shall be a single ply of heavy-weight dual glass-fiber mat with SBS/SIS modified asphalt compound and polyester reinforcement conforming to ASTM Designation; D5147. Membrane tensile strength at 25º C shall be a minimum of 240 kg MD and 285 kg XMD. Membrane tear strength at 25º C shall be a minimum of 453 kg MD and 499 kg XMD. Membrane elongation at 25º C shall be a minimum 7.5 % and 8.5% XMD.

Mineral surface base flashing sheet.--

Field modified membrane: Modified field sheet shall be a single ply of heavy-weight dual glass-fiber mat with SBS/SIS modified asphalt compound and polyester reinforcement conforming to ASTM Designation; D5147. Membrane tensile strength at 25º C shall be a minimum of 240 kg MD and 285 kg XMD. Membrane tear strength at 25º C shall be a minimum of 453 kg MD and 499 kg XMD. Membrane elongation at 25º C shall be a minimum 7.5 % and 8.5% XMD.

BITUMINOUS MATERIALS.--

Bitumen.--

Bitumen shall be roofing asphalt conforming to ASTM Designation: D 312, type to be determined by the manufacturer of the roofing material.

Asphalt/cement primer.--

Asphalt/cement primer shall conform to ASTM Designation: D 41.

Asphalt cement.--

Asphalt cement shall conform to ASTM Designation: D 2822, type to be determined by the manufacturer of the roofing material.

FLASHING MATERIALS.--

Base flashing.--

Base flashing shall be two ply modified built up Flashings. The field modified membrane shall be used as the modified reinforcing ply (1-st ply0. The modified cap sheet shall be used as the modified flashing sheet (2-nd ply0. Both plies shall be set in hot asphalt.

ACCESSORIES.--

Insulation for toll plaza canopy.—

Insulation for toll plaza canopy shall be 25 mm rigid wood fiber insulation.

Insulation for operations building.—

Insulation for operations building shall be R-5.5. K• m^2/W polyisocyanurate/13 mm wood fiber composite insulation.

Insulation for courtyard canopy.—

Insulation for courtyard canopy shall be 6 mm/305 mm tapered polyisocyanurate/13 mm wood fiber insulation.

Crickets.—

Crickets shall be 13 mm/305 mm tapered polyisocyanurate/wood fiber insulation.

Roofing fasteners.--

Roofing fasteners shall be hot-dip galvanized or non-ferrous type, size and spacing shall be UL approved by fastener manufacturer. Minimum 64 mm disks shall be formed to prevent cupping and be approved by the roofing material manufacturer.

Gravel.--

Gravel shall be dry, clean, dust free, opaque to ultraviolet light, hard (but not brittle), roofing gravel, sized to all pass the 19 mm sieve and no more than 15 percent to pass the 4.75 mm sieve. Maximum moisture content shall be 0.5 percent for gravel as determined by California Tests 226 or 370 or by the test method ASTM Designation: D 1864.

Roof walkways.--

Roof walkways shall be the manufacturer's standard roof walkways bituminous composition panels or modified membrane intended as a protective course for foot traffic.

PART 3.- EXECUTION

PREPARATION.--

Protection.--Provide protection to the building, its contents, grounds, and landscape from damage, providing guards and coverings as necessary.

Bituminous materials, aggregates, and debris shall be prevented from entering and clogging drains and downspouts.

Surface preparation.--Surfaces to be covered shall be smooth, hard, and dry; and shall be free from high spots, depressions, frost or defects from frost, dust, loosened material and debris. Openings, holes or crevices shall be filled or covered before any roofing materials are applied.

Roofing material shall not be applied to wet or damp surfaces. Moisture transfer to colored toilet tissue or Kleenex brought in contact with roof surfaces shall indicate that the surfaces are too wet to apply roofing material. Foaming of a pint of bitumen heated to 205°C and applied to the deck surface shall indicate that the deck is not dry enough to roof. If the applied hot bitumen can be chipped clean from the deck after it cools, the deck is not dry enough for the roofing application.

Asphalt bitumen heating.--Bitumen shall be heated and applied in accordance with the manufacturer's recommendations and as recommended by the National Roofing Contractors Association (NRCA).

Bitumen shall be within -3.8°C of the equiviscous temperature at the point of application on the roof. Bitumen shall not be heated above the finished blowing temperature for extended periods of time. The temperature of bitumen shall be kept at least -3.8°C below its flash point temperature.

To insure good adhesion at lower air temperatures, care shall be taken to maintain bitumen temperatures at a minimum of 175°C at the point of application or at the roofing asphalt equiviscous temperature (EVT) when supplied by an asphalt supplier.

Roofing work pumping equipment.--Pumping equipment located on the ground shall be at a safe distance from the buildings. The location shall be subject to the approval of the Engineer.

Operators shall be in attendance whenever pumping equipment is in use.

Pumping equipment to be set on roofs shall be subject to the approval of the Engineer regarding loading of structural elements and spillage. Pumping equipment shall not be set on building walkways or new roof coverings.

INSTALLATION.--

Wood nailers and curbs.--Wood nailers and curbs shall be installed at the locations shown on the plans.

Wood nailers and curbs shall be multiple thicknesses of solid stock lumber nailed together and attached to the deck with corrosion resistant fasteners.

Prefabricated curbs shall be installed according to the manufacturer’s recommendations.

Cants.--Nominal 100 mm minimum sized cants shall be installed at all intersections of the roof deck and vertical walls or curbs, except as otherwise shown on the plans. Cants shall be tight fitting and shall be rigidly and securely attached to the decking or insulation.

When insulating board cants are installed, the faces of the cant contiguous with the deck shall be buttered with bituminous plastic cement and firmly set in a full bed of bituminous plastic cement.

APPLICATION.--

General.-- Modified bitumen asphalt roofing materials shall be applied in accordance with the manufacturer's installation instructions, specifications, and these special provisions to provide a watertight, non-leaking roof covering.

Modified bitumen asphalt roofing work and work of other trades shall be coordinated and scheduled to minimize interference and to eliminate traffic on the completed modified bitumen asphalt roofing.

Roofing material shall not be applied to wet or damp surfaces. Moisture transfer to colored toilet tissue or Kleenex brought in contact with roof surfaces shall indicate that the surfaces are too wet to apply roofing material. Foaming of a pint of bitumen heated to 205°C and applied to the deck surface shall indicate that the deck is not dry enough to roof. If the applied hot bitumen can be chipped clean from the deck after it cools, the deck is not dry enough for the roofing application.

Ply application.—Interplies shall be rolled out in strips and allowed to flatten before placing.

Concrete and masonry surfaces shall be primed as required prior to the application of the membrane and flashing.

Roofing plies shall be applied in three plies with interply mopping of asphalt. Interply hot asphalt application rate shall be a minimum 25 lbs./square per ply.

Felts shall be squeegeed during construction to minimize voids, fish mouths or wrinkles and to firmly embed the felts into the hot bitumen. Voids, fish mouths or wrinkles built into a ply shall be cut, remopped, and repaired with at least one ply of reinforcing material and hot bitumen before applying the next ply.

Roofing plies shall be solid mopped to cants at vertical walls or curbs.

One ply of smooth modified membrane shall be mopped and sealed around all penetrations.

Flashing application.—One ply of smooth surface modified membrane and one ply of mineral surface modified membrane shall be solidly mopped into all base flashings and up parapet walls in accordance with the manufacturer’s recommendations.

All sheet metal accessories, pipes, expansion joints, area dividers, and any penetrations in the roofing shall be flashed weathertight.

Plastic cement shall be troweled to the top of flashing at the end of each day's operations to close joints and prevent water from entering behind flashing until counterflashing is placed.

Gravel application.--A flood coat of hot bitumen shall be applied uniformly over the final ply of roofing felt at the rate of not less than 29 kilograms per 10 square meters.

While the flood coat is still hot, gravel shall be firmly embedded uniformly at the rate of at least 195 kilograms per 10 square meters.

Roofing walkways.--Roofing walkways shall be installed in accordance with the manufacturer’s instructions in areas subject to frequent foot traffic.

FIELD QUALITY CONTROL.--

Testing.--Upon completion, the Engineer may at his option, take at least one 305 mm x 305 mm sample including gravel, from each roof plane, not to exceed one sample per 100 square meters of roof plane.

Sample shall be cut as accurately as possible using metal template and knife.

The Contractor at his expense shall patch sample test areas with the same roofing materials as used for the rest of the roof to insure watertightness. The test cut panel shall be put back in place and readhered, and additional plies, equal to the original specification, shall be applied over the panel location before proceeding to install surfacing materials.

If any sample does not comply with these special provisions or the manufacturer's requirements, the entire roof or roofs shall be considered unacceptable and shall be replaced at the Contractor's expense.

CLEANING.--

General.--Upon completion of the roofing work, remove all tools and implements from the work area.

Bituminous markings shall be removed from surrounding surfaces. In areas where finished areas are soiled by roofing work, the manufacturer of the surfacing shall be consulted concerning removal of the asphalt products.

12-7.11 SHEET METAL FLASHING

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of fabricating, furnishing and installing sheet metal flashing in accordance with the details shown on the plans and these special provisions.

Sheet metal shall include metal flashings, counterflashings, straps, gutters, downspouts, gravel stops, reglets, roof jacks, and screen type vents.

Alternatives.--Premolded roof flashings may be used in lieu of sheet metal flashings where shown on the plans.

QUALITY ASSURANCE.--

Codes and standards.--Sheet metal work shall in accordance with the requirements in the latest edition of the Sheet Metal and Air Conditioning Contractors National Association "Standard Practice in Architectural Sheet Metal Work."

PART 2.- PRODUCTS

MATERIALS.--

Galvanized sheet steel.--

Galvanized sheet steel shall conform to ASTM Designation: A 361, not less than 0.71 mm (24-gage), unless otherwise shown on the plans. Surfaces to be painted shall not have factory coatings on galvanizing that cannot be removed by paint thinner.

Sheet aluminum.--

Sheet aluminum shall be not less than 0.81 mm thick, mill finish, 3003-H14 alloy, conforming to ASTM Designation: B 209.

Sheet lead.--

Sheet lead shall be not less than 1.6 mm thick, made from chemical lead, conforming to ASTM Designation: B 29.

Premolded roof flashing.--

Premolded flashing shall be premolded neoprene or ethylene propylene diene monomer (EPDM) flashing, resistant to ozone and ultraviolet. Units shall have overlapping tab to flash the seam.

Hardware and fastenings.--

Hardware and fastening for premolded roof flashings shall be stainless steel.

Solder.--

Solder shall conform to ASTM Designation: B 32, Alloy Grade Sn50.

Soldering flux.--

Soldering flux shall be acid type, conforming to Federal Specification: O-F-506C, Type I, Form A.

Insect screen.--

Insect screen shall be industrial wire cloth and screen, medium grade, 18 mesh, 0.43 mm diameter, 1 mm openings, plain weave, galvanized steel conforming to ASTM Designation: E 437.

Lap joint sealant.--

Lap joint sealant for concealed locations shall be a non-drying butyl.

Flashing cement.--

Flashing cement shall be a bituminous plastic cement, asbestos free, conforming to ASTM Designation: D 4586, Type II.

Sealant.--

Sealant for exposed locations shall be a silicone sealant conforming to ASTM Designation: C 920.

Primer.--

Primer shall be as recommended by the sealant manufacturer.

Coal tar paint.--

Coal tar paint shall be coal-tar epoxy coating conforming to U.S. Corps of Engineers Specification: C-200 or Steel Structures Painting Council Paint Specification: SSPC-16-68T.

FABRICATION.--

General.--Sheet metal shall be assembled to Sheet Metal and Air Conditioning Contractors National Association Standards.

Sheet metal shall be formed to the sizes, shapes and dimensions shown on the plans or as specified herein with angles and lines straight, sharp and in true alignment. The number of joints shall be kept to a minimum.

Angle bends and folds for interlocking the metal shall be made with full regard for expansion and contraction to avoid buckling or fullness in the metal after it is installed.

Joints in sheet metal work shall be closed watertight unless slip joints are specifically required. Watertight joints shall be mechanically interlocked and then thoroughly soldered for metals other than aluminum. Watertight joints in aluminum or between aluminum and other metals shall be sealed with acrylic sealant.

Sheet metal joints to be soldered shall be cleaned with steel wool or other means, pre-tinned and soldered watertight.

All joints shall be wiped clean of flux after soldering. Acid flux shall be neutralized by washing the joints with sodium bicarbonate.

Flashings shall have a 45 degree drip return at bottom edges. Unless otherwise shown on the plans, counterflashing shall extend not less than 100 mm over roofing or other materials protected by the counterflashing and shall be arranged so that roofing or materials can be repaired without damage to the counterflashing. Where reglets are indicated, counterflashing shall be fastened by lead wedges or snap-in flashing.

PART 3.- EXECUTION

PREPARATION.--Surfaces to receive sheet metal shall be clean, smooth and free from defects.

PROTECTION.--Aluminum surfaces to be in contact with concrete, mortar, or dissimilar metals shall be given a heavy coat of coal tar paint.

INSTALLATION.--

Roof penetration flashings.--All pipes, ducts, vents and flues passing through roofs shall be made waterproof with flashings of storm collars or counterflashings.

Roof penetration flashings shall be fabricated from galvanized sheet steel, not less than 0.71 mm (24-gage). Size and shape shall be as shown on the plans.

On built-up roofing, 2 flashings shall be furnished for each pipe, vent or flue through roof. Flashings shall be constructed so that the lower flashing shall sit directly on the roof deck, with the top flashing set over it on top of the roof felts.

The lower flashing shall be galvanized sheet metal, 0.71 mm (24-gage), and extend 150 mm minimum from outside of the pipe in all directions and 38 mm above the top of the roofing.

The top flashing shall be galvanized sheet steel or sheet lead as shown on the plans.

Hung gutters.--Hung gutters shall be fabricated from galvanized sheet steel, not less than 0.71 mm (24-gage). Gutters shall be size and shape as shown on the plans.

Gutters shall be fabricated in sections not less than 3 meters in length. Use sections as long as practicable for lengths over 3 meters.

Joints shall be lapped at least 38 mm, rivet and solder watertight. Butt type expansion joints, 19 mm wide, shall be provided at midpoint between down spouts and where expansion joints occur in the structure.

Downspouts.--Downspouts shall be fabricated from galvanized sheet steel, not less than 0.71 mm (24-gage). Size and shape shall be as shown on the plans.

Downspouts shall be installed as shown on the plans, secured to the wall with straps near top, bottom and at intermediate points not more than 2.4 meters apart. Straps shall extend 50 mm out on wall and be secured with suitable anchors.

Unless otherwise shown on the plans, the lower end of downspout shall terminate with mitered 45 degree elbow.

Premolded roof flashings.--Premolded roof flashings shall be installed in accordance with the manufacturer's instructions.

Gravel stops.--Gravel stops shall have upstanding lip, an apron with drip edge and 100 mm minimum width roof flange. Joints between lengths shall be 13 mm wide sliding joints with 305 mm long internal sleeves set in plastic cement. Corners shall be mitered and soldered. Gravel stops shall be set in 6 mm thick bed of plastic cement and stagger nailed at 75 mm centers on the roof flange. Nails shall be 25 mm from the edge of the roof flange. Blind clips of galvanized steel shall be provided.

After metal work is completed and watertight, flashings and gravel stops shall be covered by one of the following methods:

1. The top of the stop flanges and inside the upstanding lip at the joints shall be cleaned with an acid etching detergent, rinsed and dried. A 13 mm thick coat of plastic cement shall be applied on the roof flange and onto the roofing at least 100 mm. A 13 mm thick coat of plastic cement shall be applied 100 mm wide on the upstanding lip at the joints.
2. A hot mopping of roofing asphalt or a uniform coating of plastic cement shall be applied, over which shall be laid Type IV asphalt saturated felt strips, 255 mm and 330 mm wide, in 2 layers over the flange of the stops feathered out onto the roofing.

12-7.12 SEALANTS AND CAULKING

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and applying sealants and caulking which are required for this project, but not specified elsewhere, in accordance with the details shown on the plans and these special provisions.

QUALITY ASSURANCE.--

Certificates of Compliance.--Certificates of compliance shall be furnished for the sealants and caulking in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data and installation instructions for all sealants shall be submitted for approval.

Samples.--Color samples of all sealants shall be submitted for approval. Unless otherwise shown on the plans, colors will be selected by the Engineer from the manufacturer's standard colors.

PART 2.- PRODUCTS

MATERIALS.--

General.--All sealants, primers and accessories shall be non-staining to adjacent exposed surfaces. Products having similar applications and usage shall be of the same type and same manufacturer. Gun consistency compound shall be used unless otherwise required by the job conditions.

Acrylic sealant.--

Acrylic sealant shall be one compound, solvent release acrylic sealant.

Butyl sealant.--

Butyl sealant shall be one component, skinning type.

Silicone sealant.--

Silicone sealant shall be one component, low modulus building sealant. Sealant shall be tack-free in one hour, shall not sag or flow, shall be ozone resistant and capable of 100 percent extension without failure.

Joint sealant.--

Joint sealant shall be a two-part, non sag polysulfide base, synthetic rubber sealant formulated from liquid polysulfide polymer.

Backer rod.--

Backer rod shall be round, open or closed cell polyurethane. Backer rod shall be sized such that it must be compressed between 25 and 75 percent of its uncompressed diameter during installation in the joint.

Neoprene.--

Neoprene shall conform to the requirements of ASTM Designation: C 542.

PART 3.- EXECUTION

APPLICATION.--

General.--Unless otherwise shown on the plans, sealants shall be applied in accordance with the manufacturer's instructions.

Silicone sealants shall not be used in locations where painting is required.

Butyl sealants shall not be used in exterior applications, and acrylic sealants shall not be used in interior applications.

Sealants shall be applied in a continuous operation for the full length of the joint. Immediately following the application of the sealant, the sealant shall be tooled smooth using a tool similar to that used to produce concave masonry joints. Following tooling, the sealant shall remain undisturbed for not less than 48 hours.

SECTION 12-8. DOORS AND WINDOWS

12-8.01 HINGED DOORS

GENERAL.--This work shall consist of furnishing and installing hinged doors and frames in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--Manufacturer's descriptive data, installation instructions for fire rated assemblies and a door schedule shall be submitted for approval. The door schedule shall include a description of the type, location and size of each door and frame.

PRODUCTS.--

Wood door.--

Wood door shall be Woodwork Institute of California (WIC) "Custom" grade flush, hollow or solid core wood doors as shown on the plans. Face shall be paint grade hardwood veneer except as otherwise shown on the plans. Doors shall bear the WIC quality grade mark or shall be accompanied by a Certificate of Compliance certifying compliance with the WIC quality specified herein. Certificates of Compliance shall be in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

Where fire rated doors are required, solid core doors shall be listed and labeled for the fire rating shown on the plans.

Metal door.--

Metal door shall be flush, seamless steel door factory prepared and reinforced to receive hardware and having cold rolled stretcher leveled sheet steel face sheets not less than 1.2 mm thick (18-gage). Face sheets shall be bonded with thermosetting adhesive to rigid board honeycomb or precured foam core; or face sheets shall be welded to all parts of an assembled grid of cold formed pressed metal stiffeners and framing members located around edges, ends, openings and at all locations necessary to prevent buckling of face sheets. Seams shall be tack welded, filled and ground smooth. Bottom edge and internal stiffeners of grid type core shall have moisture vents. Welds on exposed surfaces shall be ground smooth. Louvered or glazed openings shall be provided where shown on the plans.

Where fire rated doors are required, doors shall be listed and labeled for the fire rating shown on the plans.

Active leaf of double door shall have a full height astragal of 3 mm flat bar or folded sheet strip, not less than 1.5 mm thick (16-gage), welded on the outside of the active leaf.

Door shall be cleaned and treated by the bonderized process or approved phosphatizing process and then given one factory application of metal protective rust inhibitive primer. Primer shall not contain lead type pigments.

Aluminum door.--

Aluminum door shall be glazed door with medium stiles of not less than 3 mm nominal wall thickness, clear anodized, thermally treated and artificially aged 6061 or 6063 extruded aluminum alloy tubing reinforced to receive hardware.

Glazing for doors.--

Glazing for doors shall be safety glass as specified under "Glazing" in Section 12-8, "Doors and Windows," of these special provisions. Glazing shall be not less than 5 mm thick.

Door louvers.--

Door louvers shall be inverted V-type factory primed, galvanized sheet steel louvers. Exterior door louvers shall not be removable from outside of the building. Louvers at exterior doors shall have inside mounted bronze insect screens.

Fire rated louvers.--

Fire rated louvers shall be factory fabricated, multi-blade adjustable fire damper type units of galvanized steel sheet not less than 1.5 mm thick (16-gage) with a 71°C fusible link and removable bronze 16 x 16 mesh insect screen mounted on the inside of the units. Fire rated louvers shall be listed for the fire rating shown on the plans.

Louvers shall be cleaned and treated by the bonderized process or approved phosphatizing process and then given one factory application of metal protective rust inhibitive primer. Primer shall not contain lead type pigments.

Pressed metal frame.--

Pressed metal frame shall be not less than 1.5 mm thick (16-gage) sheet steel with integral stop, mitered corners, face welded and ground smooth corners. Frames shall be reinforced for all hardware and shall be cleaned and treated by the bonderized process or an approved phosphatizing process and then given one factory application of metal protective rust inhibitive primer. Primer shall not contain lead type pigments.

Frames for fire rated doors shall be listed for the same rating shown on the plans for fire rated doors.

Aluminum frame.--

Aluminum frame shall be manufactured by aluminum door manufacturer of clear anodized thermally treated and artificially aged 6061 or 6063 aluminum alloy extrusions with minimum nominal wall thickness of 3 mm. Frame shall be reinforced to receive hardware.

Sealants.--

Sealants shall be ultraviolet and ozone resistant, gun grade polysulfide or polyurethane, multicomponent, Federal Specification: TT-S-227.

EXECUTION.--

INSTALLATION.--Doors and frames shall be installed rigidly, securely, plumb and true and in such a manner that the doors operate freely without rubbing or binding. Clearance between frame and door shall be not more than 3 mm. The exterior frame shall be sealed weathertight.

Pressed metal frames shall be secured with clips and anchors as shown on the plans.

Fire rated assemblies shall be installed according to the manufacturer's recommendations.

Fire rated assemblies shall include doors, door frames, automatic smoke-actuated closers, self-closing mechanisms, panic hardware, wire glass, and fire rated louvers. Assemblies shall be approved by the California State Fire Marshal.

PAINTING.--Except for the primer application specified herein, doors and frames shall be cleaned, prepared and painted in accordance with the requirements specified under "Painting" in Section 12-9, "Finishes," of these special provisions.

12-8.02 ACCESS DOORS

GENERAL.--This work shall consist of furnishing and installing access doors in accordance with the details shown on the plans and these special provisions

SUBMITTALS.--Manufacturer's descriptive data and installation instructions shall be submitted for approval.

PRODUCTS.--

Access doors.--

Access doors shall be factory assembled and factory prime painted steel. Door panel shall be 1.90 mm thick (18-gage) and door frame shall be 1.5 mm thick (16-gage), 30 min label rating and for flush installation use in drywall. The door and frame assembly shall have standard screw driver operated cam locks, concealed springs or continuous piano hinge and inside release handle. Access doors shall be by Acudor, The Williams Bros Corporation of America, or equal.

EXECUTION.--

INSTALLATION.--Access doors shall be installed in accordance with the manufacturer's recommendations.
The access door assemblies shall be painted to the match the color of the adjacent surrounding surfaces.

12-8.03 SECTIONAL OVERHEAD DOORS

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing sectional overhead doors in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data, roughing-in diagram and installation instructions for each size and type of door shall be submitted for approval.

Manufacturer's descriptive data shall include door panel construction and material thickness, door track size and material thickness, counterbalance spring service life and motor operator specifications.

Materials list shall contain all items proposed to be furnished and installed under this section of these special provisions.

Working drawings shall show details of special components and installations which are not fully dimensioned in manufacturer’s descriptive data.

QUALITY ASSURANCE.--

Single source.--Each sectional door shall be provided as a complete unit produced by one manufacturer, including frames, sections, bracket guides, tracks, counterbalance mechanisms, hardware, operators and installation accessories, to suit opening and head room available.

Wind loading.--Design and reinforce section overhead doors to withstand a 960 PA wind load with a midspan deflection not to exceed 1/120 span.

PART 2.- PRODUCTS

MANUFACTURERS.--

Available manufacturers.--Subject to compliance with the specifications, manufacturers offering products which may be incorporated into the work include, but are not limited to the following: Clopay Corp.; Overhead Door Corp.; Raynor Garage Doors.

STEEL SECTIONS.--

Door sections.--

Door sections shall be galvanized commercial quality steel sheets and a minimum of G60 zinc coating complying with ASTM Designation: A 525.

Face sheets shall be not less than 0.86mm (20-gage). Back sheet shall be not less than 0.45 mm (26-gage).

Sections shall be fabricated from a single sheet to provide sections not more than 610 mm high, and nominal 50 mm deep. Meeting horizontal edges shall be rolled to a continuous shiplap, rabbeted. or keyed weather seal, with a reinforcing flange return.

Intermediate and end stiles shall be 1.52 mm (16-gage) galvanized steel welded in place. Intermediate stiles shall be spaced at not more than 1220 mm on center.

Bottom section shall be reinforced with a continuous channel or angle conforming to the bottom section profile.

Insulation.--

Insulation shall be the manufacturer's glass fiber, polystyrene or polyurethane foam type insulation and have an R-Value not less than 1.4 K•m^2/W.

Finish.--

Finish shall be the manufacturer's standard baked on polyester or epoxy prime and finish coats, applied to interior and exterior faces.

TRACKS, SUPPORTS. AND ACCESSORIES.--

Door tracks.--

Door tracks shall be the manufacturers standard galvanized steel track system, sized for door size and weight, and designed for the clearances shown on the plans. Complete track assembly shall be provided, including brackets, bracing and reinforcing for rigid support of ball bearing roller guides, for required door type and size.

Track reinforcement and supports.--

Track reinforcement and supports shall be galvanized steel. Tracks shall be reinforced and supported as required for the size and weight of door to provide strength and rigidity, and to ensure against sag, sway and vibration during operation.

Door seals.--

Doors shall have perimeter gasket seals at head and jambs and seal shall have a replaceable vinyl or neoprene bottom seal.

Vision panels.--

Vision panels shall be door manufacturer's standard glazed opening with wire safety glass, metal frame and vinyl or neoprene glazing gasket for water tight construction. The approximate size shall be as shown on the plans.

Louvers.--

Louvers shall be 50 mm deep Z-shaped blades, formed from galvanized sheet steel not less than 0.68 mm thick (24-gage), set in a continuous channel frame, and with a 6 mm mesh bird-screen in a removable frame on inside.

Adjustable louvers.--

Adjustable louvers shall be factory fabricated units of extruded aluminum alloy not less than 2.0 mm thick or galvanized steel not less than 0.91 mm thick (20-gage) with standard "Z" type blades set in a continuous channel frame, with a 6 mm mesh galvanized bird-screen in a removable frame on the inside.

Blades shall have center pivot on 10 mm aluminum rods in stainless steel ball bearings in cadmium plated races.

Adjustable louvers shall be equipped with hand-hold fixed to the operating bar for easy adjustment with wingnut spring tension to lock louvers in desired position.

HARDWARE.--

General.--Hardware shall be heavy-duty, rust-resistant, with galvanized or cadmium-plated or stainless steel fasteners, to suit type of door.

Hinges.--

Heavy steel hinges shall be provided at each end stile and at intermediate stiles, per manufacturer's recommendations for size of door.

Rollers.--

Rollers shall be heavy-duty with steel ball bearings in case-hardened steel races, mounted to suit slope of track. Rollers shall have case-hardened tires.

Lifting handles, locks and latches.--

Lifting handles for manually operated doors shall be galvanized steel.

Locking bars shall be single side operable from inside only.

Locking device assembly shall be fabricated with mortise lock, spring loaded dead bolt, chromium-plated operating handle, cam plate and adjustable locking bar to engage through slots in tracks.

COUNTERBALANCE MECHANISMS.--

Counterbalance spring.--

The door shall have a torsion spring counterbalance on a continuous cross header shaft; the entire assembly shall be all-bearing mounted. The spring shall have a rated service life of not less than 25,000 cycles.

ELECTRIC DOOR OPERATORS.--

Door operator shall be heavy duty, commercial type. Motor shall be a 208-volt, single-phase, high starting torque motor with single reduction worm gear, completely housed and running in an oil bath. Motor shall be of sufficient capacity to raise and lower the door at speed of approximately 0.2 m per second.

Door operator and assembly shall be equipped with solenoid brake, limit switches for upper and lower limits of door travel, emergency hand chain with electrical interlock to break motor circuit when hand chain is engaged, 3-button operating station in a NEMA Type 4 enclosure, and a factory wired NEMA Type 1 control panel.

Control panel shall contain an instrument transformer, reversing magnetic contractor with overload relay, and all necessary control relays and other devices required for complete automatic operation of the door. Motor shall be removable for repair without affecting emergency operation. Motor shall be centermounted or sidemounted as shown on the plans.

Reversing door edge.--

Reversing door edge shall be an electrically or pneumatically operated safety device extending across the full width of the bottom of the door which shall cause the door to stop automatically and return to open position upon contact with any obstruction.

PART 3.- EXECUTION

INSTALLATION.--

General.--Door, track, and operating equipment, complete with necessary hardware, jamb and head mold stops, anchors, inserts, hangers, and equipment supports, shall be installed in accordance with the final drawings, manufacturer's installation instructions and these special provisions.

Vertical track assembly shall be fastened to framing at not less than 610 mm on center. Horizontal track shall be hung from structural overhead framing with angle or channel hangers, welded or bolted into place. Sway bracing, diagonal bracing, and reinforcing as required for rigid installation of track and door operating equipment.

12-8.04 POWER OPERATED ROLL-UP STEEL DOOR

GENERAL.--This work shall consist of furnishing and installing electric motor operated, roll-up door in accordance with the details shown on the plans and these special provisions.

The mountings for the door shall be located above the ceiling for complete concealment.

SUBMITTALS.--Manufacturer's descriptive data, materials list, working drawings and installation instructions shall be submitted for approval.

Manufacturer's descriptive data shall show manufacturer's name and conformance to these special provisions for door panel construction and material thickness, curtain guide size and material thickness, counterbalance spring service life, and motor operator specifications.

Materials list shall contain all items proposed to be furnished and installed under this section of these special provisions.

Working drawings shall show details of the door frame and track, elevations of the door design type, details of the sectional door panels, and all details required for complete installation and anchorage.

PRODUCT.--

Curtain.--

Curtain shall be interlocking flat faced sheet steel slats; sectional dimensions shall be 38 mm to76 mm in height and 13 mm to 22 mm in depth. Sheet steel shall be galvanized and not less then0.91 mm (20 gage) thickness. Both ends of alternate slats shall be fitted with endlocks. The bottom of the curtain shall be reinforced with two steel angles and provided with a pressure sensitive bottom edge. Angles shall be not less than 3.175 mm thick.

Curtain guides.--

Curtain guides shall be fabricated from channels and angles of galvanized steel bolted together with10 mm diameter bolts at 762 mm maximum spacing. All mounting holes in wall angle shall be slotted to allow for heat expansion.

Brackets.--

Bracket shall be constructed of heavy steel plate and reinforced to carry full door weight, roller shaft, hood, curtain and the motorized operator. Sealed ball bearings shall be furnished at all rotating support points. Bracket shall be attached to guide wall angle with a minimum of three 13 mm diameter bolts.

Roller shaft.--

Steel pipe or welded type with internal counterbalancing spring and sized to prevent distortion of the slats and deflection greater than 0.762 mm per 0.3048 m of span. Journal shall be fitted with self-lubricating bronze bearings of permanently lubricated shielded or sealed ball bearings.

Counterbalancing spring.--

Oil-tempered, helical torsion springs spring sized to provide sufficient torque for easy operation of curtain from any position. Spring tension shall be adjustable from outside without removing the hood or skirting. Spring shall be rated for a minimum of 10,000 cycle service life.

Manual curtain operator.--

Manually operated, continuous chain driven mechanism with machine cut gears. Galvanized chain shall extend to within approximately 610 mm of floor and be provided with a hand-chain keeper.

Hood.--

Hood shall be fabricated of galvanized sheet steel formed to fit the contour of the brackets and shall be not less than 0.76 mm (22 gage) nominal thickness, reinforced to prevent bending or sagging and to provide a rigid, quiet and vibrationless installation.

Motor.--

Instantly reversing type, single-phase, 240-volt minimum 0.37 kilowatt induction motor of size and type recommended by the door manufacturer to adequately power the unit for proper operation of the door. Motor shall be equipped with a nonfusible, combination reversible type line voltage starter in a NEMA type l enclosure. Starter shall have double break silver contacts and one bi-metallic thermal overloads unless protection is provided in the motor.

Reversing door edge.--

A safety device extending across the full width at the bottom of the door which will cause the door to stop automatically and return to open position upon contact with any obstruction.

Controls.--

Limit switches, remote control panel (3-button) control, and solenoid operated brake.

EXECUTION.—

The power operated roll-up steel door and accessories shall be installed in accordance with the manufacturer's instructions and shall operate freely without binding.

Curtain guides shall be secured, reinforced, braced and supported as necessary to prevent swaying and vibration of the door. Door control panel shall be located approximately 1219 mm above the floor at a convenient location on the interior wall adjacent to the roll-up door as shown on the plans. Conduit and wiring of adequate size shall be installed between the door control panel and the associated overhead door junction box.

Door shall be locked with an automatic brake and a hand-chain keeper. Locking device shall be installed on the inside of the door.

FINISH.—

Door curtain shall have one coat of factory applied baked on polyester primer and all other galvanized parts of the door shall have one coat of factory applied rust inhibitive primer. Final finish shall be field applied in accordance with the requirements specified under "Painting," in Section 12-9, of these special provisions.

12-8.05 WINDOWS

PART 1.- GENERAL

SUMMARY.--This work shall consist of furnishing and installing windows in accordance with the details shown on the plans and these special provisions.

Windows shall be commercial (C) grade aluminum prime windows unless otherwise shown on the plans.

Windows shall meet the requirement of NAFS-1, “Voluntary Performance Specification for Windows, Skylights, and Glass Doors,” and shall meet the C30 (Commercial) product designation unless otherwise shown on the plans. Windows shall be labeled with the AAMA label.

Finish for windows shall be Architectural Class I, clear anodized finish meeting American Architectural Manufacturer's Association Standard 611 unless otherwise shown on the plans.

Glazing for windows shall be in accordance with the requirements specified under "Glazing" in Section 12-8, "Doors and Windows," of these special provisions.

CERTIFICATES OF COMPLIANCE.--Certificates of compliance shall be furnished for all windows in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

SUBMITTALS.--Manufacturer's descriptive data, installation instructions and schedule shall be submitted for approval.

Manufacturer's descriptive data and installation instructions shall show window elevations, plan views, full size sections, anchoring details to all substrates, anchors and hardware.

Installation schedule shall show location, size and type for each window.

PART 2.- PRODUCTS

Door and transom windows.--

Door and transom windows shall be door or door frame manufacturer's standard window framing, glazing stops and glazing accessories.

Fixed windows.--

Fixed windows shall be non-operable glazed panel inserted into a frame to include muntins, glazing stops, and glazing accessories.

Aluminum.--

Aluminum shall be extruded 6063-T5 aluminum alloy.

Screws, fasteners and window accessories.--

Screws, fasteners and window accessories shall be non-corrosive metals compatible with aluminum except guides and rollers may be vinyl and nylon respectively. Finish for locks, operators, strikes, keepers and other metal hardware shall match window finish.

Weatherstripping.--

Weatherstripping shall be continuous, replaceable type, wool pile mounted in metal or double runs of ultraviolet resistant neoprene or vinyl.

Vent screen.--

Vent screen shall be aluminum frame with 18 x 14 mesh aluminum screening and polyvinyl-chloride splines. Screen frames shall be removable from interior of building. Finish of screen frame shall match window finish.

Sealant.--

Sealant shall be single-component, solvent type acrylic, self-leveling, non-sag, conforming to Federal Specification: TT-S-230.

Tape.--

Tape shall be compatible with sealant; Pecora, "B-44 Extra-Seal;" Pittsburg Plate Glass, "Duribbon;" Protective Treatment, "PTU 606;" Tremco, "440 Tape;" or equal.

PART 3.- EXECUTION

FABRICATION.--Frame shall be accurately machined and fitted to hairline joinery that develops the members. Joints shall be factory sealed weathertight.

DELIVERY AND STORAGE.--Windows shall be delivered in original, unopened, unbroken containers, wrappings, or bags with labels bearing the brand name, name of manufacturer or supplier, standard of manufacture, and product description.

Windows and accessories shall be stored off the ground, kept dry, fully protected from weather and damage

INSTALLATION.--Window units shall be set straight, level, plumb and in true alignment in prepared openings. Windows shall be centered in openings. Clearance between the window unit and the building framing shall be from 4 mm to 6 mm at the sides and 13 mm at the top. Ventilator sash shall be adjusted after glazing for easy, smooth and proper operation.

The installation shall be flashed and sealed weathertight.

All aluminum surfaces in contact with masonry, steel or other incompatible materials shall be isolated with pressure sensitive tape, zinc chromate primer, bituminous paint or such other material recommended by the window manufacturer and approved by the Engineer.

12-8.06 FINISH HARDWARE

PART 1.- GENERAL

SUMMARY.--

This work shall consist of furnishing and installing hardware items for doors in accordance with the details shown on the plans and these special provisions.

Hardware assemblies shall comply with the fire code and the disabled accessibility requirements indicated on the plans and specified in these special provisions.

SUBMITTALS.—

Manufacturer's technical information and catalog cuts for each item of door hardware and a door hardware schedule shall be submitted for approval prior to installation.

Manufacturer's catalog cuts shall include catalog numbers, material, grade, type, size, function, design, quality and finish of hardware.

The door hardware schedule shall indicate the location and size of door opening, the door and frame material, and the size, style, finish and quantity of the hardware components required.

FINISHES.—

Hardware shall be provided with standard US 26D metal plated finish.

KEYING INSTRUCTIONS.—

New facilities shall have a building master key system established.

Locks shall have cylinders with figure eight interchangeable cores with six pin barrels. Permanent cores and keys shall be delivered to the Engineer for final installation at completion of project.

The Contractor shall also provide figure eight interchangeable cores for use during construction which shall remain the property of the State.

The Contractor shall provide cylinders for use during construction. Construction cylinders shall remain in place until permanent cylinders are installed. Construction cylinders shall remain the property of the Contractor.

Key bows shall be stamped "State of California" and "Do Not Duplicate."

PART 2.- PRODUCTS.--

GENERAL.—

Door hardware equal in material, grade, type, size, function, design, quality and manufacture to that specified herein may be submitted for approval.

Butt hinges.--

Butt hinges shall be steel, 1 1/2-pair per door unless otherwise specified or shown on the plans. Nonremovable pins shall be provided at outswing doors including T3, L14 and L8. Hinge size shall be 114 mm x 114 mm unless otherwise noted. Outswing exterior doors to have stainless steel hinges.

Standard weight hinges shall be:

Hager	BB 1279/BB1191
McKinney	TB 2714
Stanley	BB 179
or equal.	

Heavy weight hinges shall be:

Hager	BB 1168/BB1199
McKinney	T4B 37869
Stanley	BB 168
or equal.	

Mortise locksets, latchsets and privacy sets.--

Mortise locksets, latchsets and privacy sets shall be steel case with 32 mm x 203 mm face plate and 70 mm backset. Door and frame preparation for mortise locksets, latchset and privacy sets shall conform to ANSI A115.1.

Lever operated lockset shall be:

Best	35H 6FW 15H
Falcon	LM521 DG
Schlage	L9453P x 06
or equal.	

Lever operated latchset:

Best	35H 0N 15H
Falcon	LM101 DG
Schlage	L9010 x 06
or equal.	

Lever operated privacy set:

Best	35H 0L 15H
Falcon	LM311 DG
Schlage	L9040 x 06
or equal.	

Cylindrical locksets, latchsets and privacy sets.--

Cylindrical locksets, latchsets and privacy sets shall be steel chassis, 54 mm diameter, 70 mm backset. Door and frame preparation for cylindrical lockset, latchsets and privacy sets shall conform to ANSI A115.1.

Lever operated lockset shall be:

Best	83K6 AB 9C
Schlage	D53PD RHO
Falcon	LY501 DG
or equal.	

Lever operated latchset shall be:

Best	83K ON 9C
Falcon	LY101 DG
Schlage	D10S RHO
or equal.	

Lever operated privacy set shall be:

Best	83K OL 9C
Falcon	LY301 DG
Schlage	D40S RHO
or equal.	

Message dead locks.--

Message dead locks shall have 25 mm throw bolt, 70 mm backset, inside thumb turn, with an "OCCUPIED/VACANT" message on the outside face of the lock.

Cylindrical dead locks.--

Cylindrical dead locks shall have 25 mm throw bolt with concealed hardened steel inserts and one inch diameter bolt housing, 70 mm backset.

Single cylinder dead lock with inside thumb turn shall be:

Best	83T 7K
Falcon	D441
Schlage	B460P
or equal.	

Double cylinder dead lock shall be:

Best	83T 7M
Falcon	D431
Schlage	B462P
or equal.	

Electric strike.--

Electric strike shall be :

Von Duprin	6000 series
Folger Adams	1000 series
Rutherford	4104 series
or equal	

Flush bolts.--

Flush bolts shall be installed at the top and bottom of the inactive leaf of pairs of doors. Provide automatic bolts on UL rated pairs of doors.

Flush bolts for manual operation shall be:

Builders Brass	5020
Glynn Johnson	FB6
H.B. Ives	457
or equal.	

Flush bolts for automatic operation shall be:

Door Control	840
Glynn Johnson	FB31P
H.B. Ives	559
or equal.	

Coordinators.--

Coordinators shall be installed at pairs of UL rated doors and at pairs of doors having panic devices.

Coordinators shall be:

Door Control	600
Glynn Johnson	GJCOR
H.B. Ives	936
or equal.	

Door closers.--

Parallel arms for closers shall be installed at outswing exterior doors. Closers shall have sprayed finish to match other hardware on door.

Door closers shall be:

LCN	4040
Russwin	R900 series
Norton	85001
Dorma	7800
or equal.	

Panic devices.--

Rim type panic devices shall be installed at single doors and on the active leaf of pairs of doors, unless indicated otherwise. A vertical rod device shall be provided for the inactive leaf of pairs of doors. Dogging devices shall be omitted at UL rated door openings.

Panic devices with outside key operation shall be:

Monarch	18R-P
Von Duprin	99NL
Dorma	5000 series
or equal.	

Panic devices with exit only operation shall be:

Dorma	5000 series
Monarch	18R-BA
Von Duprin	99EO
or equal.	

Panic devices with vertical rod operation shall be:

Monarch	18-C-LE
Von Duprin	9947L5000 Series
Dorma	
or equal.	

Pushplates and pullplates.--

Pushplates and pullplates shall be 102 mm x 406 mm x 1.52 mm (16-gage). Grips shall be 25 mm diameter with 38 mm standoff and 203 mm center to center fastening, unless indicated otherwise.

Pushplates shall be:

Builders Brass	47
Quality	40
Trimco	1001-3
Ives	8200
or equal.	

Pullplates shall be:

Builders Brass	47x290-1
Quality	1515
Trimco	01-3 x 1193-2
Ives	8302-6 3.5x15
or equal.	

Kickplates.—

Kickplates shall be 254 mm in height x 51 mm less than door width x 1.52 mm (16-gage).

Kickplates shall be:

Builders Brass	37
Quality	48
Trimco	6000
Ives	8400
or equal.	

Mop plates.—

Mop plates shall be stainless steel, 1.52 mm (16-gage), 152 mm in height x 51 mm less than the door width.

Mop plates shall be:

Builders Brass
Ives
or equal.

Floor mounted stops.—

Floor mounted stops shall be dome type. The height of the stop shall be determined by the clearance required when a threshold is used or not used.

Stops for openings without thresholds shall be:

Builders Brass	8061
Quality	331
Trimco	1210
Glynn Johnson	FB13
or equal.	

Stops for openings with thresholds shall be:

Builders Brass	8063
Quality	431
Trimco	1213
Glynn Johnson	FB14
or equal.	

Wall or door mounted door stop.--

Wall or door mounted door stop shall have a 95 mm projection and 3-point anchoring.

Wall or door mounted door stop shall be:

Builders Brass	W96
Quality	38
Trimco	1236-1/4-2
Glynn Johnson	FB35
or equal.	

Wall mounted door stop and holder.—

Wall mounted door stop and holder shall be:

Builders Brass	W140, W141X
Quality	36, 136
Trimco	1202, 1207
Glynn Johnson	W27
or equal.	

Wall bumpers.—

Wall bumpers base diameter shall be 64 mm with a 25 mm projection.

Bumpers shall be:

Builders Brass	WC9
Quality	302
Trimco	1272-1/4-CCS
Glynn Johnson	60C
or equal.	

By-passing door hardware.--

Door track shall be extruded aluminum:

Grant	8004
Johnson	2200
Stanley	72857
or equal.	

Carrier sets shall be single wheel, side mount carriers:

Grant	6320 and 6330
Johnson	2216 and 2238
Stanley	2850-1 and 2850-2
or equal.	

Finger pull shall be approximately 89 mm x 38 mm x 13 mm deep, recessed into the door:

Builders Brass	9365-aluminum
Ives	SP223-B26D
Elmes door hardware	Product No. T201-01-023
or equal.	

Floor guide shall be non-adjustable, 1.52 mm (16-gage) steel with nylon covered steel uprights, for 35 mm bypassing door.

Automatic door bottom.--

Automatic door bottom shall be heavy duty, full mortise.

Bottom shall be:

Pemko	434 AR
Zero	360
Hager	730S
or equal.	

Thresholds, rain drips, door sweeps and door shoes.--

Thresholds, rain drips, door sweeps and door shoes shall conform to the sizes and configurations shown on plans. Thresholds at door openings with accessibility requirements shall not exceed 13 mm in height.

Threshold, rain drip, door sweep and door shoe manufacturers shall be Pemko, Reese, Zero, National Guard Products, or equal.

Threshold bedding sealant.--

Threshold bedding sealant shall conform to Federal Specification: SS-C-153.

Weatherstrip and draft stop.--

Weatherstrip and draft stop shall conform to the sizes and shapes shown on plans. Assemblies shall be UL listed and shall be provided where shown on the plans or as specified in these special provisions.

Weatherstrip (wool pile).--

Weatherstripping (wool pile) shall be continuous, replaceable type, wool pile mounted in metal or double runs of ultraviolet resistant neoprene or vinyl.

Door signs and name plates.--

Door signs and name plates shall be as specified under "Signs" in Section 12-10, "Specialties," of these special provisions.

DOOR HARDWARE TOLL BOOTH

Butt hinges.--

Butt hinges shall be steel, 1 1/2-pair per door unless otherwise specified or shown on the plans.

Standard weight hinges shall be:

Hager	BB 1191
McKinney	TB 2314
Stanley	BB 191
or equal.	

Lockset.—

Lockset shall have a dead bolt with 25 mm throw, cylinder on outside and thumb turn on inside:

Lever operated lockset shall be:

Corbin	9549X799L
Schlage	L6453X20X71 5
or equal.	

Door closers.--

Parallel arms for closers shall be installed at outswing exterior doors. Closers shall have sprayed finish with corrosion infiltrating prime coat. Closers shall be rated by the manufacturer for location and width of door to be used, except parallel arm closers shall be rated for width at least 100 mm greater than actual door width.

Door closers shall be:

LCN	4014
Norton	7704
Corbin	110
or equal.	

Door holder.—

Door holder shall be door mounted, lever type, with a 25 mm by 50 mm base and 4 mounting screws and a 100 mm rubber tipped leg:

Floor mounted door guide.—

Floor mounted door guide shall be stainless steel, angle 38 mm by 38 mm by 51 mm long with countersunk machine screw and expansion shield.

Kickplates.—

Kickplates shall be 254 mm in height by 1.6 mm thick by width 51 mm less than door width with beveled edges.

Floor mounted door stop.—

Floor mounted door stop shall be stainless steel dome shaped, approximately 51 mm diameter base with machine screw and expansion shield. Height of stop shall be as required to suit the conditions.

Overhead track and accessories.—

Overhead track and accessories shall have one assembly per sliding door and folding door. Tracks shall be stainless steel, one hanger per folding door, 2 hangers per sliding door. Hangers shall have bearings, rated for 150-pound minimum capacity. Wheel pendants shall be drop forged and equipped with hardened machined steel thrust rollers. Folding door hangers shall be pivotable. All components shall be corrosion resistant to marine environment.

Gate hinge.—

Gate hinge shall be continuous, 64 mm stainless steel hinge.

Gate latch.—

Gate latch shall be44 mm throw with keeper. Handle shall lock into position perpendicular to floor.

Threshold.--

Threshold shall be extruded aluminum, approximately 152 mm wide with configuration shown on the plans.

Weatherstripping.--

Weatherstripping (wool pile) shall be continuous, replaceable type, wool pile with metal backing.

Weatherstripping (sweep type) shall be door sweep type, 3 mm ultraviolet resistant neoprene strip in continuous extruded aluminum holder.

Weatherstripping (silicone bubble type) shall be self-adhesive silicone bubble type at door sides and top.

TOLL BOOTH CABINET HARDWARE

Drawer and swing door flush pulls.—

Drawer and swing door flush pulls shall be stainless steel, approximately 51 mm by 76 mm and 16 mm deep.

Hinges.—

Hinges shall be continuous 51 mm wide stainless steel.

PART 3.- EXECUTION

DOORS AND FRAMES.--Doors and frames shall be set square and plumb and be properly prepared before the installation of hardware.

INSTALLATION.--Hardware items shall be accurately fitted, securely applied, and adjusted and lubricated in accordance with the manufacturer's instructions. Installation shall provide proper operation without bind or excessive play.

Hinges shall be installed at equal spacing with the center of the end hinges not more than 244 mm from the top and bottom of the door. Pushplates and door pulls shall be centered 1118 mm from the finished floor. Locksets, latchsets, privacy sets and panic exit mechanisms shall be 1024 mm from the finished floor. Kickplates shall be mounted on the push side of the doors, 25 mm clear of door edges.

Thresholds shall be set in a continuous bed of sealant material.

Door controls shall be set so that the effort required to operate doors with closers shall not exceed 3.9 kg maximum for exterior doors and 2.7 kg maximum for interior doors. The effort required to operate fire doors may be increased above the values shown for exterior and interior doors but shall not exceed 6.8 kg maximum.

Door stops located on concrete surfaces shall be fastened rigidly and securely in place with expansion anchoring devices. Door stops mounted elsewhere shall be securely attached with wood screws or expansion devices as required.

Backing shall be provided in wall framing at wall bumper locations.

The location and inscriptions for door signs and name plates shall be as shown on the plans.

Hardware, except hinges, shall be removed from surfaces to be painted before painting.

Upon completion of installation and adjustment, the Contractor shall deliver to the Engineer all dogging keys, closer valve keys, lock spanner wrenches, and other factory furnished installation aids, instructions and maintenance guides.

DOOR HARDWARE GROUPS AND SCHEDULE.--Hardware groups specified herein shall correspond to those shown on the plans:

DESIGNATION
M= main floor
L=lower floor
OB=observation gallery
T=tunnel

GROUP 1: SLIDING STOREFRONT EXTERIOR: doors M1, M8

per manufacturer
aluminum threshold

GROUP 2: EXTERIOR STOREFRONT EXIT: doors M9

1 1/2-pair butt heavy duty stainless steel hinges
1 each door closer
1 each lever handle cylindrical lockset
1 each floor mounted door stop
1 each frame weatherstripping
1 each aluminum threshold
1 each door shoe with rain drip

GROUP 3: INTERIOR SLIDING STOREFRONT: doors M7

per manufacturer

GROUP 4: EXTERIOR EXIT: doors M40,

1 1/2-pair butt hinges, heavy duty stainless steel
1 each door closer
1 each kick plate
1 each electric strike
1 each mortise lever handle lockset
1 each frame weatherstripping
1 each wall door stop
1 each aluminum threshold
1 each door shoe with rain drip

note: This door will have electric strike and remote and card operation.

GROUP 4A: EXTERIOR EXIT: door L15

1 1/2-pair butt hinges, heavy duty stainless steel
1 each door closer
1 each kick plate
1 each mortise lever handle lockset
1 each frame weatherstripping
1 each wall mounted door stop
1 each aluminum threshold
1 each door shoe with rain drip

GROUP 5: RATED (60 MINUTES) EQUIPMENT/STORAGE DOOR: doors M41, L3,L5, L6, T3

1 1/2-pair butt hinges
1 each kick plate
1 each mortise lever handle lockset
1 each frame weatherstripping
1 each floor mounted door stop
1 each aluminum threshold
1 each door closer

GROUP 5A: RATED (60 MINUTES) EQUIPMENT/STORAGE DOOR: doors, L14, T1

1 1/2-pair butt hinges
1 each kick plate
1 each mortise lever handle lockset
1 each smokeseal
1 each floor mounted door stop
1 each aluminum threshold
1 each door closer

GROUP 6: RATED (60 MINUTES) EQUIPMENT DOUBLE DOOR: doors L1, L2,

3-pair butt hinges, heavy weight
1 each smokeseal
2 each kick plates
1 each mortise lever handle lockset
2 each floor mounted door stop
1 each aluminum threshold
1 each astragal on active leaf
1 each dust proof strike
2 each door closer

GROUP 6A: RATED (60 MINUTES) EQUIPMENT DOUBLE DOOR: doors L4, L10

3-pair butt hinges, heavy weight
1 each smokeseal
2 each kick plates
1 each mortise lever handle lockset
2 each floor mounted door stop
1 each aluminum threshold
1 each astragal on active leaf
1 each coordinator
1 each dust proof strike
2 each door closer

GROUP 7: RATED (90 MINUTES) SHOP/EQUIPMENT DOOR: doors M42,

2-pair butt hinges, heavy weight
1 each smokeseal
1 each floor mounted door stop
1 each kick plate
1 each cylindrical lever handle lockset
1 each door closer

GROUP 7A: RATED (60 MINUTES) SHOP/EQUIPMENT DOOR: doors L7,

1 1/2-pair butt hinges, heavy weight
1 each smokeseal
1 each floor mounted door stop

1 each kick plate
1 each cylindrical lever handle lockset
1 each aluminum threshold
1 each door closer

GROUP 8: RATED (90 MINUTES) SHOP DOUBLE DOORS: doors L8

4-pair butt hinges, heavy weight stainless steel
1 each smokeseal
2 each kick plates
1 each cylindrical lever handle lockset
2 each floor mounted door stop
1 each rated coordinator
1 each astragal on active leaf
1 each aluminum threshold
1 each auto flush bolts
1 each dust proof strike
2 each door closers

GROUP 9: STORAGE DOOR: doors M14, M36

1 1/2-pair butt hinges
1 each flush bolt
1 each kick plate
1 each cylindrical lever handle lockset
1 each floor mounted door stop
1 each door shoe with rain drip

GROUP 10: INTERIOR EQUIPMENT DOOR: doors M6, M24, M29, M32, L9

1 1/2-pair butt hinges
1 each kick plate
1 each cylindrical lever handle lockset
1 each floor mounted door stop

GROUP 11: SINGLE OCCUPANCY RESTROOM: doors M2, M3, M12, L12, L13, OB2

1 1/2-pair butt hinges
1 each kick plate
1 each cylindrical lever handle privacy set
1 each floor mounted door stop
1 each message dead lock with "occupied message"

GROUP 12: MULTIPLE ACCOMMODATION ROOM: doors M10, M19, M13, M15, M19, M25, M26, M27, M28, M30, M31

1 1/2-pair butt hinges
1 each kick plate
1 each door closer
1 each cylindrical lever handle latchset
1 each floor mounted door stop

GROUP 13: OFFICE: doors M5, M16, M17, M18, M34, M35, L11, L17

1 1/2-pair butt hinges
1 each kick plate
1 each cylindrical lever handle lockset
1 each floor mounted door stop

GROUP 14: INTERIOR DOUBLE EXIT DOOR: doors M20

1 1/2-pair butt hinges
1 each kick plate
1 each door closer
1 each cylindrical lever handle lockset
1 each floor mounted door stop

GROUP 15: INTERIOR DOUBLE EXIT DOOR: doors M11, M33

3-pair butt hinges
2 each kick plate
2 each door closer
1 each cylindrical lever handle latchset
2 each floor mounted door stop
1 each astragal on active leaf
1 each coordinator
1 each dust proof strike

GROUP 16: OVERHEAD DOOR: doors L16

per manufacturer
1 each flush bolt

GROUP 17: SALLYPORT OVERHEAD DOOR: doors M39

Per manufacturer
1 each SPECIAL XXX
1 each flush bolt

GROUP 18: VAULT: doors M37

Per manufacturer

GROUP 19: RATED (90 MINUTES) EXTERIOR EXIT: door M22

1 1/2pair butt hinges, heavy duty stainless steel
1 each kick plate
1 each door closer
1 each mortise lever handle lockset
1 each floor mounted door stop
1 each frame weatherstripping
1 each aluminum threshold
1 each door shoe with rain drip
1 each electric strike plate (remote operation)

GROUP 20: RATED (90 MINUTES) EXTERIOR EXIT: door M23

1 1/2pair butt hinges, heavy duty stainless steel
1 each kick plate
1 each door closer
1 each mortise lever handle lockset
1 each floor mounted door stop
1 each frame weatherstripping
1 each aluminum threshold
1 each door shoe with rain drip

GROUP 21: INTERIOR DOOR: door M4

1 1/2pair butt hinges
1 each kick plate
1 each door closer
1 each cylindrical lever handle lockset
1 each floor mounted door stop
1 each electric strike plate (remote operation/card operated)

GROUP 22: RATED (60 MINUTES) EQUIPMENT DOUBLE DOOR: door M38

3 pair butt hinges heavy duty stainless steel
1 each smokeseal
2 each kick plates
1 each mortise lever handle lockset
2 each floor mounted door stop
1 each astragal on active leaf
1 each coordinator
1 each electric strike plate (card operated)
1 each smokeseal
2 each door closer

GROUP 23: EXTERIOR EXIT: door OB1

1 1/2pair butt hinges, heavy duty stainless steel
1 each kick plate
1 each door closer, hold open feature
1 each mortise lever handle lockset
1 each frame weatherstripping
1 each wall mounted door stop
1 each door shoe with rain drip
1 each aluminum threshold

GROUP 24: RATED (90 MINUTES) EXTERIOR DOOR: door M21

1 1/2pair butt hinges, heavy duty stainless steel
1 each kick plate
1 each door closer
1 each mortise lever handle lockset
1 each floor mounted door stop
1 each frame weatherstripping
1 each aluminum threshold
1 each door shoe with rain drip

GROUP 25: INTERIOR EQUIPMENT DOOR AT TUNNEL: door T3

1 1/2pair butt hinges
1 each kick plate
1 each cylindrical lever handle lockset
1 each floor mounted door stop
1 each electric strike plate (card operated)

GROUP 26: RATED (60 MINUTES) TRASH AREA DOOR: doorL18

2 pair butt hinges, heavy duty stainless steel
1 each kick plate
1 each mortise lever handle lockset
1 each floor mounted door stop
1 each frame weatherstripping
1 each door closer

12-8.07 GLAZING

PART 1.- GENERAL

SUMMARY.---

This work shall consist of furnishing and installing glazing in accordance with the details shown on the plans and these special provisions.

Glazing shall consist of glass and acrylic sheets for windows, doors and other glazed openings.

All glass shall conform to ASTM Designation: C 1036 and the classifications specified herein and shall be clear glass except as noted.

All acrylic sheets shall conform to ASTM Designation: D 702, Type III, Grade 3.

Safety glass shall be furnished and installed at all locations designated in Consumer Product Safety Commission's Safety Standard For Architectural Glazing Materials 16 CFR 1201.

SUBMITTALS.—

A detailed list of glazing materials including glass, sheet, sealants, tapes, setting blocks, shims, compression seals, and glazing channels shall be submitted for approval. The list shall include a schedule of the materials to be used at each location.

LABELS.—

Each individual pane of heat strengthened or fully tempered glass shall bear an identification label in accordance with ASTM Designation: C 1048.

PART 2.- PRODUCTS

Sheet glass, float glass, or plate glass.--

Sheet glass, float glass, or plate glass shall be Type I, Class 1, Quality q4 or better, double strength for panes to 0.93 m^2, 5 mm thick for panes between 0.93 m^2 and 2.6 m^2, and 6 mm thick for panes over 2.6 m^2, except as otherwise shown on the plans.

Spandrel glass.--

Spandrel glass shall be heat-treated, (tint) float glass with a ceramic backing. Glass shall be evergreen spandrel, heat-treated in accordance with ASTM Designation: C 1048.

Safety glass.--

Safety glass shall conform to Consumer Product Safety Commission Safety Standard For Architectural Glazing Materials: 16 CFR 1201, and ANSI Standard Z97.1 and shall be one of the following:

Tempered glass.--

Tempered glass shall conform to ASTM Designation: C 1048, Kind FT, Condition A, Type 1, Quality q4 or better.

Wire glass.--

Wire glass shall be Type II, Class 1, Form 1, Mesh m1; 6 mm thick clear polished wire glass with diamond mesh.

Bullet resistant glass.--

Bullet resistant glass shall be multiple laminated glass fused to plastic interlayers; one inch minimum thickness; UL rated for medium power small arms. Glass shall be evergreen in color.

Tinted glass.--

Tinted glass shall be evergreen; all the same tint.

Insulating glass assemblies.--

Insulating glass assemblies shall be double pane units consisting of 2 pieces of glass separated by a spacer and hermetically sealed with double seal sealants. The entrapped air shall be at atmospheric pressure and maintained in a hydrated condition by a drying agent located in the spacer. Glass shall be evergreen in color. Insulating glass assemblies shall have a 13 mm minimum air space.

Acrylic plastic sheet.--

Acrylic plastic sheet shall be cast acrylic substrate with crosslinked fluorocarbon copolymer surface coating; 93 percent luminous transmission and 0.5 percent haze as determined by ASTM Designation: D 1003.

Seals, caulks, putties, setting blocks, shims, tapes, compression seals, felt, spacers, and channels.--

Seals, caulks, putties, setting blocks, shims, tapes, compression seals, felt, spacers, and channels shall be top grade, commercial quality, as recommended by the glass or sheet manufacturer and shall conform to the requirements in the publications of the Flat Glass Marketing Association.

PART 3.- EXECUTION

INSTALLATION.—

Glazing shall conform to the general conditions and applicable details in the publications of the Flat Glass Marketing Association.

Cut edges of tinted glass shall conform to the recommendations of the glass manufacturer. The glazier shall inspect each edge of tinted glass. Panes with edges that do not conform to the manufacturer's standards for tinted glass edges for sunny elevations shall not be used.

Panes shall be bedded fully and evenly, set straight and square within panels in such a manner that the pane is entirely free of any contact with metal edges and surfaces.

For all panes on the exterior of the building, the glazing on both sides of window panes shall provide a watertight seal and watershed. Seals shall extend not more than 2 mm beyond the holding members. A void shall be left between the vertical edges of the panes and the glazing channel. Weep systems shall be provided to drain condensation to the outside.

Panes in assemblies using extruded gasket glazing shall be set in accordance with the assembly manufacturer's instructions using gaskets and stops supplied by the manufacturer.

Laminated glass shall be set on setting blocks.

Whenever welding or burning of metal is in progress within 4.6 m of glazing materials, a protective cover shall be provided over exposed surfaces.

REPLACEMENT AND CLEANING.—

All broken or cracked glass and glass with scratches which reduce the strength shall be replaced before completion of the project.

Panes shall be kept clean of cement and plaster products, cleansers, sealants, tapes and all other foreign material that may cause discoloration, etching, staining, or surface blemishes to the materials.

Excess sealant left on the surface of the glass or surrounding materials shall be removed during the work life of the sealant.

Solvents and cleaning compounds shall be chemically compatible with materials, coatings and glazing compounds to remain. Cleaners shall not have abrasives that scratch or mar the surfaces.

The protective covering on acrylic sheet surfaces shall be left until construction is completed or 2 weeks after glazing, whichever is shorter. The covering shall be removed before adhesives dry sufficiently to adhere to the sheet during removal rather than the protective membrane.

Acrylic sheets shall be protected against scuffs, scratches and marring of the surface during construction and any such damaged sheet shall be replaced or restored to like new condition. Restoration work shall conform to the manufacturer's recommendations.

All panes shall be cleaned just before the final inspection. All stains and defects shall be removed. Paint, dirt, stains, labels (except etched labels), and surplus glazing compound shall be removed without scratching or marring the surface of the panes or metal work.

12-8.08 AUTOMATIC SLIDING DOORS

GENERAL.

This work shall consist of furnishing and installing electro-mechanical operated automatic sliding doors and appurtenances in accordance with the details shown on the plans and these special provisions.

Automatic sliding door with frame shall include sliding door, glass, operators and operator housings, emergency breakaway feature and failsafe devices where specified, frame with header, track, and sliding door controls.

Automatic sliding door assemble shall comply with ANSI A156.10. Standard and powered door operators that comply with UL 325. Service life of automatic sliding door assembly shall be capable without failure of any component, for not less than 3,000,000 open and close cycles, with normal maintenance as defined in manufacturer's standard operating manual.

SUBMITTALS.--

Manufacturer's descriptive data and drawings of automatic sliding door and frame shall be submitted for approval. The data and drawings shall be approved before the doors and frames are installed. The drawings shall include details of electric control systems, fastenings to walls, ceilings and floors and details of glazing stops. Such details shall include bite and edge clearance of glass or sheet for specified maximum and minimum expected temperatures and for installation temperatures. Panes in doors are expected to undergo temperature variations between -12°C. and 93°C.

The door manufacturer shall have an established parts store and service organization with offices in California. The names and addresses of the manufacturer's authorized service organization and the parts supply store shall be submitted with the data and drawings. The length of time such businesses have represented the manufacturer for service and parts supply shall be listed.

PRODUCTS.--

Metal extrusions.--

Metal extrusions shall be aluminum alloy 6063-T5, ASTM Designation: B 221. Aluminum thickness shall not be less than 3 mm.

Formed steel reinforcing.--

Formed steel reinforcing shall be commercial quality weldable steel not less than 3 mm thick.

Fasteners, hardware, weatherstrip and locks.--

Fasteners, hardware, weatherstrip and locks shall be aluminum, nonmagnetic stainless steel or other corrosion resistant material compatible with aluminum.

Anodic coating.--

Anodic coating shall be clear, ASTM Designation: B 580.

Sealant.--

Sealant shall be multi-component, gun grade, polysulfide, Federal Specification: TT-S-227.

Glass.--

Glass shall conform to the requirements specified under "Glazing" in Section 12-8, "Doors and Windows," of these special provisions. Glazing stops and frame must be compatible with the required bullet resistant glazing.

Signage.--

Signage to be overhead on header. Signage to say "NOT AN EXIT".

EXECUTION.--

FABRICATION.--

Exposed aluminum surfaces shall be given a clear anodized coating. Surfaces to be anodized shall be free of scratches, porosity, inclusions, roll and die marks, cold-sheets, and cracks detrimental to the appearance and performance of the coating.

SLIDING DOORS.--

Sliding doors shall be Horton, Series 2000; Besam, Power glide; KM, Ultraglide; Stanley, Duraglide 2000; Dor-O-Matic, Astroslide, Slide Door System; or equal, with electro-mechanical operation and automatically locked in the closed position.

Sliding door shall be architectural grade manufactured for use in commercial and institutional buildings.

Framing for sliding doors shall be part of a complete package consisting of framing, end posts, sliding door and controls, together with all their necessary components (glass may be installed at the jobsite at the Contractor's option) all manufactured by a nationally recognized sliding door manufacturer. Components shall be fabricated to adequately support and receive the interconnecting framework.

Doors shall be heavy-duty panel construction by means of tongue-and-groove- key fitted gussets that have two tempered bolts in each corner section to assure against racking failure and with 44 mm thick by 114 mm high door rails, with the exception of the top rail on the sliding door which shall be 89 mm high.

Integral intermediate height door rails shall be provided. The door shall have nonremovable glazing beads on the exterior side.

The sliding door shall be center hung from a one piece trussed trolley with built-in rollers for positive door alignment. The door and trolley shall be hung from a removable nylon coated steel track. Alignment of the door by lateral adjustment shall provide positive sealing at door edges.

Door height shall be adjustable to 1/4 inch.

The top of the threshold shall be flush with surrounding floor surfaces.

OPERATOR.--

The operator shall be electrically operated and shall provide built-in separate opening and closing pressure regulators; separate opening and closing checking adjustments; power checking adjustments; control of opening and closing speeds; manual operation with power off; guide rod slide carriage for positive piston rod alignment; and fast recycle at any point in stroke. Controls shall be fully adjustable.

The operator shall be listed for the type of installation involved.

The sliding door operator shall be mounted in the header. Easy serviceability and support to the header shall be provided by a hinged snap-in cover.

The sliding door operator shall be sized accordingly to accommodate additional weight of the bullet resistant glazing without compromising the minimum service life.

CONTROLS AND CIRCUITRY.--

Sliding door controls and circuitry shall be manufactured by the door manufacturer and shall be installed to provide the door operation specified.

The sliding door at the entrance to the ready room shall have the following control and circuitry features:

Three manual door release buttons and necessary control transformers shall be furnished and installed as specified under the applicable section in Section 12-16, "Electrical," of these special provisions.

The door shall be provided with a key switch security lock circuit and solenoid operated security latch. For entrance into the ready area, the controls for releasing the security latch and opening the sliding door shall be a key operated control and a remote pushbutton control. The closing control shall be an adjustable time delay switch. For exit from the ready area, the door shall be automatically actuated by a microwave sensor mounted in the header. The sensor controls shall not override the solenoid operated security latch.

Key control shall be keyed to the building lock system.

INSTALLATION.--

The sliding door and frame shall be set plumb and true and shall be anchored rigidly and securely. The door shall be adjusted to operate freely from all positions without binding.

Glazing stops and framework shall be sealed weathertight.

Plumbing for wiring for the electrical controls and energy supplies shall conform to the requirements under the applicable sections in Section 12-16, "Electrical" of these special provisions.

All installation work for the sliding door and frame shall conform to the recommendations of the manufacturer, the details shown on the plans and these special provisions.

GLAZING.--

Glazing shall be installed by the manufacturer or in accordance with the requirements specified under "Glazing" in Section 12-8, "Doors and Windows," of these special provisions.

OPERATIONAL ADJUSTMENTS.--

The Contractor shall have the manufacturer's technical representative inspect the completed installation and make necessary adjustments for proper operation of the sliding door.

The Contractor shall notify the Engineer not less than 3 working days in advance of the date the manufacturer's technical representative will be at the job site.

Proper operation shall include the proper functioning of the controls, circuitry, and mechanical and electrical equipment as specified and appropriate shielding of the sensing equipment. Shielding shall confine the sensitivity of operation and the activating field to a limited area as determined by the Engineer. Adjustments shall also eliminate unwanted opening and closing of the sliding door caused by the following:

1. Passing vehicles and reflections from people or moving objects outside the activating fields.
2. Self-induced operation due to movement of the door or its mechanisms.
3. Any other malfunction.

12-8.09 GLAZED ALUMINUM CURTAIN WALLS

PART 1. GENERAL.--

SUMMARY

This work shall consist of furnishing and installing glazed aluminum curtain walls, including glazing, aluminum support frames complete with all hardware and accessories necessary for a complete weathertight and operable installation, in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--

Complete shop drawings showing elevations of wall's elevation; details of each frame type; typical and special details of construction; location installation requirements for hardware; size, shape, and thickness of materials; finishes; fastenings and method of anchoring; size and spacing of anchors; details of operating hardware; method and materials for weatherstripping; and details of installation.

Exposed surfaces shall be free from defects, scratches, streaks, or other surface blemishes. Color shall be uniform without light and dark spots.

Finish samples shall be a representative section of a specified window with the color finish specified applied to that section. Section shall be a minimum of 203 mm long complete with stops and glazing beads, fasteners and anchors for all substrates on the job.

FINISHES.--

Finish on all exposed areas of aluminum windows and components shall be clear anodized as shown on the plans.

Exposed surfaces shall be free from defects, scratches, streaks, or other surface blemishes.

PART 2. PRODUCTS.--

Acceptable manufactures

Aluminum curtain wall manufacture shall be VistaWall, CW-250 Window System, Kawneer, 1600 Wall System, United States Aluminum or equal.

Glazing.--

Glazing shall conform to the requirements under "Glazing," in these special provisions.

Aluminum support frames.--

Aluminum for made from extruded bars, rods, shapes, and tubes shall conform to ASTM designation: B 221M. Sheets and plans shall conform to ASTM designation: B 429.

Screws, fasteners, anchors and accessories.--

Screws, fasteners, anchors and accessories shall be noncorrosive metals compatible with aluminum. Finish shall match adjacent surfaces.

Sealant.--

Sealant shall be self-leveling, non-sag, single component, solvent type acrylic polymer, Federal Specification TT-S-230. Color shall match aluminum.

FABRICATION.--

Entrance door hardware, unless otherwise shown on the plans, shall be provided and installed as part of the work. Hardware shall be factory installed as practicable.

FINISHES.--

Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes. Class I, Color Anodic Finish integrally colored coating 0.018 mm or thicker) complying with AAMA 606.1 or AAMA 608.1. Color shall be selected from the manufacture's standard color palate by the engineer.

PART 3. EXECUTION.--

EXAMINATION.--

Installer to examine areas for installation and do not begin until unsatisfactory condition have been corrected or accommodations acceptable to the Engineer have been made.

STORAGE.--

Materials shall be delivered to the site of the work in original, unopened, unbroken containers, wrappings, or bags with labels intact and legible. Labels shall show the product name, brand, manufacturer, directions, color, and quality, all of which shall be legible at the time of use.

Materials and accessories shall be undamaged and shall be carefully stored off the ground to provide proper ventilation, drainage, and protection against weather, dampness, staining, soiling contamination, deterioration, chipping, and breakage.

INSTALLATION.--

Curtain Wall shall be set straight, level, plumb and in true alignment on frames in accordance with the installation instructions. Clearance between the unit and the building framing shall be as shown on the plans.

Erection tolerances shall be as follows:

Plumb; 3 mm in 3m, 6 mm in 12 m.

Level; 3 mm in 6 m, 6 mm in 12 m.

Alignment; Where surfaces abut in a line, limit offset from true alignment to 1.5 mm; where a reveal or protruding element separates aligned surfaces by less than 50.8 mm, limit offsets to 12.7 mm.

Location; Limit variation from plan or location shown on Shop Drawings to 3 mm in 3.7 m; 12.7 mm over total length.

The installation shall be flashed and sealed weathertight.

Isolation coating shall be provided to separate adjoining incompatible materials.

Both inside and outside surfaces of metal shall be cleaned of all mortar, plaster, paint, and other foreign matter. Surfaces that are stained, discolored, or that cannot be satisfactorily cleaned and repaired shall be replaced with new materials at no additional cost to the State.

FIELD QUALITY CONTROL.--

After complete installation, areas 23 m by 2 story area of glazed aluminum curtain wall system, test system for water penetration according to AAMA 501.2 in a 2-bay area directed by the engineer. Repair or remove any work that does not comply or is damaged by this test.

PERFORMANCE.--

Deflection of storefront system shall be limited to L/175 when subjected to 718 Pa of wind pressure. Note: Higher wind load test pressures may be required. Comply with UBC and the American National Standard A58-1-1972 for applicable wind load test pressure. Provide wind load calculations. Provide wind and load calculations recognizing sloped glazed condition. Calculations are to be signed by a California Licensed Engineer.

SECTION 12-9. FINISHES

12-9.01 PORTLAND CEMENT PLASTER

GENERAL.--This work shall consist of installing lath and applying portland cement plaster in accordance with the details shown on the plans and these special provisions.

Plaster shall be 3 coat work. The total thickness of plaster shall be 19 mm unless otherwise shown on the plans. The color and the surface finish shall be as shown on the plans.

PRODUCTS.--

Sand.--

Sand shall be lean commercial quality plaster sand.

Cement.--

Cement shall be portland cement, blended hydraulic cement, or portland cement with a maximum of 15 percent mineral admixture. Portland cement shall be Type II, conforming to ASTM Designation: C 150. Blended hydraulic cement shall be Type IP, conforming to ASTM Designation: C 595. Mineral admixture shall be Class N, Class F or Class C, conforming to ASTM Designation: C 618, except loss on ignition shall not exceed 4 percent.

Lime.--

Lime shall conform to ASTM Designation: C 206.

Color for plaster.--

Color for plaster shall be non-fading, sunproof, and limeproof fine ground synthetic mineral oxide.

Premixed portland cement plaster.--

Premixed portland cement plaster shall be a premixed packaged blend of cement, lime and sand, with or without color, that requires only water to prepare for use as portland cement plaster, may be furnished. Premixed plaster shall be proportioned as specified herein. Packages of premix shall bear the manufacturer's name, brand, weight and color identification.

Metal lath.--

Metal lath shall be self-furring expanded metal diamond mesh with rust inhibitive coating and waterproof vapor barrier backing. Mesh shall weigh not less than 1.8 kg/m^2.

Metal lath fasteners.--

Metal lath fasteners shall be galvanized or corrosion resistant nails, screws or staples.

Beads, screeds, control joints and accessories.--

Beads, screeds, control joints and accessories shall be galvanized steel, not less than 0.50 mm thickness.

Vent screen.--

Vent screen shall be galvanized sheet steel combination screen and vent with corrosion resistant metal insect screen on the inside.

Water.--

Water shall be potable.

EXECUTION.--

METAL LATH INSTALLATION.--Metal lath, beads, screeds, control joints, vent screens and other metal accessories shall be installed rigidly and securely in place in accordance with the manufacturer's recommendations.

The type, size and spacing of fasteners for fastening the metal lath and accessories shall be as recommended by the metal lath manufacturer for the type of substrate and the location of the lath and accessories.

PLASTER PROPORTIONING AND MIXING.--Materials shall be accurately proportioned and measured for each batch. All batches for a given coat shall be proportioned the same. Plaster shall be proportioned one part cement to between 3 and 5 parts sand by volume, only sufficient water to obtain a workable mix, and a lime plasticizing agent. Not more than 9 kg of dry hydrated lime or lime putty per sack of cement shall be used in the first and second plaster coat. Plaster for finish coat shall contain not more than 42 kg of dry hydrated lime or lime putty per sack of cement. Lime shall not be used if mineral admixture or blended hydraulic cement is used.

Frozen materials shall not be used in the mix.

All plaster mixing ingredients shall be mixed in a mechanical mixer. After all ingredients are in the mixer, the plaster shall be mixed for a minimum of 2 minutes. The mixture shall be uniform in color after mixing. Hand mixing of plaster will be allowed only with the written approval of the Engineer.

Plaster to be colored shall be colored by mixing the coloring ingredient uniformly and homogeneously into the plaster. Color, if used, will be required only in materials for the finish coat.

PLASTER APPLICATION.--Plaster shall not be applied if the ambient temperature is 4°C or less. Plaster shall not be applied to frost covered or frozen surfaces. Surfaces to receive plaster shall be clean.

The coats of plaster shall be applied continuously in one general direction without allowing mortar to dry at the edges.

The first coat shall be applied with sufficient material and pressure to form full keys and good bond and to cover surfaces. Before setting, the first coat shall be cross-scratched to receive the second coat. The first coat shall be moisture cured, without soaking, for not less than 48 hours after application or until covered by the second coat.

The second coat of plaster shall not be placed until the first coat of plaster has set thoroughly or until at least 12 hours after the first coat of plaster has been placed. The second coat shall be brought out to grounds, straightened to a true, even surface, roughened to assure a bond with the finish coat, and made free of imperfections which would reflect in the finish coat. The second coat shall be moisture cured, without soaking, for not less than 48 hours after application.

The third coat of plaster shall not be placed until at least 7 days after the second coat of plaster has been placed. Troweling of the third coat of plaster shall leave the surface smooth and free from rough areas, trowel marks, checks, or other blemishes. The finished surface shall be true and even and shall not vary more than 3 millimeters in 1.5 meters from the required plane. Plaster with cracks, blisters, pits, stains, efflorescence, shadowing, dryouts, or checks will not be accepted. Surfaces shall be clean and sound.

The third coat shall have the type of finish shown on the plans.

After all other related work has been completed, pointing around trim and set work and repairing of damaged portions of plaster shall be done. Repairs and patching shall match surrounding work in texture and appearance.

Plaster coats shall be protected against freezing for a period of 24 hours after application.

12-9.02 VENEER PLASTER SYSTEM

GENERAL.--This work shall consist of installing a veneer plaster system in accordance with the details shown on the plans and these special provisions.

PRODUCTS.—

Gypsum plastering base board.--

Gypsum plastering base board shall be 16 mm type x, high impact resistant and shall be compatible with one coat plaster as recommended by the manufacturer. Gypsum plastering base board shall be National Gypsum Gold Bond, Kal-Kore Fire-Shield Type X Hi-Impact; USG Imperial, Brand-Abuse-Resistant (AR) Gypsum Base Fire Code Core; or equal.

One coat plaster.--

One coat plaster shall be single component mill-mixed veneer plaster with abrasion resistant finish. One coat plaster shall be National Gypsum Gold Bond, Uni-Kal 3000; USG Imperial, finish plaster; Georgia-Pacific, Cameo Veneer Plaster; or equal.

Trim accessories.--

Trim accessories shall be compatible with veneer plaster system as recommended by the manufacturer.

EXECUTION.--

Installation.--Installation shall be in accordance with the approved shop drawing and the veneer plaster system manufacturer's recommendations.

12-9.03 GYPSUM WALLBOARD

GENERAL.--This work shall consist of furnishing, installing and finishing gypsum wallboard in accordance with the details shown on the plans and these special provisions.

Where assembly fire ratings are indicated on the plans, construction shall provide the fire resistance in accordance with the applicable standards.

Wallboard backing for use in restroom and shower areas shall be water-resistant gypsum backing board.

PRODUCTS.--

Gypsum wallboard.--

All gypsum wallboard shall be 16 mm thick and conform to ASTM Designation: C 36.

Gypsum backing board.--

All gypsum backing board shall be 16 mm thick and conform to ASTM Designation: C 442.

Water-resistant gypsum backing board.--

All water-resistant gypsum backing board shall be 16 mm thick and conform to ASTM Designation: C 630.

Gypsum sheathing board.--

Gypsum sheathing board shall conform to ASTM Designation: C 79.

Gypsum wallboard liner panel.--

Gypsum wallboard liner panel shall bear the UL classification marking.

Gypsum lath board.--

Gypsum lath board.

Exterior gypsum soffit board.--

Exterior gypsum soffit board shall conform to ASTM Designation: C 931.

Joint tape and joint and finishing compound.--

Joint tape and joint and finishing compound shall conform to ASTM Designation: C 475.

Corner beads, metal trim and control joints.--

Corner beads, metal trim and control joints shall be galvanized steel of standard manufacture.

Resilient metal channel.--

Resilient metal channel shall be galvanized sheet steel channels of standard manufacture for reducing sound transmission in wood frame partitions.

Fasteners.--

Fasteners shall be gypsum wallboard nails conforming to ASTM Designation: C 514 or steel drill screws conforming to ASTM Designation: C 1002.

EXECUTION.--

DELIVERY AND STORAGE.--Materials shall be delivered in original packages, containers or bundles bearing brand name, applicable standard of manufacture, and name of manufacturer or supplier and shall be kept dry and fully protected

from weather and direct sunlight exposure. Gypsum wallboard shall be stacked flat with adequate support to prevent sagging or damage to edges, ends and surfaces.

INSTALLATION.--Wallboard panels to be installed on ceilings and soffits shall be installed with the long dimension of the panels perpendicular to the framing members. Wallboard panels to be installed on walls may be installed with the long dimension of the panels either parallel or perpendicular to the framing members. The direction of placing the panels shall be the same on any one wall or partition assembly.

Edges of wallboard panels shall be butted loosely together. All cut edges and ends shall be smoothed as needed for neat fitting joints.

All edges and ends of gypsum wallboard panels shall coincide with the framing members, except those edges and ends which are perpendicular to the framing members. End joints on ceiling and on the opposite sides of a partition assembly shall be staggered.

Except where closer spacings are shown on the plans, the spacing of fasteners shall not exceed the following:

Nails	175 mm
Screws	300 mm
Screws at perimeter of panels for fire resistive assemblies having metal framing	200 mm

Type S steel drill screws shall be used to fasten wallboard to metal framing. Nails or Type W steel drill screws shall be used to fasten wallboard to wood framing. Except as shown on the plans, screws shall not be used in fire resistive assemblies.

Adhesives shall not be used for securing wallboard to framing.

Gypsum wallboard panels shown on the plans for shear wall sheathing or for fire resistive assemblies shall be fastened to all framing members. Gypsum wallboard panels at other locations and gypsum wallboard finish over plywood sheathed shear walls shall be fastened to all framing members except at the following locations:

At internal angles formed by ceiling and walls; ceiling panels shall be installed first with the fasteners terminating at a row 175 mm from the walls, except for walls parallel to ceiling framing. Wall panels shall butt the ceiling panels. The top row of wall panel fasteners shall terminate 200 mm from the ceiling.

At internal vertical angles formed by the walls; fasteners shall not be installed along the edge or end of the panel that is installed first. Fasteners shall be installed only along the edge or end of the panel that butts and overlaps the panel installed first.

Fasteners shall be located at least 10 mm from wallboard panel edges and ends. Nails shall penetrate into wood framing at least 30 mm. Screws shall penetrate into wood framing at least 20 mm. All metal fasteners shall be driven slightly below surface level without breaking the paper or fracturing the core.

Metal trim shall be installed at all free edges of panels, at locations where wallboard panels abut dissimilar materials and at locations shown on the plans. Corner beads shall be installed at external corners. Control joints shall be installed at the locations shown on the plans.

Joints between face panels, the internal angles formed by ceiling and walls and the internal vertical angles formed by walls shall be filled and finished with joint tape and at least 3 coats of joint compound. Tape in the corners shall be folded to conform to the angle of the corner. Tape at joints and corners shall be embedded in joint compound.

Dimples at nail and screw heads, dents, and voids or surface irregularities shall be patched with joint compound. Each patch shall consist of at least 3 coats and each coat shall be applied in a different direction.

Flanges of corner beads, control joints and trim shall be finished with a least 3 coats of joint compound.

Each coat of joint compound shall be feathered out onto the panel surface and shall be dry and lightly sanded before applying the next coat. The finished surfaces of joint compound at the panel joints, internal angles, patches and at the flanges of trim, corner beads and control joints shall be flat and true to the plane of the surrounding surfaces and shall be lightly sanded.

Good lighting of the work area shall be provided during the final application and sanding of the joint compound.

Gypsum wallboard used as backing boards for tile or rigid sheet wall covering or wainscotting shall be water resistant. Joints in backing board shall not be taped or filled and dimples at the fastener heads shall not be patched. Edges of cuts and holes in backing board shall be sealed with a primer or sealer that is compatible with the wall covering or wainscotting adhesive to be used.

Surfaces of wallboard to be textured shall receive an orange peel texture, unless otherwise shown on the plans.

12-9.04 CERAMIC TILE

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing ceramic tile in accordance with the details shown on the plans and these special provisions.

Ceramic tile shall include glazed wall tile, patterned porcelain tile, matte porcelain tile, textured porcelain tile, polished porcelain tile, trim tile, setting materials, grouts and such other materials as maybe required for a complete installation.

Related Work.—Material descriptions for floor transitional moulding can be found in "Floor Transitional Moulding" listed elsewhere in these special provisions.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data, a list of materials to be used, and installation instructions for all materials required for the work shall be submitted for approval.

Manufacturer's descriptive data shall be submitted for each type of tile, mortar bed materials, bond coat materials and additives, and grout materials and additives.

Materials list and installation instructions shall include all products and materials to be incorporated into the work.

Friction reports shall be submitted for tile products to be used on floors and other pedestrian surfaces.

Samples.--Samples shall include 2 individual samples of each type and color of tile and trim to be installed and shall be of the same size, shape, pattern and finish as the tile and trim to be installed.

QUALITY ASSURANCE.--

Single source responsibility.--Each type and color of tile, grout and setting materials shall be obtained from a single source.

Master Grade Certificates.--Each shipment of tile to the project site shall be accompanied by a Master Grade Certificate issued by the tile manufacturer.

Certificates of Compliance.--Certificates of compliance shall be furnished for bond coat materials, setting bed materials and grout in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

DELIVERY, STORAGE AND HANDLING.--

Delivery.--Tile and packaged materials shall be delivered to the job site in sealed, unbroken, unopened containers with the labels intact. Tile containers shall bear the Standard Grade label.

Storage and handling.--Materials shall be stored and handled in such a manner as to prevent damage or contamination by water, freezing or foreign matter.

PROJECT CONDITIONS.--

Protection.--Tile work shall be protected and environmental conditions maintained during and after installation to comply with the reference standards and manufacturer's printed instructions.

Temperatures.--Unless otherwise specified in the manufacturer's installation instructions, the ambient temperature shall be maintained at not less than 10°C nor more than 38°C in tiled areas during installation and for 7 days after completion. Exterior work areas shall be shaded from direct sunlight during installation.

Tile shall not be installed when the temperature of the substrate is greater than 32°C or is frost covered.

Illumination.--Interior work areas shall be illuminated to provide the same level and angle of illumination as will be available during final inspection.

PART 2.- PRODUCTS

MANUFACTURERS.--

Available manufacture's.--Subject to compliance with the specifications, tile shall be American Olean Tile Co., Inc.; Summitville Tiles, Inc.; United States Ceramic Tile Co.; or equal.

GENERAL.--

Ceramic tile.--Ceramic tile shall conform to the requirements in ANSI Standard: A137.1, "American National Standard Specifications for Ceramic Tile" for types and grades of tile indicated.
Ceramic tile shall conform to the "Standard Grade" requirements.

Tile installation materials.--Tile installation materials shall conform to the requirements in ANSI standard referenced with products and materials indicated for setting and grouting.

Tile color and size.--Tile color shall be as shown on the plans; tile size shall be as indicated in the Schedule elsewhere in this special provision.

Slip resistant tile.--Slip resistant tile shall have sufficient abrasives added such that the static coefficient of friction, wet or dry, shall be not less than 0.6 for walking surfaces and 0.8 for ramps when tested in accordance with ASTM Designation: C 1028.

TILE PRODUCTS.--

Glazed wall tile.--

Glazed wall tile shall be machine made, dust pressed white body clay, and shall have a glossy glaze finish, plain face, and cushion edges. Tile shall be 8 mm nominal thickness.

Ceramic tile trim shall match material, size and finish of field tile. Free edges of tiled areas of walls shall have bullnose type trim. Outside corners shall have bullnose type runner trim (not beads). Reentrant corners shall have cove type trim.

Matte porcelain tile.--

Matte porcelain tile shall be machine made, unpolished, dust pressed natural porcelain clay and shall have a plain face. Tile shall have a nominal thickness of 8 mm. Matte porcelain tile shall be slip resistant.

Matte porcelain trim tile shall include cove type base at walls and single piece intersecting cove base at corners.

SETTING MATERIALS.--

Portland cement mortar installation materials.--

Materials for portland cement mortar installation shall conform to the requirements in ANSI Standard: A108.1 as required for installation method designated, unless otherwise indicated.

Membrane.--Membrane shall be asphalt impregnated felt conforming to ASTM Designation: D 226, Type I, or polyethylene film conforming to ASTM Designation: C 171, Type 1.1.2. Polyethylene film shall not be less than 0.1 mm thick.

Reinforcement.--Reinforcement shall be galvanized welded wire fabric with 50 mm x 50 mm - 1.6 mm x 1.6 mm conforming to ASTM Designations: A 82 and A 185 except for minimum wire size. Reinforcement shall be provided in flat sheets.

Metal lath.--Metal lath shall be self furring, galvanized, conforming to ASTM Designation: C 847, flat expanded type weighing not less than 1.4 kg/m^2. Factory assembled metal lath and paper backing may be used where reinforcement over paper is shown on the plans.

Tile bond coat.--

Tile bond coat shall be latex-portland cement bond coat.

Latex-portland cement mortar bond coat shall be a prepackaged mortar mix, conforming to ANSI Standard: A118.4, incorporating a dry acrylic resin, and to which only water is added at the job site. Mortar shall be suitable for exterior use and be labeled for the type of tile to be installed.

Epoxy bond coat.--

Epoxy bond coat shall be a 2 part prepackaged epoxy mortar conforming to ANSI Standard: A118.3, suitable for exterior use. Mortar shall be labeled for the type of tile to be installed.

GROUTING MATERIALS.--

Tile grout.--

Tile grout shall be latex-portland cement grout.

Latex-portland cement grout shall be a prepackaged grout mix, conforming to ANSI Standard: A118.6, incorporating a dry acrylic resin, and to which only water is added at the jobsite. Epoxy grout shall be suitable for exterior use and labeled for the type of tile to be installed.

Epoxy grout.--

Epoxy grout shall be a 2 part prepackaged epoxy mortar conforming to ANSI Standard: A118.3 and suitable for exterior use. Tile shall be labeled for the type of tile to be used.

Grout pigment.--

Grout pigment shall be chemically inert, fade resistant mineral oxide or synthetic type. Color shall be as shown on the plans.

SEALANTS.--

Sealant.--

Sealant for vertical expansion joints shall be a medium modulus silicone or polyurethane. Sealant for horizontal joints shall be a 2-part polyurethane type material with a Shore Hardness of 35 to 45.

Color of exposed sealants shall match color of grout in tile adjoining sealed joints.

MORTAR BEDS.--

Cement mortar bed.--

Cement mortar bed for walls shall be proportioned of one part cement, 1/2 part hydrated lime, 6 parts damp sand by volume and only enough water to provide the necessary workability. Ingredients shall be dry mixed, water added, and materials blended to produce a stiff mix. Mortar bed shall be not less than 20 mm in thickness.

Cement mortar bed for floors shall be proportioned of one part cement, 1/10 parts hydrated lime, 5 parts damp sand by volume and only enough water added to provide the necessary workability. Ingredients shall be dry mixed, water added, and materials blended to produce a stiff mix. Mortar bed shall be not less than 32 mm in thickness.

Pea gravel mortar bed.--

Pea gravel mortar bed for tile roadway installations shall have a minimum thickness of not less than 50 mm plus the additional thickness of the tile.

Pea gravel mortar beds shall be proportioned one part cement, 3 parts damp sand, 4 parts pea gravel by volume, and only enough water to produce the necessary workability. Ingredients shall be dry mixed, water added, and materials blended to produce a stiff mix.

MISCELLANEOUS MATERIALS.--

Sand.--

Sand shall be a natural or manufactured sand conforming to ASTM Designation: C 144, except that no more than 10 percent shall pass the No. 150 µm sieve.

Pea gravel.--

Pea gravel shall conform to ASTM Designation: C 33, except that 100 percent shall pass the No. 4.75 µm sieve and 100 percent shall be retained on the No. 2.36 µm sieve.

Sealers.--

Sealer for unglazed quarry tile shall be water repellent, clear solution of ammonium cementitious compound, silicone base material, or other commercially manufactured sealer.

Sealer for grout shall be a penetrating proprietary compound designed for sealing grout. Silicone sealers shall not be used.

Cement.--

Cement shall conform to ASTM Designation: C 150, Type I.

Hydrated lime.--

Hydrated lime shall conform to ASTM Designation: C 206, Type S, or ASTM Designation: C 207, Type S.

Water.--

Water shall be clean and potable.

Metal edge strips.--

Metal edge strips shall be stainless steel terrazzo strips, 3 mm wide at top edge with integral provision for anchorage to mortar bed or substrate.

Cementitious tile backer board.--

Cementitious backer board shall be a backing and underlayment panel composed of a concrete core with glass mesh reinforcing on both faces and conforming to the requirements of ANSI Standard: A118.9.

Shower pan.--

Shower pan shall be flexible polyvinyl chloride (PVC) sheeting conforming to ASTM Designation: D 4551, Grade 40, and manufactured for use as a shower membrane.

Solvent cement shall be as recommended by the manufacturer.

MIXING MORTAR AND GROUT.--

Mixing.--Mortar and grout shall be mixed to comply with the requirements of referenced standards and manufacturers for accurately proportioning of materials, water or additive content, mixing equipment and mixer speeds, mixing containers, mixing time, and other procedures need to produce mortars and grout of uniform quality with optimum performance characteristics for application intended.

PART 3.- EXECUTION

PREPARATION.--

General.--Concrete, mortar, or masonry substrate surfaces which are to receive a mortar bed shall not vary more than 5 mm in 2.4 m from the required plane and shall be true, plumb at vertical surfaces, and square at intersection edges.

Surfaces to receive a mortar setting bed or a bond coat shall be cleaned adequately to assure a tight bond to the applied material. Such cleaning shall leave the surface thoroughly roughened and free from laitance, coatings, oil, sand, dust and loose particles.

The cleaned surfaces which are to receive a mortar bed shall be saturated with water just prior to placing mortar or the cleaned surfaces shall be coated with fresh neat cement slurry. If the surface is saturated with water, excess water shall be removed and the wetted surfaces uniformly dusted with portland cement. The slurry or wetted cement dust shall be broomed to completely coat the surface with a thin and uniform coating just prior to placing the mortar.

Substrates shall be inspected to insure that grounds, anchors, plugs, recessed frames, bucks, drains, electrical work, mechanical work, and similar items in or behind the tile have been installed before proceeding with installation of the tiles.

INSTALLATION.--

General.--Tile installation shall conform to applicable parts of ANSI 108 Series of the tile installation standards included under "American National Standard Specifications for the Installation of Ceramic Tile" and Tile Council of American, "Handbook for Ceramic Tile Installation."

All tile shall be installed on a bond coat over a setting bed. The setting bed shall be a cured cement mortar bed or a prepared, dimensionally stable substrate of concrete, masonry, cementitious backer board, or other cementitious material.

The back face of the tile shall be free of paper, adhesives, fiber mesh, resins, or other materials affecting the bond of the tile to the bedding material.

Tile sheets shall have permanent edge bonding or temporary mounting materials on the exposed face. Water soluble or absorbent adhesives shall not be used for edge bonding. Temporary mounting materials shall allow observation during tile setting operations.

Tile work shall extend into recesses and under or behind equipment and fixtures, to form a complete covering without interruptions, except as shown on the plans. Work shall be terminated neatly at obstructions, edges and corners without disrupting pattern or joint alignments.

Intersections and returns shall be accurately formed. Cutting and drilling of tile shall be performed without marring visible surfaces. Cut edges of tile abutting trim, finish or built-in items shall be carefully ground to produce straight aligned joints. Tile shall be closely fit to electrical outlets, piping, fixtures and other penetrations such that plates, collars, or covers overlap the tile.

Mortar bed placement.--The mortar bed, with or without reinforcement as shown on the plans, shall be placed, consolidated, and finished to the required thickness.

The surface of the mortar bed shall be true and pitched as shown on the plans, without high or low spots. The mortar bed surface shall not vary more than 3 mm in 2.4 m from a plane parallel to the finished tile surface when tile is installed on a cured mortar bed.

In no case shall the allowed tolerances result in offsets between adjoining tiles, low spots on finished tile surfaces than can pond water, or finished tile surfaces that are not plumb or not true.

Pea gravel mortar shall be tightly compacted so as to fill all voids in the aggregate. Compaction shall be obtained using a stand-up wooden tamper weighing not less than 16 kg or using a motor driven tamper and leveler.

Pea gravel mortar beds shall be damp cured under cover for not less than 72 hours at a temperature of not less than 21°C.

Cement mortar beds to receive a tile bond coat shall be damp cured under cover for a minimum of 48 hours at a temperature of not less than 21°C.

Cement mortar beds to receive an epoxy bond coat shall be damp cured under cover for a minimum of 96 hours at a temperature of not less than 21°C and allowed to dry thoroughly prior to setting tile.

Cementitious backer board.--Cementitious backer board shall be installed in accordance with the provisions of ANSI Standard: A118.11.

Shower pan.--Substrate shall be thoroughly cleaned prior to forming the shower pan. Drain shall be a bolt-down clamping ring type with weep holes, installed such that the lip of the drain is flush with the subfloor.

Shower pan shall be turned up for a distance of not less than 152 mm in room areas and 75 mm above curb level in curbed spaces, with sufficient material to fold over and fasten to outside face of curb. Corners shall be dog-earred and folded between pan and studs. Material shall only nailed in the top inch of the upstand.

Shower pan material shall be cut exactly to size of the drain opening, do not trim out to bolt holes, but pierce to accommodate bolts with a tight fit. Place adhesive or mastic between pan and subdrain.

Tile bond coat.--The tile bond coat mortar shall be mixed according to the manufacturer's recommendations. The consistency of the mixture shall be such that ridges formed with the recommended notched trowel shall not flow or slump. Reworking will be allowed provided no water or materials are added. The setting bed surfaces shall be dampened before placing the bond coat as necessary tile installation, but the setting bed shall not be soaked. The setting bed surfaces for epoxy bond coat shall be dry.

The bond coat shall be floated onto the cured mortar bed surface with sufficient pressure to cover the surface evenly with no bare spots. The surface area to be covered with the bond coat shall be no greater than the area that can be tiled while the bond coat is still plastic. The bond coat shall be combed with a notched trowel as recommended by the manufacturer within 10 minutes before installing tile. Tile shall not be installed on a skinned over bond coat.

Installing tiles.--Tile shall be installed in accordance with the manufacturer's instructions and shall be set solid and shall be well bonded to the substrate.

Tile set on a tile bond coat shall be installed in accordance with ANSI Standard: A108.5, and tile set on an epoxy mortar shall be installed in accordance with ANSI Standard; A108.6.

If tiles are cut, the cuts shall be made with saws. Cut edges shall be rubbed with an abrasive stone to bring the edge of the glaze slightly back from the body of the tile. Cuts shall be accurately made to neatly fit the tile in place. Cut edges shall not be butted against other tile. Cut tile shall be at least half the size of a full size tile.

Tile shall completely cover wall areas behind mirrors and fixtures.

Tile shall be installed so that the finished tile surface does not vary more than 3 mm in 2.4 m from the finished tile surface shown on the plans. In no case shall there be offsets in adjoining tiles, low spots on finished tile surfaces that can pond water, or finished tile surfaces that are not plumb or true in the completed tile work.

Tiles shall be firmly pressed into the freshly notched bond coat. Tile on interior surfaces shall be tapped and beat into a true surface and to obtain at least 80 percent coverage by the mortar on the back of each tile. Tile on exterior surfaces shall have 100 percent coverage and shall be back-buttered immediately prior to setting the tile.

If tile is face mounted, the paper and glue shall be removed within one hour after tile is installed and all tiles that do not meet the requirements for joints and surface tolerance shall be adjusted or replaced.

Mortar that exudes into the grout spaces between tiles shall be removed to the bottom of tile.

Joints.--Joints between tile shall be continuous both vertically and horizontally. Joints shall be straight and of uniform and equal width. Where tiles on adjoining surface are the same size, the joints shall align, one with the other. Joint width shall be as recommended by the tile manufacturer.

Grouting tile.--Grout shall be mixed, applied and cured in accordance with the manufacturer's recommendations and ANSI Standard: A108.10 for cement grout and ANSI Standard: A108.9 for epoxy grout.

Spacers, strings, ropes, pegs, glue, paper, and face mounting material shall be removed before grouting. Joints between glazed wall tile shall be wetted if they have become dry. Joints for epoxy mortar shall be dry.

Grouting shall not begin until at least 48 hours after installing tile.

A maximum amount of grout shall be forced into the joints between tiles in accordance with the manufacturer's recommendations. The grout shall be finished to the depth of the cushion for cushion edge tile and finished flush with the surface for square edge tile. All gaps and skips in the grout spaces shall be filled.

Mortar or mounting mesh shall not show through the grouted joints.

The finished grout shall have a uniform color and shall be smooth without voids, pinholes or low spots.

Expansion joints shall be kept free of grout or mortar.

Grout shall be protected from freezing or frost for a least 5 days after installation.

Expansion joints.--Expansion joints shall be installed at the perimeter of all tile floors and at all substrate control joints and changes in the substrate material. Exterior expansion joint spacing shall not exceed 5 m in any direction.

All expansion joints shall be made with sealant over backer rods. The thickness of sealant at the center of expansion joints shall not exceed the width of the joint. Joint edges shall be primed as recommended by the sealant manufacturer.

Edge strips.--Edge strips shall be installed at openings where the threshold has not been shown on the plans, but where tile floor abuts other flooring materials at the same level. Edge strips shall be installed centered under the closed door, or where there is no door, centered in the opening.

Sounding tile.--Tiled surfaces shall be sounded with a metal bar or chain for improperly bonded tile or setting bed. Tile or setting bed that emits a hollow sound shall be replaced.

Replacement.--Cracked, chipped, broken, or otherwise defective tiles shall be removed and replaced. All tiles which differ more than 2 mm in elevation from adjacent tile edges shall be removed and replaced.

Curing.--After the installation of tile and the grouting of joints, the tile and grout shall be cured by keeping the surface continuously damp for at least 72 hours after grouting. Curing materials shall not stain the tile or grouted joints. Curing methods shall not erode away the grout.

After grouting, horizontal tiled surfaces shall be closed to traffic, and all tiled surfaces shall be kept free from impact, vibration or shock, for at least 72 hours.

CLEANING AND PROTECTION.--

Cleaning tile surfaces.--All exposed tile surfaces shall be cleaned of all grout haze upon completion of grouting. Acids and chemicals used to clean tile shall conform to the tile manufacturer's recommendations. Cleaners shall not be harmful to materials on surfaces of abutting floors, walls, and ceilings. Tile work shall be rinsed thoroughly with clean water before and after using acid or chemical cleaners. After cleaning and rinsing, tile surfaces shall be polished using a soft cloth.

Tile work shall be cleaned and polished again immediately prior to completion of the contract. All dirt, grime, stains, paints, grease, and other discoloring agents or foreign materials shall be removed.

Protection.--After grouting, horizontal tiled surfaces shall be closed to traffic, and all tiled surfaces shall be kept free from impact, vibration or shock, for at least 72 hours after.

Roadway tile shall be protected from vehicle traffic during installation and for not less than 7 days after grouting.

Tile surfaces damaged by construction operations shall be retiled.

SCHEDULES.--

Wall tile.--

Wall tile shall be nominal 150 mm x 150 mm glazed wall tile. Installation on cementitious backer board or mortar bed, using a tile bond coat and grout, shall conform to the requirements of Method F 112, “Handbook for Ceramic Tile Installation.” Installation on concrete and masonry shall be on a mortar bed using tile bond coat and grout, and shall conform to the requirements of Method W 243, “Handbook for Ceramic Tile Installation.

Tile color band.--

Tile color band shall be nominal 152 mm x 152 mm glazed ceramic tile as manufactured by Ceramic Vogue; Chroma,; or equal.

Floor tile.--

Floor tile shall be nominal 50 mm x 50 mm matte porcelain tile installed on a mortar bed using a tile bond coat and grout and shall conform to the requirements of Method F 11at shower area tow service locker room (lower floor) and F122 at locker room and restrooms (mainfloor), “Handbook for Ceramic Tile Installation.”

12-9.05 RESILIENT SHEET FLOORING

GENERAL.--This work shall consist of furnishing and installing resilient sheet flooring in accordance with the details shown on the plans and these special provisions.

Resilient sheet flooring shall also include cove molding, metal caps, edger strips, floor wax and flooring manufacturer's recommended primers and adhesives.

Related Work.—Material descriptions for floor transitional moulding can be found in "Floor Transitional Moulding" listed elsewhere in these special provisions.

SUBMITTALS.--Manufacturer's descriptive data, installation instructions, color and pattern samples shall be submitted for approval. Samples of sheet flooring shall be 305 mm x 305 mm in size.

PRODUCTS.--

Resilient sheet flooring.--

Resilient sheet flooring shall be flexible linoleum sheet not less than 2.5 mm thick. Color and pattern shall be as shown on the plans.

Primer, leveling compound crack filler and adhesives.--

Primer, leveling compound crack filler and adhesives shall be waterproof types as recommended by the flooring manufacturer.

Wax.--

Wax shall be water emulsion, self-polishing type containing not less than 16 percent wax solids, wetting agents, and a nonslip agent. The wax shall meet UL antislip standards.

Cove molding.--

Cove molding shall be integral self-cove.

Edger strips.--

Edger strips shall be commercial quality, stainless steel or aluminum.

Metal caps.--

Metal caps shall be commercial quality, noncorrosive metal.

EXECUTION.--

PREPARATION.--Before placing adhesives, all surfaces to receive resilient sheet flooring shall be made free of localized depressions or bumps. Bumps shall be ground flat. Holes, depressions and cracks shall be filled with crack filler or leveling compound.

Immediately prior to installation of the resilient sheet flooring, the surface to be covered shall be thoroughly dry, free of paint, oil, grease, mortar, plaster droppings, scaly surfaces or other irregularities and shall be broom clean. Primer, when recommended, shall be thoroughly brushed on the surface at the rate recommended by the adhesive manufacturer and shall be completely dry before application of adhesives.

The rooms where resilient sheet flooring is to be installed shall be maintained at a temperature of at least 21°C for not less than 72 hours before installation, during installation and for 5 days after installation.

INSTALLATION.--Resilient sheet flooring shall be laid to a true, straight, smooth and even finish surface in accordance with the manufacturer's instructions. Resilient sheet flooring shall be laid parallel to building lines with the minimum of seams using manufacturer's standard widths. Seams shall be tight fitting, fully bonded along their length and present a continuous pattern.

Resilient sheet flooring shall be placed before floor mounted fixtures are installed.

After resilient sheet flooring has been installed, the finished surface shall be rolled and crossrolled with a roller weighing 50 kg or more.

Edger strips shall be installed at free edges.

Upon completion of the flooring installation, all stains, surplus adhesive, dirt and debris resulting from the work shall be removed and the floor left broom clean. Resilient sheet flooring shall be protected from damage at all times during construction. As a last order of work, floor covering shall be washed with soap and warm water, rinsed, and then waxed in accordance with the floor covering and wax manufacturers' printed instructions. Not less than 2 applications of wax shall be placed on the floor covering. Provide cleaning instructions to Engineer. Emphasize not using alkali cleaners.

12-9.06 RUBBER TILE

GENERAL.--This work shall consist of furnishing and installing rubber tile in accordance with the details shown on the plans and these special provisions.

Rubber tile shall consist of rubber tile, edger strips, and tile manufacturer's recommended primers and adhesives.

Related Work.—Material descriptions for floor transitional moulding can be found in "Floor Transitional Moulding" listed elsewhere in these special provisions.

SUBMITTALS.--Manufacturer's descriptive data, installation instructions, color and pattern samples shall be submitted for approval. Samples of tile shall be 305 mm x 305 mm in size.

PRODUCTS.--

Rubber tile.--

Rubber tile shall be no wax, 3 mm thick, 500 mm x 500 mm (nominal) conforming to ASTM Designation: F1334 Class I, and Federal Specification: SS-T-312 Type II. Pattern shall be raised 0.25 mm x 38 mm (nominal) square studs. Color shall be as shown on the plans.

Primer, leveling compound crack filler and adhesives.--

Primer, leveling compound crack filler and adhesives shall be waterproof types as recommended by the tile manufacturer.

Edger strips.--

Edger strips shall be commercial quality, stainless steel or aluminum.

EXECUTION.--

PREPARATION.--Before placing adhesives, all surfaces to receive tile shall be made free of localized depressions or bumps. Bumps shall be ground flat. Holes, depressions and cracks shall be filled with crack filler or leveling compound.

Immediately prior to application of the tile flooring, the surface to be covered shall be thoroughly dry, free of paint, oil, grease, mortar, plaster droppings, scaly surfaces or other irregularities and shall be broom clean. Primer, when recommended, shall be thoroughly brushed on the surface at the rate recommended by the adhesive manufacturer and shall be completely dry before the application of adhesives.

The rooms where tile is to be installed shall be maintained at a temperature of at least.21°C for not less than 72 hours before installation, during installation and for 5 days after installation.

APPLICATION.--Tile shall be laid to a true, straight, smooth and even finished surface in accordance with the manufacturer's instructions. Joints shall be tight fitting. Floor covering shall be placed before floor mounted fixtures are installed. After tile has been set, the finished surface shall be rolled and crossrolled with a roller weighing 45 kg or more.

Edger strips shall be installed at free edges.

Where tile patterns between rooms differ, the pattern break at openings shall occur at the centerline of the common wall.

Upon completion of the tile application, all stains, surplus adhesive, dirt and debris resulting from the work shall be removed and the floor left broom clean. Tile shall be protected from damage at all times during construction. As a last order of work, tile shall be washed with soap and warm water, rinsed, and then waxed in accordance with the tile manufacturer's printed instructions. Not less than 2 applications of wax shall be placed on the tile flooring.

12-9.07 RESILIENT BASE

GENERAL.--This work shall consist of furnishing and installing resilient base in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--Manufacturer's descriptive data, installation instructions, color palette, and samples of resilient base shall be submitted for approval. Samples shall be not less than 50 mm in length.

PRODUCTS.--

Resilient base.--

Resilient base shall be manufacturer's best grade, rubber or vinyl base, with premolded internal and external corner pieces. The height and color shall be as shown on the plans.

Adhesive.--

Adhesive shall be as recommended by base manufacturer.

EXECUTION.--

INSTALLATION.--Bases shall be firmly and totally attached to walls with adhesive and shall be accurately scribed to trim, molding and cabinets. All joints shall be tight fitting. Bases between premolded corners or other termini may be installed continuous or installed using one m minimum standard manufactured lengths. Filler pieces shall be not less than 0.5 m.

12-9.08 PLASTIC BASE

GENERAL.--This work shall consist of furnishing and installing plastic base in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--Manufacturer's descriptive data, installation instructions, color palette, and samples of plastic base shall be submitted for approval. Samples shall be not less than 50 mm in length.

PRODUCTS.--

Plastic base.--

Plastic base shall have smooth surface with one edge radius. The profile, height and color shall be as shown on the plans. Plastic base shall be Extrutech Plastics Inc., Ventana USA, Phoenix Recycled Plastics, or equal.

Adhesive.--

Adhesive shall be as recommended by base manufacturer.

EXECUTION.--

INSTALLATION.--Bases shall be firmly and totally attached to walls with adhesive and shall be accurately scribed to trim, molding and cabinets. All joints shall be tight fitting. Bases between premolded corners or other termini may be installed continuous or installed using one m minimum standard manufactured lengths. Filler pieces shall be not less than 0.5 m.

12-9.09 FLOOR TRANSITIONAL MOULDING

GENERAL.--This work shall consist of furnishing and installing floor transitional moulding to floor charge in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--Manufacturer's descriptive data, installation instructions and samples of floor charge shall be submitted for approval.

PRODUCTS.--

Floor transition moulding.--

Floor transitional moulding shall eliminate abrubt transitions, allowing wheeled, and pedestrian traffic to glide easily between different flooring surfaces with varying heights. It shall transition carpet, resilient tiles, resilient sheet vinyl, ceramic and wood to 0 mm. Floor transitional moulding shall be Burke Mercer Flooring Products, Marley Flexco, Johnsonite, or equal.

Adhesive.--

Adhesive shall be as recommended by floor transition moulding manufacturer.

EXECUTION.--

INSTALLATION.--Floor transitional moulding shall be installed in accordance with the manufacturer's recommendations.

12-9.10 CARPETING

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing carpeting, carpet cushion, adhesives and accessories in accordance with the details shown on the plans and these special provisions.

Carpeting and carpeting materials shall be rated by the manufacturer as suitable for heavy pedestrian traffic and as suitable for use under chairs with casters.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data for carpet, carpet cushion and adhesives, standard color and pattern line and installation instructions for all materials shall be submitted for approval.

Samples.--Carpet colors will be selected from the manufacturer's standard color and pattern line by the Engineer. After the color and pattern have been selected, one sample of carpet and carpet cushion at least 610 mm x 610 mm in size shall be submitted for approval.

Related Work.—Material descriptions for floor transitional moulding can be found in "Floor Transitional Moulding" listed elsewhere in these special provisions.

QUALITY ASSURANCE.--

Single source responsibility.--Materials shall be produced by a single manufacturer for each type of carpet.

DELIVERY, STORAGE AND HANDLING.--

Delivery.--Materials shall be delivered to the job site in original factory wrappings and containers**,** clearly labeled with identification of manufacturer, brand name, quality or grade, fire hazard classification, and lot number.

Storage.--Materials shall be stored in original undamaged packages and containers inside well ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

MAINTENANCE.--

Maintenance instructions.--Contractor shall furnish the manufacturer’s instructions for maintenance of the installed work, including methods and frequency recommended for maintaining optimum condition under anticipated traffic and use conditions.

Extra materials.--After completion of the work, not less than 2 percent of each type and color of carpet, as well as usable scraps, shall be delivered to the Engineer at the jobsite. Accessories shall be furnished to properly complete the installation.

PART 2.- PRODUCTS

Carpet.--

Carpet shall be third generation nylon, continuous filament yarn with a woven polypropylene backing. Yarn shall be solution dyed. Carpet constructions shall be textured loop, 3 mm gage minimum, pile height shall be between 4 mm and 6 mm with a yarn weight of not less than 950 g/m^2. Carpet shall be permanently anti-static.

Cushion.--

Cushion shall be closed cell foamed rubber sheet, made from styrene-butadiene rubber (SBR), not less than 4 mm thick, weighing not less than 2105 g/m^2 with a top and bottom facing which will prevent liquid from being absorbed into the cushion.

Adhesives.--

Cushion to floor adhesive shall be pressure sensitive adhesive as recommended by the cushion manufacturer.

Carpet to cushion adhesive shall be a premium quality, multi-purpose carpet adhesive, compatible with the carpet backing and as recommended by the cushion manufacturer.

Primer, sealant, leveling compound and crack filler.--

Primer, sealant, leveling compound and crack filler shall be as recommended by the cushion manufacturer.

Seaming adhesive.--

Hot-melt seaming adhesive or similar product recommended by carpet manufacturer, shall be used for taping seams and butting cut edges at backing to form secure seams and prevent pile loss at seams.

Edger strips.-- Edger strips shall be commercial quality stainless steel or aluminum.

PART 3.- EXECUTION

PREPARATION.--

General.--Surfaces to receive carpet shall be free of cracks, localized depressions and bumps. Bumps shall be ground flat, holes, depressions and cracks shall be filled with leveling compound or crack filler.

Prior to installation of carpeting, the surface shall be dry broomed clean and free from paint, oil grease, mortar, plaster droppings, wax or other materials that will interfere with the adhesives.

New concrete shall be cured for not less than 30 days and free from parting or curing compound which interfere with the adhesives. Concrete surfaces shall be checked for dusting. Sealer shall be applied to dusting concrete surfaces.

Carpet, carpet cushion and adhesives shall be stored at a temperature not less than 19°C and a humidity not more than 65 percent for not less than 24 hours. Locations where carpet is to installed shall be maintained between 19°C and 32°C for not less than 72 hours prior to and for 5 days following installation.

INSTALLATION.--

Applying primer or sealer.--Primer or sealer, when recommended by the manufacturer, shall be thoroughly brushed on the surface as recommended by the adhesive manufacturer and shall be thoroughly dry prior to application of adhesives.

Installing cushion.--Cushion shall be installed onto a continuous film of adhesive. Adhesive shall be applied in accordance with the manufacturer's instruction. Cushion shall be installed in the longest length possible with consideration for traffic patterns and seam placement. Cushion seams shall be at right angles to the carpet seams and not directly under carpet seams.

When cushion adhesive is tacky, place cushion onto the adhesive and adjust as necessary to insure there is no gap at seams and full contact is made with adhesive. Air bubbles shall be smoothed out to provide a level surface.

Installing carpet.--Carpet installation, seaming techniques and seaming cement shall be in accordance with the carpet manufacturer's recommendation.

Carpet shall be spread full width on cushion for 24 hours prior to installation.

Seam edges shall be trimmed using appropriate seam cutting tools prior to applying adhesives. Seams shall not be cut where cutting tools will penetrate the carpet cushion.

Carpet adhesive shall be spread uniformly over the cushion in accordance with the manufacturer's instructions. After sufficient time, carpet shall be firmly pressed into the adhesive using a roller weighing approximately 25 kg to ensure carpet has full contact with adhesive. Carpet shall be rolled in both directions.

Carpet shall be installed wall to wall in continuous lengths and widths as wide as possible; cut edges shall be trued and appropriately treated to form non-raveling seams where exposed. Excess carpet shall be trimmed to the wall using a wall trimmer adjusted to net trim.

Where carpet patterns or floor finish between rooms differ, pattern or material break shall occur at centerline of common wall; at door openings, the break shall occur at centerline of closed door.

Edger strips shall be installed at free edges.

CLEANING.--

General.--Debris and unusable scraps shall be removed and disposed of. Carpet shall be vacuumed using commercial machine with face-beater element.

Soiled spots, excessive adhesive or other unsightly material on the carpet shall be removed in accordance with the carpet manufacturer's recommendations. Where spots cannot be removed, carpet shall be replaced. Protruding face yard shall be trimmed using sharp scissors.

PROTECTION.--

General.--The Contractor shall protect the carpet from heavy traffic or wear for 24 hours after completion of installation.

Contractor shall provide protective methods and materials as needed to ensure that carpeting will be without deterioration or damage at time of project completion.

12-9.11 PAINTING

PART 1.- GENERAL

SUMMARY.--This work shall consist of preparing surfaces to receive coatings, and furnishing and applying coatings, in accordance with the schedules and details shown on the plans, and these special provisions.

The coatings specified in this section are in addition to any factory finishes, shop priming, or surface treatment specified elsewhere in these special provisions.

SUBMITTALS.--Manufacturer's descriptive data, a materials list, and color samples shall be submitted for approval.

Product descriptive data shall include product description, manufacturer's recommendations for product mixing, thinning, tinting, handling, site environmental requirements, product application and drying time.

Materials list shall include manufacturer's name, trade name, and product numbers for each type coating to be applied.

Color samples shall be manufacturer's color cards, approximately 50 mm x 75 mm, for each color of coating shown on the plans. Color samples for stains shall be submitted on wood of the same species, color, and texture as the wood to receive the stain.

REGULATORY REQUIREMENTS.--Coatings and applications shall conform to the rules for control of volatile organic compound emissions adopted by the air quality control district in the air basin in which the coatings are applied.

SITE ENVIRONMENTAL REQUIREMENTS.--Coatings shall not be applied when the air temperature is below 10°C (20°C for varnishes) or when the relative humidity exceeds 75 percent.

The surface to be coated shall be maintained at a minimum temperature of 7°C for a period of 24 hours prior to, and 48 hours after the application of the coating. Heating facilities shall be provided when necessary.

Continuous ventilation shall be provided during application of the coatings.

A minimum lighting level of 865 lux, measured 1 m from the surface to be coated, shall be provided while surfaces are being prepared for coatings and during coating applications.

DELIVERY, STORAGE, AND HANDLING.--Products shall be delivered to the site in sealed, labeled containers and stored in a well ventilated area at an ambient air temperature of not less than 7°C. Container labeling shall include manufacturer's name, type of coating, trade name, color designation, drying time, and instructions for tinting, mixing, and thinning.

MAINTENANCE STOCK.--Upon completion of coating work, a full 3.8 liter container of each type and color of finish coat and stain used shall be delivered to the location at the project site designated by the Engineer. Containers shall be tightly sealed and labeled with color, texture, and room locations where used, in addition to the manufacturer's standard product label.

PART 2.- PRODUCTS

GENERAL.--The products shall be the best quality grade coatings of the specified types as regularly manufactured by nationally recognized paint and varnish manufacturers that have not less than 10 years experience in manufacturing paints and varnishes. Products that do not bear the manufacturer's identification as the best quality grade product shall not be used. Products for each coating system shall be by a single manufacturer and shall not contain lead type pigments.

Thinners, shellac, fillers, patching compounds, coloring tint, and other products required to achieve the specified finish shall be the manufacturer's best quality and shall be used as recommended.

PART 3.- EXECUTION

INSPECTION.--Surfaces to be coated at the jobsite shall be approved by the Engineer prior to the application of coatings. The Contractor shall notify the Engineer at least 3 working days prior to the application of coatings.

SURFACE PREPARATION.--Surfaces scheduled to be coated shall be prepared in accordance with the following, except that the surfaces not specified herein shall be prepared as recommended by the coating manufacturer.

GENERAL.--Hardware, cover plates, light fixture trim, and similar items shall be removed prior to preparing surfaces for coating. Following the application of the finish coating, the removed items shall be reinstalled in their original locations.

WOOD.--Oil and grease shall be removed by solvent wash. Mildew shall be removed by mildew wash. Surfaces to be coated shall be cleaned of all dirt, excess material, or filler by hand cleaning. Smooth surfaced wood shall be sanded lightly.

A sealer composed of equal parts of shellac and alcohol shall be spot applied to knots, sap, pitch, tar, creosote, and other bleeding substances.

After the application of the prime coat, all nail holes, cracks, open joints, dents, scars, and surface irregularities shall be filled, hand cleaned, and spot primed to provide smooth surfaces for the application of finish coats.

Irregularities in wood surfaces to receive a transparent stain finish shall be filled and hand cleaned after the first coat of stain has been applied. The color of the filler shall match the color of the stained wood.

Irregularities in wood surfaces to receive a clear finish shall be filled and hand cleaned before the application of coatings. The color of the filler shall match the color of the coated wood.

GALVANIZED METAL.--Oils, grease, and fabrication lubricants shall be removed by solvent wash. Surfaces shall be cleaned of remaining surface treatments by hand cleaning. New surfaces shall be roughened by hand cleaning or light abrasive blasting.

Abraded or corroded areas shall be hand cleaned and spot coated with one coat of vinyl wash pretreatment. Abraded or corroded areas on new surfaces not scheduled to be painted shall be cleaned by solvent wash, hand cleaned, and given 2 spot applications of zinc rich paint.

STEEL AND OTHER FERROUS METALS.--Oils, grease, and fabrication lubricants shall be removed by solvent wash. Dirt, water soluble chemicals, and similar surface contamination shall be removed by detergent wash or steam cleaning. Mill scale and rust shall be removed by hand cleaning or abrasive blasting.

ALUMINUM AND OTHER NON-FERROUS METALS.--Oils, grease, and fabrication lubricants shall be removed by solvent wash. Dirt, water soluble chemicals, and similar surface contamination shall be removed by detergent wash.

GYPSUM BOARD.--Holes, cracks, and other surface imperfections shall be filled with joint compound or suitable filler prior to application of coatings. Taped joints and filled areas shall be hand sanded to remove excess joint compound and filler.

CEMENT PLASTER.--New plaster shall be cured a minimum of 14 days before coating. Cracks, holes, and surface imperfections shall be filled with patching plaster and hand textured to match adjacent surfaces.

CONCRETE AND CONCRETE UNIT MASONRY.--New material shall be cured a minimum of 14 days before coating. Surface dirt and dust shall be removed by brooming, air blast, or vacuum cleaner. Oil and grease shall be removed by steam cleaning. Form release agents, weak concrete, surface laitance, dirt, and other deleterious material shall be removed by sandblasting. Cracks and voids shall be filled with cement mortar patching material.

PREVIOUSLY COATED AND SHOP PRIMED SURFACES.--Dirt, oil, grease, or other surface contaminants shall be removed by water blasting, steam cleaning, or TSP wash. Minor surface imperfections shall be filled as required for new work. Mildew shall be removed by mildew wash. Chalking paint shall be removed by hand cleaning. The surfaces of existing hard or glossy coatings shall be abraded to dull the finish by hand cleaning or light abrasive blasting. Abrasive blasting shall not be used on wood or non-ferrous metal surfaces.

Chipped, peeling, blistered, or loose coatings shall be removed by hand cleaning, water blasting, or abrasive blasting. Bare areas shall be pretreated and primed as required for new work.

DEFINITIONS.--

DETERGENT WASH.--Removal of dirt and water soluble chemicals by scrubbing with a solution of detergent and water, and removal of all solution and residues with clean water.

HAND CLEANING.--Removal of dirt, loose rust, mill scale, excess base material, filler, aluminum oxide, chalking paint, peeling paint, or paint which is not firmly bonded to the surfaces by using hand or powered wire brushes, hand scraping tools, power grinders, or sandpaper and removal of all loose particles and dust prior to coating.

MILDEW WASH.--Removal of mildew by scrubbing with a solution of detergent, hypochlorite-type household bleach, and warm water, and removal of all solution and residues with clean water.

ABRASIVE BLASTING.--Removal of oil, grease, form release agents, paint, dirt, rust, mill scale, efflorescence, weak concrete, or laitance, by the use of airborne abrasives, and removal of loose particles, dust, and abrasives by blasting with clean air.

Abrasives shall be limited to clean dry sand, mineral grit, steel grit, or steel shot, and shall be graded to produce satisfactory results. Unwashed beach sand containing salt or silt shall not be used.

Abrasive blasting shall conform to the requirements of SSPC-SP6-85, Commercial Blast Cleaning, as defined in the Steel Structures Painting Council Manual.

Light abrasive blasting shall conform to the requirements of SSPC-SP7-85, Brush-Off Blast Cleaning, as defined in the Steel Structures Painting Council Manual.

SOLVENT WASH.--Removal of oil, grease, wax, dirt, or other foreign matter by using solvents, such as mineral spirits or xylol, or other approved cleaning compounds.

STEAM CLEANING.--Removal of oil, grease, dirt, rust, scale, or other foreign matter by using steam generated by commercial steam cleaning equipment, from a solution of water and steam cleaning compounds, and removal of all residues and cleaning compounds with clean water.

TSP WASH.--Removal of oil, grease, dirt, paint gloss, and other foreign matter by scrubbing with a solution of trisodium phosphate and warm water, and removal of all solution and residues with clean water.

WATER BLASTING.--High pressure, low volume water stream for removing dirt, light scale, chalking or peeling paint. Water blasting equipment shall produce not less than a 13 800 MPa minimum output pressure when used. Heated water shall not exceed 66°C. If a detergent solution is used, it shall be biodegradable and shall be removed from all surfaces with clean water.

PROTECTION.--The Contractor shall provide protective devices, such as tarps, screens or covers, as necessary to prevent damage to the work and to other property or persons from all cleaning and painting operations.

Paint or paint stains on surfaces not designated to be painted shall be removed by the Contractor at his expense and the original surface restored to the satisfaction of the Engineer.

APPLICATION.--

GENERAL.--Coatings shall be applied in accordance with the printed instructions and at the application rates recommended by the manufacturer to achieve the dry film thickness specified in these special provisions.

Mixing, thinning and tinting shall conform to the manufacturer's printed instructions. Thinning will be allowed only when recommended by the manufacturer.

Coatings shall be applied only when surfaces are dry and properly prepared.

Cleaning and painting shall be scheduled so that dust and other contaminants from the cleaning process will not fall on wet, newly coated surfaces.

Materials required to be coated shall have coatings applied to all exposed surfaces, including the tops and bottoms of wood and metal doors, the insides of cabinets, and other surfaces not normally visible from eye level.

APPLICATION SURFACE FINISH.--Each coat shall be applied to a uniform finish. Finished surfaces shall be free of surface deviations and imperfections such as skips, cloudiness, spotting, holidays, laps, brush marks, runs, sags, curtains, ropiness, improper cutting in, overspray, drips, ridges, waves, and variations in color and texture.

Each application of a multiple application finish system shall closely resemble the final color coat, except each application shall provide enough contrast in shade to distinguish the separate applications.

WORK REQUIRED BETWEEN APPLICATIONS.--Each application of material shall be cured in accordance with the coating manufacturer's recommendations before applying the succeeding coating. Enamels and clear finishes shall be lightly sanded, dusted, and wiped clean between applications.

Stain blocking primer shall be spot applied whenever stains bleed through the previous application of a coating.

TIMING OF APPLICATIONS.--The first application of the specified coating system shall be applied prior to any deterioration of the newly prepared surface. Metal surfaces shall be prepared and prime coated the same day that cleaning of bare metal is performed. Additional prime coats shall be applied as soon as drying time of the preceding coat permits.

Metal surfaces shall be prime coated within 12 hours of application of vinyl wash pretreatment.

Shellac sealer shall be allowed to dry at least 12 hours before applying the next coat.

Drying time between applications of water borne coatings shall be at least 12 hours.

APPLICATION METHODS.--Coatings shall be applied by brush, roller or spray. Rollers shall be of a type which do not leave a stippled texture in the paint film. Extension handles for rollers shall not be greater than 2 m in length.

If spray methods are used, surface deviations and imperfections such as, overspray, thickness deviations, lap marks, and orange peel shall be considered as evidence that the work is unsatisfactory and the Contractor shall apply the remainder of the coating by brush or roller, as approved by the Engineer.

DRY FILM THICKNESS.--

Vinyl wash pretreatment	0.007 mm to 0.13 mm, maximum.
Bituminous paint	0.1 mm, minimum.
Epoxy polyamide primer	0.1 mm, minimum.
Aliphatic polyurethane enamel	0.05 mm, minimum.
Other primers, undercoats, sealers, and coatings	As recommended by the manufacturer.

BACKPRIMING.--The first application of the specified coating system shall be applied to all wood surfaces (face, back, edges, and ends) of wood materials that are not factory coated, immediately upon delivery to the project site, except surfaces of interior finish woodwork that adjoin concrete or masonry shall be coated with one application of alkyd exterior wood primer before installation.

When clear or stain type coatings are required on millwork, trim, or paneling, varnish, reduced 25 percent by mineral spirits, shall be used for coating the back faces.

All primed metal surfaces in contact with concrete or concrete block exterior walls shall be coated with a bituminous paint on those surfaces in contact with the wall.

PATCHES IN PREVIOUSLY COATED SURFACES.--Where patches are made on surfaces of previously coated walls or ceilings, the entire surface to corners on every side of the patch shall be coated with a minimum of one application of the finish coat.

FINISHING MECHANICAL AND ELECTRICAL COMPONENTS.--Shop primed mechanical and electrical components shall be finish coated in accordance with the coating system entitled, "Shop Primed Steel." Louvers, grilles, covers, and access panels on mechanical and electrical components shall be removed and coated separately.

Interior surfaces of air ducts which are visible through grilles or louvers shall be coated with one application of flat black enamel, to limit of the sight line.

Exposed conduit, piping, and other mechanical and electrical components visible in public areas shall be painted.

Both sides and all surfaces, including edges and back of wood mounting panels for electrical and telephone equipment shall be finish coated before installing equipment.

CLEANING.--Upon completion of all operations, the coated surfaces shall be thoroughly cleaned of dust, dirt, grease, or other unsightly materials or substances.

Surfaces marred or damaged as a result of the Contractor's operations shall be repaired, at his expense, to match the condition of the surfaces prior to the beginning of the Contractor's operations.

COATING SYSTEMS.--The surfaces to be coated shall be as shown on the plans and as specified elsewhere in these special provisions. When a coating system is not shown or specified for a surface to be finish coated, the coating system to be used shall be as specified for the substrate material. The number of applications specified for each coating system listed herein is a minimum. Additional coats shall be applied if necessary to obtain a uniform color, texture, appearance, or required dry film thickness.

SYSTEM 1- ALUMINUM AND OTHER NON-FERROUS METALS.--

1 pretreat coat:	vinyl wash pretreatment
1 prime coat:	aluminum primer
2 finish coats:	acrylic, exterior enamel, semi-gloss

SYSTEM 2- CEMENT PLASTER AND CONCRETE.--

1 prime coat:	concrete and masonry primer
2 finish coats:	acrylic, exterior enamel, semi-gloss

SYSTEM 3- VENEER PLASTER SYSTEM (lower floor).--

1 prime coat:	exterior, acrylic masonry sealer
2 finish coats:	exterior, elastomeric wall coating

SYSTEM 4- VENEER PLASTER SYSTEM (main floor).--

1 prime coat:	interior, alkyd pigmented sealer
2 finish coats:	interior, acrylic semi-gloss enamel

SYSTEM 5- CONCRETE UNIT MASONRY.--

1 pretreat coat:	block filler
1 prime coat:	concrete and masonry primer
2 finish coats:	acrylic, exterior enamel, semi-gloss

SYSTEM 6- GALVANIZED METAL.--

1 pretreat coat:	vinyl wash pretreatment
1 prime coat:	galvanized metal primer
2 finish coats:	acrylic, exterior enamel, semi-gloss

SYSTEM 7- GYPSUM BOARD.--

1 prime coat:	PVA wall sealer
2 finish coats:	acrylic, interior enamel, semi-gloss

SYSTEM 8- SHOP PRIMED STEEL.--

1 prime coat :	red oxide ferrous metal primer
2 finish coats:	alkyd, exterior enamel, semi-gloss

SYSTEM 9- STEEL AND OTHER FERROUS METALS.--

2 prime coats:	red oxide ferrous metal primer
2 finish coats:	alkyd, exterior enamel, semi-gloss

COLOR SCHEDULE.--Colors shall be as shown on the plans.

12-9.12 VINYL WALLCOVERING

GENERAL.--This work shall consist of furnishing and installing vinyl wallcovering in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--Product descriptive data, installation instructions and samples of the vinyl wallcovering shall be submitted for approval. The size of samples shall be not less than 155 mm x 155 mm.

PRODUCTS.--

Vinyl wallcovering.--

Vinyl wallcovering shall be scrubbable, colorfast, and stain resistant vinyl conforming to Federal Specification: CCC-W-408A, Type II. Vinyl shall have a maximum flame spread rating of 25 and a total weight of not less than 745 g/m of material that is 1370 mm wide. Vinyl wallcovering shall be Tower, Koroseal, Genon, or equal. Color pattern and texture shall be similar to the color pattern and texture shown on room finish schedule:

Paste.--

Paste shall be as recommended by the wallcovering manufacturer.

EXECUTION.--

PREPARATION.--Surfaces to receive vinyl wallcovering shall be smooth, clean and free of irregularities. Cracks, holes and depressions shall be filled and bumps shall be removed. Fillers shall be compatible with the wallcovering and paste to be used.

INSTALLATION.--The vinyl wallcovering shall be installed in accordance with the manufacturer's recommendations.

The installed wallcovering shall have tight fitting butt joints and shall be free of air bubbles, wrinkles, open joints, mismatched sheets, loose edges, or other defects. Joints shall be located no closer than 105 mm from external corners. Internal corner joints shall be butt joined.

Paste shall be removed from the exposed surfaces of the installed wallcovering.

12-9.13 FIBERGLASS REINFORCED PLASTIC PANELS

GENERAL.--This work shall consist of furnishing and installing fiberglass reinforced plastic (FRP) panels and trim molding in accordance with details shown on the plans and these special provisions.

SUBMITTALS.--Manufacturer's descriptive data, installation instructions, and finish options shall be submitted for approval.

Product descriptive data shall show the manufacturer's name and shall indicate conformance to these special provisions.

Installation instructions shall show the FRP panel manufacturer's recommended method of installation.

Finish options shall show the manufacturer's standard color palette for FRP panels and trim molding. Color shall be as shown on the plans.

PRODUCTS.--

FRP panel.--

FRP panel shall be Class I flame-spread, minimum nominal thickness of 2 mm; Marlite, Class A/I FRP; Kemlite, Fire-X Glasbord; or equal.

Trim molding.--

Trim molding shall be manufacturer's standard vinyl molding with nailing flanges and a 9 mm deep channel of sufficient width to receive panels and sealant.

Adhesive and sealant.--

Adhesive and sealant shall be as recommended by the FRP panel manufacturer.

EXECUTION.--

INSTALLATION.--The FRP panels and trim molding shall be installed in accordance with the manufacturer's installation instructions.

Trim molding shall be nailed through the flange into solid wood backing. All nails shall be concealed by FRP panels in the completed installation. Trim shall be one continuous piece along each wall unless the wall length exceeds the manufacturer's standard trim length. If more than one piece is used on one wall, the pieces shall be approximately equal length, with no piece less than 1 m in length. All FRP panel edges shall be covered by a trim molding.

Panels shall be one continuous piece along each wall unless the wall length exceeds the manufacturer's standard panel length. If more than one panel piece is used on one wall, the pieces shall be approximately equal length, with no piece less than one meter in length.

CLEAN-UP.--Adjacent surfaces shall be protected from adhesive or sealant. Excess adhesive and sealant shall be removed as the installation progresses using a solvent or cleaning agent recommended by the FRP panel manufacturer.

12-9.14 SUSPENDED CEILINGS

GENERAL.--This work shall consist of furnishing and installing suspended ceilings in accordance with the details shown on the plans and these special provisions.

Suspended ceilings shall consist of lay-in acoustical ceilings panels and an exposed grid suspension system. Listed fire rated assemblies shall be installed where shown on the plans.

DESIGN.--The suspension system shall be designed to support the weight of ceiling panels, lighting fixtures, air terminals, service assemblies and such other items, not mentioned, which are supported by the suspended ceiling system.

The deflection of any component of the suspension system shall not exceed 1/360 of the span.

The suspension system shall be designed for seismic restraint in accordance with ASTM Designation: E 580.

Lighting fixture attachments shall be designed for a capacity of 100 percent of the lighting fixture weight acting in any direction.

SUBMITTALS.--Manufacturer's descriptive data and installation instructions and complete working drawings of all supporting details, lighting fixture attachments, lateral force bracing, partition bracing and runner and panel layouts shall be submitted for approval.

Acceptable manufacturer's.—Acceptable manufacturers are Armstrong, Cortega Second Look (square/medium texture) or Cirrus Second Look (fine texture); Celotex, Celotone Everest Designer Series Ceiling or Softone Cashmere Designer Series Ceiling; USG Corporation, Frost Face Cuts or Omni Face Cuts; or equal.

PRODUCTS.--

Acoustical panels.--

Acoustical panels shall be factory produced, lay-in panels, 610 mm x 1219 mm x 16 mm thick with non-directional natural fissured random perforated surface texture and factory applied, washable, off-white, vinyl latex finish. Panels shall conform to ASTM E 1264 Type III, form 2. Noise Reduction Coefficient (NRC) shall be minimum 0.65. Panels shall have a flame spread rating not exceeding 25.

Acoustical panels type 2.--

Acoustical panels type 2 shall have be 152 mm x 152 mm scoring pattern.

Suspension system.--

Suspension system shall be galvanized steel, tee shaped main runners and cross runners and wall molding angles or channels conforming to ASTM Designation: C 635, intermediate duty or heavy duty. Runners shall have exposed flanges approximately one inch wide and positive interlocks between main runners and cross runners. Wall moldings shall have a 19 mm wide exposed face. Runners and moldings shall be bonderized and shall have a flat off-white color, factory painted finish unless otherwise shown on the plans.

Wire hangers.--

Wire hangers shall be 2.7 mm (12-gage) minimum, galvanized, soft-annealed, mild steel wire.

Assembly devices, splices, intersection connectors and expansion devices.--

Assembly devices, splices, intersection connectors and expansion devices shall be as recommended by the suspension system manufacturer.

EXECUTION.--

INSTALLATION.--The suspended ceiling shall be installed square, level and true in accordance with the approved working drawings, the manufacturer's installation instructions and the requirements of ASTM Designations: C 636 and E 580 and Uniform Building Code (UBC) Standard No. 25-2.

Hangers for the suspension system shall be spaced at not more than 1.2 m on centers and shall be saddle tied or wrapped around the main runner members.

Except as specified herein, all lighting fixtures, air terminals, services or other ceiling supported items shall be positively attached to the suspension system.

Lighting fixtures, air terminals, services or other items weighing less than 25 kg shall have, in addition to the requirements specified herein, two 2.7 mm (12-gage) hangers connected from the housing of the fixture, terminal, service or other items to the structure above. These hanger wires may be slack.

Lighting fixtures, air terminals, services or other items weighing more than 25 kg shall be supported directly from the structure above.

The ceiling shall be leveled to within 3 mm in 3.6 m.

MAINTENANCE STOCK.--Upon completion of the suspended ceiling work, one unopened carton of acoustical panels shall be delivered to a location at the project site designated by the Engineer.

12-9.15 LINEAR METAL CEILING

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing linear metal ceiling and lighting fixture in accordance with the detail shown on the plans and these special provisions.

Linear metal ceiling includes factory fabricated and finished panels, carriers, fasteners and other components and accessories which are required for a complete installation.

Linear metal ceiling shall be installed in flat ceiling configurations.

Design.--The suspension system shall be designed for seismic restraint in accordance with ASTM Designation: E 580.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data, manufacturer's standard color palette, catalog cuts or standard drawings showing details of system and manufacturer's recommended installation instructions shall be submitted for approval.

Working drawings.--Reflected ceiling plan and installation drawings shall be submitted for approval.
Reflected ceiling plan shall indicate the layout and dimensions of the ceiling components.
Installation drawings shall detail the complete installation, including carrier system assembly, carrier system connection to structural elements, bracing details, joining details, connections between carriers and panels, details of level change and changes in patterns.

Samples.--Samples, including 3 samples of each type of linear metal ceiling system, not less than 8 inches in length and 3 panels wide shall be submitted for approval. Carriers shall be included with each sample to allow representative assembly of the ceiling system.
Three samples of each type of trim, not less than 8 inches long shall be submitted.

DELIVERY, STORAGE AND HANDLING.--

Delivery.--Materials shall be delivered in original, unopened packages clearly labeled with manufacturer's name and identification numbers.

Storage.--Materials shall be stored in a fully enclosed space above the floor on skids in such a manner as to prevent warpage, scratches or damage of any kind.

Handling.--Materials shall be handled in such a manner as to prevent racking, bending, chipping of edges, distortion or other damage.

PROJECT CONDITIONS.--

Environmental conditions.—Installation of the linear metal ceiling system shall occur only when temperature and humidity conditions closely approximate the conditions that will exist when area is complete and occupied.
All overhead work above the ceiling support system, including electrical and mechanical installation, shall be complete prior to the installation of the linear metal ceiling.

MAINTENANCE.--

Extra materials.--After completion of the work, not less than 2 percent of each type and color of linear metal ceiling components installed, as well as usable scraps, shall be delivered to the Engineer at the job site.
Necessary accessories shall be furnished to properly maintain the installation.
Materials shall be labeled and securely wrapped for storage.

PART 2.- PRODUCTS

MATERIALS.--

Exterior ceiling panels.--

Exterior ceiling panels shall be roll-formed from commercial quality sheet aluminum, 0.61 mm minimum thickness. Panels shall have a nominal 82 mm wide face with a closed reveral or have closures between panels and 19 mm deep vertical legs with edges formed to snap onto carrier members and be positively locked in place with no additional fasteners. Panel shall be factory-finished with a baked enamel paint finish. Color shall be selected from the manufacturer's standard color palette after the award of the contract.

Splice plate shall be aluminum with finish color to match panels and formed for snap-fit in butt-cut panel ends.

Exterior carrier system.--

Exterior carriers shall be made from commercial quality roll-formed aluminum alloy, 1 mm minimum thickness and shall be factory-finished with a matte black baked enamel paint finish. Carriers shall be formed and fabricated to provide a mechanical connection for panel attachment and shall have prepunched holes for direct suspension. Carriers shall maintain a panel spacing of 102 mm on center.

Closures.--

Closures shall be as recommended by the ceiling manufacturer. Closures shall be factory finished in matte black.

ACCESSORIES.—

Trim channel.--

Trim channel shall be 0.61 mm nominal aluminum, roll-formed into channel shape and factory finished to match panels.

End plugs.--

End plugs shall be the size and configuration of panel design, factory finished to match panels.

Spacer clip.--

Spacer clip used to set module and prevent linear movement of panels shall be the manufacturer's standard vinyl clip extruded from matte black vinyl material.

Hanger wire.--

Hanger wire shall be 12-gage galvanized soft-annealed, mild steel wire.

Pan retainer and seismic clips.--

Pan retainer and seismic clips shall be the manufacturer's standard steel clips to prevent panels from being dislodged from main tee due to impact or seismic events.

Acoustical insulation.--

Acoustical insulation shall be black Class A acoustical fiberglass material, no surface printing, 25 mm thick, 32 kg per cubic meter density, 0.60 Noise Reduction Coefficient (NCR).

Light fixture.--

Light fixture shall be flourescent light from double lamp design of the liner metal ceiling line of accessories.

FABRICATION.—

Panels.--Edges of panels shall be formed to shape to carrier members and provide a positive locking mechanism, and shall be factory finished to match approved samples.

Carrier system.--Support system shall be formed and fabricated for mechanical connection with adjoining sections and prepunched holes for direct suspension.

PART 3.- EXECUTION

INSPECTION.--

Work to be concealed.--The Contractor shall verify that all work above the support system is complete, tested in a manner which will not affect layout and installation of the linear metal ceiling system.

PREPARATION.--

Layout.--The Contractor shall verify field dimensions and compare with installation drawing prior to installation.

INSTALLATION.--

General.--The linear panel ceiling suspension system shall be installed square, level and true in accordance with the approved working drawings, the manufacturer's installation instructions and the requirements of ASTM Designations: C 636 and E 580 and Uniform Building Code (UBC) Standard No. 47-18.

Carrier system.--Symmetrical carriers shall be spaced at 1.2 m on centers and secured to main tee with hanger wires or secured directly to structural supports.

Carrier system shall be aligned to be straight, level and in required position.

At the perimeter of the installation, utilize wall angle, channel mold, or edge trim when end caps are not or cannot be utilized.

Hanger wires.--Hanger wires shall be spaced at 1.2 m on center along length of carrier system and attached directly to the building structure above. Hanger wires shall not be attached directly to mechanical or electrical equipment, piping, or other equipment occurring above ceiling.

Ceiling panels.--Panels shall be snapped into position, splice end-to-end with snap-fit splice plates.

Panels shall be installed in alternate rows to permit point access

Where ceiling panels change direction, panels shall be trimmed to the correct angle and secured at ends for rigidity.

Where panel ends are visible, end plugs shall be installed flush with end surface.

Access.--Where access to area above ceiling is shown on the drawings, cut ceiling panels and carriers to the required dimensions and install access door assembly as recommended by the ceiling manufacturer and in accordance with the approved working drawings.

FIELD QUALITY CONTROL.--

Deflection.--Maximum deflection on installed system shall not exceed 1/360 of the span.

Cleaning.--Clean painted panels with non-abrasive, non-solvent-base commercial cleaner. Immediately remove and corrosive substances or chemicals that would attack the painted finish. Touch-up all minor scratches and spots with a compatible, color matched touch-up paint as recommended by the ceiling manufacturer.

SECTION 12-10. SPECIALTIES

12-10.01 TACKBOARDS

GENERAL.--This work shall consist of furnishing and installing tackboards in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--Manufacturer's descriptive data, color and texture samples and installation instructions shall be submitted for approval. Color and texture will be selected by the Engineer after the award of the contract.

PRODUCTS.--

Tackboards.--

Tackboards shall be vinyl, Class I flame spread, laminated to 6 mm natural cork underlayment. Lamination to be free of bubbles and wrinkles. Cork underlayment shall be bonded to a 6 mm thick hardboard backing. Tackboard dimensions shall be2.4 m wide x 1.2 m high.

Border moldings.--

Border moldings shall be factory applied, extruded clear anodized aluminum trim.

EXECUTION.--

INSTALLATION.--Tackboards shall be installed rigidly, securely, plumb and true, and in accordance with the manufacturer's recommendations.

12-10.02 MARKER BOARDS

GENERAL.--This work shall consist of furnishing and installing a marker boards in accordance with the details shown on the plans and these special provisions.

One felt eraser and 12 felt tipped liquid chalk markers of assorted colors shall be furnished for each marker board installed.

SUBMITTALS.--Manufacturer's descriptive data and installation instructions shall be submitted for approval.

PRODUCTS.--

Marker board.--

Marker board shall conform to Porcelain Enamel Institute Standard PEI-S-104, and shall be porcelain enamel surface on 0.61 mm thick (24-gage) sheet steel pressure laminated to 6 mm thick tempered hardboard. Hardboard shall have a backing of 0.38 mm nominal thickness aluminum sheet. Enamel surface shall be suitable for marking with felt tipped liquid chalk markers and erasing with a felt eraser or dry cloth. The enamel surface shall be white in color. Markerboard shall have 6063-T5 aluminum trim with satin etched and anodized clear finish.

Marker board dimensions shall be 2.4 m long x 1.2 m high.

Trim and marker tray.--

Trim and marker tray shall be factory installed, satin finish, clear anodized aluminum extrusions.

EXECUTION.--

INSTALLATION.--Marker boards shall be installed rigidly, securely, plumb and true in accordance with the manufacturer's instructions.

12-10.03 METAL TOILET PARTITIONS

GENERAL.--This work shall consist of furnishing and installing metal toilet partitions in accordance with the details shown on the plans and these special provisions.

Metal toilet partitions shall consist of panels, doors, pilasters, headrails, urinal screens, fasteners, anchorages and hardware. Internal reinforcement shall be provided at all fasteners, anchorages, hardware and accessories.

Doors, panels, pilasters, and urinal screens shall be stainless steel with a No. 4 satin finish.

SUBMITTALS.--Manufacturer's descriptive data, installation instructions and working drawings shall be submitted for approval.

Working drawings shall show the plan layout, door and panel elevations and all details required for the complete installation and anchorage of the partition system.

PRODUCTS.--

Doors and panels.--

Doors and panels shall be flush, 25 mm thick, formed of two 0.76 mm (22-gage) Type 304 stainless steel sheets over a honeycomb core. Doors and panels shall have formed edges sealed with a continuous oval crown locking strip, and shall be mitered, welded, and finished at corners.

Doors shall have controlled action hinges, with vertical pintle and ball bearing roller operating on adjustable cams, or moving parts of nylon and stainless steel. Top pivots shall be recessed into edges of doors.

Doors shall be provided with slide bar latch and a combination coat-hat hook and door stop. Doors on stalls designed for use by the disabled shall also be provided with door pulls.

Pilasters.--

Pilasters shall be 32 mm thick, of the same construction as the doors and panels, except face sheets shall be 0.91 mm (20-gage), with adjustable leveling base.

Pilasters shall be 32 mm thick, of the same construction as the doors and panels, except face sheets shall be 1.3 mm for galvanized steel and 1.2 mm for stainless steel (18-gage), with adjustable, leveling base incorporating two 9.5 mm diameter stud expansion anchors with leveling nuts.

Headrails.--

Headrails shall be anodized aluminum, 25 mm x 38 mm minimum, with exposed ends capped.

Urinal screens.--

Urinal screens shall be wedge type, wall-mounted, and of the same construction as the doors and panels, except face sheets shall be 1.0 mm (20-gage) minimum thickness. All fasteners shall be concealed.

Fasteners and anchorages.--

Fasteners and anchorages shall be stainless steel with vandal resistant heads.

Hardware.--

Hardware shall be highly polished chromium plated, cast alloy, or heavy duty anodized aluminum.

Pilasters anchors.--

Pilasters anchors shall be integral stud anchor type or internally threaded expansion sleeve type with single cone expander. Self-drilling type anchorage shall not be used.

Pilaster shoes.--

Pilaster shoes shall be one-piece, stainless steel, with concealed hold down clips, and of sufficient height to completely cover the base and anchors.

EXECUTION.--

INSTALLATION.--Metal toilet partitions shall be installed rigidly, securely, plumb, and true and in accordance with the manufacturer's recommendations. Tops and bottoms of doors shall align with tops and bottoms of panels, and all horizontal lines shall be level.

Rigid backing shall be provided in walls to receive anchorages.

Panels shall be anchored with at least 3 brackets at each wall and pilaster. Two anchors shall be used to fasten each pilaster base to the floor.

Doors shall not bind during opening and closing. The clearance between the door edges and pilasters shall be uniform, equidistant, and shall not exceed 5 mm. Hinges shall be adjusted to hold doors ajar when unlatched. Doors on stalls designed for use by the disabled shall return to the closed position.

Drilling, cutting and fitting of wall and floor finishes shall be concealed by the completed installation.

CLEAN-UP.--Toilet partitions shall be cleaned, polished and free of all defects. Chipped, dented, scratched, or otherwise damaged work shall be replaced at the Contractor's expense.

12-10.04 LOUVERS

GENERAL.--This work consists of furnishing and installing louvers in accordance with the details shown on the plans and these special provisions. Fire dampers shall conform to the requirements specified under "Heating, Ventilating and Air Conditioning Equipment and Systems," in Section 12-15, "Mechanical," of these special provisions.

SUBMITTALS.--Manufacturer's descriptive data and installation instructions shall be submitted for approval.

PRODUCTS.--

Louvers.--

Louvers shall be factory fabricated units of extruded aluminum alloy not less than 2 mm thick (12-gage) or galvanized steel sheet not less than 1.63 mm thick (16-gage) with standard "Z" type blades, and removable bronze 16 x 16 mesh insect screens mounted on the inside of the units.

Louvers shall have integral caulking strips and retaining beads.

Aluminum louvers shall be installed where the adjacent exterior wall finish is the aluminum composite wall panel. Finish and color of the louvers to match the adjacent surfaces.

All other louvers shall be galvanized sheet steel.

EXECUTION.--

INSTALLATION.--Louvers shall be installed in accordance with the manufacturer's instructions. The completed louver installation shall be weather tight.

PAINTING.--Louvers shall be cleaned, prepared and painted in accordance with the requirements specified under "Painting" in Section 12-9, "Finishes," of these special provisions.

12-10.05 FLAGPOLE

GENERAL.--This work shall consist of designing, furnishing, and installing a groundset flagpole and foundation in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--Manufacturer's descriptive data and installation instructions shall be submitted for approval.

PRODUCTS.--

Flagpole.--

Flagpole shall be tapered, 7.6 meter exposed height, 6063-T6 aluminum alloy pole with 150 mm diameter aluminum ball, ball bearing non-fouling truck with aluminum body and 102 mm diameter aluminum sleeves, 230 mm cast aluminum cleat and 8 mm polypropylene rope halyards with flag clasps. Flagpole shall be designed for the wind loads shown on the plans. Aluminum shall be clear anodized after fabrication.

Metal sleeve, sand, wedges and sealant for flagpole foundation.--

Metal sleeve, sand, wedges and sealant for flagpole foundation shall be as recommended by the flagpole manufacturer. Metal sleeve shall be capped and shall have a ground spike with support plate.

Concrete.--

Concrete shall be as specified "Cast-In-Place Concrete" in Section 12-3, "Concrete and Reinforcement," of these special provisions and shall contain not less than 350 kg of cement per cubic meter.

EXECUTION.--The flagpole shall be erected plumb and rigid in accordance with the manufacturer's recommendations. Sand shall be consolidated before placing sealant.

12-10.06 METAL SIGNS

GENERAL.--This work shall consist of furnishing and installing metal signs in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--Manufacturer's descriptive data, colors, graphics and fastening details shall be submitted for approval.

PRODUCTS.--

Signs.--

Signs shall be sheet steel, not less than 1.22 mm thick (18-gage) with a baked-on enamel coating.

Signs shall have a white background with contrasting red letters. Red letters shall be 50 mm minimum in height.

Fasteners.--

Fasteners shall be as recommended by the sign manufacturer.

EXECUTION.--Sign inscriptions shall read as shown on the plans.

Each sign shall be located as shown on the plans and shall be fastened in place with a minimum of 6 fasteners for each sign.

12-10.07 WARDROBE LOCKERS

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing wardrobe lockers in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data, installation instructions, and standard color palette shall be submitted for approval.

Unless otherwise shown on the plans, the color will be selected by the Engineer from the standard color palette after the award of the contract.

PART 2.- PRODUCTS

ACCEPTABLE MANUFACTURERS.--

Available manufacturers.--Subject to conformance with the contract provisions, metal lockers shall be Penco Products Inc.; Republic Storage Systems; List Industries, Inc; Lyon Metal Products; or equal.

Lockers.--

Lockers shall be standard, factory fabricated steel units. Framing shall be 1.52 mm thick (16-gage) and face sheets shall be 0.61 mm (24-gage), except door face sheets shall be 1.5 mm (16-gage).

Lockers shall be equipped with the following: hat shelf located approximately 255 mm below the top of the wardrobe locker, side to side coat rod, coat hook, louver vents at top and bottom of door, nonbreakable handle with provisions for a padlock, lockbar with 3-point latching contact with door frame and 1 1/2 pair full looped leaf hinges.

Provide lockers that comply with the ADA requirements as shown on the plans.

The approximate dimensions of the wardrobe lockers shall be 380 mm wide, 457 mm deep and 1829 mm high.

Base.--

Base shall be as shown on the plan.

Top.--

Top shall be the manufacturer's standard flat top with recessed trim, fabricated of the same material and designed for use with the lockers provided. Install recess trim in accordance with the details shown on the plans.

FABRICATION.--

Shop assembly.--Lockers shall be fabricated square, rigid, and without warp, with metal faces flat and free of dents or distortion.

Frame joints and seams shall be welded. Exposed welds shall be ground smooth. Hinge and latch connections shall be welded or riveted.

Bolts shall be used for assembly and mounting lockers components. Bolt or rivet heads on fronts of locker doors or frame shall not be exposed.

Factory finish.--Lockers shall be chemically pretreated with degreasing and phosphatizing process. Wardrobe lockers shall have a baked enamel finish on all surfaces, exposed and concealed.

PART 3.- EXECUTION

Installation.--Lockers shall be mounted on closed bases at locations shown in accordance with the manufacturer's instructions for plumb, level, rigid, and flush installation.

Wardrobe lockers shall be bolted together at tops and bottoms. The backs of the end lockers shall be bolted to wall anchors with 6 mm bolts installed near the tops of the wardrobe lockers as recommended by the locker manufacturer.

Trim, tops, and metal filler panels, if required, shall be installed using concealed fasteners to provide flush, hairline joints against adjacent surfaces.

The number of lockers shall be as shown on the plans.

12-10.08 WALL GUARD

General.--

This work shall consist of furnishing and installing wall guard at the location shown on the plans and these special provisions.

SUBMITTALS

Manufacturer's descriptive data, color sample and installation instructions shall be submitted for approval.

PRODUCTS.--

Wall guard.--

Wall guard shall be 76 mm or 102 mm in height. Wall guard shall have a continuous aluminum retainer and vinyl cover. Wall guard shall be InPro Corporation, Model No. 500; American Floor Products Co., Inc., Model Navajo (WG-2169); Pawling Corporation, Model No. WGG-4; or equal.

EXECUTION.--

INSTALLATION

The wall guards shall be installed and fastened securely in accordance with the manufacturer's recommendations.

12-10.09 ACCESS FLOOR

General.--

This work shall consist of furnishing and installing access floor at the location shown on the plans and these special provisions.

SUBMITTALS

Manufacturer's descriptive data, working drawings and installation instructions shall be submitted for approval.

PRODUCTS.--

Access floor.--

Access floor system shall consist of interchangeable steel square panels. Panels shall have a vinyl composition tile or solid vinyl tile finish. Panel concentrated design load shall not be less than 454 kg. Pedestal assembly shall provide an 3628 kg axial load without permanent deformation. Steel stringers shall be heavy duty, roll formed and withstand 204 kg mid-span load. Access floor shall be Tate Access Floors, Inc., Model No. Xena 3000; Interface Architectural Resources, Atlantic series; Maxcess Technologies, Inc., S-series; or equal.

EXECUTION.--

INSTALLATION

The access floor shall be installed in accordance with the manufacturer's recommendations.

12-10.10 WOOD BENCHES

GENERAL.--This work shall consist of furnishing and installing wood benches in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--Manufacturer's descriptive data and installation instructions shall be submitted for approval.

PRODUCTS.--

Acceptable manufacturer's.--Subject to compliance with these requirements, manufacturer's shall be Debourgh Mfg. Co., Art Metal Products, RPI, or equal.

Seat.--

Seat shall be factory fabricated, laminated seat units of solid birch or other suitable, dense hardwood and manufacturer's standard clear coating. Seat units shall be approximately 240 mm wide by 32 mm thick, in lengths as shown on the plans. Edges of the seat shall be rounded and all surfaces shall be smooth and free of splinters which would snag clothing or skin.

Supports assemblies.--

Supports assemblies shall be bell shaped cast iron pedestal base with continuously welded top and bottom flange fittings. Flanges shall have provisions for concealed fasteners to the floor and securing to the bench. Pedestal diameter shall be not less than 32 mm. Pedestal color and finish shall be selected from the manufacturer's standard colors.

Fasteners.--

Fasteners for fastening seat units and support assemblies shall be the manufacturer's standard fasteners for the purpose intended.

PART 3.- EXECUTION

Installation.--Bottom flange fittings of the support assemblies shall bear solidly on the floor without rocking and shall be fastened rigidly and securely to the floor in accordance with the manufacturer's recommendations.

12-10.11 TELEPHONE ENCLOSURES

GENERAL.--This work shall consist of furnishing and installing telephone enclosures in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--Manufacturer's descriptive data and installation instructions shall be submitted for approval.

PRODUCTS.--

Telephone enclosure.--

Telephone enclosure shall be standard factory fabricated, wall mounted unit with integral stainless steel writing and directory shelves, concealed theft and vandal resistant steel mounting bracket, steel frame with acoustical blanket behind perforated stainless steel back panel and 13 mm thick clear acrylic side panels. The telephone enclosure shall be not less than 864 mm high by 483 mm wide by and 330 mm deep.

The size of the telephone apparatus box shall be verified with the telephone company prior to ordering or fabricating the enclosure.

The telephone enclosure shall be Acoustics Development Corporation, Model Series 10; RedyRef, Model No. MS220; PBG Inc., Model Series 104; or equal.

Electrical service and telephone service conduit and conductors.--

Electrical service and telephone service conduit and conductors shall be as specified in Section 12-16, "Electrical" of these special provisions.

EXECUTION.--

INSTALLATION.--The telephone enclosures shall be installed and fastened rigidly and securely in accordance with the manufacturer's instructions.

ELECTRICAL SERVICE.--Electrical service conduits and conductors shall be installed as shown on the plans.

TELEPHONE SERVICE.--Conduits for the telephone service conductors shall be installed as shown on the plans. A pull wire shall be installed in the telephone conduit, and shall be doubled back into the conduit at both ends.

The telephone company shall furnish and install the telephone set, apparatus box and telephone service conductors in accordance with the provisions specified under "Utility Connection" in Section 12-1, "General Requirements," of these special provisions.

12-10.12 TELEPHONE SHELTER

GENERAL.--This work shall consist of furnishing and installing a telephone shelter in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--Manufacturer's descriptive data, installation and anchoring instructions and standard color palette for porcelain enamel colors shall be submitted for approval.

PRODUCTS.--

Telephone shelter.--

Telephone shelter shall be pedestal mounted, single, illuminated, walk-in type shelter approximately 1.3 meters in height. The opening width shall be not less than 762 mm. Overall depth shall be not less than 610 mm. The overall height, including pedestal, shall be approximately 2.3 meters.

The shelter shall have satin finished, anodized aluminum frame and top; bronze tinted tempered safety glass side panels; porcelain enameled steel body and pedestal; sloped stainless steel shelf; internally illuminated header side signs and dome.

The pedestal anchor plate and anchorage fasteners shall be covered with a stainless steel escutcheon. Pedestal shall have an access opening with vandal resistant cover.

The tapered side panels shall be locked into an aluminum frame with continuous moisture and sun resistant vinyl gaskets.

Signs on both sides and the front of the headers shall read: "PHONE".

Illumination shall be automatically operated by a photoelectric cell at the shelter.

The size of the telephone apparatus box required for the shelter shall be verified with the telephone company before ordering the shelter.

Electrical service and telephone service conduit and conductors.--

Electrical service and telephone service conduit and conductors shall be as specified in Section 12-16, "Electrical," of these special provisions.

EXECUTION.--

INSTALLATION.--The telephone shelter shall be installed and anchored rigidly and securely in accordance with the manufacturer's instructions.

ELECTRICAL SERVICE.--Electrical service conduits and conductors shall be installed as shown on the plans.

TELEPHONE SERVICE.--Conduits for the telephone service conductors shall be installed as shown on the plans. A pull wire shall be installed in the telephone conduit, and shall be doubled back into the conduit at both ends.

The telephone company shall furnish and install the telephone set, apparatus box and telephone service conductors in accordance with the provisions specified under "Utility Connection" in Section 12-1, "General Requirements," of these special provisions.

12-10.13 FIRE EXTINGUISHERS AND CABINETS

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing fire extinguishers with cabinets in accordance with the details shown on the plans and these special provisions.

REFERENCES.--

General.--Fire Extinguishers shall conform to the requirements in California Code of Regulations, Title 19 Division 1, Chapter 3, “Portable Fire Extinguishers.”

SUBMITTALS.--

Product data.--Manufacturer's descriptive data and installation instructions shall be submitted for approval.

QUALITY ASSURANCE.--

Codes and standards.--Fire extinguishers shall be Underwriters Laboratories or Factory Mutual Laboratories approved for the type, rating and classification of extinguisher specified.

PART 2.- PRODUCTS

MANUFACTURER’S.--

Acceptable manufacturers.--Subject to contract compliance, manufacturers shall be J. L. Industries; Larsen’s Manufacturing; Potter-Roemer; or equal. Fire extinguisher and fire extinguisher cabinet shall be compatible.

COMPONENTS.--

Fire extinguisher.--

Fire extinguisher shall be 4.5 kg stored, fully charged, multi-purpose dry chemical type, UL Rated 2A-10-BC with charge indicator, hose and nozzle, and attached service record tag.

Fire extinguisher cabinet.--

Fire extinguisher cabinet shall be factory fabricated, constructed of stainless steel with a full 6 mm tempered glass panel in a stainless steel door frame.

Fire extinguisher cabinet shall be surface mounted, semi-recessed not more than 38 mm trim protrusion from the face of the finished wall.

PART 3.- EXECUTION

INSTALLATION.--

General.--Fire extinguishers shall be installed in locations and at mounting heights shown on the plans, or if not shown, at a height of 1220 mm from the finished floor to the top of the fire extinguisher.

Fire extinguisher cabinets shall be attached to structure, square and plumb, in accordance with the manufacturer's recommendations.

IDENTIFICATION.--

Cabinet-mounted.--Extinguishers in cabinets shall be identified with letter spelling “FIRE EXTINGUISHER” applied to the cabinet door. Letter size, styles, and color shall be selected by the Engineer from manufacturer’s standard arrangements.

SERVICING.--

General.--Fire extinguishers shall be serviced, charged, and tagged not more than 5 days prior to contract acceptance.

12-10.14 TOILET AND SHOWER ACCESSORIES

PART 1.- GENERAL

Scope.--This work shall consist of furnishing and installing toilet and shower accessories in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data and installation instructions and details shall be submitted for approval.

PART 2.- PRODUCTS

Toilet tissue dispenser.--

Toilet tissue dispenser shall be dual roll, surface mounted, stainless steel with satin finish, approximately 150 mm x 290 mm x 150 mm deep. Dispenser shall utilize standard toilet tissue rolls. The top roll shall automatically drop into place after the bottom roll is depleted. One dispenser per toilet stall.

Combination paper towel dispenser and waste receptacle.--

Combination paper towel dispenser and waste receptacle shall be semi-recessed unit of stainless steel with satin finish. The approximate size shall be 355 mm x 1880 mm x 190 mm deep with 102 mm skirt. The paper towel

dispenser shall have a capacity of 1000 single fold paper towels. The waste receptacle shall have a capacity of not less than 50 liters. One unit per lavatory.

Toilet seat cover dispenser.--

Toilet seat cover dispenser shall be white plastic dispenser, approximately 210 mm x 320 mm x 48 mm deep, single pack. One dispenser per toilet stall.

Napkin receptacle.--

Napkin receptacle shall be wall hung, white enameled sheet steel napkin receptacle with hinged top and bottom, disposable liner, approximate 3.8 liter capacity container. One receptacle per women's toilet stall.

Clothes hook.--

Clothes hook shall be stainless steel clothes hook with 2 prongs.

Liquid soap dispenser.--

Liquid soap dispenser shall be surface mounted, heavy duty plastic dispenser for industrial use with a capacity of at least 710 mL. One dispenser per lavatory.

Mirror, wall hung.--

Mirror, wall hung shall be Number 1 quality, 6 mm thick, electrolytically copper plated float or plate glass mirror with nonmoisture-absorbing filler. Mirror shall have a heavy gage galvanized steel back and stainless steel frame. The frame shall have a satin finish and shall be mitered and welded and the corners shall be ground smooth. Fasteners shall not penetrate surfaces of the frame exposed to view. Mirror shall conform to Federal Specification: DD-M-411b and shall be guaranteed against silver spoilage for not less than 10 years.

Mirror, wall hung with shelf.--

Mirror, wall hung shall be Number 1 quality, 6 mm thick, electrolytically copper plated float or plate glass mirror with nonmoisture-absorbing filler. Mirror shall have a heavy gage galvanized steel back and stainless steel frame with integral 127 mm wide stainless steel shelf. The frame shall have a satin finish and shall be mitered and welded and the corners shall be ground smooth. Fasteners shall not penetrate surfaces of the frame exposed to view. Mirror shall conform to Federal Specification: DD-M-411b and shall be guaranteed against silver spoilage for not less than 10 years.

Steel grab bars.--

Steel grab bars shall be stainless steel, 38 mm diameter bars and escutcheon covered integral mounting flanges.

Combination soap dispenser-utility shelf.--

Combination soap dispenser-utility shelf shall be stainless steel with satin finish. Liquid soap dispenser with a capacity of more than 3 liters and an unbreakable refill indicator.

Mop and broom holder.--

Mop and broom holder shall be stainless steel with spring loaded rubber cam that grips handles 19 mm to 32 mm in diameter. Holds mops 83 mm from wall.

Folding seat.--

Folding seat shall be factory fabricated with teakwood or woodgrain phenolic slats, Type 304 stainless steel tube frame with satin finish, wall bracket and hinge. Wood slats shall be factory stained and varnished. Folding seat shall be Bradley, Bobrick, Florestone, or equal.

Privacy curtain.--

Privacy curtain shall be flame resistant, one-way draw, nylon reinforced, anti-bacterial vinyl fabric. Curtain shall be 1.8 meters long.

Privacy curtain rod shall be stainless steel, fixed mounted shower rod with stainless steel mounting plates.

PART 3.- EXECUTION

Installation.--Toilet and shower accessories shall be installed in accordance with the manufacturer's recommendations. Fasteners for mounting accessories shall be concealed and tamper proof.

Expansion anchors shall be used for mounting accessories on masonry or concrete walls.

Toilet and shower accessories shall be mounted after painting work is complete.

All toilet room accessories shall be mounted plumb, secure and rigid. Grab bars shall be supported adequately so the bars will withstand an applied load of 113 kg at any point.

Support assembly for folding seat shall bear solidly on the wall without rocking and shall be fastened rigidly and securely to the wall in accordance with the manufacturer's recommendations.

SECTION 12-11. EQUIPMENT

12-11.01 BARRIER GATES

GENERAL.—

This work shall consist of fabricating and installing barrier gates, with white and red reflective tape striping, for toll booth islands in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.—

Submittals for barrier gates, including working drawings and installation details, shall conform to the requirements specified under "Submittals," in Section 12-1, "General Requirements," of the special provisions.

PRODUCTS.--

Barrier gate.--

Barrier gate arm shall be single wooden arm, of the length shown on the plans. Gate arms shall be select structural Douglas Fir.

Reflective tape shall be red and white in color and shall conform the Federal Highway Administration Specification FP-79, Section 718.01(c).

Transmission.--

The transmission shall be a self-contained unit, totally enclosed in an oil and dust-tight steel housing. The design shall provide for uniform acceleration and deceleration of the gate arm travel, with maximum velocity at the midpoint of the travel.

Gate operator switch.--

Gate operator switch shall be as specified under 12-16, 'Electrical," of these special provisions.

Bars, bolts, plates and shapes.--

Bars, bolts, plates, and shapes shall be as specified in Section 12-5, "Building Miscellaneous Metal," of these specifications.

Controls.--

Controls shall include reversing starter, disconnect switch and limit switches. The control system shall be a complete control system routinely advertised, furnished and guaranteed by the motorized gate manufacturer.

Counterweights.--

Counterweights shall be hot-dipped galvanized steel counterweights of the sectional, bolt-on type.

EXECUTION.--

INSTALLATION.--

The gate shall be electrically controlled, to raise or lower or stop, from a remote location as shown on the plans. The total time for the gate to raise and lower shall not be less than 4 seconds not more than 6 seconds. The motor, reversing starter and the other equipment required for arm operation shall be housed in a completely enclosed weatherproof enclosure. The enclosure shall be designated to prevent unauthorized entry by the use of a padlock or built in device. Two sets of keys and the padlock or locking device shall be furnished.

Overload heaters sensing total motor current shall provided motor overload protection. Thermostatically controlled auxiliary space heater shall be installed inside the motor operation gate enclosure to prevent condensation on the motor. The motor shall be equipped with a solenoid and spring-controlled brake which shall assure positive quick acting stopping of gate arm.

Manual operation of the gate shall be provided in the event of a power failure or internal malfunction.

All gears shall run in an oil bath.

A handcrank shall be provided, with sufficient gear reduction to permit manually raising or lowering the gate arm without the use of excessive force.

The reversing starter shall be adequate rating for the motor supplied, and shall be located within the gate mechanism housing. A disconnect switch shall be provided within the gate mechanism housing to disconnect all power from the equipment. Limit switches shall be provided at the extreme ends of arm travel to automatically stop the gate arm, and in the down position to disconnect the obstruction control circuit. Limit switches shall prevent the gate arm from being reversed in direction before completing any cycle. Limit switch shall be rated not less than 10 amperes at 120 volts.

Any obstruction switch shall be provided on the gate arm to automatically change direction in the event of an obstruction on its bottom edge.

CONSTRUCTION.--

Weight of counterbalance shall be adjusted so that the gate will hold steady in either open or closed position.

Gate arm shall be painted using 2 undercoats of wood primer and 2 finish coats of sign post enamel and striped with 152 mm wide alternate red and white diagonal stripes of reflective tape.

The operating spring shall have proper strength and tension for correct operation of the gate.

Miscellaneous parts shall be of standard manufacturer suitable for the purpose intended.

Metal parts shall be cleaned by wire brushing, mineral spirits, or other approved means and painted as specified for painting steel.

12-11.02 DEPOSITORY AT OPERATIONS CENTER COUNTER

GENERAL.—

This work shall consist of furnishing and installing depository at the location shown on the plans and these special provisions.

SUBMITTALS.—

Manufacturer's descriptive data, working drawings, and installation instructions shall be submitted for approval.

PRODUCTS.--

Depository.--

Depository shall have exposed surfaces of stainless steel, shall pass 229 mm x 305 mm bags of money, and shall be equipped with receiving hopper designed to prevent fishing or trapping deposits. Chute shall be welded 6 mm thick welded steel. Depository shall have key lock such that door can remain locked or unlocked with the key removed. The maximum pull or push effort to operate depository door shall not exceed 2.3 kg. Depository at operations center counter shall be Mosler, Model No. 615 WH; Kingsley Library Equipment Company, Model No. 0120 (Building Book Return); Security Products Company, Series NS670000; or equal.

EXECUTION.--

INSTALLATION.--Depository shall be installed in accordance with the manufacturer's recommendations

12-11.03 DEPOSITORY AT VAULT

GENERAL.—

This work shall consist of furnishing and installing depository at the location shown on the plans and these special provisions.

SUBMITTALS.—

Manufacturer's descriptive data, working drawings, and installation instructions shall be submitted for approval.

PRODUCTS.--

Depository.--

Depository shall have exposed surfaces of stainless steel, shall pass 305 mm x 380 mm bags of money, and shall be equipped with receiving hopper designed to prevent fishing or trapping deposits. Chute shall be welded 6 mm thick welded steel. Depository shall have key lock such that door can remain locked or unlocked with the key removed. The maximum pull or push effort to operate depository door shall not exceed 2.3 kg. A slide shall be constructed as shown on the shop drawings.

EXECUTION.--

INSTALLATION.--Depository shall be installed in accordance with the manufacturer's recommendations

12-11.04 DEAL TRAY

GENERAL.—

This work shall consist of furnishing and installing deal tray at the location shown on the plans and these special provisions.

SUBMITTALS.—

Manufacturer's descriptive data and installation instructions shall be submitted for approval.

PRODUCTS.--

Deal tray.--

Deal tray shall have exposed surfaces of stainless steel designed with a bullet resistant protection tray. Deal tray shall be CR Laurence, Model No. BRT116; Creative Industries, Inc., Model No. 1611-NR; Security Products Company, Model SP-8RLK; or equal.

EXECUTION.--

INSTALLATION.—Deal tray shall be installed in accordance with the manufacturer's recommendations

12-11.05 SAFE DEPOSIT BOXES

GENERAL.—

This work shall consist of furnishing and installing a complete modular unit of safe deposit boxes at the location shown on the plans and these special provisions.

SUBMITTALS.—

Manufacturer's descriptive data, shop drawings, and installation instructions shall be submitted for approval.

PRODUCTS.--

Safe deposit boxes.--

Safe deposit box modules shall be as manufactured by Mosler, Diebold, Security Products, or equal, and the size shall fit the cabinet enclosure. Casing and locks shall be of standard manufacturer to provide for the custom size bond boxes.

Bond boxes.--

Bond boxes shall be 12 gauge minimum thickness sheet steel equipped with handles front and rear and slide on lid, gray enamel bonderized, baked grey enamel finish inside and out. The size shall be 140 mm wide x 127 mm high x 432 mm deep. Each door shall have individually and consecutively engraved numbers. All edges shall be made smooth and all corners rounded.

Locks.--

Locks shall be single nose locks with guard key to match existing units. Provide two (2) combination locks with engraved numbers.

Casing.--

Casing shall be stainless steel conforming to the requirements of ASTM Designation: A240/A 240M, Type 304 with a No. 4 satin finish., welded construction with interlock between horizontal and vertical dividers, 13 mm thick stainless steel door with polished steel front finish. Door number shall be provided after award of the project but will be a maximum of 3 digits. Exterior plates shall be at least 6 mm thick stainless steel and interior dividers at least 3 mm thick stainless steel.

EXECUTION.--

INSTALLATION

Safe deposit box casing shall be installed plumb, rigid and secure. Fasteners shall be installed from inside of the casing. Cabinet framing shall be provided as recommended by the safe deposit box manufacturer.

12-11.06 MONEY SAFE

GENERAL.—

This work shall consist of furnishing and installing a money safe at the location shown on the plans and these special provisions.

SUBMITTALS.—

Manufacturer's descriptive data, shop drawings and installation instructions shall be submitted for approval.

PRODUCTS.--

Money safe.--

Money safe shall be as manufactured by Mosler, Model No. B-18; Mutual Safes, Model No. AP-1; All West Security, Model No. ES-032, Es-035; or equal, and shall have a maximum size 560 mm high x 457 mm wide x 610 mm deep (outside body). Body shall be 6 mm solid steel with continuous welds and be fire rated. Door shall be a 12 mm steel door closely fitted and recessed. Lock shall be UL Listed, Group 2 three tumbler, key change with internal relocking device and 1,000,000 possible combination changes. Money safe shall UL Listed, tool attack resistant TL-15 money safe that are insurance rated under Mercantile and Bank Safe coverage.

EXECUTION.--

INSTALLATION

Money safe shall be installed at the locations shown on the plans.

12-11.07 PACKAGE RECEIVER

GENERAL.—

This work shall consist of furnishing and installing a package receiver at the location shown on the plans and these special provisions.

SUBMITTALS.—

Manufacturer's descriptive data and installation instructions shall be submitted for approval.

PRODUCTS.--

Package receiver.--

Package receiver shall have exposed surfaces of stainless steel and a vision panel in the rear door. Package receiver shall be CR Laurence, Model No. SPRVP1; Armortex Bullet Resistant, Model No. S SPRVP-2424; Nissen & Co., Inc., Rota-Server; or equal.

EXECUTION.--

INSTALLATION

Package receiver shall be installed in accordance with the manufacturer’s recommendations.

12-11.08 MODULAR VAULT SYSTEM

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing a modular vault, including vault door, and accessories in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data, catalog cuts, UL ratings, and installation instructions shall be submitted for approval.

Working drawings showing complete installation details shall be submitted for approval.

CLOSEOUT SUBMITTALS.--

Operations and maintenance manuals.--Prior to completion of the contract, 3 identified copies of the operation and maintenance instructions for the vault door shall be delivered to the Engineer at the jobsite. Manuals shall be bound and shall include the following:

Manufacturer’s name
Name, address, and telephone number of factory authorized repair facility
Model and serial number
Service manual shall show:

Assembly drawings, parts list, and simplified system diagrams
Descriptions of all equipment and their basic operating features
Routine maintenance and service requirements.

Inadequate or incomplete manuals will be returned. The Contractor shall resubmit adequate and complete manuals at no expense to the State.

QUALITY ASSURANCE.--

Manufacturer's qualifications.--The modular vault system shall be furnished and installed by a manufacturer or authorized representative who has not less than 5 years experience in the manufacture and installation of this type of equipment and who maintains an authorized service representative within the State of California.

Source Limitations.--The modular vault panels and the vault door shall be obtained from same manufacturer.

Codes and standards.—The modular vault panels and vault door shall have a minimum UL Class I security rating.

Certificates of Compliance.--Certificates of Compliance shall be furnished for the modular vault system in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

WARRANTY.--

Warranties and guarantees.--Manufacturer's warranties and guarantees for materials or equipment used in the work shall be delivered to the Engineer at the jobsite prior to acceptance of the contract.

PART 2.- PRODUCTS

Acceptable manufacturers.—Subject to complying with these requirements, manufacturer's shall be Diebold, Hamilton Safe, Vault Structures, or equal.

Vault panels.--

Vault wall and ceiling panels shall be lightweight concrete composite or lightweight laminated panels, weighing not more than 342 kg per m^2.

Vault floor plate shall be 13 mm thick steel plate conforming to ASTM Designation A 36.

Vault door.--

Vault door with frame shall comply with UL standards and shall be labeled for the following:

Minimum Class I security rating.
Group 1R combination lock.
Group 1, Class B, mercantile relock device.

Clear door opening shall be not less than 1486 mm wide by 2120 mm high.

Hinges shall be heavy duty rolled steel hinges equipped with ball bearings.

Door shall be equipped with emergency escape device inside the vault. The escape device shall release the door latch without the need for instructions and without operating switches, lights or other auxiliary equipment.

Door shall be equipped with automatic interlock to prevent bolts from being extended unless the door is fully closed.

Vault door shall be equipped with a time interlock and a dual key. Time lock shall be triple movement timer.

Dual lock shall consist of a changeable combination type lock and key operated lock, both of which shall unlock simultaneously for the door to be opened from the outside of the vault. Locks shall have at least 4 tumblers.

Door shall have built-in ventilator.

PART 3.- EXECUTION

INSTALLATION.--

General.—The modular vault system shall be installed rigid and secure in accordance with the manufacturer's recommendations and the approved working drawings.

The vault door shall be set to swing 13 mm above the finished floor. The vault door and locking mechanisms shall operate easily without binding.

FIELD QUALITY CONTROL.--

Acceptance tests.--Testing of the vault door shall be conducted by the Contractor in the presence of the Engineer. If the vault door malfunctions or a failure develops, the parts causing the failure shall be replaced or repaired and the test repeated until the vault door performs satisfactorily.

The Contractor shall notify the Engineer in writing not less than 5 days prior to the time that the testing is scheduled.

Manufacturer's field service.--The Contractor shall arrange for a manufacturer’s authorized representative at the site of the work to supervise installation and testing.

12-11.09 REFRIGERATOR

GENERAL.--This work shall consist of furnishing and installing an electric refrigerator in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--Manufacturer's descriptive data and installation instructions shall be submitted for approval.

PRODUCTS.—

Refrigerator.--

Refrigerator shall be free standing, 2 door, no frost type, UL Listed, 120-volt, AC, single phase, 60 hertz, with upper freezer compartment 1 full width adjustable freezer shelf, 2 ice trays, 2 vegetable/fruit pans, nominal 18 cubic feet capacity, 3 interior adjustable shelves, polystyrene inner cabinet liner. The minimum size shall be 810 mm wide x 810 mm deep x 1650 mm in height. Refrigerator shall be General Electric, Model No. TBX 18I ADWW; Whirpool, Model No. ET 18GKHW; KitchenAid, Model KCMS185JBL; or equal.

EXECUTION.--

INSTALLATION.—Installation shall be as recommended by the manufacturer.

12-11.10 COOKTOP HOOD

GENERAL.--This work shall consist of furnishing and installing a modular electric cooktop unit as shown on the plans.

SUBMITTALS.--Manufacturer's descriptive data and installation instructions shall be submitted for approval.

PRODUCTS.--

Cooktop hood.--

Cooktop hood shall have dual centrifuge blowers and cooktop lighting. Cooktop hood surface shall be stainless steel.

Cooktop hood shall be Broan Model 89000, Frigidaire Model HC8830, Kenmore Model 52340 or equal.

EXECUTION.--

Installation shall be as recommended by the manufacturer.

12-11.11 MICROWAVE

GENERAL.--This work shall consist of furnishing a countertop microwave unit as shown on the plans.

SUBMITTALS.--Manufacturer's descriptive data and installation instructions shall be submitted for approval.

PRODUCTS.--

Countertop microwave.--

The countertop microwave shall have a 1.3 cubic foot oven capacity and at least 1000 watts cooking power. Countertop microwave shall be black in color.

Countertop microwave shall be General Electric Model JE134OGB; Whirlpool Model MT1135SGB; KitchenAid, Model KCMS185JBL; or equal.

EXECUTION.--

Installation location shall be as shown on the plans.

12-11.12 DOCK BUMPERS

GENERAL.--This work shall consist of furnishing and installing dock bumpers in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--Manufacturer's descriptive data and installation instructions shall be submitted for approval.

Dock bumpers.--

Dock bumpers shall be fabric reinforced rubber pads, 152 mm thick projected from dock x 254 mm high, with galvanized steel angle mounting plates complete with galvanized anchor bolts. The length shall be as shown on the plans. All exposed metal parts are to be factory painted. Dock bumper shall be Blue Giant, Durable Corporation, or equal.

EXECUTION.--

INSTALLATION.--The dock bumpers shall be installed and fastened rigidly and securely in accordance with the manufacturer's instructions.

12-11.13 CEILING MOUNTED MONITOR SUPPORT BRACKET

GENERAL.—

This work shall consist of furnishing and installing ceiling mounted monitor support bracket as shown on the plans and these special provisions.

SUBMITTALS.—

Manufacturer's descriptive data, working drawings and installation instructions shall be submitted for approval.

PRODUCTS.--

Ceiling mounted monitor support bracket.—

Ceiling mounted monitor support bracket shall be constructed of steel and support a monitor weight of 30 kg and fit a 508 mm screen monitor. Ceiling mounted monitor support bracket shall be Peerless, Model No. CDS 20/CDS 20W; Da-Lite, Model No. CMY-2134; Bretford Manufacturing, Inc., Model No. TVCY20T-BK; or equal.

Installation.—Ceiling monitor support bracket shall be installed in accordance with the manufacturer's recommendations and approved shop drawings.

SECTION 12-12. FURNISHINGS

12-12.01 HORIZONTAL BLINDS

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing horizontal blinds in accordance with the details shown on the plans and these special provisions.

Horizontal blinds shall be standard, factory manufactured assemblies suitable for use on exterior wall windows.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data, color chips, and installation instructions shall be submitted for approval.

PART 2.- PRODUCTS

Horizontal blinds.--

Horizontal blinds shall be nominal 25 mm wide, spring tempered virgin aluminum alloy horizontal slats supported by braided polyester ladders. Braided ladders shall hold slats at equal spaces, parallel, straight, and shall provide tilt control and adequate overlap of slats. The distance between ladders shall not exceed 585 mm. Slat tilt shall be adjustable by a transparent wand. Blinds shall be adjustable to any height using lift cords.

Hardware shall be enclosed in a metal head and the opening hardware shall be clinched to the head. All metal parts shall have a corrosion resistant coating.

Horizontal blinds (operations building and toll booth) for incline windows shall have a wire guide.

Horizontal blinds shall be Hunter Douglas; Spring Window Fashions Division, Inc.; Levolor Home Fashions, Inc.; or equal.

PART 3.- EXECUTION

Installation.--Horizontal blinds shall be installed in accordance with the manufacturer's instructions.

SECTION 12-13. SPECIAL CONSTRUCTION

12-13.01 TOLL BOOTHS

GENERAL

This work shall consist of construction toll booths in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.—

Working drawings for the toll booths and its cabinets shall be submitted for approval prior to fabrication.

PRODUCTS.--

Plates, rolled shapes.--

Plates, rolled shapes shall conform to ASTM Designation: A 36.

Steel tubing.--

Steel tubing shall conform to ASTM Designation; A 500 Grade B.

Bolts and nuts.--

Bolts and nuts shall conform to ASTM Designation: A 307.

Lock strip gaskets.--

Lock strip gaskets shall be H-type, preformed neoprene, and conform to ASTM Designation: A 542.

Neoprene pad.--

Neoprene pad shall be medium grade, durometer reading 45/55, with a tensile strength of 1200 psi minimum.

Waste receptacle, cabinet assembly, low partition with gate, drawers, and accessories.-

Waste receptacle, cabinet assembly, low partition with gate, drawers, and accessories shall be No. 304 stainless steel, No. 4 satin finish, all welded construction with seamless corners.

Sheet metal work.--

Sheet metal work shall conform to the requirements of Section 12-7, "Sheet Metal," in these special provisions.

Hardware.--

Hardware shall conform to the requirements of Section 12-8, "Finish Hardware," of these special provisions.

Doors.--

Doors and door assemblies shall conform to the requirements of Section 12-8, "Hinged Doors, " of these special provisions.

Glazing.--

Glazing shall conform to the requirements of Section 12-8,"Glazing," of these special provisions.

Electric wall heater.--

Electric wall heater shall be radiant, recessed type, and shall be equipped with a grille and integral thermostat.

Sealant.--

Sealant shall be a multicomponent, ultraviolet and ozone resistant gun grade polysulfide of polyurethane, Federal Specifications TT-S-227, black in color.

EXECUTION.--

Fabrication.—

Workmanship and finish shall be equal to the best general practice in modern shops. The fabricator shall assemble one complete prototypical booth for approval and installation. Work on the remaining booths shall not be commenced until the prototype is approved.

Attention is directed to the glazing for the toll booths. The tolerances in the fabrication of toll booth framework shall conform to the glazer's requirements for the system shown.

Cuts shall not deviate more than 1.5 mm from the intended line. Roughness, notches or gouges shall be removes by machining or grinding to a depth not to exceed 1.5 mm.

Finished members shall be true to line and free from twists, bends, open joints, and heat caused distortion.

Tubular steel surfaces shall not have any distortions greater that 1.5 mm in 610 mm, including distortion allowed by Standard Mill Practice.

Corner offsets to the frame shall be less than 1.5 mm.

All welding shall conform to the requirements in the latest edition of the American Welding Society's Publication, AWS D1.1, Structural Welding Code.

All frame joints shall be seal welded.

Contractor may submit alternative type welds to maintain tolerances, eliminate distortions caused by welding, and maintain weathertight construction. Welding shall be done in such sequence to minimize distortion.

The parts shall be accurately assembled in their final position as shown on the plans, and all matched marks shall be followed. The materials shall be carefully handled so that no part is bent, broken, or otherwise damaged.

Hammering which will weaken or distort the members shall not be done.

Drifting, done during assembly, shall be only such as to bring the parts into position, and not sufficient to enlarge bolt holes or distort the metal.

Bolt holes shall be cylindrical, perpendicular to the plane of the connection and shall be not more than 1.5 mm larger than the nominal diameter of the bolt. Holes shall be clean cut, without torn or ragged edges. All burrs, fins, sharp edges and hole irregularities which would prevent solid seating of the parts shall be removed.

Toll booths shall be erected true to line and grade.

Lock strip gasket glazing shall have a supplementary wet seal and a weep system, both as recommended by the glass fabricator. Lock strip gaskets shall be factory fabricated as continuous closed frames. The frame onto which the gasket is installed shall be clean, smooth and free of imperfections. Glass, gasket and framing sizes shall be within the manufacturer's recommended tolerances to assure proper lip pressure and bite and to achieve a weathertight installation.

Painting.—

Toll booths shall be factory finished as shown on the plans and as specified under "Painting," in Section 12-9, "Finishes" elsewhere in these special provisions.

12-13.02 BULLET RESISTANT FIBERGLASS PANELS

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing bullet resistant fiberglass panels in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data and installation instructions shall be submitted for approval.

Samples.--Two samples, 305 mm x 305 mm shall be submitted for approval.

DELIVERY, HANDLING AND STORAGE.--

Delivery.--Materials shall be delivered in original packages and containers with seals unbroken and bearing manufacturer's labels containing brand name.

Storage.--Materials shall be kept dry and protected from the weather.

PART 2.- PRODUCTS

Bullet resistant fiberglass panel.--

Bullet resistant fiberglass panel shall be made of multiple layers of woven roving ballistic grade fiberglass cloth impregnated with a thermoset polyester resin and compressed into flat rigid sheets. The production technique and materials used shall provide the controlled internal delimitation to permit the encapture of a penetrating projectile. Bullet resistant fiberglass panel shall be 8 mm maximum thickness, and 3.0 pounds per square foot maximum weight.

Bullet resistant fiberglass panel shall have a security level conforming to U. L. Standard 752, Level 1.

Bullet resistant fiberglass panel shall be Armortex; Waco Composites, inc., C.R. Laurence; or equal.

PART 3.- EXECUTION

Installation.--Bullet resistant fiberglass panels shall be installed and fastened rigidly and securely in accordance with the manufacturer's recommendations.

SECTION 12-14. CONVEYING SYSTEMS

12-14.01 VERTICAL PLATFORM LIFT

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing a vertical platform lift and accessories in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data, catalog cuts, and installation instructions shall be submitted for approval.

Working drawings shall be submitted for approval. Working drawings shall show rough-in and wiring requirements.

CLOSEOUT SUBMITTALS.--

Operations and maintenance manuals--Prior to completion of the contract, 3 identified copies of the operation and maintenance instructions for the vertical platform lift shall be delivered to the Engineer at the jobsite. Manuals shall be bound and shall include the following:

Manufacturer’s name
Name, address, and telephone number of factory authorized repair facility
Model and serial number

Service manual shall show:

Assembly drawings, parts list, and simplified system diagrams
Descriptions of all equipment and their basic operating features
Routine maintenance and service requirements
Troubleshooting and repair procedures

Inadequate or incomplete manuals will be returned. The Contractor shall resubmit adequate and complete manuals at no expense to the State.

QUALITY ASSURANCE.--

Manufacturer’s qualifications.--The vertical platform lift shall be furnished and installed by a manufacturer or authorized representative who has not less than 5 years experience in the manufacture and installation of this type of equipment and who maintains an authorized service representative within the State of California.

Codes and standards.--All loading ratings and safety factors shall meet or exceed those specified in ASME/ANSI Standard A17.1. The vertical platform lift shall comply with the requirements of the Americans with Disabilities Act.

Certificates of Compliance.--Certificates of Compliance shall be furnished for the vertical platform lift in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

WARRANTY.--

Warranties and guarantees.--Manufacturer's warranties and guarantees for materials or equipment used in the work shall be delivered to the Engineer at the jobsite prior to acceptance of the contract.

PART 2.- PRODUCTS

Lift.--

Lift shall be constructed of steel components finished with a baked polyester electrostatically applied for outdoor use. The color shall be as shown on the plans.

Lift shall be freestanding.

Lift shall have a minimum rated capacity of 327 kg and a minimum lifting height as shown on the plans.

Lift shall have a screw drive powered by an electric motor. Motor shall be 208-volt, single phase, with instant reverse capability. Lifting speed shall be between 3.0 and 4.6 meters per minute. Lift shall stop automatically at landings.

Lift platform shall be 914 mm wide x 1219 mm long with 1067 mm side panels and self closing gates. The platform shall have a slip resistant surface. Gates shall be arranged to provide straight through entry/exit. Gates shall mechanical interlock that allow platform ascent/descent only when gates are closed and locked.

Lift platform underpanel shall be equipped with obstruction sensitive cut-out safety.

A grab bar shall be provided on the side panel above the platform control panel.

Platform control panel shall have on/off key switch, constant pressure directional buttons, and emergency stop switch, and an emergency call button connected to intercom system. Communication means shall be provided.

Landing control panels shall have on/off key switch, constant pressure call/send buttons, and emergency stop switch.

Lift shall have manual lowering device to lower platform in the event of power or component failure.

Information plate.--

Information plate with the following inscriptions shall be attached to the lift:

Manufacturer's name and address
Model number
Serial number
Lift capacity
Date of installation
Statement of compliance with ANSI A17.1

PART 3.- EXECUTION

INSTALLATION.--

General.--All equipment shall be installed in accordance with the lift manufacturer's recommendations and the details shown on the plans.

The lift shall be installed in a pit as shown on the plans. The Contractor shall verify the pit dimensions with the lift manufacturer’s requirements.

FIELD QUALITY CONTROL.--

Acceptance tests.--Testing of the lift shall be conducted by the Contractor in the presence of the Engineer, using various loads up to the maximum specified. If the lift malfunctions or a failure develops, the parts causing the failure shall be replaced or repaired and the test repeated until the lift performs satisfactorily.

The Contractor shall notify the Engineer in writing not less than 5 days prior to the time that the testing is scheduled.

Manufacturer's field service.--The Contractor shall arrange for a manufacturer's authorized representative at the site of the work to supervise installation and check start-up.

12-14.02 HYDRAULIC ELEVATOR

GENERAL.--This work shall consist of furnishing and installing holeless hydraulic elevator equipment, complete in place, in accordance with the details shown on the plans and these special provisions.

The Contractor shall do all the work and furnish all materials necessary for the complete installation, and shall perform and provide the following work, facilities and services in accordance with the requirements of these special provisions.

The size of the hoistway shown on the plans shall be verified and determined by the Elevator Manufacturer prior to construction.

1. Construction Facilities and Temporary Controls; protection of floor openings and personnel barriers, temporary power and lighting.
2. Cast-In-Place Concrete; elevator pit elevator motor and pump foundation, and grouting sills.
3. West/East Elevator Enclosure at Operations Building; Concrete/light gauge metal framing with gypsum wall board shaft liner panels.
   Elevator enclosure at toll booth; Concrete/steel framing and glass enclosure. See drawings for specific conditions.
4. Metal Fabrications; pit ladder, divider beams, supports for entrances and guide rails, hoist beam at top of hoistway.
5. Cementitious Waterproofing; waterproofing of elevator pit.
6. Heating, Ventilating, and Air Conditioning; ventilation and temperature control of elevator equipment room.
7. Electrical; electrical service to main disconnect in elevator machine room, electrical power for elevator installation and testing, electrical disconnecting device to elevator equipment prior to activation of sprinkler system, electrical service for machine room, machine room and pit receptacles with ground fault current protection, lighting in machine room and pit, wiring for telephone service to machine room.
8. Fire Alarm Systems; fire and smoke detectors, fire alarm signal lines to contacts in the machine room.
9. Telephone Systems; ADAAG-required emergency communications equipment installed and connected to telephone system.
10. Dry contacts for remote annunciation outputs to the Supervisory Control and Data Acquisition (SCADA) System.

The elevator equipment, apparatus and material shall be furnished and installed by the Otis Elevator Company, The KONE Corporation, The Thyssen Dover Elevator Company, or by another manufacturer, who has been operating successfully of not less than 10 years in the manufacture and 10 years in the installation of similar elevators, who maintains a continuous checking and repair service within a radius of 80 km of the project, and who is the manufacturer of the basic elevator equipment, such as the elevator platform sling, cab and basic controller. All items furnished by the manufacturer shall be erected, installed adjusted, tested, and placed in operation by competent personnel under the supervision and direct employ of the elevator system manufacturer.

The facilities shown on the plans are diagrammatic and do not show offsets, fittings, and accessories that may be required. Cutting of walls, floors, etc. and removal of such obstructions may be necessary for proper installation of the elevators; settings of anchors and sleeves; and pockets or blackouts for signal fixtures shall be provided as a part of this contract.

Design requirements.—Elevators shall be capable of operating when temperature range outside or inside the hoistways or machine rooms is 0.56 ˚C to 49 ˚C.

All equipment including motors, wiring, conduits, pipes, and counterweights shall be designed to fit with the confines of the hoistways and their clearances. Particular attention shall be paid to visual aesthetics.

All elevators, parts and accessories shall be designed to be protected from fire sprinkler-activated water and inclement weather within the hoistways and other operating areas.

Permits and fees.—The Contractor shall obtain and pay for all necessary State and local permits and make all tests as required by the governing bodies.

SUBMITTALS.—

Product data.—Manufacturer's technical data, including certified test reports, and installation instructions for each principal product or component of the elevator system shall be submitted for approval. Features of control system, performances and operating characteristics shall be listed and described.

Working drawings.—Working drawings for elevators shall be submitted for approval.

Working drawings for elevators shall show elevations of car enclosures and hoistway entrances, calculations and specifications for elevator rails and rail attachments to the structures. Elevator diagrams shall show service to each level. Drawings shall show minimum struts, connections and structure to support the elevators. Layout of mechanical and electrical work shall be shown as well as plans for wiring and control diagrams.

Samples.—Samples of exposed finished for elevator car enclosures, hoistway entrances, and signal equipment shall be submitted for approval. Samples of sheet materials shall be 152 mm x 152 mm and running trim members shall be 610 mm in length.

QUALITY ASSURANCE.--

Manufacturers qualifications.—The elevator system shall be by manufacturer's regularly engaged in the business of engineering, design and manufacturer of elevators of the type and character described in these special provisions for a period on not less than 10 years.

The entire power unit, signal panel, power panel and all other parts of the elevator system operating equipment, including door operating mechanisms and signal apparatus and signal fixtures, as well as all mechanisms constituting various electrical and mechanical safety systems and shall be manufactured, provided and installed by the single manufacturer, except that motor, pump, and controller relays may be manufactured by recognized manufacturers of these items to the elevator manufacturers recommendations.

Standards compliance.—Where equipment or materials are specified to conform to requirements of the standards of organizations such as ASTM, ANSI, ASME, or UL, submit evidence of such conformance to the Engineer.

The label or listing of the specified agency will be acceptable evidence.

In lieu of the label or listing, the Contractor may submit a written certificate from an approved testing organization stating that the items have been tested and the units conform to the specified standard.

Evidence of compliance with the seismic safety requirements in the California State Building Code, Title 24 and Uniform Building Code with all applicable supplements to each shall be submitted to the Engineer.

Certificates of Compliance.—Certificates of compliance shall be submitted for all coatings, sealing and protective material. Certificates shall include material identification, quantity, batch number, date of manufacturer, and all laboratory data covering requirements of specifications, standards and codes under which the material is being furnished.

DELIVERY, STORAGE AND HANDLING.—

General.—Materials, tools, and equipment shall be delivered to the jobsite and stored in a dry and protected location on site.

Coated, polished, and the factory finished surfaces shall be protected to prevent damage to the finished surfaces.

INITIAL MAINTENANCE AND GUARANTEE.--

Maintenance service.—Maintenance and call back service for the elevators shall be provided after they have been completed and placed in operation for a period of 12 months. This service shall consist of examinations of equipment, adjustments, lubrications, cleaning, supplies and parts to keep equipment in proper operation, except such adjustments, parts or repairs made necessary by abuse, misuse or any other causes beyond control of the elevator installer. All work shall be done by trained employees of the installer during regular working hours of the trade.

Maintenance manuals.—Prior to completion of the contract, 5 bound and identified copies of the operation and maintenance instructions with parts lists, recommended parts inventory, purchase source listing for major and critical

components, emergency instructions and similar information for the equipment specified therein shall be delivered to the Engineer.

Special tools.—The Contractor shall furnish to the Engineer at the time of instruction, two (2) each of any tools including diagnostic tool, designed specifically for tasks associated with elevator examinations, maintenance and repair or are required for these tasks and are not readily available through normal purchasing channels.

DEFINITIONS.--All terms in this section shall have the meaning defined in the A17.1 Safety Code for Elevators as approved by ANSI and hereinafter referred to as the ANSI Code, including all revisions and authorized changed to date.

CODES AND STANDARDS.—Design criteria shall be in accordance with the provision of Title 8 and Title 24, California Code of Regulations and the National Fire Protection Association (NFPA).

Work shall be performed in accordance with the latest edition of American National Standard Safety Code for Elevators, Dumbwaiters, Escalators, and Moving Walks (ANSI A17.1) and such other State and local codes as may be applicable.

All work performed and materials installed shall be in accordance with the National Electrical Code; California Code of Regulations, Title 24, Part 3; "California Electric Code, " and Title 8, Chapter 4, "Electrical Safety Orders, " and all State and local ordinances.

Welding shall be in accordance with the requirements in American Welding Society (AWS) D 1.1, "Structural Welding Code-Steel. "

PERMITS AND TESTS.--The Contractor shall obtain and pay for all necessary Municipal and state permits and, at his expense, make all tests as required by the governing codes.

PAINTING.--All exposed metal work furnished under this section, except as otherwise specified, and shall be properly painted.

EQUIPMENT.-- Equipment shall be as follows:

TOLL BOOTH AND EAST ELEVATOR;

Quantity	Two
Capacity (kg)	907
Up-speed with rated load	24.6 meter per minute
Travel in meters	As shown on plans
Number of landings	Two (in-line)
Number of openings	Two (in-line)
Operation	Simplex collective automatic
Car size (Interior dimensions)	2032 mm wide x 1295 mm in depth
Guide rails	Manufacturer's standard shapes
Buffers	Shapes
Cab enclosure	Steel structural cab
Car doors	1067 mm clear by 2134 mm center opening,, 1 opening
Door operation	Power
Signals	Car operation station, call registered lighted buttons, service/telephone cabinet, and car direction signs with audible signal, hall lantern.
Machine room location	Adjacent
Main power supply	480-volt, 3-phase, 60 Hz
Lighting power supply	120-volt, single phase, 60 Hz

WEST ELEVATOR:

Quantity	One
Capacity (kg)	907
Up-speed with rated load	24.6 meter per minute
Travel in meters	As shown on plans
Number of landings	Two (in-line), 1 offset
Number of openings	Two (in-line), 1 offset
Operation	Simplex collective automatic
Car size (Interior dimensions)	2032 mm wide x 1295 mm in depth
Guide rails	Manufacturer's standard shapes
Buffers	Shapes
Cab enclosure	Steel structural cab
Car doors	1067 mm clear by 2134 mm high single slide opening, front right and rear left, 2 openings
Door operation	Power
Signals	Car operation station, call registered lighted buttons, service/telephone cabinet, and car direction signs with audible signal, hall lantern.
Machine room location	Adjacent
Main power supply	480-volt, 3-phase, 60 Hz
Lighting power supply	120-volt, single phase, 60 Hz

OPERATION.--

Toll booth elevator car only, shall be designed to return to the tunnel floor where there is no landing call.

PRODUCTS.--

Car Frames and Platforms.--

Car frames shall be made of formed steel or structural steel members, having the factor of safety required by the ANSI Code. The members shall be securely fastened by welding or bolts to form a rigid assembly to support the specified load, the car enclosure and all necessary accessories.

Each platform shall consist of a steel frame and necessary wood or steel stringers and a substantial wood floor, or shall be constructed entirely of steel suitably reinforced. The underside of wood platforms, if used, shall be fireproofed by sheet steel or not less than 28 gauge. The platform shall be mounted within the car frame.

Mechanical Equipment.--

1. A hydraulic power unit, especially designed and manufactured for these services, shall be furnished. The motor and pump shall be submersed under the oil inside the tank in order to provide for sound isolation. A muffler designed to reduce pulsation and noise, which may be present in the flow of hydraulic oil, shall be provided in the oil line at the top of the pump.

2. Control valves shall be mounted in a compact unit assembly. These valves include a safety check valve; up-direction valve with high pressure relief, including up leveling and soft stop features; lowering valve, including down leveling and manual leveling features. Automatic two-way leveling shall be provided to automatically stop and maintain the car approximately level with the landing, regardless of change in load. An up-traveling car shall automatically descend to the lower terminal landing if the hydraulic system does not have a sufficient reservoir of oil. Power-operated and hoistway doors will automatically open at the lowest terminal landing, permitting passenger egress. The doors shall then automatically close and all control buttons, except the Door Open Button in the car-operating panel, shall be made ineffective.

3. A valve designed to shut off the flow of oil between the cylinder and the Power Unit shall be provided in the oil line in the machine room.

Hydraulic Equipment.--

1. Hydraulic Plunger: Two accurately ground and polished, three-stage fully synchronized telescopic hydraulic plungers shall be provided. The bottom of each jack stage shall be fitted with a cushioned, positive stop designed to prevent the plungers from leaving their cylinders. The top of the second stage plunger shall be fitted with a backup ring and a gland containing the oil seals and air bleeder valve. The first stage plunger shall be made from a solid steel shaft and shall be fastened to the car frame.

2. Hydraulic Cylinders: Two hydraulic cylinders designed to stand upright on the pit floor, on either side of the car, shall be provided for the second stage of each jack unit. Each cylinder shall be constructed from steel pipe with a machined steel flange at the upper end and a heavy steel bulkhead at the lower end. Each cylinder shall be connected to the oil line. A packing gland with guide bearing, wiper ring and packing especially designed for hydraulic elevator service shall be mounted at the top of each cylinder along with an air bleeder valve. Provisions shall be made to collect any oil seepage and drain it away. Each cylinder shall be finished with a coat of rust inhibiting air-dry enamel.

3. Tank Heater: A hydraulic oil viscosity control system shall be provided to maintain a minimum oil temperature.

4. Seismic Provisions: In accordance with the proposed Project Location and applicable Seismic Risk Zone, all applicable material and equipment provided and installed by the elevator manufacturer, as explained within this part, shall be designed and installed to be earthquake resistant in accordance with the zone location and governing Code(s) requirements.

5. Guide Rails: Elevator car guide rails shall be provided, erected plumb, and securely fastened to the hoistway framing. Design and provision of hoistway framing shall be of adequate strength and properly positioned to withstand loads applied in conjunction with data provided by the elevator contractor.

6. Platform Isolation: The top of the plungers shall be mounted to the car frame with suitable sound dampeners designed to isolate the plungers from the car. The elevator contractor shall provide spring buffers in the elevator pit.

7. Logic Control: The logic control operation will be accomplished utilizing microprocessor computer logic control contained in a cabinet. The elevator control program will be contained in non-volatile, programmable, read only memory. Control will be constructed such that future alterations in elevator operation may readily be made by altering the read only memory. Safety circuits will be monitored and controlled by the programmable Logic Control for redundant protection.

8. Controller: A microprocessor based controller shall be provided, including necessary starting switches together with all relays, switches, solid-state components and hardware required for operation, including door operation, as described herein. A three (3) phase overload device shall be provided to protect the motor against overloading.
The controller shall govern starting and stopping, as well as preventing damages to the motor from overload or excessive current. It shall automatically cut off the power supply and bring the car to rest in the event any of the safety devices are activated. The controller shall be monitored in a vented cabinet within the machine room.

9. Selective Collective Operation: Pressure upon one or more car buttons shall send the car to the designated landings in the order in which the landings are reached by the car, irrespective of the sequence in which the buttons are pressed, provided the hoistway door interlock and car door switch circuits are completed. During this operation, the car shall also answer calls from the landings, which are in the prevailing direction of travel. Each landing call shall be canceled when answered.

Signal Devices and Fixtures.--

1. Car Operation Station: Each elevator shall be equipped with a Main Car Operating Station, located integrally in a vertical swing panel and containing call registration buttons in accordance with the logic operation specified. The Main Car operating Station shall also include a stop switch, door open and door close buttons, alarm button, tactile plates, and light switch, as well as any other devices required by applicable code and/or as explained within this part.

2. Each Car Operating Station shall be equipped with illuminating pushbuttons which, when pressed, shall signal the car passenger that the call has been registered. The button shall remain illuminated until the call has been answered.

3. Service/Telephone Cabinet: A combination Service Cabinet/Telephone Cabinet, integral to the Main Car Operating Station, with a flush door, concealed hinge, and pull handle shall be provided. Within this cabinet, specialized controls shall be installed for restricted elevator functions.

4. A telephone complying with ADA requirements shall be installed in the telephone box.

5. Car Position Indicator: A dot-matrix car position indicator(s) consisting of a red LED display shall be provided in the car and also with an audible signal which shall sound when the car passes each floor or stops at a floor. The position indicator shall be located above the Car Operation Station.

6. Hall Pushbutton Stations: One hall pushbutton station shall be provided at each landing served by the elevator system proposed. Illuminating pushbuttons shall be provided in each hall pushbutton station which, when pressed, shall signal the waiting passenger that the call has been registered. The button shall remain illuminated until the call has been answered.

7. Hall Lanterns: Hall lanterns, including audible signals, shall be provided. As soon as the car has reached a predetermined distance from a landing and is set to stop a that landing, the hall lantern, corresponding to the direction the car shall travel, shall be illuminated and the audible signal shall sound once for up and twice for down. The lantern shall remain illuminated until the doors have closed. Single lanterns shall be furnished at terminal landings and Up/Down lanterns shall be furnished at intermediate landings.

8. Hall Position Indicator: A dot-matrix hall position indicator consisting of a red LED display shall be provided at (indicate floors where required). The position of the car shall be indicated by single or dual numeral and/or letter floor designations along with an arrow indicating direction of car travel.

9. Signal Fixture Finishes: All metal used on exterior surfaces of the signal fixtures shall be #4 brushed stainless steel.

Passenger Cab Enclosure.--

The elevator cabs shall meet the requirements of the ASME/ANSI A17.1 Elevator Code, and all Elevator Code Supplements issued to date, including Code restrictions pertaining to flame spread and smoke generation.

Elevator cabs shall be of the steel structure type or equal. The cab frame, walls, ceiling and both sides of the doors shall be faced with stainless steel. The thickness of the stainless steel and the mounting and fastening details shall be as recommended by the elevator manufacturer. The surfaces of the stainless steel exposed to view shall have a No. 2D finish with “Rigidized” surface texture. The thickness of the stainless steel and the mounting and fastening details shall be as recommended by the elevator manufacturer.
Pipes for handrails shall be No. 304 stainless steel pipe, No. 4 Satin finish with stainless steel mounting bracket.

Ceiling shall be stainless steel support system including stainless steel ceiling panels, exhaust fan, public address system speaker and a hinged access panel.

Elevator fluorescent fixture shall be the manufacturer’s standard recessed fluorescent lighting fixture.

Hardware for access panels shall be standard US 32D finish accurately fitted and securely applied.

Threshold plate shall be extruded aluminum.

Car doors shall be horizontal sliding, center opening, flush hollow metal, No. 4 stainless steel panels hung on sheave hangers with polyurethane tires and sheaves not less than 89 mm diameter running on a polished steel track and guided at the bottom by non-metallic shoes sliding in a smooth threshold groove.

Sight guards shall hatch the door finish.

An emergency power unit employing a 12 volt sealed rechargeable battery shall be provided.

Telephone cabinets.--

Telephone cabinets shall be flush design of finish and appearance to match car opening panel, complete with wiring to controller. Instrument and connections shall be provided by others.

Passenger Type Hoistway Entrances (UL "B" Labeled).--

1. Hollow metal, horizontal sliding hoistway entrances shall be provided.

2. Entrance type and clear opening entrance size shall be as specified elsewhere in these special provisions. Sills, struts, headers, hanger covers and unit frames shall be erected by the elevator contractor and set in proper relation to the car guide rails. Such erection is to be accomplished prior to construction of rough walls. Door panels shall be installed by the elevator contractor after the wall erection is completed.

3. Entrances shall include unit frames, flush design door panels, sight guards, sills, strut angles, headers, hanger covers, fascia plates, toe guards, dust covers, and necessary hardware. Necessary support for entrance sills shall be included.

4. Material and finish for fascia, hanger covers, toe guards, dust cover and structural members shall be fabricated and finished in accordance with the elevator contractor standards.

5. Hoistway entrance frame shall be finished in #4 brushed stainless steel. Kick plates fabricated from #4 brushed stainless steel shall be mounted directly to hoistway entrance frames and landings and shall be 152 mm high.

6. Hoistway door panels and sight guards shall be finished in #4 brushed stainless steel.

7. Entrance sills shall be constructed of silver nickel.

8. Standard entrance jamb tactile markings (jamb plates) shall be supplied on both jambs, at all floors. Plates shall be finished to match #4 brushed stainless steel.

Door Operator Equipment.--

1. A gearless master door operator with direct current motor shall be provided to open and close the car and hoistway doors simultaneously. Door movement shall be cushioned at both limits of travel. An electro-mechanical interlock shall be provided at each hoistway entrance to prevent operation of the elevator unless all doors are closed and locked. An electric contact shall be provided on the car at each car entrance to prevent the operation of the elevator unless the car door is closed.

2. The door operator shall be arranged so that, in case of interruption or failure of electric power, the doors can be readily opened by hand from within the car, in accordance with applicable code. Emergency devices and keys for opening doors from the landing shall be provided as required by the State code.

3. Doors shall open automatically when the car has arrived at or is leveling at the respective landings. Doors shall close after a predetermined time interval or immediately upon pressing of a car button. A door open button shall be provided in the car. Momentary pressing of this button shall reopen the doors and reset the time interval.

4. The car door shall be provided with a protective device extending the full height. This device shall be designed to sense an obstruction in its path while the doors are closing and automatically cause the car and hoistway doors to return to the open position. The doors shall remain open until the door delay time interval of 6 seconds has elapsed; the doors will then close automatically.

5. Door hangers and tracks shall be provided for each car and hoistway door. Tracks shall be contoured to match the hanger sheaves. The hangers shall be designed for power operation with provisions for vertical and lateral adjustment. Hanger sheaves shall have polyurethane tires and prefabricated and sealed-for-life bearings.

Electronic Door Safety Device.--

The elevator car shall be equipped with an electronic sensing device, which operates across the car entrance. When activated, this sensor shall prevent the doors from closing or cause them to stop and reopen if they are in the process of closing. The doors shall remain open as long as the flow of traffic continues and shall close shortly after the last

person passes through the door opening. This device shall include a self-contained diagnostic system that shall display a code to indicate the exact nature of any problems that may occur.

EXECUTION.—

PREPARATION.--Take field dimensions and examine condition of substrates, supports, and other conditions under which this work is to be performed. Do not proceed with work until unsatisfactory conditions are corrected.

INSTALLATION.—Install all elevator components except as specifically provided for elsewhere.

ACCEPTANCE INSPECTION AND TESTS.—

General.—Final inspection of the installation of elevator shall be made only after all field inspections have been made, tests are complete, all submittals and certificates have been received and the Engineer is satisfied that the following have been satisfactorily completed:

Workmanship and equipment comply with the specifications.
Contract speed and capacity comply with the specifications.
Starting and running performance is satisfactory and equipment noise levels are within acceptable limits.
In all test conditions, speed and performance time specified shall be met and general riding quality shall be acceptable to the Engineer.

Performance guarantee.—Should these tests develop any defects or poor workmanship, any variance or non-compliance with the requirements of the specified codes and/or ordinances or any variance of non-compliance with the requirements of the specifications, all faulty equipment or workmanship shall be repaired, replaced and retested at no cost to the State.

INSTRUCTION.--

The Contractor shall instruct designated maintenance personnel in the proper use, operation and preventative maintenance of the elevator including normal procedures to be followed in checking for the source of operational failure or malfunction.

TEMPORARY USE OF ELEVATOR.--

If temporary use of an elevator is required by the contractor before the elevator is placed in service, temporary enclosures, guards or other protection of hoistway openings, elevator operations, and such other items as are necessary to permit temporary operation of the elevator, shall be furnished and installed. The Contractor shall provide all maintenance during the period of temporary operation, and shall return the elevator to the same condition of repair and maintenance as existed prior to such temporary use.

SECTION 12-15. MECHANICAL

12-15.01 MECHANICAL WORK

GENERAL.--

Scope.--This work shall consist of performing mechanical work in accordance with the details shown on the plans and these special provisions.

Mechanical work shall include furnishing all labor, materials, equipment and services required for providing heating, ventilating, air conditioning, plumbing and natural gas distribution systems.

Earthwork, foundations, sheet metal, painting, electrical, and such other work incidental and necessary to the proper installation and operation of the mechanical work shall be in accordance with the requirements specified for similar type work elsewhere in these special provisions.

System layouts are generally diagrammatic and location of equipment is approximate. Exact routing of pipes, ducts, etc., and location of equipment is to be governed by structural conditions and obstructions. Equipment requiring maintenance and inspection is to be readily accessible.

Roof penetrations shall be flashed and sealed watertight in accordance with the requirements specified under "Sheet Metal Flashing" in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

SUBMITTALS.--

Product data.--A list of materials and equipment to be installed, manufacturer's descriptive data, and such other data as may be requested by the Engineer shall be submitted for approval.

Manufacturer's descriptive data shall include complete description, performance data and installation instructions for the materials and equipment specified herein. Control and wiring diagrams, rough-in dimensions for plumbing fixtures, and component layout shall be included where applicable.

Manufacturer's descriptive data shall be submitted for the following:

Electric water coolers	Balance dampers	Air conditioning units
Hose faucet	Louvered penthouse	Louvers
Water Service Connections	Duct heaters	Motor operated damper
Blower	Gages	Fire hydrant
Air Supply Fan	Air flow switch	Roof Cap
Water heaters	Heat pump	Water hammer arrestors
Access door	Flexible duct	Compression stop
Linear diffuser	Plenum Slot Diffuser	Tapping sleeve
P-trap w/ funnel	Rigid duct	Balance damper
Pipe insulation	Cleanouts	Oil interceptor
Backflow preventer	Valve box	Floor drains
Water meter	Detector check valve assembly	
Handicap accessible shower	Water closet	Urinal
Lavatory	Lavatory carrier	Mop sink
Kitchen sink	Check valve	Gate valve
Ball valve	Diffusers	Temperature controller
Return register	Thermostats	Time switches
Duct insulation	Duct liner	Exhaust fans
Barometric relief ventilator		
Plenum Slot Return	Sump pump	Flexible hose
Double wall duct	Thermal blanket	Exhaust fan wall cap
Flue vent cap	Meter Box	

CLOSEOUT SUBMITTALS.--

Operation and maintenance manuals.--Prior to the completion of the contract, 3 identified copies of the operation and maintenance instructions with parts lists for the equipment specified herein shall be delivered to the Engineer at the jobsite. The instructions and parts lists shall be indexed and bound in a manual form and shall be complete and adequate for the equipment installed. Inadequate or incomplete material shall be returned. The Contractor shall resubmit adequate and complete manuals at no expense to the State.

Operation and maintenance manuals shall be submitted for the following equipment:

electric water coolers	thermostats
duct heaters	backflow preventer
sump pump	water meter
blower	air conditioners
heat pump	water heaters
time switches	oil interceptor
detector check valve	

QUALITY ASSURANCE.--

Codes and standards.--Mechanical work, including equipment, materials and installation, shall conform to the California Building Standards Code, Title 24, and to the California Code of Regulations, Title 8, Chapter 4, Division of Industrial Safety (DIS).

WARRANTY.--

Warranties and guarantees.--Manufacturer's warranties and guarantees for materials or equipment used in the work shall be delivered to the Engineer at the jobsite prior to acceptance of the contract.

SYSTEM IDENTIFICATION.--

Piping, ducts, valves and equipment.--Identification of piping, ducts, valves and equipment shall be as shown on the plans or these special provisions:

Above ground piping and ducts.--Markers shall be provided on lines which are either exposed or concealed in accessible spaces. For piping systems, except drain and vent lines, indicate the fluid conveyed or its abbreviation; either by preprinted markers or stenciled markings, and include arrows to show the direction of flow. Colors shall comply with ANSI Standard: A13.1. Locate markers at ends of lines, near major branches and other interruptions including equipment in the line, where lines pass through penetrations in floors, walls or ceilings or otherwise pass into inaccessible spaces, and at 50-foot maximum intervals along exposed portions of the lines. Marking of short branches and repetitive branches for equipment connections is not required.

Valves.--Valve tags shall be provided on all valves of each piping system, excluding check valves, valves within equipment, faucets, stops and shut-off valves at fixtures and other repetitive terminal units. Provide brass or plastic laminate tags. Prepare and submit a tagged valve schedule, listing each valve by tag number, location and piping service. Valve schedule shall be mounted in a glazed frame at a location approved by the Engineer.

Equipment.--All equipment shall be identified with a plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (for example, AC-4). Provide 1/2 inch high lettering, white on black background. Nameplates shall be permanently secured to the unit.

12-15.02 PIPE, FITTINGS AND VALVES

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing pipes, fittings and valves in accordance with the details shown on the plans and these special provisions. Pipe, fittings and valves shall include such plumbing and piping accessories and appurtenances, not mentioned, that are required for the proper installation and operation of the plumbing and piping systems.

All piping insulation and wrapping material shall be in accordance with the requirements specified under "Mechanical Insulation," in this Section 12-15.

The pipe sizes shown on the plans are nominal pipe size. No change in the pipe size shown on the plans shall be permitted without written permission from the Engineer.

The pipe and fitting classes and material descriptions shall be as specified herein. No change in class or description shall be permitted without written permission from the Engineer.

QUALITY ASSURANCE.--

Codes and standards.--Pipe, fittings and valves shall be installed in accordance with the requirements in the 1998 edition of the California Plumbing Code, the manufacturer's recommendations and the requirements specified herein.

PART 2.- PRODUCTS

MATERIALS.--

PIPE AND FITTINGS --

Class **Description**

A1.--

Schedule 40 galvanized steel pipe conforming to ASTM Designation: A 53, with 1040 kPa 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.

A2.--

Schedule 40 galvanized steel pipe conforming to ASTM Designation: A 53, with black cast iron recessed drainage fittings. For rainwater leaders, neoprene-gasket compression couplings, Smith Blair, Dresser, or equal, may be used. The weight of the zinc coating shall be not less than 90 percent of that specified in ASTM Designation: A 53.

A3.--

Schedule 5 steel pipe conforming to ASTM Designation: A 135 with pressfit fittings and couplings for service as designated.

A4.--

Pipe and fittings shall be UL or FM listed, ferrous (Schedule 20 minimum) or copper (Type L minimum), suitable for the working pressure involved but not less than 1210 kPa. Pipe and fittings shall be in accordance with NFPA Code requirements.

B1.--

Schedule 40 black steel pipe conforming to ASTM Designation: A 53, with screwed fittings suitable for working pressure involved, but not less than 1210 kPa. Fittings shall be listed for fire protection.

B2.--

Schedule 40 black steel pipe conforming to ASTM Designation: A 53, with 1040 kPa black malleable iron banded screwed fittings and black steel couplings.

Steel pipe coating, where required, shall be factory applied plastic. Pipe coating shall be Standard Pipe Protection, X-Tru-Coat (0.50 mm thick); Pipe Line Service Corporation, Republic; 3M Company, Scotchkote 205 (0.30 mm thick); or equal.

C1.--

Hub and plain end cast iron soil pipe with neoprene gaskets conforming to Cast Iron Soil Pipe Institute's Standard 301. Pipe, fittings and gaskets shall be of one manufacturer.

C2.--

Hubless cast iron soil pipe with neoprene gaskets, corrugated stainless steel shields and stainless steel clamps conforming to Cast Iron Soil Pipe Institute's Standard 301. Joint materials shall be furnished by pipe manufacturer.

D1.--

Ductile iron push on joint pipe conforming to AWWA Designation: C151. Fittings shall be push on ductile iron conforming to AWWA Designation: C153. Joints shall be rubber gasketed and designed for a working pressure of 2420 kPa. Pipe and fittings shall be supplied with bituminous outer coating and cement lining. Pipe shall be listed for fire protection.

H1.--

Type DWV hard copper tubing conforming to ASTM Designation: B 306, with DWV drainage fittings, stop type couplings and threaded adapters.

H2.--

Type K hard copper tubing conforming to ASTM Designation: B 88, with wrought copper or cast bronze solder joint pressure fittings, stop type couplings and threaded adapters. Solder shall be lead-free.

H3.--

Type L hard copper tubing conforming to ASTM Designation: B 88, with wrought copper or cast bronze solder joint pressure fittings, stop type couplings and threaded adapters. Solder shall be lead-free.

P1.--

Polyvinyl chloride (PVC) gravity sewer plastic pipe and fittings conforming to ASTM Designation: D 3034, Standard Dimension Ratio (SDR) 35, with integral bell and bell and spigot rubber gasketed joints or conforming to ASTM Designation: D2665 with solvent welded fittings. Rubber gaskets shall conform to ASTM Designation: F 477. Stainless steel clamps with rubber boots shall not be used.

P2.--

Polyvinyl chloride (PVC) plastic pipe and fittings conforming to ASTM Designation: D 2241, Type I, Grade 1, Standard Dimension Ratio (SDR) 21, rated for 1380 kPa working pressure at 23°C, National Sanitation Foundation approved. Pipe shall have bell ends conforming to ASTM Designation: D 3139 with triple edge rubber sealing ring. For pipe sizes 50 mm diameter and smaller, plain end pipe with solvent welded fittings ASTM Designation: D 2241, Type I, Grade 1, Standard Dimension Ratio (SDR) 21, rated for 1380 kPa may be used.

P3.--

Polyvinyl chloride (PVC) standard weight pipe and fittings, Schedule 40, conforming to ASTM Designation: D 1785. Pipe shall meet or exceed requirements of National Sanitation Foundation Standard No. 14. Pipe shall have bell ends conforming to ASTM Designation: D 2672. For pipe sizes 75 mm and smaller, plain end pipe with solvent welded fittings conforming to ASTM Designation: D 2241, may be used.

P4.--

Polyvinyl chloride (PVC) plastic pipe and fittings shall conform to AWWA Designation: C900, class 150, Standard Dimension Ratio (SDR) 18. Pipe shall have bell end with a solid cross section elastomeric ring conforming to ASTM Designation: D 1869. Pipe shall be listed for fire protection.

P5.--

Polyethylene plastic gas pipe and fittings conforming to ASTM Designation: D 1248 and D 2513 with Standard Dimension Ratio (SDR) 11, rated for 415 kPa working pressure at 23°C, socket type fittings, joined by heat fusion.

P6.--

Polyvinyl chloride (PVC) natural gas pipe, Class 315, conforming to ASTM Designation: D 2513. Fittings shall be Schedule 40 conforming to ASTM Designation: D 2513, and shall be primed and glued. Primer shall conform to ASTM Designation: F656. Solvent cement shall conform to ASTM Designation: D2564. Approved adapters shall be used for transition to other pipe materials.

Unions (for steel pipe).--

Unions (for steel pipe) shall be 1730 kPa, threaded malleable iron, ground joint, brass to iron seat, galvanized or black to match piping.

Unions (for copper or brass pipe).--

Unions (for copper or brass pipe) shall be 1040 kPa cast bronze, ground joint, bronze to bronze seat with silver brazing threadless ends or 860 kPa cast brass, ground joint, brass to brass seat with threaded ends.

Unions (for brass waste and flush pipes).--

Unions (for brass waste and flush pipes) shall be slip or flange joint unions with soft rubber or leather gaskets. Unions shall be placed on the fixture side of the traps.

Insulating union.--

Insulating union or flange as applicable shall be suitable for the service on which used. Connections shall be constructed such that the 2 pipes being connected are completely insulated from each other with no metal to metal contact. Insulating couplings shall not be used. Insulating union shall be F. H. Maloney; Central Plastics; EPCO; or equal.

Insulating connection (to hot water tanks).--

Insulating connection (to hot water tanks) shall be 150 mm minimum, flexible copper tubing with dielectric union at each end and designed to withstand a pressure of 1040 kPa and a temperature of 93°C.

VALVES.--

Gate valve (65 mm and smaller).--

Gate valve (65 mm and smaller) shall be bronze body and trim, removable bonnet and non rising stem, Class 125 and same size as pipe in which installed. Gate valve shall be Crane, 438; Nibco Scott, T-113; Jenkins, 370; or equal.

Gate valve in nonferrous water piping systems may be solder joint type with bronze body and trim. Valve shall be Kitz, 59; Nibco Scott, S-113; Jenkins, 1240; or equal.

Gate valve (75 mm and larger, above ground).--

Gate valve (75 mm and larger, above ground) shall be iron body with bronze trim, removable bonnet and non-rising stem, class 125 and same size as pipe in which installed. Gate valve shall be Crane, 461; Nibco Scott, F-619; Jenkins, 326; or equal.

Gate valve (75 mm and larger, below ground).--

Gate valve (75 mm and larger, below ground) shall be AWWA double disc, hub or rubber ring type, removable bonnet and non-rising stem, equipped with operating nuts, 1380 kPa working pressure, and Tee handle wrench for each valve. Valve shall be Mueller, A-2380; American Valve, Model 28; or equal.

Ball valve.--

Ball valve shall be two piece, minimum 2760 kPa WOG, bronze body and chrome plated or brass ball with full size port. Valve shall be Nibco Scott, T-580; Watts, B-6000; Kitz, 56; or equal.

Gas valve.--

Gas valve shall be natural gas service type, bronze body, quarter turn, flathead and rated for 860 kPa. Gas valve shall be Crane, American or equal.

Check valve (50 mm and larger).--

Check valve (50 mm and larger) shall be silent wafer type, full faced for installation between 860 kPa flanges, iron body with bronze trim, nylon or teflon disc, stainless steel helical spring and shaft, Class 125 and same size as pipe in which installed. Check valve shall be APCO, Series 300; CPV, 10D; Metraflex, Series 900; or equal.

FAUCET AND HYDRANTS.--

Hose faucet.--

Hose faucet shall be compression type, angle pattern, wall flange at exterior locations, tee handle, 20 mm female thread with hose end, rough chrome or nickel plated finish for locations inside building, rough brass finish for others. Hose faucet shall be supplied with an integral or nonremovable threaded outlet vacuum breaker which meets

the requirements of the American Society of Sanitary Engineering (ASSE) Standard: 1011. Hose faucet shall be Nibco, No. 63VB; Chicago, No. 13T; or equal.

Fire hydrant.--

Fire hydrant shall conform to the requirements of AWWA Designation: C503. Fire hydrant shall have 150 mm inlet, and have one nominal size 4 outlet steamer hose and two nominal size 2 1/2 outlets. Fire hydrant shall be Jones, Model J-3765; Rich, Model 960; American Cast, Darling Division, Mark-73; or equal.

CLEANOUTS.--

Cleanout through wall.--

Cleanout through wall shall be cast iron cleanout tee type with polished stainless access plates. Plug shall be countersunk brass or bronze with tapered threads. Cleanout shall be Wade, No. W-8460; Smith, No. 4532; Zurn, No. 1445; or equal.

Cleanout through floor.--

Cleanout through floor shall have nonslip scoriated nickel bronze access plate and adjustable frame with square pattern top for ceramic tile and round pattern top for other finishes. Where floors are constructed with a membrane, access frame shall be provided with membrane clamping flange. Plug shall be countersunk brass or bronze with tapered threads. Cleanout shall be Wade, W-7000 Series; Smith, 4023 Series; Zurn, No. 1400; or equal.

Cleanout through floors in exterior locations shall be heavy duty, floating pipe type with cast iron cover. Cleanouts shall be Wade, No. W-8300-HF; Smith, No. 4253; Zurn, No. 1474; or equal.

Cleanout to grade.--

Cleanout to grade shall be cast iron ferrule type. Plug shall be countersunk brass or bronze with tapered threads. Cleanout to grade shall be Wade, No. W-8450; Smith, 4420; Zurn, No 1440; or equal.

MISCELLANEOUS ITEMS.--

Oil interceptor.--

Oil interceptor shall be cast iron or fabricated steel with acid resistant coating inside and out, steel extensions, adjustable gravity draw-off with draw-off valve, cleanout, vent connections, removable sediment bucket, internal air-relief, gasketed scoriated heavy-duty cover, flow control fitting and threaded inlet and outlet. Oil interceptor shall be Wade, W-5300-XT, Smith, 8510, Zurn, Z-1186 or equal.

Water hammer arrestor.--

Water hammer arrestor shall be stainless steel body with bellows or piston. Arrestor compression chambers shall be pneumatically charged. Water hammer arrestor shall be tested and certified in accordance with the Plumbing and Drainage Institute Standard: PDI-WH201 and sized as shown on the plans.

Access door.--

Access door shall be 1.52 mm prime coated steel, face mounting square frame, minimum 300 mm x 300 mm door with concealed hinge and screwdriver latch.

Compression stop (exposed).--

Compression stop (exposed) shall be metal full free waterway, angle type, ground joint union, non-rising stem, molded rubber seat and wheel handle.

Compression stop (concealed).--

Compression stop (concealed) shall be long neck, built-in compression stops for required wall thickness, loose key and exposed parts polished chromium plated. Supplies shall be Chicago, 1771; California Brass, No. 172; or equal.

Wye strainer.--

Wye strainer shall be wye pattern, cast iron body and Type 304 stainless steel or monel strainer screen. The strainer screen shall have an open area equal to at least 3 times the cross sectional area of the pipe in which it is installed and shall be woven wire fabric with 20 mesh or perforated sheet with 850 micron maximum diameter holes.

Backflow preventer.--

Backflow preventer shall be factory assembled with 2 check valves, one pressure differential relief valve, 2 ball valves and 4 test cocks. Backflow preventers shall be of the approved type reduced pressure principle devices listed by the County of Los Angeles Department of Health Services, Cross-Connection and Water Pollution Control Section, 2525 Corporate Place, Monterey Park, California 91754, Telephone (213) 881-4140.

Detector Check Valve Assembly.--

Detector check valve assembly shall be a single detector check valve assembly and shall include 20 mm by-pass piping with 20 mm rising stem gate valve, flow meter and 20 mm check valve, all mounted on brass pipe fittings. Detector assembly shall be Underwriters Laboratories or Factory Mutual Approved and shall be Watts; Febco; or equal. Contractor shall submit shop drawings for check valve assembly to Engineer for approval before actual installation.

Domestic water service connection (100 mm).--

Water service connection shall include service saddle and corporation stops as specified. Water service connection shall include all necessary appurtenances required to insure connection complies with the requirements of local water utility district.

Service saddle shall be 100 mm service tap, double strap, bronze full circle with rubber gasket.

Corporation stop connection outlet shall be 15 mm larger than service size with dielectric insulating bushing and rubber gasket.

Water meter.--

Water meter shall be disc or turbine type, suitable for water service with a magnetic coupling and a minimum 860 kPa working pressure. Meter shall be 100 mm with a maximum pressure drop at 379 LPM of 24 kPa. Readout shall be in cubic meters. Water meter shall be Badger; Neptune; Rockwell; Hersey; or equal.

Pipe hanger (for piping supported from overhead).--

Pipe hanger (for piping supported from overhead) shall be Grinnell, Model 269; Super Struct, C711; or equal.

Pipe wrapping tape and primer.--

Pipe wrapping tape shall be pressure sensitive polyvinyl chloride or pressure sensitive polyethylene tape having nominal thickness of 0.50 mm. Wrapping tape shall be Polyken, 922; Manville, Trantex VID-20; Scotchrap, 51; or equal.

Pipe wrapping primer shall be compatible with the pipe wrapping tape used.

Floor, wall, and ceiling plates.--

Floor, wall, and ceiling plates shall be chromium plated steel or plastic plates having screw or spring clamping devices and concealed hinges. Plates shall be sized to completely cover the hole.

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.

Roof drain.--

Roof drain shall be cast iron body, with integral flashing clamp and gravel stop with seepage openings, 400 mm nominal polyethylene low profile dome, 75 mm caulk or no-hub outlet and underdeck clamp. Roof drain shall be J. R. Smith, 1010; Zurn, Z-100; Wade, W-3500; or equal.

Floor drain.--

Floor drain shall be cast iron body and flashing collar, adjustable nickel bronze 150 mm strainer head with seepage openings and caulk or no-hub outlet. Floor drain shall be round or square as shown on the Architectural plans. Floor drain shall be J. R. Smith, 2005/2010; Wade, W-1100; Zurn, Z-415; or equal.

Meter box--

Meter box shall be precast high density concrete with polyethylene face and concrete cover. Cover shall have a center meter reading lid. Meter box shall be Christy Type 52, with 3 piece lid; Brooks; BES; or equal.

Sump pump.--

Sump pump shall be close coupled submersible type, with, integral thermal overload protection and type SO cable. The pump and motor shall be assembled on a single vertical stainless steel shaft fitted with a mechanical seal. Pump control shall be diaphragm liquid level controller, attached to the sump pump, with type SO cable if externally wired. Horsepower, voltage, phase, RPM, and flow and total dynamic head characteristics shall be as shown on the plans.

Hose--

Hose for sump pump discharge shall include rubber liner, 2 cord plays and an abrasion resistant cover. The hose shall be rated for a pressure of 690 Kpa. The hose shall include stainless steel nipples and hose clamps as required.

P-trap (with funnel).--

P-trap shall be dura-coated cast iron combination funnel and trap drain, complete with bronze cleanout plug. P-trap shall be Zurn, Z-1019, Wade, W-2450-EF or equal.

PART 3.- EXECUTION

INSTALLATION.--

INSTALLATION OF PIPES AND FITTINGS.--

Pipe and fittings.--Pipe and fittings shall be installed in accordance with the following designated uses:

Designated Use	Pipe and Fitting Class
Domestic water (CW and HW) in buildings	H3 or A1
Domestic water underground within 1.5 m of the building	A1 or H2
Domestic water underground 1.5 m beyond the building	P2, P3, P4, A1 or H2
Fire protection water, underground	B1,D1 or P4
Fire protection water riser	B1, D1 or H3
Fire protection sprinkler piping in building	A1, A3, A4 or B1
Sanitary drain piping above ground in building	H1, C1, or C2
Sanitary drain and vent piping underground within 1.5 m of the building	C1 or C2
Sanitary vent piping above ground in building	A2, H1, C1, or C2
Sanitary drain pipe, 1.5 m beyond the building	C1, C2, or P1
Natural gas, above ground	A1 or B2
Natural gas, underground	B2 (plastic coated), P5 or P6
Rainwater leaders	A2
Equipment drains and relief valve discharge	H3 or A1

Installing piping.--Water piping shall be installed generally level, free of traps and bends, and arranged to conform to the building requirements.

Piping installed underground shall be tested as specified elsewhere in these special provisions before backfilling.

Public use areas, offices, rest rooms, locker rooms, crew rooms, training rooms, storage rooms in office areas, hallway type rooms, and similar type use areas shall have concealed piping.

Piping shall not be run in floor fill, except as shown on the plans.

Piping shall be installed parallel to walls. All obstructions shall be cleared, headroom preserved and openings and passageways kept clear whether shown or not. Piping shall not interfere with other work.

Where pipes pass through exterior walls, a clear space around pipe shall be provided. Space shall be caulked water tight with silicone caulk.

Underground copper pipe shall have brazed joints. Underground plastic pipe shall be buried with No. 14 solid bare copper wire. Wire ends at pipe ends shall be brought up 200 mm and looped around pipe.

Exposed supply and drain piping in rest rooms shall be chrome finished.

Gas piping shall not be installed under building concrete slabs or structure. An insulating connection and valve shall be installed above ground at each building supply.

Gas piping shall be pitched to equipment or to low point and provided with a 200 mm minimum dirt leg.

Plastic pipe used for natural gas shall be below grade outside of building only. Transition to Class B2 plastic coated shall be before meter, regulator, or building wall with approved metal to plastic transition fitting. PVC natural gas pipe shall be installed in accordance with International Association of Plumbing and Mechanical Officials (IAPMO) Standard: IS10.

Forty-five degree bends shall be used where offsets are required in venting. Vent pipe headers shall be sloped to eliminate any water or condensation.

Vent piping shall extend a minimum of 200 mm above the roof.

Horizontal sanitary sewer pipe inside buildings shall be installed on a uniform grade of not less than 2 percent unless shown otherwise on the plans.

Drainage pipe shall be run as straight as possible and shall have easy bends with long turns.

Wye fittings and 1/8 or 1/16 bends shall be used where possible. Long sweep bends and combination wye and 1/8 bends may be used only for the connection of branch pipes to fixtures and on vertical runs of pipe.

Water pipe near sewers.--Water pipe shall not be installed below sewer pipe in the same trench or at any crossing, or below sewer pipe in parallel trenches less than 3 m apart.

When a water pipe crosses above a sewer pipe, a vertical separation of at least 300 mm between the top of the sewer and the bottom of the water pipe shall be maintained.

When water and sewer pipe is installed in the same trench, the water pipe shall be on a solid shelf at least 300 mm above the top of the sewer pipe and 300 mm to one side.

Pipe sleeves.--The Contractor shall provide sleeves, inserts and openings necessary for the installation of pipe, fittings and valves. Damage to surrounding surfaces shall be patched to match existing.

PVC pipe sleeves shall be provided where each pipe passes through concrete floors, footings, walls or ceilings. Inside diameter of sleeves shall be at least 20 mm larger than outside diameter of pipe. Sleeves shall be installed to provide at least 10 mm space all around pipe the full depth of concrete. Space between pipes and pipe sleeves shall be caulked watertight.

Pipe penetrations in fire rated assemblies.--Where pipes pass through fire rated wall, floor or ceiling assemblies, the penetration shall be protected in accordance with the requirements specified under "Through-Penetration Firestopping," in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

Cutting pipe.--All pipe shall be cut straight and true and the ends shall be reamed to the full inside diameter of the pipe after cutting.

Damaged pipe.--Pipe that is cracked, bent or otherwise damaged shall be removed from the work.

Pipe joints and connections.--Joints in threaded steel pipe shall be made with teflon tape or a pipe joint compound that is nonhardening and noncorrosive, placed on the pipe and not in the fittings.

The use of thread cement or caulking on threaded joints will not be permitted. Threaded joints shall be made tight. Long screw or other packed joints will not be permitted. Any leaky joints shall be remade with new material.

Exposed polished or enameled connections to fixtures or equipment shall be made with special care, showing no tool marks or threads.

Cleaning and closing pipe.--The interior of all pipe shall be cleaned before installation. All openings shall be capped or plugged as soon as the pipe is installed to prevent the entrance of any materials. The caps or plugs shall remain in place until their removal is necessary for completion of the installation.

Securing pipe.--Pipe in the buildings shall be held in place by iron hangers, supports, pipe rests, anchors, sway braces, guides or other special hangers. Material for hangers and supports shall be compatible with the piping or neoprene isolators shall be used. Allowances shall be made for expansion and contraction. Steel pipe shall have hangers or supports every 3 m. Copper pipe 25 mm or smaller shall have hangers or supports every 2 m and sizes larger than 25 mm shall have hangers or supports every 3 m. Plastic pipe shall have hangers or supports every 1 m. Cast iron soil pipe with neoprene gaskets shall be supported at each joint. Vertical pipes shall be supported with clamps or straps. Horizontal and vertical piping shall be securely supported and braced to prevent swaying, sagging or flexing of joints.

Hangers and supports.--Hangers and supports shall be selected to withstand all conditions of loading to which the piping and associated equipment may be subjected and within the manufacturer's load ratings. Hangers and supports shall be spaced and distributed so as to avoid load concentrations and to minimize the loading effect on the building structure.

Hangers and supports shall be sized to fit the outside diameter of pipe or pipe insulation. Hangers shall be removable from around pipe and shall have provisions for vertical adjustment after erection. Turnbuckles may be used.

Materials for holding pipe in place shall be compatible with piping material.

Hanger rods shall be provided with locknuts at all threaded connections. Hanger rods shall be sized as follows:

Pipe Size	Minimum Hanger Rod Diameter
15 mm to 50 mm	10 mm
65 mm to 87 mm	13 mm
100 mm to 125 mm	16 mm

Wrapping and coating steel pipe.--Steel pipe buried in the ground shall be wrapped or shall be plastic coated as specified herein:

1. Wrapped steel pipe shall be thoroughly cleaned and primed as recommended by the tape manufacturer.

2. Tapes shall be tightly applied with 1/2 uniform lap, free from wrinkles and voids with approved wrapping machines and experienced operators to provide not less than 1.00 mm thickness.

3. Plastic coating on steel pipe shall be factory applied. Coating imperfections and damage shall be repaired to the satisfaction of the Engineer.

4. Field joints, fittings and valves for wrapped and plastic coated steel pipe shall be covered to provide continuous protection by puttying and double wrapping with 0.50 mm thick tape. Wrapping at joints shall extend a minimum of 150 mm over the adjacent pipe covering. Width of tape for wrapping fittings shall not exceed 50 mm. Adequate tension shall be applied so tape will conform closely to contours of fittings. Putty tape insulation compounds approved by the Engineer shall be used to fill voids and provide a smooth even surface for the application of the tape wrap.

Wrapped or coated pipe, fittings, and filed joints shall be approved by the Engineer after assembly. Piping shall be placed on temporary blocks to allow for inspection. Deficiencies shall be repaired to the satisfaction of the Engineer before backfilling or closing in.

Thrust blocks.--Thrust blocks 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.

Plastic pipe underground shall be provided with thrust blocks and clamps at changes in direction of piping, connections or branches from mains 50 mm and larger, and all capped connections.

Union.--Unions shall be installed where shown and at each threaded or soldered connection to equipment and tanks. Unions shall be located so piping can be easily disconnected for removal of equipment or tanks. Unions shall be omitted at compression stops.

Insulating union and insulating connection.--Insulating union and insulating connection shall be provided where shown and at the following locations:

1. In metallic water and gas connections into each building; within 300 mm of building wall or slab penetration. Insulating connections shall be installed on the exterior of the building, above ground and after shut-off valve.

2. In water and gas service connections in ground at point where new metallic pipes connect to existing metallic pipes. Install valve box above insulating connection.

3. At points of connections of copper or steel water pipes to steel domestic water heaters and tanks.

Bonding at insulating connections.--Interior water piping and other interior piping that may be electrically energized and are connected with insulating connections shall be bonded in accordance with the California Electrical Code. Bonding shall all be coordinated with electrical work.

Compression stop.--Each fixture, including hose faucets, shall be equipped with a compression stop installed on water supply pipes to permit repairs without shutting off water mains. Ball valves may be installed where shown on the plans or otherwise permitted by the Engineer.

INSTALLATION OF VALVES.--

Pressure reducing valve.--A capped tee connection and strainer shall be installed ahead of the pressure reducing valve.

Exterior valves.--Exterior valves located underground shall be installed in a valve box marked "Water." Extensions shall be provided as required.

Detector Check Valve Assembly.--Detector check assembly shall be installed in a meter box

INSTALLATION OF FAUCETS AND HYDRANTS.--

Hose faucet and hydrants.--Faucets and hydrants shall be installed with outlets 0.5 m above finished grade, unless otherwise shown on the plans.

INSTALLATION OF CLEANOUTS.--

Cleanouts.--A concrete pad 0.5 m long and 100 mm thick shall be placed across the full width of trench under cleanout Wye or 1/8 bend. Cast iron soil pipe (C1 or C2) and fittings shall be used from Wye to surface. Required clearance around cleanouts shall be maintained.

Cleanout risers outside of a building installed in a surface other than concrete shall terminate in a cleanout to grade. Cleanout to grade shall terminate in a valve box with cover marked "CO-SS". Top of box shall be set flush with finished grade. Cleanout plug shall be 100 mm below grade and shall be located in the box to provide sufficient room for rodding.

Cleanout risers installed in tile and concrete floors, including building aprons and sidewalks, shall terminate in a cleanout through floor.

INSTALLATION OF MISCELLANEOUS ITEMS.--

Oil Interceptor.--Oil interceptor shall be installed with all the required vents and the gravity oil draw-off line to adjacent sump. Oil draw-off line shall be full size with manual valve to allow oil to be drained. There shall be an adjacent sump for maintenance personnel to gravity draw-off oil. See plans for exact location. Installation shall be according to manufacturer's recommendations.

Water hammer arrestor.--Water hammer arrestor shall be installed so that they are vertical and accessible for replacement. Water hammer arrestor shall be installed with access door when in walls or there is no access to ceiling crawl spaces. Access door location shall be where shown on the plans or as approved by the Engineer.

Gas appliance connection.--Gas valve and flexible connector shall be provided for gas piping at each appliance. Appropriately rated gas cocks may be used in 15 mm gas pipe. Cock or valve shall be within one meter of the appliance.

Backflow preventer.--Backflow preventer assembly shall include a wye strainer, backflow preventer, fittings and pipe. Assembly components shall be the same size as the pipe in which they are installed unless otherwise shown on the plans. Backflow preventer shall include a thermal blanket to completely cover and insulate backflow preventer, and lock and cable to secure the blanket.

Backflow preventer shall be installed a minimum of 300 mm above ground and shall be the same size as the pipe in which it is installed unless otherwise shown on the plans.

Water meter.--Water meter shall be installed in horizontal piping run with no fittings located within 100 mm of either side of the meter.

Flushing completed systems.--All completed systems shall be flushed and blown out.

Chlorination.--The Contractor shall flush and chlorinate all domestic water piping and fixtures.

Calcium hypochlorite granules or tablets, if used, shall not be applied in the dry form, but shall first be dissolved into a solution before application.

The Contractor shall take adequate precautions in handling chlorine so as not to endanger workmen or damage materials. All pipes and fittings shall be completely filled with water containing a minimum of 50 ppm available chlorine. Each outlet in the system shall be opened and water run to waste until a strong chlorine test is obtained. The line shall then be closed and the chlorine solution allowed to remain in the system for a minimum of 24 hours so that the line shall contain no less than 25 ppm chlorine throughout. After the retention period, the system shall be drained, flushed and refilled with fresh water.

FIELD QUALITY CONTROL.--

Testing.--The Contractor shall test piping at completion of roughing in, before backfilling, and at other times as directed by the Engineer.

The system shall be tested as a single unit, or in sections as approved by the Engineer. The Contractor shall furnish necessary materials, test pumps, instruments and labor and notify the Engineer at least 3 working days in advance of testing. After testing, the Contractor shall repair all leaks and retest to determine that leaks have been stopped. Surplus water shall be disposed of after testing as directed by the Engineer.

The Contractor shall take precautions to prevent joints from drawing while pipes and appurtenances are being tested. The Contractor shall repair damage to pipes and appurtenances or to other structures resulting from or caused by tests.

General tests.--All piping shall be tested after assembly and prior to backfill, pipe wrapping, connecting fixtures, wrapping joints and covering the pipe. Systems shall show no loss in pressure or visible leaks.

The Contractor shall test systems according to the following schedule for a period of not less than 4 hours:

Test Schedule		
Piping System	Test Pressure	Test Media
Sanitary sewer and vent	250 mm head	Water
Water	860 kPa	Water
Gas (except P6)	690 kPa	Air
Gas (P6)	350 kPa	Air

During testing of water systems, valves shall be closed and pipeline filled with water. Provisions shall be made for release of air.

Sanitary sewers shall be cleared of obstructions before testing for leakage. The pipe shall be proved clear of obstructions by pulling an appropriate size inflatable plug through the pipe. The plug shall be moved slowly through the pipe with a tag line. The Contractor shall remove or repair any obstructions or irregularities.

Sanitary sewer pipes beyond 1.5 m perpendicular to the building shall be tested for leakage for a period of not less than 4 hours by filling with water to an elevation of 1.2 m above average invert of sewer or to top of manholes where less than

1.2 m deep. The system shall show no visible leaks The sewer may be tested in sections with testing water progressively passed down the sewer as feasible. Water shall be released at a rate that will not create water hammer or surge in plugged sections of sewer.

Testing backflow preventers.--Backflow preventers installed by the Contractor shall be tested at the completion of the supply system installation for proper operation by a certified Backflow Preventer Tester.

The tester shall hold a valid certificate as a Backflow Preventer Tester from the county in which the device to be tested is located or, if the county does not have a certification program for Backflow Preventer Testers, the tester shall have a certificate from one of the following:

1. The American Water Works Association.

2. A county which has a certification program for Backflow Preventer Testers. The certification under which the tester has been certified shall be acceptable to the water purveyor and the local agency having jurisdiction.

Testing for proper operation shall conform to the procedures of the county in which the testing is being performed, or, if such procedures are not available in the county, such tests shall conform to the provisions in the latest edition of the Guidance Manual For Cross Connection Control Program, which is available from the California Department of Health Services, Division of Drinking Water and Environmental Management, 601 N 7th Street, P.O. Box 942732, Sacramento, CA 94234.

The Contractor shall notify the Engineer at least 5 days prior to testing backflow preventers. Such tests shall be satisfactorily completed after installation of the backflow preventer assemblies and before operation of the systems.

One copy of all test results for each backflow preventer shall be furnished to the Engineer.

Full compensation for providing the certified Backflow Preventer Tester and for testing the backflow preventers shall be considered as included in the lump sum price paid for building work and no additional compensation will be allowed therefor.

12-15.03 MECHANICAL INSULATION

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing mechanical insulation in accordance with the details shown on the plans and these special provisions.

Piping insulation shall be installed on all domestic hot water piping, above grade, in non-conditioned spaces.

P-trap, hot water supply pipes and angle valves for lavatories and sinks, except in janitor closets or similar enclosed spaces, shall be insulated.

Duct insulation shall be installed on all rigid ductwork installed in concealed non-conditioned spaces.

Duct liner shall be installed in all rectangular ductwork installed in exposed non-conditioned spaces and in exterior locations. Plenum liner shall be installed in all plenums in non-conditioned spaces or in walls facing a non-conditioned space.

QUALITY ASSURANCE.--

Codes and standards.--Mechanical insulation shall conform to California State Energy Commission regulations and, where applicable, shall meet American Society of Testing and Materials (ASTM) standards.

All materials shall bear the label of the Underwriters Laboratory (UL) or other approved testing laboratory indicating that the materials proposed for use conform to the required fire hazard ratings.

Pipe safety insulation shall conform to Section 1504.1.2 of Title 24, Part 5, California Plumbing Code.

PART 2.- PRODUCTS

MATERIAL.--

General.--All pipe insulation and wrapping material, including adhesives and jackets, located within buildings shall be certified to have a composite flame spread rating of not more than 25 and smoke development rating of not more than 450 when tested in accordance with ASTM Designation: E 84.

Duct insulation and wrapping material, including adhesives and jackets, located within buildings shall be certified to have a composite flame spread of not more than 25 and smoke development rating of not more than 50 when tested in accordance with ASTM Designation: E 84.

Domestic water piping insulation.--

Piping insulation shall be glass fiber molded pipe insulation with factory applied jacket suitable for service temperatures up to 175°C. Covering jacket shall have pressure sealing lap adhesive joints. Pipe insulation shall have a minimum thermal resistance of R-0.5 K•m^2/W. Insulation and jackets shall be Owens-Corning, Fiberglass 25 with ASJ/SSL All Service Jacket; Manville, Micro-Lok 650ML with AP-T All Purpose Jacket; or equal.

Piping insulation cement.--

Insulation cement shall be Fenco, All Purpose Cement; Manville, JM375; or equal.

PVC jacket.--

PCV jacket shall be rated for a service temperature of 80°C. PVC jacket shall include covers specifically designed to cover pipe fittings.

Pipe safety insulation.--

Pipe safety insulation for P-traps, hot water supply pipes and angle valves shall be molded closed cell vinyl or closed cell foam with exterior vinyl surface. Pipe safety insulation shall be configured to protect against contact. Pipe safety insulation shall be Truebro Inc., Handi Lav-guard; Plumberex Specialty Products, Handy Shield; or equal.

External duct insulation.--

External duct insulation shall be 38 mm thick, 0.5 kg density glass-fiber blanket type. Material and coatings shall be fire resistive and shall be approved by the State Fire Marshal. External duct insulation shall be Fiberglas, Type PF-336; Ultralite, No. 100; Pittsburgh Plate Glass, Superfine; Johns-Manville, Microlite; Silvercote, Silvercel; or equal.

Plenum and duct liner.--

Plenum and duct liner shall be 25 mm minimum thickness unless shown otherwise on the plans. Material and coatings shall be fire resistive and shall be approved by the State Fire Marshal. Liner shall be Gustin-Bacon, Ultra-Liner duct insulation; Owens-Corning Fiberglas, Type CE; Gustin-Bacon, coated insulation Board No. 90-A; Owens-Corning Fiberglas 0.7 kg density coated flexible duct liner; Johns-Manville, MicroBar, or 0.7 kg density coated Microlite; Pittsburgh Plate Glass, Superfine 0.7 kg density coated interior duct insulation; or equal.

Adhesive.--

Adhesive shall be non-flammable type: Benjamin Foster Company, No. 85-20 Spark Safe; Goodloe E. Moore Company, Tuff Bond No. 6; Permacel, No. PA-3l0; 3M, No. 38 Insulation Adhesive; Swift's, No. 7228 brush type or No. 7336 spray type; Chicago Mastic, 17-461; or equal.

Studs.--

Studs shall be cement-in-place type, pneumatic driven type or percussive welding type, and shall have 25 mm minimum diameter washers.

Insulation inserts.--

Insulation inserts at pipe hangers supports for pipes NPS 2 or larger shall be calcium silicate, cellular glass, or other acceptable material of the same thickness as the adjacent insulation and not less than 6 kg density.

PART 3.- EXECUTION

INSTALLATION.--

General.--Insulation materials shall be neatly installed with smooth and even surfaces, jackets drawn tight and smoothly cemented down.

Insulation material shall not be installed until all pipes or surfaces to be covered are tested for leaks, cleaned and dried, and foreign materials, such as rust, have been removed.

Piping insulation.--Piping insulation shall be in accordance with the following, except that unions, unless integral with valves, and flexible connections shall not be insulated.

a. Where insulation butts against flanges or is discontinued, insulation shall be tapered to pipe to allow for covering jacket to completely seal off end of insulation.

   Insulation shall be extended on the valve bodies up to the valve bonnet.

   Extend insulation continuous through pipe hangers and pipe sleeves. At hangers where pipe is supported, provide an insulated protection shield.
   Insulating cement shall be applied to fittings, valves, and strainers and troweled smooth to thickness of adjacent covering. Strainer cleanout plugs shall remain accessible. Covers fabricated from molded pipe covering may be used in lieu of cement, provided covers are neat and well secured.

b. Jacket flap shall be sealed down with factory applied self-sealing lap. Seams shall be lapped not less than 40 mm. Jacket shall be secured with aluminum bands installed at 300 mm centers.

c. Exposed outdoor insulation shall have an additional 0.40 mm minimum thickness aluminum jacket applied over the completed insulation. The jacket shall have a factory applied moisture barrier and shall be Childers; Smith; or equal.

   End joints shall be lapped with aluminum holding traps located directly over the lap. Additional aluminum holding straps shall be placed at 200 mm centers. Jacket at ells and tees shall be mitered, or premanufactured fitting jackets shall be provided, with additional aluminum holding bands, as required. All joints shall be sealed watertight using silicon type, heat resistant sealant.

d. In-ground insulation shall have an additional PVC jacket applied over the completed insulation and vapor barrier. PVC jacket shall be made water with adhesive or sealant as recommended by the PVC jacket manufacturer.

Pipe safety insulation.--Pipe safety insulation shall be installed in accordance with the manufacturer's recommendations.

Duct insulation.--Ragged edges shall be repaired or taped. Coverings shall be neatly finished at joints and edges. Each joint shall have a 50 mm minimum lap.

Where transitions are made between externally covered ducts and lined ducts, the lined duct shall be overlapped 200 mm with external covering.

Insulation shall be flush with but not cover control devices, damper controls or access doors.

Before insulation is wrapped around concealed ducts, an adhesive shall be spot applied at a maximum of 100 mm centers on each side of the ducts to prevent sagging of the insulation. Insulation shall be wrapped entirely around the ducts and shall be wired securely in place with No. 16 copper clad wire, metal bands at least 10 mm wide or plastic ties. Supports shall be spaced a maximum of 300 mm on centers. Metal bands shall be installed with the use of a banding machine. Seams in the insulation shall be taped.

The finished insulation covering shall be even and level and shall not contain humps.

Plenum and duct liner.--Plenums and exposed ducts shall be lined with plenum and duct liner. Plenums and ducts shall be sized to provide the clear inside dimensions shown on plans after the liner is installed.

The insulation shall be applied with coated side exposed to air stream to prevent surface erosion.

The lining shall be fastened in place with adhesive and with studs with washers spaced a maximum of 500 mm on center each way.

Applying adhesive.--The adhesive shall be liberally applied over entire interior surfaces of ducts or plenums.

Stud installation.--Studs shall be installed as follows:

a. Cement-In-Place Type Studs.--Cement-in-place type studs shall be cemented in place with adhesives manufactured for this purpose and shall be as recommended by the stud manufacturer. Cement-in-place type studs shall be used where concrete walls form part of plenum.

b. Percussive Welding Type Studs.--Percussive welding type studs shall be carefully welded in place with current settings that will not appreciably burn galvanizing on opposite side of the sheet metal.

c. Pneumatic Driven Type Studs.--At locations where pneumatic driven type studs are used, hardened steel backup plates or dollies shall be used under the sheet metal.

12-15.04 AUTOMATIC FIRE SPRINKLER SYSTEM

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of designing, furnishing and installing an automatic wet pipe type fire sprinkler system, complete and ready for use, in accordance with the details shown on the plans and these special provisions.

The automatic fire sprinkling system shall include water flow indicator, check valve, electric alarm bell, valves, sprinkler heads and related appurtenances, valves, piping and fittings.

Design.--The design of the sprinkler system shall be in accordance with the code requirements for ordinary hazard occupancies, group B, S-1,S-2 & S-3, and shall provide coverage of the building as shown on sheet A0-4.1.

The water pressure and flow rate shall be verified with the local agency having jurisdiction.

SUBMITTALS.--

State Fire Marshal approval.--The contractor shall submit complete working drawings within 10 weeks after the contract has been approved to the Engineer at the jobsite for review and approval by the State Fire Marshal. After said drawings are reviewed and stamped "APPROVED" by the State Fire Marshal, the Engineer will return the drawings to the Contractor at the jobsite. Allow 12 weeks for State Fire Marshal review and approval.

Working drawings.--After State Fire Marshal approval, the complete stamped working drawings, including written verification of the water pressure and flow rate, shall be submitted by the Contractor for approval to the California Department of Transportation as specified under "Submittals" in Section 12-1, "General Requirements," of these special provisions.

QUALITY ASSURANCE.--

Codes and standards.--All work shall be in accordance with the requirements of the State Fire Marshal, the National Fire Protection Association (NFPA) Standard No. 13, 1996 Edition, "Installation of Sprinkler Systems," and the requirements of other regulatory authorities having jurisdiction.

PART 2.- PRODUCTS

Water flow indicator.--

Water flow indicator shall be UL or FM listed for fire protection, vane type switch designed for wet pipe systems. Water flow indicator shall be designed for minimum flow rate of 40 liters per minute, and shall have an adjustable delay setting of from 0 to 90 seconds. Water flow indicator shall be Viking, Model VSR-D; Grinnell, Model F620; Reliable, Model A; or equal.

Check valve.--

Check valve shall be UL or FM listed, swing type, self draining, iron body with brass trim and rubber clapper with removable cover plate. Check valve shall be Viking, Grinnell, Groeniger, or equal.

Alarm bell.--

Alarm bell shall be UL or FM listed electric bell type, 120 volt AC with a minimum sound rating of 95 decibels at 3 m. Alarm bell shall have a die cast aluminum housing with built-in rubber gasket for dust proof seal for bell striking mechanism. Alarm bell shall be Viking, Grinnell, Reliable, or equal.

Pipe and fittings.--

Pipe and fittings shall be in accordance with the requirements specified under "Pipe, Fittings and Valves," elsewhere in this Section 12-15.

Pipe and fittings for drain lines shall be as recommended by the valve manufacturer.

Pipe hangers.--

Pipe hangers shall be of types listed as acceptable for specific applications in NFPA No. 13.

Valves.--

Valves shall be UL or FM listed, outside screw and yoke (OS&Y) rising stem type.

Valves (OS&Y) 65 mm and larger in size shall be Crane, 467; Walworth, 8713F; Nibco Scott, F-607-0; or equal.

Valves (OS&Y) 50 mm and smaller in size shall be Crane, 459; Walworth, 873; Nibco Scott, T-104-D; or equal.

Optional; Valves 100 mm and larger may be butterfly type, UL or FM listed, working pressure 1210 kPa, gear operated, indicator flag, ductile iron body, bronze trim, with provisions for locking. Valve shall be provided with mounting block for supervisory switch.

Supervisory switch.--

Supervisory switch shall be UL or FM listed, for the type of valve supplied, single contact set with tamper resistant cover. Supervisory switch shall be suitable for exterior installations.

Sprinkler head.--

Sprinkler head shall be upright type above ceiling and pendant type below ceiling. Sprinkler head shall be brass body, chemical or solder fusing type, with proper temperature rating element. Sprinkler head shall be Viking, Grinnell, Reliable, or equal.

Spare sprinkler cabinet.--

Spare sprinkler cabinet shall be metal cabinet as recommended by the sprinkler head manufacturer and conforming to NFPA requirements. The cabinet shall be painted red.

Accessories.--

Drains, test connection, flush connections, pressure gauges, and other accessories shall be supplied as required.

Sign.--

Sign shall be sheet steel, not less than 0.76 mm thick, with red letters on a white background and a baked enamel coating.

PART 3.- EXECUTION

INSTALLATION.--

General.--Sprinkler piping and equipment shall be installed in accordance with the approved working drawings and shall be located to avoid interference with the lighting system, access openings, or other piping.

Reductions in pipe size shall be made with one piece reduction fittings. Bushings shall not be used.

Piping.--Fire sprinkler piping shall be installed level.

Drain piping and test connections shall discharge into the nearest floor drain or to the outside of the building. Discharge piping shall not drain across walkways.

Pipe penetrations in fire rated assemblies.--Where pipes pass through fire rated wall, floor or ceiling assemblies, the penetration shall be protected in accordance with the requirements specified under "Through-Penetration Firestopping" in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

Spare sprinkler cabinet.--The spare sprinkler cabinet shall be installed where temperatures will not exceed 38°C at any time. Such location shall be approved by the Engineer. Six spare sprinklers and 2 sprinkler head wrenches shall be furnished and placed in the cabinet.

Securing main shutoff valve.--A galvanized chain, with a nominal material diameter of at least 5 mm, shall be provided to lock the main shutoff in the open position. The lock will be State-Furnished as provided under "State-Furnished Materials" in Section 8, "Materials," of these special provisions.

Signs.--Signs and messages shall be as required by NFPA No. 13 and the regulatory authorities having jurisdiction. Lettering shall be standard-type of the following heights:

Item	Minimum Lettering Height
Nameplate date	6 mm
Drain signs	19 mm
Tamper sign	19 mm

FIELD QUALITY CONTROL.--

Acceptance tests.--The Contractor shall arrange for testing of the automatic fire sprinkler system in the presence of the Engineer and the State Fire Marshal. Three days written notice of said testing shall be provided by the Contractor.

The system shall be pressure tested for 2 hours at 1380 kPa. A successful test shall have no visible leaks or loss of pressure.

The Contractor shall perform such other tests as may be required by the State Fire Marshal.

12-15.05 PLUMBING FIXTURES

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing plumbing fixtures in accordance with the details shown on the plans and these special provisions.

PART 2.- PRODUCTS

General.--Plumbing fixtures shall be white in color and shall meet the following requirements:

Water closet (disabled accessible, 6 liters per flush, floor mounted with tank).--

Disabled accessible water closet shall be 6 liters per flush maximum, vitreous china, siphonable jet, 410 mm to 440 mm high elongated bowl, close coupled tank, floor mounted, with solid plastic open front elongated seat with check hinges. Water closet shall meet or exceed American Disabilities Act guidelines and ANSI Standards: A117.1 and A112.19.2. Closet and accessories shall be of the following types or equal:

	American Standard	Crane	Universal Rundle
Closet	“Cadet 17 EL1.6/PA" 2168.100 or 4086.800	"Hymont” 3-154E or 3-152 with3-655	“Atlas 1.5” UR 4078-341 or UR 4078-342
Seat	Church 5321.070	Olsonite 95	Benke 527

Water closet (disabled accessible, floor mounted with flush valve).--

Disabled accessible water closet shall be vitreous china, floor mounted, siphon jet, 410 mm to 440 mm high elongated bowl, 40 mm top spud for exposed flush valve, with solid plastic open front elongated seat with check hinges. Water closet shall meet or exceed American Disabilities Act Guidelines and ANSI Standards: A117.1 and A112.19.2. Closet and accessories shall be of the following types or equal:

	American Standard	Crane	Kohler
Closet	“Cadet 17H EL1.6/FV" 3043.102	"Hymont” 3H-701	"Highcrest" K-4271
Seat	Church 5321.070	Olsonite 95	"Lustra" K-4670-C
Flush valve	Exposed, diaphragm type, chrome plated, with oscillating handle, integral control stop, adjustable tail piece and vacuum breaker suitable for use with 40 mm spud water closets.		

Water closet (floor mounted with flush valve).--

Water closet shall be vitreous china, floor mounted, siphon jet, elongated bowl, 40 mm top spud for exposed flush valve, with solid plastic open front elongated seat with check hinges. Closet and accessories shall be of the following types or equal:

	American Standard	Crane	Kohler
Closet	"Tribor" 2342.012	"Whirlton" 3-325	"Downing" K-4262-ET
Seat	Olsonite 95	Church 5321.070	"Lustra" K-4670-C
Flush valve	Exposed, diaphragm type, chrome plated, with oscillating handle, integral control stop, adjustable tail piece and vacuum breaker suitable for use with 40 mm spud water closets.		

Urinal.--

Urinal shall be vitreous china, wall hung, washout, 20 mm top spud, integral shields, spreader and trap. Urinal and valve shall be of following types or equal:

	American Standard	Crane	Kohler
Urinal	"Washbrook" 6501.010	"Cromwell" 7-187	"Bardon" K-4960-T
Flush valve	Exposed, diaphragm type, chrome plated, with oscillating handle, integral control stop, adjustable tail piece and vacuum breaker suitable for use with 20 mm spud urinals.		

Urinal (disabled accessible).--

Urinal shall be vitreous china, wall hung, siphon jet or washout, top spud, integral shields, spreader and trap, with 380 mm maximum extension from wall. Urinal and valve shall meet American Disabilities Act guidelines and shall be of following types or equal:

	American Standard	Crane	Kohler
Urinal	"Allbrook" 6540.017	"Manhattan" 7-109	"Bardon" K-4960-T
Flush valve	Exposed, diaphragm type, chrome plated, with oscillating handle, integral control stop, adjustable tail piece and vacuum breaker suitable for use with top spud urinals.		

Lavatory (wall-mounted).--

Lavatory shall be vitreous china, with back, integral perforated grid drain, drilled for 102 mm centers, size 508 mm x 457 mm, with single extra long lever mixing faucet and chair carrier with concealed arms. Lavatory shall be equipped with temperature controls to limit the hot water supply to 43°C. Lavatory shall be equipped with a flow limiting device that limits the flow rate of hot water to no more than 2 liters per minute. Lavatory and accessories shall be of the following types or equal:

	Eljer	Crane	Kohler
Lavatory	"Lucerne" 0355.012	"Norwich" 1-194-V	"Greenwich" K-2032
Drain	--	C-1065-G or Moen 52659	K-7715
Supplies	Brass Craft FR1711C	C-1151 or Moen 52664	K-7605
Faucet	2385.130	Moen 8400	K-15592-5
Trap	32 mm chromium plated brass exposed bent tube adjustable 1.37 mm (17-gage) minimum thickness.		
Carrier	Concealed wall mounted carrier with leveling screws and locking devices; Zurn, J.R. Smith, Josam, Wade, Jonespec, or equal.		

Lavatory (counter mounted).--

Lavatory shall be self-rimming vitreous china, integral perforated grid drain, drilled for 102 mm centers, nominal bowl size 254 mm x 457 mm, with single extra long lever mixing faucet. Lavatory shall be equipped with temperature controls to limit the hot water supply to 43°C. Lavatory shall be equipped with a flow limiting device that limits the flow rate of hot water to no more than 2 liters per minute. Lavatory and accessories shall be of the following types or equal:

	American Standard	Eljer	Kohler
Lavatory	"Aqualyn" 0476.028	"Kathy" 051-3334	"Rondelle" K-2185
Drain	2411.015	803-052	K-7715
Supplies	Brass Craft FR1711C	801-0111	K-7606
Faucet	Moen 8425	------	15592-5
Trap	32 mm chromium plated brass exposed bent tube adjustable 1.37 mm (17-gage) minimum thickness.		

Mop sink.--

Mop sink shall be acid resisting enameled cast iron, 711 mm x 711 mm outside dimensions, 75 mm trap, vinyl coated rim guard, vacuum breaker faucet with hose and wall hook. Sink and accessories shall be of the following types or equal:

	American Standard	Eljer	Kohler
Mop sink	"Florwell" 7740.020	"Custodial" 242-0050	"Whitby" K-6710
Strainer	7721.038	803-0630	K-9146
Faucet	8344.111	749-1450	K-8928

Kitchen sink.--

Kitchen sink shall be constructed of 18-gage minimum stainless steel with full undercoating. Sink shall be single compartment, self-rimmed with ledge for faucet. Normal bowl size shall be 533 mm x 381 mm with an outside depth of 178 mm or less. Sink shall be supplied with stainless steel strainer and chrome P-trap. Kitchen sink faucet shall be metal body, chrome plated, single lever mixing type with 200 mm long swing spout aerator and replaceable ceramic cartridge.

Water heater (electric).--

Water heater shall be minimum capacity as shown on plans, designed for minimum 860 kPa, interlocking (non-simultaneous) or single element, glass lined, and equipped with magnesium anodes, cold water drop tube, high temperature energy shut-off device, valved drain, high density R-1.4 K• m^2/W minimum foam insulation and finished with a steel jacket with baked enamel finish. Water heater shall meet the requirements of the California Energy Commission.

Water heater shall be equipped with an ASME labeled, tank mounted, pressure and temperature relief valve sized for maximum input.

Electric water cooler (at Toll Booth).--

Electric water cooler shall be wall mounted, and shall produce a minimum of 28 liters of 10°C water per hour based on an inlet water temperature of 27°C and an ambient room temperature of 32°C. Cooler shall have self-closing, front and side mounted pushbar actuators, shielded bubbler, automatic stream regulator, loose key stop, adjustable thermostat, and cast brass P-trap. Compressor shall be hermetically sealed, positive start with fan cooled condenser. Electric water cooler shall be provided with 3-wire grounded cord and plug.

Electric water cooler shall have stainless steel top and steel cabinet with baked enamel finish.

Electric water cooler shall be Haws, HWBFA8; Elkay, OEP8WM; Sunroc, NWC8; or equal.

Electric water cooler (in Operations Building).--

Electric water cooler shall be wall mounted, wheelchair accessible, and shall produce a minimum of 28 liters of 10°C water per hour based upon an inlet water temperature of 27°C and an ambient room temperature of 32°C. Cooler shall have self closing, front and side mounted pushbar actuators, shielded bubbler, automatic stream regulator, loose key stop, adjustable thermostat and cast brass P-trap.

Compressor shall be hermetically sealed, positive start with fan cooled condenser and shall be mounted above the cooler top. Cooler shall be provided with 3-wire grounded plug and cord.

Electric water cooler shall be Haws, HWCA8D; Sunroc, HCWC-8S; Elkay, EHFS-8; or equal.

PART 3.- EXECUTION

INSTALLATION.--

General.--All finish for exposed metal on any fixture, including wall flanges, bolts, nuts and washer, shall be polished chrome plated.

Fixtures shall be sealed to wall or floor with silicone caulk bead.

All exposed metal surfaces on fixture supports shall be enameled to harmonize with fixtures.

Wall mounted fixtures shall be installed on concealed chair carriers designed to support weight of fixture from the floor, made for the specific fixture to be supported and for the particular installation conditions.

All fixtures, including showers, shall be provided with accessible metal stop valves.

Hot water supply, trap and tailpiece on lavatories shall be covered with safety insulation.

Flush valves for fixtures designated on the plans as disabled accessible shall be installed so that the valve handle is on the widest side of the toilet space.

FIXTURE MOUNTING HEIGHTS.--

General.--Unless otherwise noted, fixtures shall be mounted at the heights shown on the plans.

Mop sink.--Mop sink double faucet shall be mounted on wall above sink back with spout outlet face one meter above the floor.

Water heater.--Water heater shall be installed with seismic restraints, inlet ball valve and insulating connections, and 20 mm pressure and temperature relief drain pipe.

FIELD QUALITY CONTROL.--

Testing.--The Contractor shall test piping in accordance with the requirements specified elsewhere in these special provisions.

All installed fixtures shall be tested for proper operation after all plumbing work has been completed.

12-15.06 WHEELCHAIR ACCESSIBLE SHOWER UNIT

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing a wheelchair accessible shower unit and fittings in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--

Product data.--Manufacturer's descriptive data, installation instructions and color palette shall be submitted for approval. The color will be selected from the manufacturer's standard product line by the Engineer after approval of the contract.

QUALITY ASSURANCE.--

Codes and standards.--Shower units shall conform to the requirements of the California State Accessibility Standards contained in the California Building Standards Code, Title 24.

PART 2.- PRODUCTS

Shower stall.--

Shower stall shall be single unit, single piece construction with clear interior dimensions of 1065 mm wide, 1220 mm deep, with an entrance width of 915 mm, and no obstruction at the threshold. Shower stall shall be fabricated from gel-coated fiberglass or acrylic with a Class I Flame Spread. Shower unit shall be reinforced to accommodate the grab bars and seat.

Shower unit shall have a threshold or recessed drop, a maximum of 13 mm in height, sloped at an angle not exceeding 45 degrees from the horizontal. The floor shall be slip-resistant, sloping a maximum of 4% to a drain located near the rear wall.

Shower unit shall be provided with the following fittings and accessories: stainless steel corner grab bar and folding teak wheelchair transfer seat, each capable of resisting 1112 N of lateral, vertical and tensile load, stainless steel soap dish, chromium plated or stainless steel curtain rod, chromium plated steel hand-held shower head with ball joint, chromium plated 1525 mm long flexible shower spray hose, chromium plated fixed shower head, chromium plated metal outlet drain with removable strainer, chromium plated single lever control thermostatic mixing valve with control cartridge with no metal to metal wearing surface, a lever operated shower head selector, and vinyl shower curtain with corrosion resistant hooks.

Shower stall units shall be Crane; Florestone; Maron and Associates; or equal.

PART 3.- EXECUTION

INSTALLATION.--

General.--Shower shall be installed with the manufacturer's instructions. All joints shall be sealed and caulked watertight.

12-15.07 HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT AND SYSTEMS

PART 1.- GENERAL

Scope.--This work shall consist of furnishing, installing and testing heating, ventilating and air conditioning (HVAC) equipment and systems in accordance with the details shown on the plans and these special provisions.

The performance rating and electric service of the HVAC equipment shall be as shown on the plans.

Temperature controls.--Thermostats, relays, timer switches, and other sensor type control devices required for this work shall be furnished and installed by the supplier of the heating, ventilating and air conditioning equipment. All temperature control wiring shall be furnished and installed in accordance with the requirements specified in Section 12-16, "Electrical," of these special provisions.

Codes and standards.--Equipment and systems shall conform to California State Energy Commission Regulations and, where applicable, shall be American Refrigeration Institute (ARI), American Gas Association (AGA), Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA), and Air Movement and Control Association (AMCA) approved for performance ratings and application shown on the plans.

Any appliance for which there is a California standard established in the Appliance Efficiency Standards may be installed only if the manufacturer has certified to the Commission, as specified in those regulations, that the appliance

complies with the applicable standards for that appliance. Space conditioning equipment may be installed only if the manufacturer has certified that the equipment meets or exceeds all applicable efficiency requirements listed in the Energy Efficiency Standards.

PART 2.- PRODUCTS

HEATING AND COOLING UNITS.--

Combination heating/cooling unit (single package – rooftop).—

Combination heating/cooling unit shall be standard, commercial quality, single package, curb mounted unit with weatherproof acoustically lined cabinet. The cabinet shall have convenient access panels and a baked-on enamel finish. The roof curb shall be insulated and shall be supplied by the unit manufacturer. Unit shall be provided with positive pressure combustion and mechanical flue gas venting and furnace safety controls.

Compressor shall be hermetically sealed unit, vibration isolation, with quick-start components, if single phase voltage, short cycling protection, pressure relief valve, high and low pressure switches, liquid-line filter-dryer and crankcase heater.

In door air blower shall be adjustable V-belt drive type. The fan and fan motor shall provide the specified air flow, with we coil, against the external static pressure as noted on the plans.

Motors shall have integral thermal overload protection.

Unit with fan capacity over 1180 L/s shall be provided with an economizer, except for the three toll booth units which shall not have an economizer.

Combination heating/cooling unit shall be Trane, Carrier, York or equal.

Air conditioning unit cooling only (single package – rooftop)

Cooling unit shall be standard, commercial quality, single package, curb mounted unit with weatherproof acoustically lined cabinet. The cabinet shall have convenient access panels and a baked on enamel finish. The roof curb shall be insulated and shall be supplied by the unit manufacturer.

Compressor shall be hermetically sealed unit, vibration isolated, with quick-start components, if single phase voltage, short cycling protection, pressure relief valve, high and low pressure switches, liquid-line filter-dryer and crankcase heater.

Indoor air blower shall be adjustable V-belt drive type. The fan and fan motor shall provide the specified air flow, with wet coil, against the external static pressure as noted on the plans. Motors shall have integral thermal overload protection.

Unit with fan capacity over 1180 L/s shall be provided with an economizer.

Cooling Unit shall be Trane, Carrier, York or equal

Economizer.--

Economizer shall be modulating type assembly consisting of parallel opposed blade type dampers and motor(s) with linkage for full range modulation of the outdoor and return air dampers. Dampers shall be temperature controlled and a barometric damper sized to relief a minimum of 100 percent of the rated liters per minute shall be provided. Wiring for the economizer shall be compatible with the furnace/air conditioner installed and shall provide for automatic compressor lockout and minimum position damper control to provide the minimum outside air as shown on the plans.

Electric wall heater.--

Electric wall heater shall be forced air, recessed type, and shall be equipped with a grille and integral thermostat. Unit shall be sized as shown on the plans.

Heat pump (wall mounted).--

Heat pump shall be wall mounted, through-the-wall type with backup electrical resistance heating, and shall include slide-out chassis design, thermostat, adjustable discharge grilles, multi-speed fan, and integral thermal overload protection. Capacity and electric service shall be as shown on the plans.

Inline electric duct heater.

The inline electric duct heater shall have the output and steps as shown on the plans. The heater shall include a thermostat and temperature probe and all appurtenances to provide the step control called for on the plans. The heater shall be sized to fit in the ducts as shown on the plans and shall include an externally resettable thermal cutout internal fusses and a local disconnect.

FANS AND VENTILATORS.--

Exhaust fan (ceiling mounted).--

Exhaust fan shall be ceiling mounted, AMCA certified and shall be equipped with grille, backdraft damper and metal housing. Exhaust fan motor shall have integral thermal overload protection. Ceiling exhaust fan shall be Breidert, ILG, Penn, or equal.

Exhaust fan (wall mounted).--

Exhaust fan shall be wall mounted, AMCA certified and shall be equipped with grille, metal housing, backdraft damper, centrifugal fan wheel and bird screen. Fan motor and fan assembly shall be isolated from base with rubber vibration isolators. Fan shall be completely weatherproof and shall have a disconnect means under the hood and fan motor shall have integral thermal overload protection. Wall exhaust fan shall be Jenn-Air; Carnes; EWDA; Penn; or equal. Fan shall be sized as shown on the plans.

Blower.--

Blower shall be centrifugal type, Greenheck, Acme, Ilg or equal. Fan shall have adjustable belt drive, screened discharge inlet, backdraft damper, drain fitting, vibration isolators and complete weatherproof enclosure.

Fan shall be AMCA certified and exhaust fan motor shall be equipped with integral thermal overload protection and local disconnect.

Combination heat lamp/light/fan.--

Combination heat lamp/light/fan shall be ceiling mounted, recessed type unit with metal housing, grille and backdraft damper. Ducting size shall be as required by the manufacturer. Combination heat lamp/light/fan shall be Broan, No. 164; Nutone, No. 9427; or equal. Shall be sized as shown on the plans.

Barometric relief ventilator

Barometric relief ventilator shall be stationary, relief type, and shall have an automatic barometric damper. Barometric relief ventilator shall be aluminum. Roof curb shall be supplied by the ventilator manufacturer. Barometric relief ventilator shall be Breidert, Greenheck or equal.

Gravity ventilation hood (elevator shafts and sally port).—

Gravity ventilation hood shall be stationary, gravity type, all heavy gage aluminum construction, one-piece curb w/spun inlet galvanized bird screen. Roof curb shall be supplied by the ventilator manufacturer. Gravity ventilation hood shall be Breidert, RCX11-30, Greenheck, GRS-30 or equal.

Air supply fan (tunnel)--.

Air supply fan for tunnel shall be aluminum and steel construction, belt drive propeller blade with washable inlet filters and local disconnect. The unit shall be sized as shown on the plans.

HVAC CONTROLS.--

Remote temperature controller.--

The temperature controller shall include a remote bulb sensor, on/off control with one temperature input and four relay outputs. The unit shall have adjustable range and differential with .6 degree Celsius accuracy and a range from -34 to 51 degrees Celsius. The unit shall include a LCD display and be installed in a weatherproof housing.

Thermostat (in traffic operations systems hub room and elevator mechanical room).—

Thermostat shall be line voltage, with setback and shall be provided with an independent thermometer. Thermostat shall have wide temperature range, 2.22°C – 32.2°C, and shall include set point locking feature at various temperatures.

Thermostat (office only).--

Thermostat shall be 24-volt, 7-day programmable, electronic heating/cooling thermostat, with the ability to program the fan-on mode during normal working hours, and fan-off mode during unoccupied periods. Thermostat shall be provided with sub-base selector switches for "AUTO-HEAT-OFF-COOL" and fan "AUTO-ON". Thermostat shall be auto-changeover type, and have full temperature range setback capacity. Thermostat shall be Robertshaw, 7900; Honeywell, T7300; or equal.

Time switch.--

Time switch shall be one-hour, spring-wound, "OFF" type time switch without a "HOLD" feature. Time switch shall be Intermatic, Type F60M; Tork, A500 Series; or equal.

Air flow switch.--

Flow switch shall be sail type switch with a NEMA 1 enclosure with a SPDT switch. All parts exposed to the air flow shall be steel, teflon brass or aluminum. The switch shall have an adjustable range with a minimum adjustment of flow on at 71.6 meters per minute and no flow at 53.3 meters per minute.

AUXILIARY HVAC COMPONENTS.--

Unless specified herein, all components shall be sized and have the characteristics as shown on the plans.

Rigid ductwork.--

Rigid ductwork shall be galvanized steel sheet metal conforming to the latest edition of the SMACNA "Low Velocity Duct Construction Standards." Galvanized steel shall be cleaned by washing with mineral spirit solvent sufficient to remove any oil, grease or other materials foreign to the galvanized coating.

Underground duct.--

Underground duct shall be round, spiral wound galvanized, double wall duct with a 50 mm annular space filled with fiberglass insulation. The inner shell shall be non-perforated steel, 24 gage for sizes 300 mm or less and 22 gage for sizes greater than 300 mm. The outer shell shall be 26 gage for sizes 300 mm or less and 20 gage for sizes greater ten 300 mm. The exterior of the duct shall be coated with a 4 mils thickness of polyvinyl chloride. Duct used for intake air shall meet these specification except that it shall be single wall.

Spiral duct.--

Spiral duct shall be prefabricated type.

Duct supports.--

Duct supports shall be hot-dip galvanized steel.

Flexible ductwork.--

Flexible ductwork shall be UL 181, Class 1 air duct rated and shall meet the requirements of CMC. Duct shall have steel helix wire, flexible insulation, minimum thermal resistance of R-0.7 (m^2*K/W), and flame resistant vapor barrier. Inner and outer surfaces shall be non-metallic. Outer surface shall be Copolymer or Mylar, factory applied.

Flexible connection.--

Flexible connection shall be prefabricated type and shall be commercial quality flexible glass fabric coated on both sides with neoprene or hypalon.

Ceiling diffuser (for gypsum board and suspended ceilings on main floor)

Ceiling diffuser shall be square type. Diffuser shall be steel with oven baked-on enamel bone white dull finish or extruded aluminum, equipped with individually adjustable curved blade removable core. Gypsum board ceiling diffuser shall be surface mount with a standard flanged frame with sponge rubber or felt gasket. Suspended ceiling diffuser shall be lay-in type. Each shall have counter-sunk screw holes, with face velocity less than 3.05 m/s; Titus, MCD; Hart and Cooley, MCDS-T; or equal. Size and throw shall be as shown on the plans.

Ceiling diffuser (lower floor)

Ceiling diffuser shall be rectangular or square type. Diffuser shall be steel with baked-on enamel bone white finish or extruded aluminum, equipped with adjustable curved blades and opposed blade damper adjustable from the face of the diffuser, and standard surface mounted flanged frame with sponge rubber or felt gasket. Unit shall be Air Mate, 400 series; Hart and Cooley, C-Series or equal. Size and throw shall be as shown on the plans.

Return register (for gypsum board ceiling).--

Return register for gypsum board ceilings shall be perforated face, surface mounted rectangular or square, and shall be steel with oven baked-on enamel bone white dull finish or extruded aluminum; Titus, PAR; Tuttle & Bailey, PG, APG; or equal.

Return register (for suspended ceilings).--

Return register for suspended ceilings shall be 610 mm square, steel or extruded aluminum, perforated face, flush faced, hinged for easy access; Air Mate, 700RA; Titus, PAR; or equal.

Supply register (for AC-8 and AC-9).--

Wall supply register shall be double-deflecting adjustable type, with vertical face bars and horizontal rear louvers, steel with oven baked-on enamel bone white finish or extruded aluminum, flanged frame with sponge or felt gasket; Hart and Cooley T62; Air Mate 240-HO or equal.

Return register (for AC-8 and AC-9).--

Wall return register shall be single deflecting type, with horizontal adjustable louvers, steel with oven baked-on enamel bone white finish or extruded aluminum, flanged frame with sponge or felt gasket; Hart and Cooley, T70; Air Mate, 200-HO; or equal.

Plenum slot diffusers and returns (building).—

Plenum slot diffusers and returns shall be supply and return type with 13 mm, 19 mm, 25 mm slot spacing sizes and shall be available in standard one-piece lengths up to 1.8 m and 1 or more discharge slots. Diffusers shall be provided with adjustable pattern deflectors (adjustable from the face of the diffuser) capable of providing a 180 pattern adjustment. Volume dampers shall be furnished behind all active supply sections in each diffuser, diffusers plenums shall be used at each diffuser. Plenum slot ceiling diffusers and returns shall be extruded aluminum furnished with etched and satin anodized finish to provide a lustrous finish. Plenum slot diffusers and returns shall be Titus, TBD-80; Hart & Cooley, S-Series; or equal.

Linear diffuser (toll booths).--

The linear diffuser for the toll booths shall be extruded aluminum construction with volume and throw pattern adjusters. The unit shall install flush with the air diffuser unit top and use concealed fasteners. The diffuser shall have a bare aluminum finish and mitered ends as shown on the plans. The pressure/output performance shall be as shown on the plans.

Linear diffuser (operating center).--

Linear diffuser for the operations center shall be extruded aluminum construction, single continuous slot with 24 gage galvanized steel plenum and lined inside with black matte fiberglass insulation. Pattern controllers shall be one

piece extruded aluminum. Line at diffuser shall mount flush to ceiling. Linear diffuser shall be Titus, FT-10, Krueger, 1800; or equal.

Louver (in tunnel).--

Supply fan louvers in tunnel shall be rolled-formed type 304 stainless steel return type grill. The louver shall have 13 mm blade spacing with a 35 degree downward angle. The unit shall be sized to match the duct and shall be surface mounted and shall not include a damper.

Volume damper.--

Volume damper shall be opposed blade type, operable from face with screw driver or Allen-head wrench, shall be same manufacturer as diffuser or may be furnished as part of the diffuser.

Fire damper.--

Fire damper shall be approved or listed by the State Fire Marshal. Each fire damper shall have an approved fusible link with a temperature rating 10°C. above normal maximum operating temperature, and precision machined bronze sleeve type bearings. Fire damper shall have all steel parts factory painted with an oven baked-on metal primer and enamel finish.

Balance damper.--

Balance damper shall be butterfly type, 1.52 mm (16-gage) minimum galvanized steel blade, end bearings with steel shaft and locking and indicator operator. Balance damper shall be Ventlock, Young, Anemostat, or equal.

Motor operated damper.--

Motor operated damper shall be opposed metal blade type complete with motor, motor controls and linkage. Units shall be sized for the duct as shown on the plans.

Louvered penthouse.

The penthouse shall be aluminum construction, completely weatherproof design with a minimum throat area of 0.93 square meters. The height of the hood shall not exceed 610 millimeters.

Double wall duct.--

Underground duct shall be double wall, galvanized steel type with 50 mm of fiberglass insulation and a 4 mil PVC or vinyl coating. The outer shell shall be 18 gage. The inner shell shall be a smooth non-perforated type. The fittings shall be of the same construction as the ductwork.

Pressure gage (for air duct).--

Pressure gage shall be 63 mm diameter face with stainless steel back and a 2% accuracy at the middle 1/3 of the range. The range shall be as shown on the plans.

Roof cap.--

Roof cap shall be galvanized steel or aluminum construction with 360 degree air opening and bird screen. Roof cap curb shall be supplied by the cap manufacturer.

Air filter (for HVAC units).--

Air filter shall be permanent metal viscous impingement type, constructed of aluminum or galvanized steel, 50 mm minimum thickness and be approved for Class 2 use. Filter shall have a minimum efficiency rating of 50 percent as determined when tested in accordance with ASHRAE Test Standard 52. Filter shall be mounted in 1.52 mm (16-gage) galvanized steel holding frames. Two cans of recharging adhesive shall be provided with the filter and shall be nearly odorless, have a high flash point, rapid wetting characteristics, dye tracer and be water soluble. Filter shall be Airspan, Type AF, Eco-Air Products, Inc., Type HIA; Snyder General, Type AAF; or approved equal.

Refrigerant and condensate drain piping.--

Refrigerant and condensate drain piping shall be rigid, Type L copper tubing with brazed solder fittings. The suction line shall be insulated, with vapor barrier and shall be weatherproofed for exterior installation. Factory sealed tubing shall not be used.

PART 3.- EXECUTION

INSTALLATION.--

Ventilators--Exhaust ducts connected to exhaust fans shall be routed as shown on the plans and shall terminate in a weatherproof roof cap. Duct sizes shall be as shown on the plans or as recommended by the manufacturer, whichever is larger.

Ventilators and penthouse shall be curb mounted.

Condensate drains.--Air conditioning units and heat pumps shall be provided with condensate drain trap and piping. Outdoor piping shall extend to the nearest roof drain, gutter or as shown on the plans. Air gap shall be installed where required by code. Interior condensate drain piping shall be insulated with foam insulation.

Linear diffuser.—Linear diffuser shall be installed with clips that are integral with the linear slot diffuser allowing the diffusers to be secured directly to the ceiling framing without additional supports. Volume dampers shall be installed in the supply duct to each diffuser.

Mounting heights.--Thermostats and time switches shall be installed as specified elsewhere in this special provisions.

Air outlets.--Volume dampers shall be furnished and installed for all operations building diffusers. Blocking shall be provided on all sides of air outlets between ceiling or wall joists. Collars shall be supplied for all outlets and shall be taped and sealed in place.

Vents and flues.--Vents and flues shall be securely fastened to the building construction, shall be provided with a collar at all ceiling penetrations and shall terminate with a weather cap fabricated of the same material.

Access door.--Access doors shall be provided in rigid ducts and plenums for access to volume dampers, fire dampers and control devices located within such ductwork; and shall be provided at such other locations as shown on the plans.

Ducts and vents.--Ductwork within the building shall be installed to clear lighting fixtures, doors, windows and other obstructions. Ductwork shall preserve head room and shall keep openings and passageways clear whether shown on plans or not.

Ductwork shall be installed and braced according to the latest edition of the SMACNA "HVAC Duct Construction Standards."

Slopes in sides at transitions shall be approximately one to five. The ductwork system shall not contain abrupt changes or offsets of any kind unless otherwise shown on the plans.

Where ducts pass through walls, floors or ceilings, galvanized sheet metal or steel angle collars shall be installed around the ducts.

Duct sections shall be connected by beaded sleeve-type couplings using joint sealer as recommended by the duct manufacturer. Duct sections shall be mechanically fastened with pop rivets or sheet metal screws and sealed with mastic or insulated, reinforced silver tape.

Flexible connections shall be provided at both inlet and outlet of fan coil and ventilating units.

Sheet metal plenums shall be adequately braced and supported from the floor or structure with structural steel angles to prevent sagging, flexing and vibration.

All standing seams and transverse joints of supply, return and exhaust ducts and seams around plenums, fan and coil housings shall be sealed with sealant and taped.

Duct penetrations in fire rated assemblies.--Where ductwork passes through fire rated wall, floor or ceiling assemblies, the penetration shall be protected in accordance with the requirements specified under "Through-Penetration Firestopping" in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

Ductwork identification.--Ductwork shall be identified as follows:

Duct Description	Identification Symbol
Supply duct	S
Return duct	R
Exhaust duct	EXH
Outside air duct	OA

Identification symbol letters shall be stenciled at locations visible from the access routes to be used by maintenance workers. Such letters shall be painted with black colored paint and shall be a minimum of 50 mm high.

FIELD QUALITY CONTROL.--

Pre-test requirements.--Before starting or operating systems, equipment shall be cleaned and checked for proper installation, lubrication and servicing.

In each system, at least one air path, from fan to final outlet, shall have all balance dampers open. The final air quantities shall be achieved by adjusting the volume dampers or the fan RPM.

Final adjustments and balancing of the systems shall be performed in such a manner that the systems will operate as specified and as shown on the plans.

The Contractor shall replace or revise any equipment, systems or work found deficient during tests.

All automatic operating devices which are pertinent to the adjustment of the aforementioned air systems shall be set and adjusted to deliver the required quantities of air and at temperatures specified by the Engineer. All control work shall be done in collaboration with the control manufacturer's representative.

Project completion tests.--The Engineer shall be notified at least 3 working days in advance of starting project completion tests.

The project completion tests shall consist of the following:

1. **Air Systems.--**All air systems shall be tested and balanced to the conditions set forth on the plans and in these special provisions. This work shall be performed by an Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB) certified contractor. The air systems include, but are not necessarily limited to, the following:
   a. Supply air systems
   b. Return air systems
   c. Exhaust air systems

2. **Operational Data.--**The tests shall include operation of the heating, cooling, and ventilating systems for not less than two 8-hour days, each system shall operate at not less than 90 percent of their full specified capacities.

   The required data shall be accurately measured. The data shall be measured during one operational cycle in the presence of the Engineer and shall be submitted for approval.

   The following data shall be measured and tabulated :

   a. Ambient temperatures and conditions, °C
   b. Supply and return air quantities, l^3/sec, each room
   c. Thermostat set point, °C
   d. Air temperatures at room center, °C
   e. Fan motor amperages and voltages
   f. System static pressures, Pa

SECTION 12-16. ELECTRICAL

12-16.01 ELECTRICAL WORK

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of performing electrical work in accordance with the details shown on the plans and these special provisions. Section 86, “Signal, Lighting and Electrical Systems” of the Standard Specifications shall apply when specific reference is made hereto.

Electrical work shall include furnishing all labor, materials, equipment and services required to construct and install the complete electrical system shown on the plans and the work of installing electrical connections for the thermostats, motors, and controls specified elsewhere in these special provisions.

System layouts are generally diagrammatic and location of equipment is approximate. Exact routing of conduits and other facilities and location of equipment is to be governed by structural conditions and other obstructions, and shall be coordinated with the work of other trades. Equipment requiring maintenance and inspection shall be located where it is readily accessible for the performance of such maintenance and inspection.

Related work.--Earthwork, foundations, sheet metal, painting, mechanical and such other work incidental to and necessary for the proper installation and operation of the electrical work shall be done in accordance with the requirements specified for similar work elsewhere in these special provisions.

CLOSEOUT SUBMITTALS.--

Operation and maintenance manuals.--Prior to the completion of the contract, 3 identified copies of the operation and maintenance instructions with parts lists for the equipment specified herein shall be delivered to the Engineer at the jobsite. The instructions and parts list shall be in a bound manual form and shall be complete and adequate for the equipment installed. Inadequate or incomplete material will be returned. The Contractor shall resubmit adequate and complete manuals at no expense to the State.

Manuals shall be submitted for the following equipment:

Extinguishable Message Sign
Changeable Message Sign
Standby Generator
Uninterruptible Power Supply
Fire Alarm System
Intrusion Alarm System
Intercom System
Surveillance System
Master Clock System
Closed Circuit Television System
Carbon Monoxide Detection System
Programmable Logic Controller

QUALITY ASSURANCE.--

Codes and standards.--All work performed and materials installed shall be in accordance with the National Electrical Code; the California Building Standards Code, Title 24, Part 3, "California Electrical Code," and the California Code of Regulations, Title 8, Chapter 4, "Electrical Safety Orders," and all state ordinances.

Warranties and guarantees.--Manufacturer's warranties and guarantees for materials or equipment used in the work shall be delivered to the Engineer at the jobsite prior to acceptance of the contract.

TESTING.--

After the electrical system installation work has been completed, the electrical system shall be tested in the presence of the Engineer to demonstrate that the electrical system functions properly. The Contractor shall make necessary repairs, replacements, adjustments and retests at his expense.

Attention is directed to "Automated Toll Collection and Accounting System Electrical System," elsewhere in these special provisions regarding testing of State-furnished ATCAS equipment.

12-16.02 BASIC MATERIALS AND METHODS

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing conduits, conductors, fittings, and wiring devices in accordance with the details shown on the plans and these special provisions.

Conduits, conductors, fittings, and wiring devices shall include those accessories and appurtenances, not mentioned, that are required for the proper installation and operation of the electrical system.

Related work.--Roof penetrations shall be flashed and sealed watertight conforming to the requirements specified under "Sheet Metal Flashing" in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

Where conduits pass through fire rated wall, floor or ceiling assemblies, the penetrations shall be protected in accordance with the requirements specified under "Through-Penetration Firestopping" in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

SUBMITTALS.--

Product data.--A list of materials and equipment to be installed, manufacturer's descriptive data, and such other data as may be requested by the Engineer shall be submitted for approval.

Manufacturer's descriptive data shall include complete description, performance data and installation instructions for the materials and equipment specified herein. Control and wiring diagrams, rough-in dimensions for recessed junction and pull boxes, and component layout shall be included where applicable. All control and power conductors on the shop drawings shall be identified with wire numbers.

PART 2.- PRODUCTS

CONDUITS AND FITTINGS.--

Rigid steel conduit and fittings.--

Rigid steel conduit shall be threaded, full weight rigid steel, hot-dip galvanized inside and outside with steel or malleable iron fittings. Fittings shall be threaded unless otherwise specified or shown on the plans.

Split or three-piece couplings shall be electroplated, malleable cast iron couplings.

Insulated grounding bushings shall be threaded malleable cast iron body with plastic insulated throat and steel, lay-in ground lug with compression screw.

Insulated metallic bushings shall be threaded malleable cast iron body with plastic insulated throat.

Electrical metallic tubing (EMT) and fittings.--

Electrical metallic tubing shall be formed of cold rolled strip steel, electrical resistance welded continuously along the longitudinal seam with zinc coating outside and enamel or lacquer coating inside.

Couplings shall be electroplated, rain and concrete tight, gland compression type, steel body couplings with malleable iron nuts.

Connectors shall be electroplated, rain and concrete tight, gland compression type, steel body connectors with male hub, malleable iron nut and insulated plastic throat.

Flexible metallic conduit and fittings.--

Flexible metallic conduit shall be fabricated in continuous lengths from galvanized steel strip, spirally wound and formed to provide an interlocking design.

Fittings shall be electroplated screw-in type with malleable cast iron body and threaded male hub with insulated throat.

Liquid tight flexible metallic conduit and fittings.--

Liquid tight flexible metallic conduit shall be fabricated in continuous length from galvanized sheet steel, spirally wound and formed to provide an interlocking design with an extruded polyvinyl chloride cover.

Fittings shall be electroplated, malleable cast iron body, with cap nut, grounding ferrule, and connector body with insulated throat.

Rigid non-metallic conduit and fittings.--

Rigid non-metallic conduit shall be Schedule 40, high impact, nonconducting, self-extinguishing polyvinyl chloride (PVC) rigid non-metallic conduit for direct underground burial.

Couplings shall be PVC, socket type or thread on one end and socket type on the other end as required for the particular application.

Terminal adapters for adapting PVC conduit to boxes, threaded fittings, or metallic conduit system shall be PVC adapters with threads on one end and socket type on the other end.

Cable tray.--

Cable tray shall be hot-dipped galvanized after fabrication and shall conform to NEMA Metal Cable Tray Standard Publication VE-1. Cable tray shall conform to the following requirements:

1. Cable ladder shall be NEMA Classification 12 B of widths and lengths as shown on the plans.
2. Inside load depth shall be NEMA standard 76 mm.
3. Side rail flange width shall be 21 mm.
4. Cable tray shall have outward facing side rails with tubular rungs assembled into side rails by cold swaging.

CABLES AND CONDUCTORS.--

Cables.--

50-Pair Telephone Cable.--

50-pair telephone cable shall be No. 24 AWG, solid copper conductors with individual color coded insulation, twisted pairs, and a common exterior PVC jacket. Cable shall comply with REA Spec 39 for telephone cable.

Telephone Service Cable.--

Telephone service cable shall be No. 22 AWG, solid copper conductors with individual color coded insulation, twisted pairs, and a common exterior PVC jacket. The number of pairs of conductors shall be 100, or as required by the Utility. Up to 4 cables of lessor quantity of pairs will be allowed as long as the total is at least 100 pairs, or more, and the cables will fit in the conduit shown.

ISDN Telephone Cable.--

ISDN Telephone cable shall be Integrated Signal Digital Network (ISDN) rated cable with a minimum of 20 twisted shielded conductor pairs, minimum No. 20 AWG tinned copper, polyethylene insulated, with a foil aluminum-polyester shield, drain wire and PVC jacket rated for 300 V and underground installation.

SCADA Cable.--

SCADA cable shall be 6 twisted shielded conductor pairs, minimum No. 22 AWG tinned copper, polyethylene insulated, with a foil aluminum-polyester shield, drain wire and PVC jacket rated for 300 V and underground installation.

Other cables shall be as shown on the plans and as specified elsewhere in these special provisions.

Conductors.--

Conductors shall be stranded copper wire.

Conductor insulation types unless otherwise shown or specified, shall be as follows:

1. Conductors across hinges of control panel enclosures shall be Type MTW.
2. Conductors shall be Type XHHW in wet and outdoor locations.
3. Conductors shall be Type THHN in dry locations.

Wire connections and devices.--

Wire connections and devices shall be pressure or compression type, except that connectors for No. 10 AWG and smaller conductors in dry locations may be preinsulated spring-pressure type.

ELECTRICAL BOXES.--

Outlet, device and junction boxes.--

Unless otherwise shown or specified, boxes shall be galvanized steel boxes with knock-outs and shall be the size and configuration best suited to the application indicated on the plans. Minimum size of outlet, receptacle, switch or junction boxes shall be 100 mm square by 40 mm deep, except that switch boxes for the installation of single switches and outlet boxes for flush-mounted light fixtures shall be 50 mm by 75 mm by 40 mm deep.

Multiple switches shall be installed in standard gang boxes, unless otherwise specified or shown on the plans.

Weatherproof boxes shall be cast iron boxes with threaded hubs and shall be of the size and configuration best suited to the application shown on the plans.

Flush-mounted boxes shall have stainless steel covers, one mm thick. Cover screws shall be metal with finish to match cover finish.

Unless otherwise shown or specified, surface-mounted boxes shall have galvanized steel covers with metal screws.

Weatherproof junction boxes shall have cast metal covers with gaskets.

Weatherproof switch and receptacle boxes shall have gasketed covers with gasketed hinged flaps to cover switches and receptacles.

Unless otherwise shown or specified, all fiberglass boxes shall be PVC boxes with hubs or equivalent means for conduit entry and shall be the size and configuration best suited to the application indicated on the plans.

All fiberglass junction boxes shall have fiberglass covers with urethane gaskets.

Sectional device plates will not be permitted.

Underground pull boxes.--

Pull boxes shall conform to the requirements of Section 86-2.06, “Pull boxes” of the Standard Specifications.

Traffic rated pull boxes shall conform to the requirements of Section 86-2.06, “Pull boxes” of the Standard Specifications.

RECEPTACLES AND SWITCHES.--

Ground fault circuit interrupter receptacles, (GFCI).--

Ground fault circuit interrupter receptacles shall be NEMA Type 5-20R, feed-through type, ivory color, 3-wire, 20-ampere, 125-volt AC, grounding type, specification grade, duplex receptacle with ground fault interruption. Receptacle shall detect and trip at current leakage of 5 milliamperes and shall have front mounted test and reset buttons.

Duplex receptacles.--

Duplex receptacles shall be NEMA Type 5-20R, 3-wire, 20-ampere, 125-volt AC, safety grounding, ivory color, specification grade receptacle suitable for wiring with stranded conductors.

Fourplex receptacles.--

Fourplex receptacles shall be NEMA Type 5-15R, 3-wire, 15-ampere, 125-volt AC, safety grounding, ivory color, specification grade receptacle suitable for wiring with stranded conductors.

Management information system (MIS) receptacles.--

Management information system (MIS) receptacles shall be NEMA Type 5-20R, 3-wire, 20-ampere, 125-volt AC, isolated grounding, orange color, specification grade receptacle suitable for wiring with stranded conductors.

Plotter receptacle.--

Plotter receptacle shall be NEMA Type 5-20R, 3-wire, 20-ampere, 125-volt AC, specification grade receptacle suitable for wiring with stranded conductors.

Heat pump receptacle.--

Heat pump receptacle shall match the plug of the heat pump unit.

Sump pump receptacle.--

Sump pump receptacle shall match the plug of the sump pump unit.

Snap switches.--

Snap switches shall be 20-ampere, 120/277-volt AC, quiet type, specification grade, ivory color switch with silver cadmium alloy contacts. Switch shall be suitable for wiring with stranded conductors.

Motion sensor wall switches.--

Motion sensor wall switches shall be wall-mounted, 3-wire, 1500-watt incandescent or fluorescent, off-auto-on, passive infrared sensor switch with adjustable photocell override and time delay and shall operate on 120/277 volts. The sensor switch shall cover a minimum of 84 square meters of floor area, be suitable for installation in a single gang box, and shall have a field of view of not less than 170 degrees. The time delay setting shall be adjustable from 30 seconds to 20 minutes, initially set at 5 minutes. Light level adjustment shall be adjustable from 215 lux to 2153 lux, initially set at 753 lux.

Occupancy Sensor.--

Occupancy sensor, OC, shall be a motion sensor ceiling mounted,3-wire, 600-watt incandescent or fluorescent, passive infrared sensor switch with adjustable time-out delay and shall operate on 120/277 volts. The sensor switch shall be suitable for installation in a single gang box, and shall have a field of view of not less than 360 degrees. The time delay setting shall be adjustable from 30 seconds to 20 minutes, initially set at 5 minutes.

Dimming switches.--

Dimming switches shall be a complete solid-state dimmer switch. Switch shall provide full to 2 percent light output by means of a linear slide adjustment. Dimming switches using knob type control shall not be acceptable. Dimming switch shall be compatible with the dimming ballast provided for the light fixtures and shall be of adequate capacity to control all the loads as shown on the plans. Dimming switch shall incorporate on/off switch and an integral radio frequency filter. Dimming switch shall be UL listed.

Three-way toggle switches.--

Three-way toggle switches shall be 20-ampere, 120/277-volt AC, quiet type, specification grade, ivory color switch with silver cadmium alloy contacts. Switch shall be suitable for wiring with stranded conductors.

Duct heater timer switch.--

Duct heater timer switch shall be a 60-minute spring-wound mechanical timer switch without a “hold’ feature. The switch shall be rated 10-ampere at 277-volt AC.

Radiant heater timer switch.--

Radiant heater timer switch shall be a 60-minute spring-wound mechanical timer switch without a “hold’ feature. The switch shall be rated 20-ampere at 120-volt AC.

Traffic signal light switch.--

Traffic signal light switch shall be a 3-way toggle switch.

Tunnel ventilation fan switch.--

Tunnel ventilation fan switch shall be a rotary action double-pole, 3-position switch in a NEMA Type 4 enclosure. Switch shall have pilot duty rating of 60 amperes (make), 6 ampere (break) and 10 ampere (continuous) at 120 volts (AC) and 35 percent power factor. Switch shall have a legend plate marked "HAND-OFF-AUTO."

Gate switch.--

Gate switch shall be a double pole, double throw limit switch with a resistive load rating of not less than 8-ampere at 120-volt, installed in a weatherproof box at the toll booth’s barrier gate as shown on the plans. Mounting clips shall be used to hold the limit switch in a secure and safe manner.

Security alarm push button.--

Security alarm push button shall be a heavy-duty, oiltight, purpose momentary contact normally open push button switch in a dustight enclosure. The push button shall be a mushroom type head with a diameter of not less than 63 mm.

Toll collection door switch.--

Toll collection door switch at each toll booth shall be a 2-section self-locking mounting type magnetic read door switch and shall be compatible with the material of the transaction window on which it is installed. The door switch shall be capable of being concealed on the side of the window frame as shown on the plans. Switch shall have a single-pole, double-throw contact rated at 0.25-A at 30 V, DC.

Door release push button for vestibule door.--

Door release push button for the vestibule door shall be a heavy duty push button in a flush mounted enclosure. Door release push button shall compatible with the vestibule door control system that is provided. One push shall open the vestibule door. The control system of the vestibule door shall reset upon closing.

Float switch.--

Float switch shall be 120-volt, 10-ampere minimum rated wide angle float switch with one single-pole, double-throw (SPDT) contact in an inert synthetic casing with external weight complete with cable fastener. Cable shall have sufficient length to run from the junction boxes as shown on the plans without splices.

MISCELLANEOUS MATERIALS.--

Warning Tape.--

Warning tape shall be 100 mm wide and contain the printed warning "CAUTION ELECTRICAL CONDUIT" in bold 19 mm black letters at 760 mm intervals on bright orange or yellow background. The printed warning shall be non-erasable when submerged under water and resistant to insects, acids, alkali, and other corrosive elements in the soil. The tape shall have a tensile strength of not less than 70 kg per 100 mm wide strip and shall have a minimum elongation of 700 percent before breaking.

Pull ropes.--

Pull ropes shall be nylon or polypropylene with a minimum tensile strength of 225 kg.

Watertight conduit plugs.--

Watertight conduit plugs shall be a hollow or solid stem expansion plugs complete with inner and outer white polypropylene compression plates and red thermoplastic rubber seal. Seal material shall be non-stick type rubber resistant to oils, salt, and alkaline substances normally available at the construction sites.

Anchorage devices.--

Anchorage devices shall be corrosion resistant, toggle bolts, wood screws, bolts, machine screws, studs, expansion shields, and expansion anchors and inserts.

Electrical supporting devices.--

Electrical supporting devices shall be one hole conduit clamps with clamp backs, hot-dipped galvanized, malleable cast iron.

Construction channel shall be 41 mm x 41 mm, 2.66 mm (12-gage) galvanized steel channel with 13 mm diameter bolt holes, 40 mm on center in the base of the channel.

Ground rod(s).--

Ground rod(s) shall be a 19 mm (minimum) galvanized or copper clad steel rod, 3 meters long.

Public Communication and private telephone outlet boxes.--

Public communication and private telephone outlet boxes shall be as specified elsewhere in these special provisions.

Television outlet.--

Television outlet boxes in the lunch room and in the operation center break room shall be 102 mm square boxes, flush mounted in ceiling complete with plates with bushed hole. Plates shall be Type 430 stainless steel, 1 mm thick with satin finish.

PART 3.- EXECUTION

INSTALLATION.--

Conduit, general.--Rigid steel conduit shall be used unless otherwise shown on the plans or specified in these special provisions.

Electrical metallic tubing may be used in furred spaces and for exposed work indoors above the switch height.

Unless otherwise specified or shown on the plans, flexible metal conduit shall be used to connect suspended lighting fixtures, motors, HVAC equipment, and other equipment subject to vibration in dry locations.

Unless otherwise specified or shown on the plans, liquid-tight flexible metal conduit shall be used to connect motors, HVAC equipment, and other equipment subject to vibration in wet locations.

Rigid non-metallic conduit shall be used at the locations shown on the plans for direct underground burial outside the building foundation.

Conduit installation.--Conduit trade sizes are shown on the plans. No deviation from the conduit size shown on the plans will be permitted without written permission from the Engineer.

Conduit shall be concealed unless otherwise shown on the plans.

Conduits shall be tightly covered and well protected during construction using metallic bushings and bushing "pennies" to seal open ends.

Rigid non-metallic conduit bends of 30 degrees or greater shall be factory-made long radius sweeps. Bends less than 30 degrees shall be made using an approved heat box.

A pull rope shall be installed in all empty conduits. At least one meter of pull rope shall be doubled back into the conduit at each termination.

Locations of conduit runs shall be planned in advance of the installation and coordinated with the ductwork, plumbing, ceiling and wall construction in the same areas and shall not unnecessarily cross other conduits or pipe, nor prevent removal of ceiling tiles or panels, nor block access to mechanical or electrical equipment.

Where practical, conduits shall be installed in groups in parallel, vertical or horizontal runs and at elevations that avoid unnecessary offsets.

Exposed conduit shall be installed parallel and at right angles to the building lines.

Conduits shall not be placed closer than 300 mm from a parallel hot water or steam pipe or 75 mm from such lines crossing perpendicular to the runs.

All raceway systems shall be secured to the building structures using specified fasteners, clamps and hangers.

Single conduit runs shall be supported by using one hole pipe clamps. Where run horizontally on walls in damp or wet locations, conduit shall be installed with "clamp backs" to space conduit off the surface.

Multiple conduit runs shall be supported with construction channel secured to the building structure. Conduits shall be fastened to construction channel with channel compatible pipe clamps.

Raceways of different types shall be joined using approved couplings or transition fittings.

Expansion couplings shall be installed where conduit crosses a building separation or expansion joint.

All floor and wall penetrations shall be sealed water-tight.

Existing underground conduit to be incorporated into a new system shall be cleaned with a mandrel or cylindrical wire brush and blown out with compressed air.

Conduit terminations.--Rigid steel conduits shall be securely fastened to cabinets, boxes and gutters using 2 locknuts and specified insulating metallic bushing. Electrical metallic tubing shall be securely fastened to cabinets, boxes and gutters using specified connectors. Conduit terminations at exposed weatherproof enclosures and cast outlet boxes shall be made watertight using specified hubs.

Grounding bushings with bonding jumpers shall be installed on all type of conduits terminating at concentric knockouts and on all conduits containing service conductors, grounding electrode conductor, and conductors feeding separate buildings.

Rigid non-metallic conduits shall be securely fastened to the non-metallic boxes and lighting fixtures using specified connectors.

Rigid non-metallic conduits shall be terminated inside the underground pull boxes with an approved conduit bushings or fittings. All conduits shall enter the pull box at an angle of 45 degrees or more.

All future conduits terminated in underground pull boxes or exposed indoor and outdoor shall be provided with watertight conduit plugs.

Cable trays.—Cable support surface of top rungs of cable trays shall be flattened. Inside of cable tray shall not have flanges or other projections. Rung spacing shall be 152 mm. Cable tray inside the Electrical Room in the Lower Floor shall be supported from the ceiling. Cable tray supports shall be located at 1500 mm spacing. Cable tray sections shall be rigidly secured to each other with connector plates and hardware as required. Cable tray shall be provided with hardware as required to provide rigid support at all heights and positions as indicated on the plans. Cables shall be neatly organized and secured to the cable tray with plastic restrainers or No. 10 AWG insulated conductors as required to support the suspended cable weight.

Warning Tape.--Warning tape shall be placed over each conduit in a trench. Each warning tape shall be centered over the conduit and shall be placed over the 150 mm layer of sand covering the conduit as described elsewhere in these special provisions.

Conductor and cable installation.--Conductors shall not be installed in conduit until all work of any nature that may cause injury is completed. Care shall be taken in pulling conductors that insulation is not damaged. An approved non-petroleum base and insulating type pulling compound shall be used as needed.

All cables shall be installed and tested in accordance with manufacturer's recommendations.

Splices and joints shall be insulated with insulation equivalent to that of the conductor.

Provide 155 mm of slack at each outlet and device connection. If the outlet or device is not at the end of a run of wire, connection shall be made with correctly colored pigtails tapped to the runs with splices as specified herein.

Branch circuit conductors in panelboards and load centers shall be neatly trained along a path from the breaker terminals to their exit point. The conductors shall have ample length to transverse the path without strain, but shall not be so long as to

require coiling, doubling back, or cramming. The path shall transverse the panelboard gutter spaces without entering a gutter containing service conductors and, unless otherwise shown on the plans, without entering the gutter space of any panelboard feeder.

All pressure type connectors and lugs shall be retightened after the initial set.

Splices in underground pull boxes and similar locations shall be made watertight.

Junction boxes in furred or accessible ceiling spaces shall be identified with felt-tip pen denoting the circuits contained in the box.

Provide 1.0-m slack unless otherwise shown on the plans for each spare conductor, tape ends, coil in the pull box and label as "SPARE."

Conductor identification.--The neutral and equipment grounding conductors shall be identified as follows:

Neutral conductor shall have a white or natural gray insulation except that conductors No. 4 and larger may be identified by distinctive white marker such as paint or white tape at each termination.

Equipment grounding conductor shall be bare or insulated. If insulated, equipment grounding conductors shall have green or green with one or more yellow stripes insulation over its entire length except that conductors No. 4 and larger may be permanently identified by distinctive green markers such as paint or green tape over its entire exposed insulation.

Conductors with gray insulation shall be prohibited for use in control panels.

Feeder and branch circuit ungrounded conductors shall be color coded by continuously colored insulation, except conductors No. 6 AWG or larger may be color coded by colored tape at each connection and where accessible. Ungrounded conductor color coding shall be as follows:

SYSTEM	COLOR CODE
120/240V-Single phase	Black, blue
120/240V-Three phase	Black, orange, blue
120/208V-Three phase	Black, red, blue
277/480V-Three phase	Brown, orange, yellow

Where more than one branch circuit enters or leaves a conduit, panel, gutter, or junction box, each conductor shall be identified by its panelboard and circuit number. All control conductors including control conductors of manufacturer supplied and field wired control devices shall be identified at each termination with the wire numbers shown on the plans, approved working drawings, and as directed by the Engineer where deemed necessary. Identification shall be made with one of the following:

1. Adhesive backed paper or cloth wrap-around markers with clear, heat shrinkable tubing sealed over either type of marker.
2. Self-laminating wrap around type, printable, transparent, permanent heat bonding type thermoplastic film markers.
3. Pre-printed, white, heat-shrinkable tubing.

Each terminal block shall have a molded marking strip attached with screws. The identifying numbers of the terminating conductors, as shown on the plans or on the submittal drawings, shall be engraved in the marking strip.

Outlet, device and junction box installation.--Where one or more threaded steel conduits are required to connect to an outlet, device, or junction box, the box shall be a cast metal box with threaded hubs. Unless otherwise shown on the plans or specified in these special provisions, all other boxes shall be sheet steel boxes. Weatherproof outlet, device and junction boxes shall have cast metal covers with gaskets. Unless otherwise shown on the plans or specified in these special provisions, all other boxes shall have standard galvanized covers.

All boxes shall finish flush with building walls, ceiling and floors except where exposed work is called for.

Raised device covers (plaster rings) shall be installed on all boxes concealed in concrete, masonry or stud walls.

No unused openings shall be left in any box. Knockout seals shall be installed as required to close openings.

Outlet, device, and junction boxes shall be installed at the locations and elevations shown on the plans or specified herein. Adjustments to locations may be made as required by structural conditions and to suit coordination requirements of other trades.

Boxes in stud walls and partitions shall not be mounted back to back. Through-wall boxes shall not be used.

Boxes installed in metal stud walls shall be equipped with brackets designed for attaching directly to the studs or shall be mounted on heavy gauge galvanized steel, snap-in box supports.

Fixture outlet boxes installed in suspended ceilings of gypsum board or lath and plaster construction shall be mounted on 1.52 mm (16-gage) metal channel bars attached to main ceiling runners.

Fixture outlet boxes for pendant-mounted fixtures installed in suspended ceilings supporting acoustical tiles or panels shall be supported directly from the structures above.

Underground pull box installation.--Electrical pull box covers or lids shall be marked "ELECTRICAL." Telephone service pull box covers or lids shall have plain, unmarked covers.

The bottom of pull boxes shall be bedded in 155 mm of clean, crushed rock or gravel and shall be grouted with 40 mm thick grout prior to installation of conductors. Grout shall be sloped to a 25 mm PVC pipe drain hole. Conduits shall be sealed in place with grout.

Ground rod(s) installation.--The ground rod(s) shall be driven vertically until the top is 155 mm above the surrounding surface. When vertical penetration of the ground rod cannot be obtained, an equivalent horizontal grounding system, approved by the Engineer, shall be installed.

Anchorages.--Hangers, brackets, conduit straps, supports, and electrical equipment shall be rigidly and securely fastened to surfaces by means of toggle bolts on hollow masonry; expansion shields and machine screws, or expansion anchors and studs or standard preset inserts on concrete or solid masonry; machine screws or bolts on metal surfaces; and wood or lag screws on wood construction.

Anchorage devices shall be installed in accordance with the anchorage manufacturer's recommendations.

Mounting heights.--Electrical system components shall be mounted at the following mounting heights, unless otherwise shown on the plans. The mounting height dimensions shall be measured above the finished floor to the bottom of the device or component.

Thermostats	1.0 m maximum, office areas 1.25 m maximum, hallways
Wall switches	1.0 m maximum
Convenience outlets	510 mm minimum, office areas 1.00 m minimum, all other areas
Electric water cooler outlet	As recommended by the water cooler manufacturer.
Telephone and radio outlets	510 mm minimum

12-16.03 ELECTRICAL EQUIPMENT

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing panelboards, starters, disconnect switches, transformers, heaters and related accessories in accordance with the details shown on the plans and these special provisions.

Related work.--Anchorage devices shall be as specified under "Basic Materials and Methods" elsewhere in this Section 12-16.

SUBMITTALS.--

Product data.--A list of materials and equipment to be installed, manufacturer's descriptive data, and such other data as may be requested by the Engineer shall be submitted for approval.

Manufacturer's descriptive data shall include complete description, performance data and installation instructions for the materials and equipment specified herein. Control and wiring diagrams, rough-in dimensions, and component layout shall be included where applicable. All control and power conductors on the shop drawings shall be identified with wire numbers.

PART 2.- PRODUCTS

PANELBOARDS.--

Panelboards L1, L3, E1, DH and T1.--

Panelboards L1, L3, E1, DH and T1 shall be indoor type, surface-mounted, factory assembled, 3-phase, 4-wire, 480/277-volt, AC panelboard with main circuit breaker, insulated groundable neutral, hinged door and molded case branch circuit breakers as shown on the plans. Ampere trip rating of the main circuit breaker shall be as shown on the plan. Panel L1 shall be a floor-mounted switchboard with distribution breakers as shown on the plans and specified in these special provisions. Panel shall be Square D Company, Cutler-Hammer, General Electric, or equal.

Panelboard ALP.--

Panelboard ALP shall be indoor type, surface-mounted, factory assembled, 3-phase, 3-wire, 480-volt, AC panelboard with 100-ampere lugs, hinged door and molded case branch circuit breakers as shown on the plans. Panel shall be Square D Company, Cutler-Hammer, General Electric, or equal.

Panelboards U1, UL1A, UL1B, UL2A, UL2B, UL2C, UL2D, UTP1 and UTP1.--

Panelboards U1, UL1A, UL1B, UL2A, UL2B, UL2C, UL2D, UTP1 and UTP2 shall be indoor type, surface-mounted, factory assembled, 3-phase, 4-wire, 120/208-volt, AC panelboard, with main circuit breaker, insulated groundable neutral, isolated ground bus, hinged door and molded case branch circuit breakers as shown on the plans. Ampere trip rating of the main circuit breaker shall be as shown on the plans. Panels shall be Square D Company, Cutler-Hammer, General Electric, or equal.

Panelboard UL2E.--

Panelboard UL2E shall be indoor type, flush-mounted, factory assembled, 3-phase, 4-wire, 120/208-volt, AC panelboard, with 100-ampere main lugs, insulated groundable neutral, isolated ground bus, hinged door and molded case branch circuit breakers as shown on the plans. Panelboard dimensions shall not exceed 356 mm in width and 586 mm in height. Panel shall be Square D Company, Westinghouse, General Electric, or equal.

Panelboard T2.--

Panelboard T2 shall be indoor type, surface-mounted, factory assembled, single-phase, 3-wire, 120/240-volt, AC panelboard with main circuit breaker, insulated groundable neutral, hinged door and molded case branch circuit breakers as shown on the plans. Ampere trip rating of the main circuit breaker shall be as shown on the plans. Panel shall be Square D Company, Cutler-Hammer, General Electric, or equal.

All other Panelboards.--

All other panelboards shall be indoor type, surface-mounted, factory assembled, 3-phase, 4-wire, 120/208-volt, AC panelboard at least 508 mm wide with main circuit breaker, insulated groundable neutral, hinged door and molded case branch circuit breakers as shown on the plans. Ampere trip rating of the main circuit breaker shall be as shown on the plans. Panels shall be Square D Company, Westinghouse, General Electric, or equal.

Distribution circuit breakers for Panel L1.—

Distribution circuit breakers for Panel L1 shall be of the indicating type providing ON, Tripped and OFF positions of the operating handle. Circuit breakers shall be quick-make, quick-break, with thermal-magnetic action. An overload of one pole of all multiple-pole circuit breakers shall automatically cause all poles to open. Circuit breakers shall meet the requirements of UL and NEMA AB 1. Unless noted otherwise, interrupting rating shall not be less than 42000 amperes (RMS symmetrical) at the rated voltage. Breakers shall be sized a shown on the plans and shall be manufactured by Cutler-Hammer, Square D, General Electric, or equal

SWITCHES.--

Air conditioner disconnect switch.--

Air Conditioner Disconnect switches, DS1, DS3, DS4, DS5, DS8 and DS9, shall be 3-pole, 600-volt, AC, fused, heavy duty safety switches in a NEMA Type-3R enclosure. The ampere rating and fuse sizes shall be sized to suit the air conditioner units furnished.

Air Conditioner Disconnect switches DS2, DS6 and DS7, shall be 3-pole, 240-volt, fused heavy duty safety switches in a NEMA Type 3R enclosure. The ampere rating and fuse sizes shall be sized to suit the air conditioning unit furnished.

Door operator disconnect switch.--

Door operator disconnect switch shall be 2-pole, 240-volt, AC, 30-ampere, non-fusible, general duty safety switch in a NEMA-1 enclosure with provision for padlocking in the "OFF" position.

Elevator disconnect.—

Elevator disconnect switch shall be 3-pole, 480-volt, AC, molded case circuit beaker in a NEMA-1 enclosure. Ampere trip of the circuit breaker shall be the maximum size recommended by the elevator manufacturer.

Transformer U disconnect.—

Transformer U disconnect switch shall be 3-pole, 250-ampere, 480-volt, AC, molded case circuit beaker in a NEMA-1 enclosure.

Water Heater disconnect.—

Water heater disconnect shall be 3-pole, 30-ampere, 240-volt, AC, non-fusible general duty safety switch in a NEMA Type 1 enclosure.

TRANSFORMER.--

Transformer R.--

Transformer R shall be indoor, dry type, floor mounted, 3-phase, 480-volt primary, 120/208-volt secondary, 112.5-kVA transformer with NEMA Type 1 enclosure. Transformer shall have two 2 1/2 percent full capacity taps above and four 2 1/2 percent full capacity taps below normal primary voltage, copper windings and 150˚C temperature rise.

Transformers U and E.--

Transformers U and E shall be indoor, dry type, floor mounted, 3-phase, 480-volt primary, 120/208-volt secondary, 150-kVA transformer with NEMA Type 1 enclosure. Transformer shall have two 2 1/2 percent full capacity taps above and four 2 1/2 percent full capacity taps below normal primary voltage, copper windings and 150˚C temperature rise.

Transformer.--

Transformer in the elevator machine room in the tunnel shall be indoor, dry type, wall mounted, single-phase, 480-volt primary, 120/240-volt secondary, 10-kVA transformer with NEMA Type 1 enclosure. Transformer shall have two 2 1/2 percent full capacity taps above and four 2 1/2 percent Full capacity taps below normal primary voltage, copper windings and 150˚C temperature rise.

MISCELLANEOUS MATERIALS.--

Radiant heater.--

Radiant heater shall be ceiling mounted, recessed type, UL approved and shall be controlled by a radiant heater timer switch. Radiant heater timer switch shall be as specified elsewhere in these special provisions. The panel shall be constructed of a 0.61 mm (24-gage) minimum thickness, galvanized steel. The heating element shall be a carbon (graphite) element heater. Resistance wires are not acceptable. The surface shall be a multifaceted crystalline type. The heater shall be rated 375-watt, 120-volt, AC. Dimensions shall be nominal 559 mm x 559 mm.

Intercom system for lobby transaction.--

Intercom system for the lobby transaction area at the Operations Building will be State-furnished as provided under "State-Furnished Materials" in Section 8, "Materials," of these special provisions. The system will include a master intercom station and a slave intercom station.

CCTV camera system for lobby transaction.--

CCTV camera system for lobby transaction at the Operations Building will be State-furnished as provided under "State-Furnished Materials" in Section 8, "Materials," of these special provisions. The system will include a ceiling mounted CCTV fixed camera, a motion sensor and a video camera recorder.

Nameplates.--

Nameplates shall be laminated phenolic plastic with white core and black front and back. Nameplate inscription shall be in capitals letters etched through the outer layer of the nameplate material.

Plywood backing panels.--

Plywood backing panels for mounting electrical or telephone equipment shall be 19 mm, APA plywood panels, C-D PLUGGED and touch-sanded, Exposure 1.

Paint.--

Plywood backing panels shall receive the following paint system: one prime coat, alkyd, interior wood primer and 2 finish coats, acrylic, interior enamel, semi-gloss.

PART 3.- EXECUTION

INSTALLATION.--

Plywood backing board.--Plywood backing board shall be securely fastened to walls or other vertical framing.

Surface to be coated shall be cleaned of all dirt, excess materials, of filler by hand cleaning.

Coatings shall be applied in accordance with the manufacturer's instructions. Each coat shall be applied to a uniform finish, free of skips, brush marks, laps or other imperfections.

Panelboard installation.--Set cabinets plumb and symmetrical with building lines. Train interior wiring as specified under "Conductor and Cable Installation" in "Basic Materials and Methods" of these special provisions. Touch-up paint any marks, blemishes, or other finish damage suffered during installation. Replace cabinets, doors or trim exhibiting dents, bends, warps or poor fit which may impede ready access, security or integrity.

Mounting height shall be 1.4 meters to the highest circuit breaker handle, measured above the finished floor.

Where "Space" is indicated on the plans, branch connectors, mounting brackets, and other hardware shall be furnished and installed for future breaker.

A typewritten directory under transparent protective cover shall be provided and set in metal frame inside each cabinet door. Directory panel designation for each circuit breaker shall include complete information concerning equipment controlled, including room number or area designated on the plans.

Transformer installation.--Connect primary to minimum value taps during construction period and prior to initial building start-up. Make voltage readings and adjust tap connections to nominal voltage during final construction review and prior to building occupancy. Install conduit connections which will prevent transmission of the transformer vibrations to the conduit system. Transformers shall be bolted to floor when floor mounted and bolted to wall with support brackets when wall mounted. All floor mounted transformers shall be mounted on a 106-mm thick pad.

Equipment identification.--Equipment shall be identified with nameplates fastened with self-tapping, cadmium-plated screws or nickel-plated bolts.

Nameplate inscriptions shall be 7 mm high be as shown on the plans and as follows:

1. Inscriptions for panelboards shall include designation, voltage, and phase of supply and shall read in the following example: PANEL L1, 480/277 V, 1000 A, 3-PHASE, 4-WIRE;

2. Inscription for disconnect switches and push buttons shall be the respective device it is controlling and shall read in the following example: HEAT PUMP;

3. Inscription for lighting control stations shall be the panel designation as shown in the plans and shall read in the following example: AREA LIGHTING CONTROL PANEL.

12-16.04 LIGHTING

GENERAL.--This work shall consist of furnishing, installing and connecting all lighting equipment in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--Manufacturer's descriptive information, photometric curves, catalog cuts, and installation instructions shall be submitted for approval. The Contractor shall submit to the Engineer for approval wiring diagrams for all lighting control panels.

PRODUCTS.--

Lighting fixture lamps.--

Lighting fixture lamps shall be type and size as shown on the plans. Lamps shall be General Electric, Phillips, Sylvania, or equal. Fluorescent lamps, unless otherwise noted, shall be 4100K tri-phosphor with a CRI of 70 or greater.

Ballasts.--

All fixtures shall be equipped with high power factor ballasts suitable for the line voltage and for the type, size and number of lamps required by the fixture. Fluorescent ballasts shall be UL Listed, Class P and ETL Certified ballasts with sound rating A. Fluorescent ballasts shall be high-frequency electronic ballasts with power factor greater then 0.95, nominal ballast factor of 0.88 unless specified otherwise, total harmonic distortion less than 20 percent, crest factor less than or equal to 1.7, complying with ANSI C 62.41 Category A for surge protection, and FCC Part 18 for interference. Dimming ballasts shall be solid state electronic ballasts as specified above and shall be capable of dimming the light output from 100 percent to 20 percent of the rated light output. Control wiring shall be fully compatible with the fixture and dimming switch. Ballasts shall be furnished with CBM/ETL labels attached. Dimming ballasts shall be provided in fixtures at locations as shown on the plans.

Battery backup.--

Battery backup shall be a factory installed battery pack compatible with the fixture and shall provide 90 minutes of emergency egress lighting. The battery backup shall have a test switch, “ready” light indicator, sealed maintenance free battery, inverter and charger. The battery backup shall be connected to an unswitched circuit for indication of power failure.

Lighting fixtures.--

Lighting fixtures shall be as shown on the plans and as specified herein. Outdoor luminaires shall be listed and labeled "Fixture Suitable For Wet Locations." All lighting fixtures shall be rated for 120-volt unless otherwise noted or specified.

F1.--

Recessed, compact, open reflector fluorescent downlight fixture with two 13-watt twin tube compact lamps, integral ballast and aluminum lampholder housing. Reflector shall be aluminum. Fixture shall have grooved black baffle. Maximum ceiling opening shall be 203 mm in diameter. Fixture shall have two horizontally mounted plug-in sockets. The fixture shall be Capri Lighting, PL-5 Series; Lithonia, Gotham Downlighting Series; Hubbell Lighting, D4213E Series; or equal.

F2.--

Recessed, compact, open reflector fluorescent downlight fixture with two 18-watt twin tube compact lamps, integral ballast (dimming ballast where shown on the plans) and aluminum lampholder housing. Reflector shall be precision spun 0.050 aluminum. Fixture shall have grooved black baffle. Maximum ceiling opening shall be 203 mm in diameter. Fixture shall have two horizontally mounted plug-in sockets. The fixture shall be Lithonia, Gotham Downlighting Series; Hubbell Lighting, D4218E Series; Day Brite, Capri Lighting, PL-6 Series; or equal.

F3.--

Recessed, compact, open reflector fluorescent downlight fixture with two 26-watt lamps, integral ballast (dimming ballast where shown on the plans) and aluminum lampholder housing. Reflector shall be precision spun aluminum. Fixture shall have grooved black baffle. Maximum ceiling opening shall be 203 mm in diameter. Fixture shall have two horizontally mounted plug in sockets. The fixture shall be Lithonia, Gotham Downlighting Series; Hubbell Lighting, D4226E Series; Day Brite, Capri Lighting, PL-7 Series; or equal.

F4.--

Wall mounted fluorescent fixture with one 13-watt twin tube compact lamp, integral ballast and prismatic acrylic diffuser. The fixture shall be Day Brite, Lithonia, Capri Lighting, or equal.

F5.--

Ceiling mounted, wide body, low profile wraparound fluorescent fixture with two 32-watt T8 lamps, electronic ballast and one piece clear prismatic acrylic wraparound diffuser. The fixture shall be Day Brite, Caraval Wide Series; Lithonia, 2LB Series; Columbia Lighting, Apollo AWW 4 Series; or equal.

F6.--

Ceiling mounted, corridor wraparound fluorescent fixture with one 32-watt T8 lamp, electronic ballast and one piece clear prismatic acrylic wraparound diffuser. The fixture shall be Columbia Lighting, Apollo RO4 Series; Lithonia, CB 140 Series; Prudential Lighting, P-1220 Series; or equal.

F7.--

Lay-in 600 mm x 1200 mm parabolic troffer fluorescent fixture with two 32-watt T8 lamps, electronic ballast (dimming ballast where shown on the plans) and 18-cell 75 mm deep louvers. The fixture shall be Day-Brite, Paralouver Series; Lithonia, Paramax Series; Lightolier HPV Series; or equal.

F8--

Lay-in 600 mm x 1200 mm parabolic troffer fluorescent fixture with four 32-watt T8 lamps, electronic ballast (dimming ballast where shown on the plans) and 32-cell, 75-mm deep louvers. The fixture shall be T; Day-Brite, Paralouver Series; Lithonia, Paramax Series; Lightolier HPV Series; or equal.

F9.--

Pendant mounted industrial fluorescent fixture with two 110-watt, T12 HO lamps and integral ballast with baked enamel ribbed reflector, complete with end plates. The fixture shall be Lithonia, Heavy Duty Industrial TF Series; Daybrite Specification Industrial IF Series; Columbia, Dynamo Industrial KL Series; or equal.

F10.--

Round tube fluorescent fixture with fifteen 32-watt T8 lamp, electronic dimming ballast and one piece extruded aluminum housing, upper and lower lens with die cast end plates. Fixture shall not exceed 229 mm in diameter. Each 1600 mm section shall have 2 lamps at the top and 3 lamps at the bottom for up and down wide light distribution. Fixture shall have separate dimming ballast for the upper and the lower lamps. The fixture shall be Ledalite, TLS Series; Linear Lighting, Rondalite Series; or equal.

F11.--

Ceiling mounted, low profile wraparound fluorescent fixture with two 32-watt T8 lamp, electronic ballast and one piece clear prismatic acrylic wraparound with sonic-welded, injection-molded luminous ends. The fixture shall be Columbia Lighting, Apollo AWN Series; Prudential Lighting, P-1800 Series; Lithonia, LB Series; or equal.

F12.--

Lay-in 305 mm x 305 mm parabolic troffer fluorescent fixture with two 18-watt twin tube compact lamp, integral ballast and 4-cell louvers. Louvers shall be interlocked and completely self flanged. The fixture shall be Lithonia, Paramax Series; Columbia Lighting, Parabolic T1212 Series; or equal.

F13.--

Ceiling mounted industrial vapor tight fluorescent corridor fixture with one 40-watt lamp and UL listed for wet locations. Ballast shall be rated for cold temperature operation. Housing shall have high impact fiberglass

reinforced polyester housing. Diffuser shall be secured to fully gasketed housing by captive, cam-action latches. The fixture shall be Metalux, VT2 Series; Lithonia, VR1 Series; Day Brite, Vaporlume Series; or equal.

F14.--

Strip fluorescent fixture with one 32-watt T8 lamp, electronic dimmable ballast, heavy duty channel and striplight reflectors as shown on the plans. Fixture dimensions shall not exceed 125 mm x 125 mm x 1220 mm long. Fixture mounting details and quantity of striplight reflectors shall be as shown on the Architectural plans. The fixture shall be Columbia Lighting, CH Series; Prudential Lighting, P-101 Series; Lithonia, S Series; or equal.

F15.--

Pendant-mounted industrial fluorescent fixture with two 32-watt T8 lamps, electronic ballast and baked enamel reflector complete with end plates and wire guard. The fixture shall be Columbia Lighting, Industrial Model-16 Series; Lithonia, EJA Series; Daybrite, All Purpose Industrial IF Series; or equal.

F16.--

Corner-mounted fluorescent fixture with two 32-watt T8 lamps and UL listed for wet locations. Ballast shall be rated cold temperature operation. Housing shall be heavy-duty one piece steel. Fixture shall have a secured polycarbonate diffuser. The fixture shall be Lithonia, VDC Series; Kenall, Mighty Mac Series; Morris Kurtzon, Wet Lock Series; or equal.

F17.--

Wall-mounted emergency exit signage fixture with two 5-watt lamps, integral ballast and emergency power pack. The lamps shall be fluorescent or T-1 cold cathode light sources. The fixture shall have one or two readable sides as shown on the plans. Pieces of the enclosure shall be removable to allow field-selectable directional arrows. The fixture shall be Day brite, Lithonia, Re-Energy, or equal.

F18.--

Ceiling mounted industrial vapor tight fluorescent corridor fixture with two 40-watt lamps and UL listed for wet locations. Ballast shall be rated for low temperature operation. Housing shall have high impact fiberglass reinforced polyester housing. Diffuser shall be secured to fully gasketed housing by 6 captive, cam-action stainless steel latches. The fixture shall be Metalux, VT2 Series; Lithonia, VR1 Series; Day Brite, Vaporlume Series; or equal.

F19.--

Lay-in, 229 mm x 1220 mm parabolic troffer fluorescent fixture with one 32-watt T8 lamp, electronic dimmable ballast and minimum 10-cell louvers. The fixture shall be Lithonia, Optimax 9PMO Series; Columbia Lighting, VHC94 Series; or equal.

F20.--

Lay-in, 600 mm x 600 mm parabolic troffer fluorescent fixture with two 40-watt U lamp, dimmable ballast and 36-cell louvers. The fixture shall be Lithonia, SP Small Cell Series; Columbia Lighting, P422-2 Small Cell Series; or equal.

F21--

F21 shall be similar to F13 except F21 shall be rated for 277-volt.

F22--

F22 shall be similar to F5 except F22 shall be suitable for damp location.

F23--

F23 shall be similar to F8 except F23 shall have three 32-watt lamps.

F24--

F24 shall be similar to F2 except F3 shall be UL listed for wet locations and shall have sealed lens.

F25--

Compact recessed wall fluorescent fixture with two 18-watt twin tube compact lamps with low temperature ballast, suitable for feed through wiring and wet locations. Mounting details shall be as shown on the Architectural plans. Fixture dimensions shall not exceed 230 mm x 90 mm.

F26--

Undercabinet, surface mounted, low profile fluorescent fixture with one 32-watt T8 lamps, electronic ballast and one piece clear prismatic acrylic diffuser. The fixture shall be Prudential Lighting, P-1850 Series; Lithonia, 2UC Series; Columbia Lighting, Downlight WAL Series; or equal.

H1.--

Ceiling mounted, vandal resistant luminaire with one 50-watt, 277-volt high pressure sodium lamps, integral ballast and clear prismatic polycarbonate diffuser. The fixture shall be Lithonia, VR3C Series; Holophane, Parkpak Series; Daybrite, CL Series; or equal.

MH1.--

Recessed mounted, toll collection plaza canopy downlight, 609 mm x 609 mm x 406 mm deep luminaire with one 250-watt metal halide lamp and integral ballast. Housing shall be heavy gauge steel with lapped and welded seams. All entry points shall be completely gasketed. Fixture shall be suitable for wet locations. Diffuser shall be tempered prismatic in a piano hinged channel door frame with continuous gasket all around. Fixtures shall have vapor proof hubs for quick connection.

MH2.--

Recessed mounted, canopy uplight, 546 mm x 489 mm x 133 mm deep luminaire with one 250-watt metal halide lamp and integral ballast. Housing shall be heavy gauge aluminum with all corners and joints welded and ground. Luminaire shall be suitable for wet locations. Diffuser shall be tempered lens and shall be sealed and gasketed to the frame. All fasteners shall be stainless steel. The reflector shall be specular aluminum. The fixture finish shall be “safety” yellow.

MH3.--

Recessed mounted, round luminaire with one 50-watt metal halide lamp and integral ballast. Reflector shall be spun aluminun. Fixture shall be suitable for wet locations. Fixture shall have a vertically mounted medium base glazed porcelain sockets. Luminaire shall have UV absorbing tempered low brightness prismatic glass and self flanged trim. Opening shall not exceed 153 mm in diameter. Fixture shall have a fused primary. Housing shall be rustproof and entire luminaire shall be capable of being serviced through removable trim assembly.

MH4 and MH5.--

High mast lighting MH4 and MH5 shall be as specified under “High Mast Lighting Assembly” elsewhere in these special provisions.

Rope light.--

Solid 13 mm PVC tube encasing miniature 0.5-watt lamps spaced 25 mm on center. Light shall be complete with power cord and clips for holding light in place. Light shall be UL listed for exterior use and shall operate within the temperature range from -20°C to +60°C.

Roof light.--

Low voltage landscape accent fixture complete with 12-watt, 12-volt, MR11 DC base halogen light source and a 368 mm high stem. Bezel, body and hydraulic compression mounting post shall be machined formed aluminum alloy construction with tempered glass lens and high temperature O-ring seals. The entire front bezel assembly shall be capable of being unscrewed for relamping purposes. Fixture dimensions shall not exceed 369 mm (height) x 45 mm (width). Fixture shall have stainless steel and brass socket with 250°C teflon coated lead wires and shall be supplied wire nuts and dielectric tape for water tight connection

Courtyard canopy decorative column lights.--

Low voltage miniature hanging fixture complete with 35-watt, 12-volt, MR11 DC base halogen light source. Fixture shall be made from precision machined corrosion resistant aluminum alloy construction with tempered glass lens

and high temperature O-ring seals. Fixture shall have stainless steel hardware. Dimensions and mounting details shall be as shown on the plans. Fixture shall be provided with a power supply rated at 150-watt, 120-volt primary supply and 12-volt secondary. Power supply shall be complete with circuit breakers for protection and shall be suitable for wet location.

Site identification sign light.--

Site identification sign light shall be 3 wide-beam floodlights with triple stanchion mount. Each floodlight shall be equipped with one-piece die-cast aluminum housing (minimum 31-mm wall thickness) in a cylindrical shape with integral cooling fins over the entire length, 70-watt metal halide lamp and high power factor low temperature ballast. Fixture shall have concealed integral cast slip hinges with stainless steel pins, built-in photocell unit and suitable for wet locations.

Photoelectric units, PEC (ALP), PEC2, PEC (GLCP) and PEC4.--

Photoelectric units PEC(ALP), PEC2, PEC(GLCP) and PEC4, shall be cadmium sulfide photoelectric control with capacity of 1800-watt inductive or fluorescent load, mounting adapter, and EEI-NEMA twist lock receptacle mounted in a weatherproof box; Fisher-Pierce, Ripley, or equal.

Lighting control panels, ALCP, BLCP, GLCP and TLCP.--

Lighting control panels, ALCP, BLCP, GLCP and TLCP, shall consist of a circuit breakers, lighting contactors, switches, transformers, fuses, nameplates and pilot lights in a surface mounted NEMA-12 enclosure with a hinged door. Type of switches in panels shall be as shown on the plans and as specified in these special provisions. All lighting control panels shall be factory pre-wired in conformance with NEMA Class II, Type C wiring.

Circuit breaker for GLCP--

Circuit breaker, MB3, shall be 20-ampere, 480-volt, AC 100-ampere frame molded case circuit breakers. Interrupting capacity shall be not less than 18,000 A (symmetrical) at 480 V (ac).

Circuit breakers for BLCP.--

Circuit breakers shall be 240-volt, AC 100-ampere frame molded case circuit breakers. Interrupting capacity shall be not less than 10,000 A (symmetrical) at 240 V (ac). Number of poles and ampere trip rating shall be as shown on the plans.

Fuses, F1 and F2 for ALCP and GLCP.--

Fuse, F1, for ALCP and GLCP shall be 480-volt, dual-element ceramic tube fuse complete with 2-pole barrier type fuse base. Ampere trip rating shall be as shown on the plans.

Fuse, F2, for ALCP and GLCP shall be 120-volt, dual-element ceramic tube fuse complete with single-pole barrier type fuse base. Ampere trip rating shall be as shown on the plans.

Transformer for ALCP and GLCP.--

Transformer for ALCP and GLCP shall be shall be double-wound, dry-type 0.5 kVA, 60 Hz, transformer with 480-volt primary and 120-volt secondary.

Lighting contactors for BLCP, TLCP and GLCP.--

Lighting contactors for BLCP, TLCP and GLCP shall be electrically held, lighting contactor with 120-volt AC coil and 20-ampere, 600-volt double-break, silver alloy contacts; Square D Company, I.T.E., Westinghouse, or equal. Number of poles shall be as shown on the plans.

Lighting contactor for ALCP.--

Lighting contactor for ALCP shall be electrically held, 3-pole, power lighting contactor with 120-volt AC coil and 60-ampere, 600-volt double-break, silver alloy contacts; Square D Company, I.T.E., Westinghouse, or equal.

Selector switch.--

Selector switches in all lighting control panels shall be rotary action, double-pole, 3-position, 10-ampere, 120-volt switch. Switch contacts shall have an inductive pilot duty rating of 60 amperes (make), 6 amperes (break) and

10 amperes (continuous) at 120 volts and 35 percent power factor. Selector switch shall have legend plate marked MANUAL-OFF-AUTO.

Switches, S_a through S_h for GLCP.--

Switches, S_a through S_h for GLCP shall be specification grade 277 V snap switches as specified elsewhere in these special provisions.

Switches, S_a and S_b for BLCP--

Switches, S_a and S_b for BLCP shall be dimming switches as specified elsewhere in these special provisions.

Terminal block, TB.--

Terminal block shall be 30-ampere, 600-volt, molded plastic with two or more mounting holes and two or more terminals in each cast block. The molded plastic shall have a high resistance to heat, moisture, mechanical shock, and electrical potential and shall have a smooth even finish. Each block shall have a molded marking strip attached with screws. Terminal blocks shall have tubular, high pressure clamp connectors.

FABRICATION.--

Component mounting.--The electrical components in each lighting control panel shall be mounted as shown on the plans.

All load side conductors entering or leaving the panel shall be identified and terminated on a terminal block.

EXECUTION.--

LIGHTING FIXTURES.--Lighting fixtures shall be mounted securely in accordance with the manufacturer's recommendations. Mounting methods shall be suitable for the particular type of ceiling or support at each location.

The Contractor shall provide all supports, hangers, spacers, channels, fasteners and other hardware necessary to support the fixtures.

Fixtures shall be set at the mounting heights shown on the plans, except heights shown shall be adjusted to meet conditions.

BALLASTS.--All fluorescent fixtures shall be equipped with high power factor ballasts suitable for the line voltage and for the type, size and number of lamps required by fixture. The Contractor has the option to install low voltage dimming control provided that the Contractor submit plans and specifications with appropriate revisions for the low voltage dimming control to the Engineers for approval prior to installation.

All ballasts used in unheated areas inside the building, in the tunnel and in areas outside the building shall be -20°C ballasts or less.

POLE MOUNTED LUMINAIRES.--Concrete foundations shall be as shown on the plans. Anchor bolts or devices shall be accurately located and positioned to match the holes in the pole base plates. Pole and luminaire orientation shall be as indicated on the plans. Foundation for the high mast lighting shall conform to the provisions in Section 86-2.03, "Foundations," of the Standard Specifications.

The poles for pole mounted type fixtures shall be mounted rigidly and securely on the foundations as recommended by the fixture and pole manufacturer.

12-16.05 HIGH MAST LIGHTING ASSEMBLY.--

The high mast lighting assembly shall include the foundation, 30.5 meter-pole, luminaire lowering device system, luminaires and a control panel as shown on the plans and specified in these special provisions.

GENERAL.--Installation of lowering device on each pole shall be made under the supervision of a trained representative of the lowering device manufacturer. Prior to acceptance of the contract, a trained representative of the lowering device manufacturer shall demonstrate that each high mast lighting assembly operates properly. The demonstration shall consist of a minimum of 3 complete cycles of raising and lowering the luminaries ring (complete with luminaires) the full length of its travel, as designed, within one working day, prior to acceptance of the project.

All portions of the high mast lighting assembly shall have a minimum design wind velocity rating of 129 km/h.

The lowering device system shall be submitted for inspection and testing. Inspection and testing shall be performed at a site in California approved by the Engineer. The lowering device system shall be demonstrated by the Contractor at his expense. Notification shall be given to the Engineer at least 7 days prior to demonstration.

After the high mast lighting system is in operation, the Contractor shall provide an instructional video tape (VHS), complete written instructions, and a demonstration to State Maintenance personnel on the maintenance of the high mast lighting assembly, including leveling of the luminaries ring and the procedures for the safe raising and lowering of the luminaries ring.

Spare parts, part lists, and the operating, maintenance and service instructions, packaged with or accompanying the equipment installed on the project, shall be delivered to the Engineer prior to acceptance of the project.

SUBMITTALS.--Manufacturer's descriptive information, catalog cuts and installation instructions shall be submitted for approval. Review areas will include but not be limited to structural, welding, electrical, and other areas as determined by the Engineer.

1. The Contractor shall submit descriptive data, design working drawings, erection working drawings (including aiming directions for each luminaries if the luminaries has an asymmetrical light distribution), isolux diagram for each type of luminaire, calculations, and a list of the material used for the high mast lighting assembly. The material list shall be complete as to name of manufacturer, catalog number, size, capacity, finish, pertinent ratings, and identification symbols used on the plans or in the special provisions for each unit.
2. Each submittal shall consist of 5 copies.
3. Plans and detailed drawings shall be not larger than 594 mm x 841 mm.
4. Each separate item submitted shall bear a descriptive title and the State contract number.

INSPECTION.--The high mast light poles will be inspected at the fabrication site. The Contractor shall notify the Engineer when materials have been delivered to the fabrication site and shall give the Engineer at least 10 days notice after delivery before commencing the fabrication of any light pole.

CONTROL PANEL.--A control panel shall be provided in conjunction with each high mast lighting pole and shall be mounted inside the pole. Unless otherwise indicated, the control panel shall include the following control equipment:

1. Circuit breakers for:
   a. Branch circuits (lighting)
   b. Motor and control
c. Receptacle
2. A remote control reversing switch for winch motor control.
3. A step-down transformer (properly sized to provide voltage and current necessary for winch motor and receptacle).
4. Interlock apparatus (winch motor interlocked to high mast lighting power cable connector).
5. Duplex receptacle (120 V (ac), GFCI protected).

All electrical connections and terminations shall be behind dead front panels. Live connections shall not be exposed.

CORROSION RESISTANCE.--Corrosion resistance shall be provided. Methods shall include the following:

Avoidance of contact between stainless steel and carbon steel, between different types of stainless steel (including welding material), and between aluminum and ferrous materials.

Utilizing continuous welding to eliminate crevices which retain moisture.

Minimizing welding of stainless steel.

Use of adequate sections and suitable materials to limit stress related corrosion.

POLE.--The pole shall conform to the requirements in Section 86-2.04, "Standards, Steel Pedestals and Posts," of the Standard Specifications, and these special provisions.

The pole shall include shaft, access hole, access hole cover, support plate, and anchor base.

The shaft shall consist of sections of a round or multisided (16 sides) tapered steel tube with a uniform taper of approximately 11.66 mm/m. Segments of multisided poles shall be convex and shall have a minimum bend radius of 102 mm. The pole shall be hot-dip galvanized after fabrication in accordance with the provisions in Section 75-1.05, "Galvanizing," of the Standard Specifications. Steel used in fabricating the pole shall be weldable quality steel. No field welding shall be performed in the assembly of the pole.

The pole shall have a reinforced access hole to allow adequate clearance for maintaining and servicing the lowering device. Access hole reinforcement shall provide a bending strength equal to that of the pole without an opening. Other hardware inside the pole shall accommodate the lowering device.

The access door shall be hinged to the pole, open horizontally 180 degrees, and when in the open position not interfere with access to the interior of the pole.

The pole shall be erected plumb. The vertical axis of the erected pole shall be within 75 mm of the theoretical vertical axis when measured without the action of sunlight or wind.

The pole shall conform to the requirements of the latest edition and interim revisions of the AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals." The maximum allowable wind deflection shall not exceed 14 percent of the pole height.

An embossed aluminum plate shall be attached with rivets to the outside of each pole approximately 50 mm above the access hole. The nameplate shall indicate the name of the pole manufacturer and the height of the pole.

A plastic laminated data sheet shall be secured on the inside of the access hole door, and shall include the names, addresses and telephone numbers of the manufacturers of the pole, luminaire lowering device and luminaires, and the design parameters, including wind velocity, luminaires (number, wattage, model number, weight, projected area, and coefficient of drag), and the weight, projected area, and coefficient of drag for the pole top lowering mechanism.

LUMINAIRE LOWERING DEVICE.--The luminaire lowering device shall consist of a head frame, a luminaire ring, and an internal power drive winch unit.

The maximum effective projected area of the total assembly at the top of the pole, exclusive of the luminaires, shall not exceed 0.42 m^2.

The maximum weight of the head frame, luminaire ring and cover shall not exceed 340 kg.

The head frame shall be hot rolled steel conforming to ASTM Designation: A 36, and attached to the pole by means of a steel slipfitter and secured by a minimum of 4 stainless steel setscrews conforming to ASTM Designation: F 880, Type 304. The head frame shall be hot-dip galvanized in accordance with the provisions in Section 75-1.05, "Galvanizing," of the Standard Specifications.

The head frame shall be fitted with at least 6 hoisting cable sheaves, of either galvanized or stainless steel with a minimum 127 mm pitch diameter. The head frame shall also be fitted with electrical power cable sheaves or rollers configured to provide a minimum bending radius as specified by the power cable manufacturer.

The hoisting cable sheaves and electrical power cable sheaves or rollers shall be fitted with suitable keepers to keep the cables in their tracks during pole erection and operation. The sheaves shall be supported by stainless steel shafts and shall be fitted with oil-impregnated sintered bronze bushings or roller bearings.

Three hoisting cables shall be supplied. The cables shall be 4.8 mm minimum diameter, 7x19 strand, stainless steel aircraft cable, manufactured in accordance with Military Specification: MIL-8320B.

The head frame shall be provided with a cover designed for that device and securely attached with stainless steel machine screws meeting ASTM Designation: F 593, Type 304 requirements and self-locking nuts meeting the general chemical requirements of ASTM Designation: F 594, Type 304, or a stainless steel clamp band. The shape of the lowering device and cover shall be generally symmetrical about a vertical axis.

The head frame shall also include 3 latches which support the luminaire ring when the lowering device is not in operation. Latching shall be accomplished by the alternate raising and lowering of the luminaire ring by the winch and hoisting assembly. When the luminaire ring is raised to the top of the pole, it shall automatically latch and secure in a locked position. Automatic signaling devices shall be visible to indicate that each latch of the luminaire ring is safely locked in place.

No moving latch parts or springs shall be attached to the head frame. All moving parts of the latching mechanism shall be attached to the luminaire ring and serviceable from the ground.

The luminaire ring shall be fabricated of 152 mm x 51 mm x 7-gage steel channel or a member of equal strength, with the appropriate number of 51 mm nominal steel tube or pipe mounting arms to accommodate the number of luminaires shown on the plans. The pipe shall conform to the requirements of ASTM Designation: A 53. The ring shall be galvanized in accordance with the provisions in Section 75-1.05, "Galvanizing," of the Standard Specifications.

Roller-contact, spring loaded, centering arms shall be provided which shall center the luminaire ring while ascending and descending the full length of designed travel on the pole. The arm system shall be capable of keeping the ring concentric with the pole in winds up to 50 km/h. The rollers for the centering arms shall be of a water resistant, non-marking material. All axle shafts for arms and rollers shall be of stainless steel conforming to ASTM Designation: A 276, Type 304. The arms system shall not allow the pole to be inadvertently wedged between the rollers and the luminaire ring. Ultimate support of the luminaire ring shall not be lost by individual or total spring failure.

Provisions shall be made for leveling the luminaire ring while in the lowered position. The Contractor shall level the luminaire support ring upon installation and again before completion of the contract.

A prewired 600-volt terminal block in a NEMA Type 3R enclosure, and a weatherproof power receptacle shall be mounted on the luminaire ring raceway. When the luminaire ring is lowered to ground level, the receptacle shall enable the luminaires to be energized and tested.

An electrical cable of sufficient length to power the luminaire ring and with appropriate electrical connections shall be provided to test the luminaires while in the lowered position. A circuit breaker and an outlet box shall be provided in the pole base.

All electrical cords shall be attached to a weathertight wiring chamber through weathertight cable connections. The main power cord shall be capable of supporting its full weight when installed. A positive connection between cord segments shall be provided across cord joints to prevent stress on the joints.

Power cable shall be Type SO, rated for 600-volt AC with the number and size of conductors as required. Luminaire ring distribution cord shall be Type ST with insulation suitable for 105° C. Twist-lock receptacles (male and female) shall be provided and shall be rated at a minimum of 30-ampere, 480-volt AC.

The internal drive mechanism shall be capable of raising or lowering the luminaire ring at an approximate speed of 3.4 m per minute. The winch shall be furnished with 6 mm minimum diameter, 7 x 19 strand stainless steel aircraft cable, conforming to Military Specification: MIL-8320B, of sufficient length to maintain at least four wraps around the drum with the luminaire ring in its fully lowered position. Winch cable shall wind uniformly.

The internal power drive winch unit shall include:

1. A heavy duty, totally enclosed, fan cooled, reversible universal type motor, rated at 0.37 kW, minimum, for continuous duty, and provided with overcurrent protection.
2. An adjustable torque limiter with ball or roller bearings on all rotating shafts.
3. A remote control reversing switch (labeled "UP" and "DOWN") with minimum 6-meter cord.
4. Worm-gear driven winch.
5. Mounting frame.
6. Weatherproof step-down transformer, if necessary, of sufficient power to supply the motor and provided with overcurrent protection. The transformer when installed inside the pole, shall be removable without removing any other components.
7. Other appurtenant equipment as necessary.

All internal power drive winch unit components, including transformer, shall be removable through the access hole for repair or replacement.

LUMINAIRES.--Each luminaire shall consist of a housing, a reflector, a refractor or lens, a ballast, a lamp socket, and a lamp.

Housings shall be fabricated from aluminum. Housings that are painted shall withstand a 1,000-hour salt spray test as specified in ASTM Designation: B 117. All metal component parts of the housing shall be fabricated from material at least equal in corrosion resistance and finish to the metal in the housing.

The optical system, consisting of the reflector, refractor or lens, lamp socket, and lamp, shall be in a sealed chamber. Sealing shall be provided by a gasket between the reflector and refractor or lens, and a gasket between the reflector and lamp socket. The chamber shall have provision for filtered flow of air in and out of the chamber due to lamp heat. Filtering shall be accomplished by either a separate filter or a filtering gasket.

The adjustable component (refractor or reflector) controlling the orientation of the light distribution of asymmetrical luminaires shall be rotatable 360 degrees around a vertical axis.

Each luminaire shall be provided with a slipfitter capable of mounting on a 51-mm horizontal pipe tenon and of being adjusted plus or minus 3 degrees from the axis of the tenon.

The surface of each reflector shall be specular, and shall be silvered glass or aluminum protected by either an anodized finish or a silicate film. The reflector shall be shaped so that a minimum of light is reflected through the arc tube of the lamp.

Each refractor or lens shall be made of heat resistant glass.

Each lamp socket shall be a porcelain enclosed mogul-multiple type. The shell shall contain integral lamp grips to assure electrical contact under conditions of normal vibrations. The socket shall be rated for 1,500-watt, 600-volt, and 4,000-volt pulse (400-watt lamp), or 5,000-volt pulse (1,000-watt lamp).

Metal halide lamps shall be vertical burning and protected from undue vibration and prevented from backing out of its socket by a stainless steel clamp attached to the luminaire.

Each luminaire shall enclose a dual fuseholder and 2 fuses rated at 10 amperes at 480 volts. Each fuse shall be the standard midget ferrule type, with "Non-Time-Delay" feature, shall be ETL or UL listed.

Each luminaire shall produce a Type V distribution with at least 0.002 footcandles (horizontal) per 1,000 lamp lumens at 1.95 mounting heights if mounted on a 100-foot pole, and shall produce no more than 40 candelas per 1,000 lamp lumens at 80 degrees from nadir in any direction and no more than 10 candelas per 1,000 lamp lumens at 85 degrees or more.

BALLASTS.--The ballast for each high mast luminaire shall consist of components (core and coils, capacitor(s) and starting aid if required) mounted within a weatherproof housing which integrally attaches to the top of luminaire support

bracket and lamp support assembly. The ballast shall be readily removable without removing the luminaire from the bracket arm.

Ballasts shall be electrically connected to the optical assembly by means of a prewired quick disconnect.

Ballasts shall be the regulator type.

12-16.06 SIGN AND SIGNALS

GENERAL.--This work shall consist of furnishing and installing the extinguishable message sign, traffic signal and flashing beacon light in accordance with the details shown on the standard plans, ES-14A and ES-14B and these special provisions.

SUBMITTALS.--Manufacturer's descriptive information, catalog cuts and installation instructions shall be submitted for approval.

PRODUCTS.--

Extinguishable message sign.--

Each extinguishable message sign, EMS, shall be an internally illuminated weathertight and dustight unit which will produce a clearly visible message consisting of a 254 mm high letters as follows:

Line 1	AUTOS-$2.00
Line 2	AUTOS-OK

The design of each sign shall be as shown on the plans. Minor details of construction shown are typical and may be modified subject to the approval of the Engineer.

Six sets of shop drawings shall be submitted to the Engineer for review prior to performing work on the signs.

Housing of EMS.--

The housing shall be rigid, ruggedly constructed, weathertight, dust tight, corrosion resistant and shall be made of durable materials.

Provisions shall be made for ease of maintenance of components.

Sign panels and housing window shall be made of black colored with matte finish, 13 mm thick acrylic transparent sheet which, including painted portions, shall be highly resistant to crazing, staining, discoloration, creep, warping, and the long range deleterious effects of vehicle fumes, direct sunlight, heat (up to 90°C), water, oils and aging.

The housing skin shall be made of Type 5052-H32 aluminum alloy sheet with clad finish. The housing reinforcing and miscellaneous parts shall be made of suitable gages and types of aluminum, except external fasteners, machine screw parts, lock washers, hinge pins, and other mechanical parts, which shall be made of Type 316 stainless steel.

Interior metal parts shall be made of suitable gages and types of plated steel or aluminum, except fasteners, machine screw parts, lock washers and other miscellaneous parts shall be made of corrosion resistant metals other than aluminum.

The separable hinge for mounting the reflector shall be brass as shown on the plans or shall be stainless steel.

Gaskets shall be uniform and even textured, and shall be highly resistant to stiffening and setting and the long range deleterious effects of vehicle fumes, direct sunlight, heat (up to 70°C), water, oils and aging.

Terminal strips shall be used for input, output and tie point connections and shall be of the molded phenolic, barrier type.

Ballast, control relays and terminal blocks for EMS.--

Ballast inductors shall meet the requirements in ANSI Standard: C82.1, "Fluorescent Lamp Ballasts."

The inductors shall have the inductance noted on the plans (±10 percent), losses not exceeding 15 percent of lamp watts at rated current of inductor and a maximum current crest factor of 1.5 at rated current of inductor. The maximum temperature rise of the inductor coils shall be limited to 40°C above an ambient temperature of 40°C.

Heater transformers shall produce the rated secondary voltage (±10 percent) at full load and at one-third load. The maximum temperature rise of the transformer coils shall not exceed 40°C above an ambient temperature of 40°C.

Inductors and transformers shall have cores made of a suitable grade of silicon steel lamination material and shall have thorough resin impregnation.

Each mounting chassis shall be fabricated of 3 mm, Type 5052-H32 aluminum alloy sheet. Units shall be mounted on the chassis with plated brass or steel hardware, except for lock washers which shall be beryllium copper, externally toothed.

Capacitors shall be rated 660 V (ac), 60 Hz, for operation down to -20°C with capacity as shown on the plans and shall be oil filled, paper type, hermetically sealed with solder lug terminals. Capacitance shall be within ±10 percent of rating at

25°C. Each capacitor shall withstand a limited direct current, 15-second breakdown test at 25°C of 3000 V (ac) from each terminal to case. Minimum insulation leakage resistance from terminal to terminal, in megohms, shall be not less than 1500 divided by capacitance in microfarads.

Each magnetic control relay shall be of the heavy-duty, power type with 120-V (ac) coil and double-pole, double-throw contacts with a minimum rating of 2 A at 480 V (ac), 60 Hz. The coil shall consume not more than 10 VA with sealed armature.

The relay coil shall be designed to provide reliable service under the following conditions:

A. Maximum operating voltage: 10 percent over rated volts.
B. Ambient temperature: 60°C.

The relay coil shall meet NEMA requirements for temperature rise and voltage breakdown.

Maximum dimensions of the relay shall be: mounting base, 63.5 mm by 102 mm; overall height, 63.5 mm.

Fuseholders shall be the panel mounting type rated at 250 V (ac), complete with a 10.3-mm diameter by 38-mm length, slow blowing, cartridge type fuse.

Surge limiting and ballast resistors shall be ceramic coated, 20-watt, wirewound units. Resistor leads shall have plastic insulation rated 600 V (ac), for operation at 200°C.

Wiring connections from components shall be terminated on 2 molded phenolic, barrier type, terminal block assemblies rated at 15 A, 600 V (ac). Terminal designations shall be marked as indicated on the plans.

Lampholders and lamps.—

Lampholders shall have silver plated contacts.

Lamps shall be the extra-high output, rapid-start type with T-12 bulb of the length shown on the plans, cool-white color and plated contacts for operation up to 1500 mA.

Conductors and wiring.—

Ballast and sign conductors shall be No. 16 stranded copper wire and shall be labeled by UL as 105°C appliance wiring material (AWM) for use at 600 V (ac). Ballast conductors shall be secured with easily removable, spring cross straps (not clamped, cabled or served) on the underside of the chassis. Color coding and terminal markings shall be as shown on the plans.

Lead ends shall be fitted with spade lugs.

Plug disconnect for EMS.--

Each plug disconnect shall consist of molded nylon plug and receptacle housings containing plug pins and individual sockets designed to be crimped to conductors and snapped into the housings. Housings shall have integral, molded, polarizing and locking devices. Minimum UL electrical rating shall be 10 A, 600 V (ac). Pins and sockets shall be tin plated phosphor bronze secured to conductors using a ratchet type precision crimping tool.

Testing for EMS.--

Tests shall verify that the following conditions exist:

A. Transformer output voltage: 480 V (ac) ± 10 percent.
B. Sign input current (daytime level): 4 A maximum.
C. Lamp current each (daytime level): 1.4 A ± 15 percent (nighttime level) 30 mA ± 15 percent.
D. Cathode filament voltage: 3.6 V (ac) ± 10 percent and shall be supplied from a steady (non-flashing) source.

EMS operation.--

The sign shall operate as follows:

A. During daytime, the lamps shall operate at full rated brightness.
B. During nighttime, the lamps shall be dimmed to approximately one-thirty-fifth of daytime brightness.
C. Starting and flashing shall be positive, without flickering, during daytime and nighttime levels.

Traffic signal and flashing beacon light.--

The traffic signal heads shall be installed as shown on the canopy above the toll lanes as shown on the plans. Each traffic signal shall consist of two 300 mm signal heads, one having a red lens and the other a green lens. Signal heads shall

conform to the requirements of Section 86-4, "Traffic Signal Faces and Fittings," of the Standard Specifications. Each signal head shall be provided with a visor.

Flashing beacon lights shall be similar to the traffic signal heads except it shall be 200 mm with a yellow lens.

Flashing beacon control panel.--

Flashing beacon control panel shall be a NEMA Type 1 surface mounted enclosure with a flasher. Flasher shall conform to the requirements of Section 86-4.09C(3), "Flasher," of the Standard Specifications.

Lamps.--

Lamps for traffic signals and flashing beacons shall be Type 1 LED signal module as specified under "Light Emitting Diode Signal Module," elsewhere in these special provisions.

EXECUTION.—

Extinguishable message signs, traffic signals and flashing beacons shall be mounted rigidly and securely in accordance with the manufacturer's recommendations.

The Contractor shall provide all supports, hangers, spacers, channels, fasteners and other hardware necessary to support the units.

12-16.07 LIGHT EMITTING DIODE SIGNAL MODULE

Traffic signal faces with 300-mm sections or 200-mm sections shall use light emitting diode (LED) signal modules as the light source in conformance with these special provisions.

GENERAL

Type 1 LED signal modules shall be installed in the doorframes of standard traffic signal housings. Lamp sockets, reflectors, reflector holders and lenses used with incandescent lamps shall not be used when Type 1 LED signal modules are installed.

LED signal modules, including green, yellow, red, circular balls and arrow indications shall be from the same manufacturer, and each size shall be the same model.

Type 1 LED signal modules shall be sealed units with two color-coded conductors for power connection, a printed circuit board, a power supply, a lens and a gasket. LED signal modules shall be weatherproof after installation and connection. Circuit boards and power supplies shall be contained inside Type 1 LED signal modules. Circuit boards shall conform to the requirements in Chapter 1, Section 6 of the "Transportation Electrical Equipment Specifications," (TEES) published by the Department.

Conductors for Type 1 LED signal modules shall be one meter in length with quick disconnect terminals attached, and shall conform to the provisions in Section 86-4.01C, "Electrical Components," of the Standard Specifications.

Lenses of Type 1 LED signal modules shall be integral to the units, shall be convex with a smooth outer surface and shall be made of ultraviolet (UV) stabilized plastic or glass. The lenses shall be capable of withstanding ultraviolet exposure from direct sunlight for a minimum period of 36 months without exhibiting evidence of deterioration.

Type 1 LED signal modules shall be sealed in doorframes with one-piece ethylene propylene rubber (EPDM) gaskets.

LEDs used in signal modules shall be of Aluminum Indium Gallium Phosphide (AlInGaP) technology for red and yellow indications and of Gallium Nitride (GaN) technology for green indications. LEDs shall be the ultra bright type rated for 100,000 hours of continuous operation from -40°C to +74°C.

Individual LEDs shall be wired so that a total failure of one LED will result in the loss of not more than 5 percent of the signal module light output. Failure of an individual LED in a string shall not result in the loss of the entire string or any other indication.

Maximum power consumption requirements for LED signal modules shall be as follows:

LED Signal Module	Power Consumption in Watts					
	Red		Yellow		Green	
	25°C	74°C	25°C	74°C	25°C	74°C
300 mm circular	11	17	22	25	12	12
200 mm circular	8	13	13	16	10	10
300 mm arrow	9	12	10	12	13	13

PHYSICAL AND MECHANICAL REQUIREMENTS

Installation of LED signal modules shall only require the removal of the optical unit components such as the lens, lamp module, gaskets and reflector. LED signal modules shall be weather tight, fit securely to the housing and connect directly to electrical wiring.

Arrow modules shall conform to the requirements in Section 9.01 of the Institute of Transportation Engineers (ITE) Publication: Equipment and Materials Standards, "Vehicle Traffic Control Signal Heads" for arrow indications. LEDs shall be spread evenly across the illuminated portion of the arrow area.

LED Signal Module Lens

The LED signal module shall be capable of replacing the optical unit. The lens may be tinted or may use transparent film or materials with similar characteristics to enhance "ON/OFF" contrasts. The use of tinting or other materials to enhance "ON/OFF" contrast shall not affect chromaticity and shall be uniform across the face of the lens.

If a polymeric lens is used, a surface coating or chemical surface treatment shall be used to provide front surface abrasion resistance.

Environmental Requirements

LED signal modules shall be rated for use in the operating temperature range from -40°C to +74°C.

LED signal modules shall be protected against dust and moisture intrusion in conformance with the requirements in NEMA Standard 250-1991 for Type 4 enclosures to protect internal components.

Construction

LED signal modules shall be single, self-contained devices, not requiring on-site assembly for installation into existing traffic signal housings. The power supply for LED signal modules shall be integral to the module.

Assembly and manufacturing processes for LED signal modules shall be designed to assure all internal components will be adequately supported to withstand mechanical shock and vibration from high winds and other sources.

Materials

Materials used for lenses and LED signal modules shall conform to the requirements in ASTM Specifications for the materials.

Enclosures containing the power supply or electronic components of LED signal modules shall be made of UL94VO flame-retardant materials. Lenses of LED signal modules are excluded from this requirement.

Module Identification

LED signal modules shall have the manufacturer's name, trademark, model number, serial number, lot number, month and year of manufacture, and required operating characteristics permanently marked on the back of the module. Required operating characteristics shall include rated voltage, power consumption and volt-ampere (VA).

Type 1 LED signal modules shall have prominent and permanent vertical markings for correct indexing and orientation within the signal housings. Markings shall consist of an up arrow or the word "UP" or "TOP."

PHOTOMETRIC REQUIREMENTS

Initial luminous intensity values for LED signal modules, operating at 25°C, shall meet or exceed the following minimum values:

Circular Indications (in cd)

	200 mm			300 mm		
Angle (v,h)	Red	Yellow	Green	Red	Yellow	Green
2.5, ±2.5	157	314	314	399	798	798
2.5, ±7.5	114	228	228	295	589	589
2.5, ±12.5	67	133	133	166	333	333
2.5, ±17.5	29	57	57	90	181	181
7.5, ±2.5	119	238	238	266	532	532
7.5, ±7.5	105	209	209	238	475	475
7.5, ±12.5	76	152	152	171	342	342
7.5, ±17.5	48	95	95	105	209	209
7.5, ±22.5	21	43	43	45	90	90
7.5, ±27.5	12	24	24	19	38	38
12.5, ±2.5	43	86	86	59	119	119
12.5, ±7.5	38	76	76	57	114	114
12.5, ±12.5	33	67	67	52	105	105
12.5, ±17.5	24	48	48	40	81	81
12.5, ±22.5	14	29	29	26	52	52
12.5, ±27.5	10	19	19	19	38	38
17.5, ±2.5	19	38	38	26	52	52
17.5, ±7.5	17	33	33	26	52	52
17.5, ±12.5	12	24	24	26	52	52
17.5, ±17.5	10	19	19	26	52	52
17.5, ±22.5	7	14	14	24	48	48
17.5, ±27.5	5	10	10	19	38	38

LED signal modules shall meet or exceed the following minimum illumination values for a minimum period of 36 months, based on normal use in traffic signal operation over an operating temperature range of -40°C to +74°C. In addition, yellow LED signal modules shall meet or exceed the following minimum illumination values for a minimum period of 36 months, based on normal use in traffic signal operation at 25°C:

Circular Indications (in cd)

	200 mm			300 mm		
Angle (v,h)	Red	Yellow	Green	Red	Yellow	Green
2.5, ±2.5	133	267	267	339	678	678
2.5, ±7.5	97	194	194	251	501	501
2.5, ±12.5	57	113	113	141	283	283
2.5, ±17.5	25	48	48	77	154	154
7.5, ±2.5	101	202	202	226	452	452
7.5, ±7.5	89	178	178	202	404	404
7.5, ±12.5	65	129	129	145	291	291
7.5, ±17.5	41	81	81	89	178	178
7.5, ±22.5	18	37	37	38	77	77
7.5, ±27.5	10	20	20	16	32	32
12.5, ±2.5	37	73	73	50	101	101
12.5, ±7.5	32	65	65	48	97	97
12.5, ±12.5	28	57	57	44	89	89
12.5, ±17.5	20	41	41	34	69	69
12.5, ±22.5	12	25	25	22	44	44
12.5, ±27.5	9	16	16	16	32	32
17.5, ±2.5	16	32	32	22	44	44
17.5, ±7.5	14	28	28	22	44	44
17.5, ±12.5	10	20	20	22	44	44
17.5, ±17.5	9	16	16	22	44	44
17.5, ±22.5	6	12	12	20	41	41
17.5, ±27.5	4	9	9	16	32	32

Measured chromaticity coordinates of LED signal modules shall conform to the chromaticity requirements of the following table, for a minimum period of 36 months, over an operating temperature range of -40°C to +74°C.

Chromaticity Standards

Red	Y: not greater than 0.308, or less than 0.998 -x
Yellow	Y: not less than 0.411, nor less than 0.995 - x, nor less than 0.452
Green	Y: not less than 0.506 - 0.519x, nor less than 0.150 + 1.068x, nor more than 0.730 - x

LED signal modules tested or submitted for testing shall be representative of typical production units. Circular LED modules shall be tested in conformance with California Test 604. Optical testing shall be performed with LED signal modules mounted in standard traffic signal sections without visors or hoods attached to the signal sections.

LEDs for arrow indications shall be spread evenly across the illuminated portion of the arrow area. Arrow LED signal modules shall be tested in conformance with California Test 3001. Optical testing shall be performed with LED signal modules mounted in standard traffic signal sections without visors or hoods attached to the signal sections. LED arrow signal section indication shall provide minimum initial luminous intensity as listed herein. Measurements shall be performed at the rated operating voltage of 120 V (ac).

ELECTRICAL

Maximum power consumption requirements for LED signal modules shall not exceed those listed in "General." LED signal modules shall operate at a frequency of 60 Hz ± 3 Hz over a voltage range from 95 V (ac) to 135 V (ac) without perceptible flicker. Fluctuations of line voltage shall have no visible effect on luminous intensity of the indications. Rated voltage for all measurements shall be 120 V (ac).

Wiring and terminal blocks shall conform to the requirements of Section 13.02 of the ITE Publication: Equipment and Material Standards, (Vehicle Traffic Control Signal Heads). Two secured, color coded, 1 meter long, 600 V, 20 AWG minimum, jacketed wires, conforming to the National Electronic Code, rated for service at +105°C, shall be provided for electrical connection for each Type 1 LED signal module.

LED signal module on-board circuitry shall include voltage surge protection to withstand high repetition noise transients in conformance with the requirements in Section 2.1.6 of NEMA Standard TS2-1992.

LED signal modules shall be operationally compatible with currently used controller assemblies including solid state load switches, flashers and conflict monitors. When a current of 20 milliamperes (ac) or less is applied to the unit, the voltage read across the two leads shall be 15 V (ac) or less.

LED signal modules and associated on-board circuitry shall conform to the requirements in Federal Communications Commission (FCC) Title 47, SubPart B, Section 15 regulations concerning the emission of electronic noise.

LED signal modules shall provide a power factor of 0.90 or greater.

Total harmonic distortion from current and voltage induced into an alternating current power line by LED signal modules shall not exceed 20 percent at an operating temperature of 25°C.

QUALITY CONTROL PROGRAM

LED signal modules shall be manufactured in conformance with a vendor quality control (QC) program. The QC program shall include two types of testing: (1) design qualification and (2) production quality. Production quality testing shall include statistically controlled routine tests to ensure minimum performance levels of LED signal modules built to meet these specifications.

Documentation of the QC process and test results shall be kept on file for a minimum period of seven years.

LED signal module designs not satisfying design qualification testing and the production quality testing performance requirements specified herein shall not be labeled, advertised or sold as conforming to these specifications.

Identification of components and subassemblies of LED signal modules, which may affect reliability and performance, shall be traceable to the original manufacturers.

Design Qualification Testing

Design qualification testing (DQT) shall be performed by the manufacturer or an independent testing lab hired by the manufacturer on new LED signal module designs, and on existing designs when a major design change has been implemented. Failure to conform to the requirements of any design qualification test shall be cause for rejection.

A major design change is defined as a design change, electrical or physical, which changes any of the performance characteristics of the LED signal module, results in a different circuit configuration for the power supply, or changes the layout of the individual LEDs in the signal module.

Two LED modules for each design shall be used for DQT. The two LED signal modules shall be selected at random. These signal modules shall be submitted to the Transportation Laboratory after the DQT is complete. Testing data shall be submitted with the modules to the Transportation Laboratory for verification of DQT data.

LED signal modules shall be energized for a minimum of 24 hours, at 100 percent on-time duty cycle, at a temperature of 74°C before performing any DQT.

After burn-in, LED signal modules shall be tested for rated initial luminous intensity in conformance with the provisions in "Photometric Requirements." Before measurement, LED signal modules shall be energized at rated voltage, with 100 percent on-time duty cycle, for a time period of 30 minutes. Photometrics, luminous intensity and color measurements for yellow LED signal modules shall be taken immediately after the modules are energized. The ambient temperature for these measurements shall be 25°C. Test results for this testing shall record the current, voltage, total harmonic distortion (THD) and power factor (PF) associated with each measurement.

LED signal modules shall be tested by measuring for chromaticity (color) in conformance with the provisions in "Photometric Requirements." A spectra radiometer shall be used for this measurement. The ambient temperature for this measurement shall be 25°C.

LED signal modules shall be tested by measuring the current flow in amperes. The measured current values shall be used for quality comparison of production quality assurance on production modules.

LED signal modules shall be tested by measuring the power factor. A commercially available power factor meter may be used to perform this measurement.

LED signal modules shall be tested by measuring the total harmonic distortion. A commercially available total harmonic distortion meter may be used to perform this measurement.

LED signal modules shall be tested in conformance with the provisions in "Electrical," with reference to Class A emission limits referenced in Federal Communications Commission (FCC) Title 47, SubPart B, Section 15.

LED signal modules shall be tested for compatibility with the controller unit, conflict monitor and load switch. Each signal module shall be connected to the output of a standard load switch connected to an alternating current voltage supply between the values of 95 and 135 V (ac) with the input to the load switch in the "OFF" position. The alternating current voltage developed across each LED signal module so connected shall not exceed 15 V rms as the input alternating current voltage is varied from 95 V (ac) rms to 135 V (ac) rms.

LED signal modules shall be tested for transient immunity in conformance with the provisions in "Electrical," and conforming to the procedure described in NEMA Standard TS2-1992.

Mechanical vibration testing shall be performed on LED signal modules in conformance with the requirements in MIL-STD-883, Test Method 2007, using three 4-minute cycles along each x, y, and z axis, at a force of 2.5 Gs, with a frequency sweep from 2 Hz to 120 Hz. The loosening of the lens, internal components, or other physical damage shall be cause for rejection.

Temperature cycling shall be performed on LED signal modules in conformance with the requirements of MIL-STD-883, Test Method 1010. The temperature range shall conform to the provisions in "Environmental Requirements." A minimum of 20 cycles shall be performed with a 30 minute transfer time between temperature extremes and a 30 minute dwell time at each temperature. LED signal module under test shall be non-operating. Failure of LED signal modules to function properly or evidence of cracking of LED signal module lenses or housings after temperature cycling shall be cause for rejection.

Moisture resistance testing shall be performed on LED signal modules in conformance with the requirements in NEMA Standard 250-1991 for Type 4 enclosures. Evidence of internal moisture after testing shall be cause for rejection.

Production Quality Testing

Production quality testing shall be performed on each LED signal module prior to shipment. Failure to conform to the requirements of any production quality test shall be cause for rejection. The manufacturer shall retain test results for seven years for warranty purposes.

LED signal modules shall be tested for rated initial intensity after burn-in. The burn-in period shall consist of signal modules being energized at rated voltage for a 30 minute stabilization period before the measurements are made. A single point measurement with a correlation to the minimum initial luminous intensity requirements of "Photometric Requirements" for circular modules may be used. The ambient temperature for this measurement shall be +25°C.

LED signal modules shall be tested for luminous intensity requirements in "Photometric Requirements."

LED signal modules shall be tested for required power factor after burn-in.

LED signal modules shall be tested by measuring current flow in amperes after burn-in. The measured current values shall be compared against current values resulting from design qualification measurements under "Design Qualification Testing." The current flow shall not exceed the rated value. The measured ampere values with rated voltage shall be recorded as volt-ampere (VA) on the product labels.

LED signal modules shall be visually inspected for any exterior physical damage or assembly anomalies. The surface of the lens shall be free of scratches, abrasions, cracks, chips, discoloration, or other defects. Any such defects shall be cause for rejection.

CERTIFICATE OF COMPLIANCE

The Contractor shall provide the Engineer a Certificate of Compliance from the manufacturer, in conformance with the provisions of Section 6-1.07, "Certificates of Compliance," of the Standard Specifications. The certificate shall certify that the LED signal modules comply with the requirements of these specifications. The certificate shall also include a copy of all applicable test reports on the LED signal modules.

QUALITY ASSURANCE TESTING (RANDOM SAMPLE TESTING)

The State may perform random sample testing on all shipments. Random sample testing will be completed within 30 days after delivery to the Transportation Laboratory. Circular LED signal modules shall be tested in conformance with California Test 604 and these special provisions. Arrow signal modules shall be tested in conformance with California Test 3001 and these special provisions. Optical testing shall be performed with the module mounted in a standard traffic signal section, but without a visor or hood attached to the section or housing. The number of modules tested shall be determined by the quantity of each model in the shipment. The sample size shall conform to ANSI/ASQC Z1.4. The Transportation Laboratory shall determine the sampling parameters to be used for the random sample testing. All parameters of the specification may be tested on the modules. Acceptance or rejection of the shipment shall conform to ANSI/ASQC Z1.4 for random sampled shipments.

WARRANTY

The manufacturer shall provide a written warranty against defects in materials and workmanship for LED signal modules for a period of 36 months after installation of LED signal modules. Replacement LED signal modules shall be provided within 5 days after receipt of failed LED signal modules at no cost to the State, except the cost of shipping the failed modules. All warranty documentation shall be given to the Engineer prior to installation. Replacement LED signal modules shall be delivered to Caltrans Benicia Martinez Toll Plaza Administration Building Maintenance.

12-16.08 CHANGEABLE MESSAGE SIGN

GENERAL.--This work shall consist of furnishing and installing changeable message sign (CMS)system in accordance with these special provisions.

The changeable message sign system shall be the illuminated fiberoptic type and shall consist of the following:

1. Sign housing
2. Optical system.
3. Automatic brightness control circuitry.
4. Electromagnetic shutter system
5. Electric wiring and interconnections.
6. CMS Control cabinet.
7. Communication interface.

The changeable message sign system shall permit the display of electronically controlled light emitting text by as many as 34 individual 254-mm high alphanumeric or graphic characters arranged in 2 rows.

Each character shall be capable of displaying the following in the English language:

1. Any upper case letter (using the complete height of the matrix).
2. Any lower case letter.
3. Any punctuation character.
4. Any digit from 0 to 9.
5. Semi-graphic characters.

Changes from one message to another shall take place so that the motorist only visualizes the complete and intended message on the sign face, at any one time. All lines of text shall energize and de-energize simultaneously. High speed scrolling of messages shall not be allowed.

SUBMITTALS.--Manufacturer's descriptive information, catalog cuts calculation for CMS sign tilt angle and orientation with respect to roadway and installation instructions shall be submitted for approval.

PRODUCTS.--

Sign housing.--

Sign housing shall be weatherproof, corrosion resistant and shall utilize clear natural finish aluminum material. The overall housing dimensions shall be as shown on the plans.

The housing shall have drainage holes screened ventilation louvers to facilitate natural cooling, shall be fitted with drainage holes, and shall be capable of accepting the mounting as shown on the plans. All openings shall be sealed or gasketed to prevent moisture and dirt from entering the interior of the sign.

An inspection door shall be provided to enable easy access for maintenance purposes. Included in the door assembly shall be a device to hold the door in the open position during servicing or inspection.

Screws, washers, nuts and bolts for the housing shall be stainless steel or aluminum. All other components shall be corrosion resistant.

The sign housing shall be completely surrounded by a black non-painted aluminum contrast shield. This shield shall be bolted to the sign or be an integral part of the sign. Minimum width of the contrast shield shall be equal to the character height.

Optical system.--

Individual characters shall be formed by pixels. Each pixel shall be made up of optical fibers fused together to form a lightguide. Each luminous dot shall consist of end of fiber optic bundle. There shall be a minimum of 2 fiber bundles per pixel.

Each character module shall be composed of 35 individual pixels arranged in a matrix form of 5 columns by 7 lines. Character modules shall be assembled to form a single character group. The horizontal separation between two character modules shall be a minimum of 2/5 of the standard 5 x 7 character width. The vertical separation between two characters shall be a minimum of 4/7 of the standard 5 x 7 character height.

Each character group shall contain one lamp assembly (with beam splitting mirror), character modules, and two fiberoptic harnesses. All character modules and character groups for like sized character heights shall be fully interchangeable within the sign and the replacements of a character group shall be possible without the use of tools.

The lamp assembly and fiberoptic harnesses attached to each character group shall include two 50–watt quartz halogen lamps with parabolic reflectors. The lamps shall operate at 10 V or less, and shall be rated for an average service life of 6000 hours or more by the lamp manufacturer, for full intensity use.

One of the two lamps shall be designated as "primary" for normal use, and the other as "secondary". Either primary or secondary lamp shall be capable of illuminating every pixel equally within the character group.

The optical fiber utilized in the fiber optic harnesses shall be manufactured using high quality step index glass-on-glass optical fiber. Each individual optical fiber bundle shall be protected from damage by an extruded PVC jacket. All fiberoptic bundles shall be arranged on a flat black non-reflective faceplate.

Each fiberoptic harness in the signal shall contain spare bundles equivalent to 5 percent of the total bundles employed per legend.

Each optical light guide fitted onto the faceplate shall contain a convergence cone. The cone shall produce appropriate controlled angle emission to suit field conditions and increase intensity of light axially.

The lamp and reflector shall be a single unit. Lamps shall be serviceable without the use of tools.

The lamps shall be mounted in an assembly that utilizes materials designed to reduce the mechanical transmission of shock forces. The lamps shall not be rigid mounted.

Color filters shall be supplied as an integral part of the light projection assembly. Filters shall cause emitted light to be red, green or white.

Automatic brightness control circuitry.--

Three photosensors for detecting ambient lighting conditions to set the brightness levels shall be mounted on the sign housing. One shall have a minimum range from 2 to 2000 lux for day/night selection. The other 2 shall have a range of 2000 to 20000 lux for day/overbright selection. Control of the brightness level shall be accomplished by the photosensor controls circuitry located in the CMS control cabinet.

Electromagnetic shutter system.--

Each pixel shall have its apertures controlled by an electromagnetic shutter mechanism regulated by low voltage pulses. Upon receiving a momentary control pulse, the shutter shall rotate to open or close in front of the fiber optic bundles. Each shutter shall be mechanically independent. Rotation shall occur in one direction only.

Shutters shall be suitable for an average of 200 million rotations or more. Only one shutter mechanism shall be allowed per pixel.

Electrical wiring and interconnections.--

Nominal input voltage shall be 115 volts ± 10 percent. Each sign shall contain only one transformer and the transformer shall be equipped with taps to adjust the secondary voltage at the sign location. The unit shall be capable of continuous operation over an ambient temperature range between -37°C and +49°C with a relative humidity of up to 95 percent.

For improved night visibility the light output of the fiber optic sign shall be reduced. The reduction of light output shall be accomplished by reducing the voltage at the lamps. The available voltage at the lamps shall be selectable during installation to accommodate local conditions.

In the event of a lamp failure, the lamp failure signal shall continue to display a discernible word. This graphics security feature shall be mandatory even in the night intensity mode. The sign messages shall be clearly visible in all lighting conditions, including direct and back sunlight. The fiberoptic changeable message sign shall be capable of displaying the messages shown on the plans. Each luminous dot shall consist of the end of a fiberoptic bundle. The sign shall not be readable when deenergized.

Each conductor/cable shall be individually and clearly labeled with permanent markings. The system for marking internal sign conductor/cables shall allow a maintenance person to identify the function associated with any specific cable. All connections between the character modules and the terminal blocks shall be made via positive locking, quick release connections.

A GFCI receptacle outlets connected on one circuit rated for 120 V, 15 A shall be installed for service personnel use in the sign housing. The GFCI receptacle housing shall be suitable to be installed in the sign.

Terminations for the wiring between the sign and control cabinet shall be made on screw type terminal blocks. All terminal blocks shall be accessible for servicing.

All interconnections between the shutter, lamp control, internal sign wiring and photosensors shall be factory pre-wired.

Interconnecting cables in between the sign and CMS control cabinet and in between the CMS control cabinet and CMS message programmer shall be selected and sized by the CMS manufacturer.

CMS control cabinet.--

CMS control cabinet shall be a factory pre-wired controller in a surface mounted enclosure. The CMS control cabinet shall include a microprocessor based controller, communication interface (modem), a main power supply complete with circuit breakers and fuses, photosensor controls to interface with 3 photosensors on the sign, dimming controls, relays, CMS programming device, transformers, printed circuit boards, voltage surge and lighting protection, transient protection and RFI filtering system, lamp drivers, shutter drivers, terminal blocks and other appurtenant devices that are required for the complete automatic operation of the CMS system.

Control cabinet layout shall be modular in design so that components can be easily replaced and serviced.

The controls shall be software driven microprocessor type controls with resident software stored in non volatile memory.

Communication interface.--

Communication interface shall include two RS-232C serial interface for communications, one for a future central computer and the other for the CMS message programmer.

The CMS message programmer furnished shall be a laptop computer.

Laptop computer shall be the type recommended by the CMS manufacturer and shall have a 300 MHz processor, minimum 6.0 GB of hard drive space, 64 MB EDO RAM, 56 kB modem, internal 24X CD ROM drive, one 89 mm drive, 380 mm XGA TFT active matrix LCD display and a lithium ion battery. A spare battery shall be supplied with the computer. The laptop computer shall be permanently installed on the retractable drawer inside the CMS control cabinet.

EXECUTION.—

Changeable message signs shall be mounted rigidly and securely in accordance with the manufacturer's recommendations.

The CMS sign shall be tilted and oriented in a manner so that the sign is clearly legible to vehicle drivers in all toll plaza (total 17 lanes) lanes to a distance up to 167 m from the CMS sign.

A complete and up to date documentation of the programming software and the VMS programming software along with any password shall be furnished to the Engineer after the VMS is satisfactorily tested and prior to acceptance of the contract. State of California assures that this software will not be utilized for profit making purposes or for copying to use at other locations.

The Contractor shall provide all supports, hangers, spacers, channels, fasteners and other hardware necessary to support the units.

FIELD QUALITY CONTROL.--

Testing.--The operational test for the CMS system shall be performed by the Contractor in the presence of the Engineer. The operational tests shall demonstrate that all functions of the system operate in the manner described in the manufacturer's literature and demonstrate system stability under normal vibration and shocks to components. The Contractor shall notify the Engineer in writing not less than 10 days in advance of performing the operational tests.

DEMONSTRATION.--

Training.--The Contractor shall a minimum of 4 hours of on-site training on the use, operation, and maintenance of the CMS system for not more than 6 designated State employees. The Contractor shall notify the Engineer in writing not less than 10 days in advance of proposed training class.

12-16.09 STANDBY GENERATOR

GENERAL.--This work shall consist of furnishing and installing a standby generator in accordance with the details shown on the plans and these special provisions.

The standby generator shall include engine, generator, automatic transfer switch, circuit breakers, starting batteries, engine-generator control panel, battery charger, protective housing, top-mounted exhaust silencer, remote diesel fuel tank with rupture basin and control panel, drip pan, warning sign, battery hydrometer with storage container, battery filler, distilled water, anchoring devices, vibration isolators, fuel panel remote annunciator, generator remote annunciator panel and such other miscellaneous accessories, not mentioned, which are required for the complete installation and proper operation of the standby generator.

The standby generator assembly shall be factory assembled and mounted on a steel base with vibration isolators.

SUBMITTAL.--

Product data.--A list of materials and equipment to be installed, manufacturer's descriptive data, prototype test certification, and such other data as may be requested by the Engineer shall be submitted for approval.

Manufacturer's descriptive data shall include complete description, performance data and installation instructions for the materials and equipment specified herein. Engine and generator control schematic diagrams, interconnection diagrams, and exact dimension drawings of the engine-generator set shall be submitted for approval. All control and power conductors on the diagrams shall be identified with wire numbers.

PRODUCTS.--

Engine.--

The engine shall be turbocharged, after cooled, diesel fuel type with not less than 9 liters of piston displacement, liquid cooled, and designed for continuous operation.

The engine's standby duty rated output shall be ample to drive the generator and connected normal accessories at the rated speed and unity power factor at 100 percent of the rated load with an ambient temperature of 40°C at 305 meters above sea level.

The engine shall operate satisfactorily on commercial grade No. 2-D diesel fuel. The crankshaft shall be drilled for full pressure lubrication to all bearings. All crankshaft bearing surfaces shall be hardened. The crankshaft shall have one more main bearing than there are number of cylinders. The intake and exhaust valves and valve seats shall be heat resistant alloy steel. The exposed surfaces of the engine shall be finished with one coat of primer and 2 coats of an industrial paint suitable for the intended use.

The engine shall be equipped with the following accessories:

Diesel Fuel Filter System.--The diesel fuel filter system shall consist of a primary fuel filter capable of removing particles of 50 microns and larger, and a secondary filter capable of removing particles of 25 microns and larger. Each filter shall be a spin-on, replaceable unit, designed for diesel fuel filtration and water separation. Filters shall be located for easy service access.

Oil Filter System.--The pressurized lubricating oil system shall have a full flow filter system, consisting of a strainer with openings not to exceed 0.64 mm in greatest dimension, and a separate, cleanable or replaceable filter capable of removing particles of 25 microns and larger.

Air Filter System.--The air intake shall be provided with a dry type air filter of adequate capacity to effectively remove dirt and abrasives from the combustion air. The dry type filter shall be designed to allow for easy removal and replacement of filter element. The filter shall be equipped with service indicators to indicate necessary replacement.

Engine Governor.--The governor shall be a gear driven mechanical type providing a 5 percent speed regulation from no load to full load and provide +0.5 percent steady state frequency regulation.

Engine Cooling.--The engine shall be equipped with an engine driven radiator cooling system. The radiator shall be capable of cooling the engine while operating at 100 percent rated continuous load in 52°C maximum ambient temperature. Fan shall be push type.

Engine Preheater.--The engine shall be equipped with a 208-volt, 1000-watt electric water jacket heater. The heater shall be thermostatically controlled to maintain engine coolant at the proper temperature to meet the start up requirement of NFPA-99 standard. The required circuitry for proper operation and remote annunciation of low and high water temperature shall be provided. The thermostat shall be adjustable between 35°C and 50°C. Controls shall be provided to disconnect the engine preheater power supply once the engine begins to crank.

Engine Starter.--The engine shall be provided with a 12-volt heavy duty positive engagement solenoid shift starting motor. The drive mechanism for engaging the starting motor with the engine flywheel shall engage and release without binding.

Safety Controls.--The engine shall be provided with automatic controls that shut down engine operation when low lubricating oil pressure, high water temperature or overspeed conditions occur. The values at which the low lubricating oil pressure, high jacket water temperature and overspeed controls operate to shut down engine operation, shall be as recommended by the engine manufacturer.

Overcrank safety controls shall be provided as specified in these special provisions. Equipment required for monitoring of these safety controls at the remote annunciator panel shall be provided

Engine Instrumentation.--Engine instruments shall be mounted in the engine-generator control panel. Engine instruments shall include the following:

a. Lubricating oil pressure gage.
b. Water temperature gage.
c. Engine hour meter (totalizing mechanism of 9,999 hours).

Exhaust system.--

The exhaust system shall consist of an exhaust silencer and flexible connection.

The silencer shall be a residential type, sized to meet or exceed the engine requirements.

The silencer shall be provided with a drain, flange connection and companion flanges.

The flexible connection shall be bellows type, not less than 300 mm in length and installed between the engine exhaust and the Schedule 40 galvanized steel exhaust pipe. The flexible connection shall be constructed of Type 321 stainless steel and shall be provided with flanged ends for connection to the engine and galvanized steel exhaust pipe.

Diesel fuel tank.--

The diesel fuel tank with rupture basin shall have not less than 1325 liter capacity. The fuel tank shall be UL listed, and shall be complete with fuel level indicator, engine supply and return fuel lines, emergency and normal vents, overflow and fill devices, and control panel. Provide atmospheric vent cap with screen and appropriately sized zinc-plated emergency vent cap.

Rupture basin shall consist of an open-top, welded heavy gauge steel structure sized at a minimum of 150 percent of the tank capacity. The basin shall be primed and finish painted.

Control panel shall provide a leak detection system for the rupture basin, low level and high level alarm and relays. The leak detection system shall be approved for use with hydrocarbon fuels. All system components except the control panel shall be intrinsically safe for Class I, Division I, Group D hazardous atmospheres.

All sensors, cables, conduits, hangers, control and alarm panels, accessories and appurtenances required for a complete installation per manufacturer's recommendations shall be furnished and installed by the Contractor.

Fuel panel remote annunciator.--

Fuel panel remote annunciator shall display alarm conditions of the fuel panel complete with an audible alarm and silence push button. The annunciator shall be compatible with the fuel panel supplied. Low fuel level and high fuel level shall be indicated by panel mounted pilot lamps.

The audible alarm and lamp shall have a test switch. Panel shall be mounted as shown on the plans and shall include all conductors required to be fully operational.

Starting batteries.--

Storage batteries for engine starting and other requirements shall be sufficient in number, and shall be 6-cell, heavy duty, lead-acid type. Total battery capacity shall be a minimum of 90 ampere-hours at the 20-hour rate. Batteries shall be mounted in corrosion resistant battery racks located within the skid base and shall be provided with battery cables of sufficient length to connect to the DC apparatus.

Battery charger.--

The battery charger shall be of the dual rate type. The battery charger shall be provided with the following features:

1. DC ammeter.
2. Dual fusing for AC input and DC output.
3. Automatic DC voltage regulation.
4. Automatic load regulation.
5. Compensation taps for setting the charger for average AC line and battery conditions.
6. DC cranking circuit disconnect relay.
7. Fault indication (for local and remote annunciation).
8. Low battery voltage indicator (for local and remote annunciation).

Generator.--

The generator shall be a brushless type, single bearing, rotating field, isochronous type, with a drip-proof enclosure. The insulation shall be NEMA Class F or better.

The generator shall be rated at continuous standby 250 kW, 313 kVA, 0.8 power factor, 277/480 volts, 3-phase, 4-wire, 60 Hz, and 1800 rpm. The generator shall have the following capabilities:

1. Steady state voltage regulation at full rated load shall be within plus or minus one percent.
2. Voltage regulation shall be within plus or minus 2 percent of rated steady state voltage from no load to full load.
3. Voltage recovery shall be within 2 percent of nominal rated voltage within 5 seconds, after the rated load is applied or removed in one-step.

Engine generator control panel.--

A completely wired and assembled engine-generator control panel shall be mounted on the engine-generator unit. The panel and its components shall comply with all applicable NEMA standards for industrial type controls, and shall be fully enclosed and vibration isolated. The panel shall include the following switches and instruments exposed on the front of the control panel:

1. AC ammeter.
2. AC voltmeter.
3. Three-position combination ammeter-voltmeter-phase selector switch.
4. Frequency meter.
5. Manual reset generator exciter circuit breaker with thermal magnetic trips.
6. Battery charger DC ammeter.
7. Manual "START-STOP" switch.
8. Indicating lights to show cause of emergency shutdown.
9. Emergency "STOP" switch.
10. Voltage adjust rheostat.
11. Engine oil pressure gage.
12. Engine running time meter.
13. Engine water temperature gage.

Equipment or devices to be mounted within the engine-generator control panel shall include the following:

1. Battery charger.
2. Automatic voltage regulator.
3. Automatic starting controls.
4. Radio interference suppression
5. Transformers, relays and other equipment required for proper operation.

Equipment mounted in the control panel shall be arranged for easy service access.

Generator remote annunciator panel.--

Generator remote annunciator panel shall display conditions of generator set and shall be complete with an audible alarm and silence push button. The generator remote annunciator panel shall be fully compatible with the generator

supplied. The annunciator shall be compatible with the fuel panel supplied. The following conditions shall be indicated by pilot lamps:

1. Pre-alarm high engine coolant temperature.
2. Pre-alarm low oil pressure.
3. Low water temperature (engine heater malfunction).
4. High engine temperature (if engine is shut down because of high engine coolant temperature).
5. Low oil pressure.
6. Overspeed.
7. Overcrank.
8. Battery charger malfunction.
9. Low battery voltage.
10. Generator not in auto mode.
11. Line power (normal utility power).
12. Generator power (generator has output voltage).
13. Auxiliary fault.

The audible and lamps shall have a test switches. Low fuel indicator shall be either bypassed or modified so that the remote tank is monitored. The panel shall be mounted as shown on the plans and shall include all the necessary hardware and conductors required to be fully operational.

Overcranking protection.--

Upon failure of primary power, the engine shall be automatically cranked for 20 seconds or until it starts, whichever is shorter. If the engine fails to start, within 20 seconds, further attempts to start shall be prevented by a manually reset lockout device. Overcranking default condition shall be indicated by a pilot light.

Automatic transfer switch.--

The automatic transfer switch shall be a 277/480-volt, 3-phase, 4-wire, electrically operated, mechanically held device utilizing two 3-pole contactors.

Contactors shall be rated at not less than 400 amperes continuous duty, and shall be electrically and mechanically interlocked to positively prevent simultaneous connection of both normal and standby power sources. Electrical operation shall not permit a neutral position between normal and standby power sources. The contacts shall be enclosed and shall be constructed of silver alloy. Coils shall be readily accessible for examination and replacement.

Voltage sensing relays shall monitor each phase of the normal power source, and shall initiate the sequence for transfer at the factory preset limit of 70 percent of the rated voltage on any phase. Retransfer to the normal power source shall be delayed for a period adjustable from 0 to 30 minutes, initially set at 5 minutes.

Momentary power outages shall be ignored by delaying cranking of the standby power plant for a period adjustable from 0.2 to 120 seconds, initially set at 60 seconds.

Connection of the standby load shall be prevented until the standby power plant reaches at least 90 percent of its operating voltage.

Retransfer from the stand-by power plant to the normal power source shall be delayed for a period adjustable from 0 to 30 minutes, initially set at 5 minutes.

Shutdown of the standby power plant after retransfer to the normal power source shall be delayed for a period adjustable from 2 to 10 minutes, initially set at 5 minutes.

In addition to the auxiliary contacts required for the engine-generator operation, additional SPDT auxiliary switch operated by the transfer switch shall be provided on each side of the transfer switch to operate future peripheral equipment. A programmable exerciser clock to exercise the engine-generator shall be provided. The clock shall be able to select day, time, and duration of the engine-generator exercise period. A two position selector switch with legend plate marked “WITH LOAD / WITHOUT LOAD” shall be provided to make a selection of either mode of operation.

The automatic transfer switch, including the special features specified herein, shall be mounted in a NEMA Type 12 control panel enclosure conforming to the Joint Industry Conference Standards. A 3-position "HAND-CRANK"-"OFF"-"AUTO" selector switch shall be mounted in the front panel.

Miscellaneous accessories.--

A drip pan fabricated of not less than one mm thick (20-gage) galvanized sheet steel with turned up edges rolled over wire, sized to catch all oil or grease which may drop from the engine, shall be provided under the engine-generator set.

A galvanized sheet metal duct shall be fabricated and installed between the radiator and the exhaust louvers. This radiator cooling air exhaust duct shall be installed with flexible connection.
The generator main power disconnect shall be 600-volt, 3-pole, 400-ampere trip molded case, thermal-magnetic, circuit breaker and shall be mounted in a NEMA Type-1 enclosure on the side of the generator housing. The adjustable magnetic trip shall be set for 4000 amperes. The interrupting capacity of the circuit breaker shall be not less than 25,000 amperes at 600 volts (ac).

A warning sign shall be mounted at a location on the engine generator set approved by the Engineer. The sign shall be sheet steel, not less than one mm thick (18-gage) with a baked enamel coating. The sign shall have a red background and white letters not less than 40 mm in height. The sign inscription shall read as follows:

DANGER
AUTOMATIC
MAY START AT ANY TIME

A commercial quality battery hydrometer with plastic type storage container, and a commercial quality 3.8 liter battery filler with filler hose and 3.8 liter of distilled water, shall be furnished and installed adjacent to the battery location. The body of the battery filler shall be clearly marked "DISTILLED WATER" in letters not less than 12 mm in height.

EXECUTION.--

The engine-generator set shall be installed on a concrete slab as shown on the plans.

Anchoring devices shall be as recommended by the engine-generator manufacturer and shall be installed to fasten the engine-generator set securely to the concrete slab.

Vibration isolators shall be installed between the engine base and the concrete slab. The type and size of the isolators shall be as recommended by the engine-generator manufacturer.

TESTING.--

The engine-generator power generating system, including transfer switch, shall be tested at completion of installation and adjustments.

All necessary materials, test equipment and recording instruments, and labor required for the tests shall be furnished. The Contractor shall notify the Engineer not less than 5 working days in advance of testing. Testing shall be performed in the presence of the Engineer.

The engine-generator power generating system shall be tested for compliance with the conditions shown on the plans and the requirements specified in these special provisions.

Tests shall utilize a resistive load bank. All transient requirements shall be demonstrated by means of recording instruments. All engine safety shutdown devices shall be demonstrated. Fuel remote annunciator panel and generator remote annunciator panel shall be demonstrated.

A battery and starter test shall consist of 30 seconds of continuous cold without engine start, followed by immediately by a normal engine start without excessive starter laboring.

A 4-hour heat run shall be conducted at 100 percent of generator rated full load capacity at the specified rated voltage.

12-16.10 UNINTERRUPTIBLE POWER SUPPLY

GENERAL.--This work shall consist of furnishing and installing an uninterruptible power supply (UPS) system in accordance with the details shown on the plans and these special provisions.

The UPS shall include input isolation transformer, rectifier/charger unit with input filters, inverter, display and controls, static transfer switch, maintenance bypass switch, battery system, distribution cables and such other miscellaneous accessories, not mentioned, which are required for the complete installation and proper operation of the UPS system.

The UPS shall be factory assembled in NEMA Type 12 freestanding cabinets with front access, casters and leveling feet.

The UPS shall be provided with a separate external maintenance bypass cabinet complete with circuit breakers and rotary switch to bypass the UPS system.

SUBMITTAL.--

Product data.--A list of materials and equipment to be installed, manufacturer's descriptive data, prototype test certification, and such other data as may be requested by the Engineer shall be submitted for approval.

Manufacturer's descriptive data shall include complete description, performance data and installation instructions for the materials and equipment specified herein. Operating instructions shall include step-by-step start-up, operating, test and shutdown procedures including minor adjustments for optimum performance.

Maintenance instructions shall include trouble shooting and diagnostic information, disassembly, assembly instructions and preventive maintenance.

PRODUCTS.—

Uninterruptible power supply.--

The uninterruptible power supply, UPS, system shall be a continuous duty, 480-volt (ac), 3-phase, 125-kVA on-line power conditioning system. The UPS shall meet the following requirements:

Input voltage: 480 V (ac), 60 Hz, 3-phase.
Voltage range: +10 percent, -15 percent.
Current limit: 125 percent full load.
Frequency range: 60 Hz, +/- 5 percent.
Current walk-in: 20 seconds to full load.
Output voltage: 480 V (ac), 60 Hz, 3-phase.
Voltage regulation: +/- 1 percent.
Operating temperature: from 0°C to 40°C.
Audible noise: 65 dBA measured 1 m from UPS.
The UPS shall be UL listed.

Input isolation transformer--

Input isolation transformer shall be delta to wye configuration single point ground transformer sized appropriately to provide common mode noise attenuation for all system operating modes, including while on bypass.

Rectifer/charger.--

The rectifier/charger shall be the solid-state equipment with necessary controls to convert incoming AC power to regulated DC power for input to the inverter and for battery charging. The rectifier/charger shall be a phase-controlled solid-state SCR type with constant current limiting control circuitry to limit input current to 125 percent of the full input rating. The rectifier/charger shall have the following features:

1. The rectifier/charger shall employ input filter to reduce reflected input current distortion to 10 percent of THD at full load nominal input voltage.
2. The rectifier/charger shall contain a timed walk-in circuit that causes the unit to gradually assume the load over a 20 second time interval after input voltage is applied. Walk-in time shall be field selectable for 5 or 20 seconds.
3. The rectifier/charger shall have an output filter to minimize ripple voltage into the battery.

Upon restoration of the utility AC power, after a utility AC power outage and prior to a uninterruptible power system automatic end-of-discharge shutdown, the rectifier/charger shall automatically restart, walk-in, and gradually assume the inverter and battery the inverter and battery recharge loads. In addition to supplying power for the inverter load, the rectifier/charger shall be capable of producing battery charging current sufficient to replace 95 percent of the battery discharge time. After the battery is recharged, the rectifier/charger shall maintain the battery at full charge until the next emergency operation.

Inverter.--

The inverter shall be a solid-state inverter with necessary controls to convert DC power from any rectifier/charger or battery to regulated AC power for supporting the critical load. The inverter shall have a transistorized, phase-controlled, pulse width modulated (PWM) design capable of supplying current at rated voltage for overloads exceeding 100 percent and up to 150 percent at full load current for 30 seconds. A status indicator and audible alarm shall indicate overload operation. The UPS system shall transfer the load to bypass when overload capacity is exceeded. For greater currents or longer time duration, the inverter shall have electronic current-limiting protection to prevent damage to components. The inverter shall be self-protecting against any magnitude of connected output overload. Inverter control logic shall sense and disconnect the inverter from the critical AC load without the requirements to clear protective fuses. The inverter shall have the following features:

1 A dry type power transformer sized accordingly shall be provided for the inverter AC output.
2 Inverter shall have controls to regulate each phase output voltage to be within the specified voltage unbalance loading or phase displacements due to unbalance loading and removal of the inverter from the critical load. Simultaneously for turning on the static transfer switch to maintain continuous power to the critical load.
3 The inverter shall be able to operate from the rectifier/charger with the battery disconnected.
4 DC overvoltage shutdown.
5 DC undervoltage warning (adjustable from 1 to 99 minutes).
6 DC undervoltage shutdown (end of discharge) protection.

The inverter shall have manual controls to adjust the output voltage to +/- 5 percent of the nominal value. The inverter shall have temperature compensated output frequency control to hold the inverter output frequency to +/- 0.1 percent for steady state and transient conditions. Drift shall not exceed 0.1 percent during a 24-hour period. Total frequency deviation, including short time fluctuations and drift, shall not exceed 0.1 percent from the rated frequency.

Display and controls.--

The UPS system shall be provided with a microprocessor based unit status display control section designed for convenient and reliable operation. A system power flow diagram shall be provided as part of the monitoring and controls sections which depicts a single-line diagram of the UPS system. All of the operator controls and monitors shall be located on the front of the UPS cabinet. The monitoring functions such as metering, status and alarms shall be displayed on a alphanumeric LCD display. The UPS monitoring system shall have the following controls and display:

Menu-driven display with text format
Real time clock (time and date)
Alarm history with time and date stamp
Input and output AC voltage, line-to-line and line-to-neutral for each phase
Input and output frequency
Battery voltage
Battery charge/discharge current
Percent of rated load being supplied by UPS system
Battery time left during battery operation
Input power out of tolerance and input phase rotation incorrect
Charger in reduced current mode
Battery charger problem, battery failed test and low battery shutdown
Low battery warning (adjustable 1 to 99 minutes)
Bypass frequency out of range
Load transfer to bypass
Input power single phased and input voltage sensor failed
Inverter leg over current in X-phase
Output under voltage, output over voltage and output over current
System output overloaded
Load transferred to bypass due to overload
Overload shutdown
Control error
Critical power supply failure

Load transferred due to internal protection
External shutdown (remote EPO activated0
Fan failure
Over temperature shutdown impending and over temperature shutdown
Normal operation
Load on maintenance bypass
Load on UPS system
System shutdown
UPS on battery

UPS power system start-up, shutdown and maintenance bypass operations shall be accomplished by a single rotary control switch. An advisory display and menu-driven user prompts shall be provided to guide the operator through the system operation without the use of additional manuals. Push buttons shall be provided to display the status of the UPS system and to test and reset visual and audible alarms. A mimic panel shall be provided to depict a single line diagram of the UPS system. Indicating lights shall be integrated within the single line diagram to illustrate the status of the UPS system. Two LED's located on the diagram shall indicate whether the UPS input and output power is present. The diagram shall be color coded with the positions of the rotary control switch for visual confirmation of the UPS operating mode.

The UPS power supply system shall be provided with a menu driven on-line battery test feature to ensure the capability of the battery to supply power to the inverter while the load is supplied power in the normal mode. During the battery test failure, the system shall automatically do the following:

Transfer the load to bypass
Restart the rectifier/charger
Display a warning message
Sound an audible alarm
Retransfer the load back to normal mode

The battery test feature shall have the following user selectable options:

DC bus voltage threshold (pass/fail value)
Interval between test (2 to 9 weeks)
Date and time of initial test
Enable/disable test

Static transfer switch.--

The static transfer switch shall be an integral part of the UPS system. The static switch shall be naturally commutated high speed static (SCR type) device rated to conduct full load current continuously. The switch shall have an overload rating of 125 percent rated load continuously, 200 percent rated load for 30 seconds, and 2000 percent rated load for two cycles. The static transfer switch control logic circuit shall contain an automatic transfer control circuit that senses the status of the inverter logic signals, and operating and alarm conditions. This control circuit shall provide an uninterrupted transfer of the load to an alternate bypass source, without exceeding the transient limits, when an overload or malfunction occurs within the UPS system, or for bypassing the UPS system for maintenance.

The transfer control logic shall automatically turn on the static transfer switch, transferring the critical AC load to the bypass source, after the transfer logic senses any of the following conditions:

Inverter overload capacity is exceeded
Critical AC load over voltage or under voltage
Battery protection period expired
UPS system fault condition

The transfer control logic shall inhibit an automatic transfer of the critical load to the bypass source if any of the following conditions exists:

Inverter/bypass voltage difference exceeding preset limits
Bypass frequency out of limits
Bypass out-of synchronization range with inverter output

Retransfer of the critical AC load from the bypass source to the inverter output shall be automatically initiated unless inhibited by manual control. The transfer control logic inhibit an automatic retransfer of the critical load to the inverter if one of the following condition exists:

By pass out of synchronization range with inverter output
Inverter/bypass voltage difference exceeding preset limits
Overload condition exists in excess of inverter full load rating
UPS fault condition present

Maintenance bypass switch.--

Maintenance bypass switch shall be a manually operated bypass switch incorporated into the UPS system cabinet to directly connect the critical load to the AC power source, bypassing the rectifier/charger, inverter and the static transfer switch. All energized terminals shall be shielded to ensure that maintenance personnel do not inadvertently come in contact with energized parts or terminals. A means to de-energize the static switch shall be provided when the UPS is in the maintenance bypass mode of operation. With the critical load powered from the maintenance bypass circuit, it shall be possible to check out the operation of the rectifier/charger, inverter, battery, and static transfer switch.

Battery system.--

Battery system shall include a sealed lead-acid valve regulated battery cells housed in a cabinet that matches the UPS system cabinet styling to form an integral system line-up. Battery cells shall be mounted on slide-out trays for ease of maintenance. A disconnect means shall be included for isolation of the battery pack from the UPS system module.

External maintenance bypass cabinet.--

The external maintenance bypass cabinet shall be provided to enable the UPS module to be completely isolated from the external system while the critical load is powered through the external maintenance bypass line. The external maintenance bypass cabinet shall be free standing type cabinet with casters and leveling feet. The external maintenance bypass electrical system shall consist of UPS input circuit breaker, UPS output circuit breaker and make-before-break single rotary switch with auxiliary contacts for transfer to and from maintenance bypass line. All circuit breakers and rotary transfer switch shall be sized to carry continuous rated UPS current at the rated load voltage. The input and output breakers shall be back panel mounted and rotary transfer switch shall be door mounted and shall have a legend plate marked OFF-BYPASS-UPS.

Remote contact board.--

Isolated form C contacts shall be provided to indicate a change of each of the following conditions:

1. Uninterruptible power supply system on low battery alarm
2. Low battery reserve alarm.
3. Load on bypass alarm.
4. Summary alarm.
5. New alarm – a separate alarm for a second summary alarm.

EXECUTION.--

The UPS system shall be installed as shown on the plans and in accordance with the manufacturer's recommendations. Conduits in the UPS cabinet shall be located so they are out of the way of necessary access points of the UPS. A qualified representative shall be present to oversee and assist in the installation of the system to ensure that the proper procedure is followed.

Equipment shall be anchored firmly in place to comply with the area seismic requirements.

TESTING.--

After the UPS system has been installed and the load connected, a qualified factory technician shall check the installation and perform initial on-site tests for compliance with the conditions specified in these special provisions.

All necessary materials, test equipment and recording instruments, and labor required for the tests shall be furnished. During the UPS tests, all transient requirements shall be demonstrated by means of recording instruments. The Contractor shall notify the Engineer not less than 5 working days in advance of testing. Testing shall be performed in the presence of the Engineer.

The UPS system shall be tested at 100 percent of the UPS capacity utilizing a linear load bank with the utility power input power being disconnected at the start of the test and no other input power to the UPS. The UPS shall automatically switch to the battery back-up without affecting loads and be able to maintain proper output voltage and frequency during the next 5 minutes. During the test, the following UPS conditions shall be indicated:

Load on UPS
UPS alarm conditions if any

After no more than 5 hours period of battery recharging, another test similar to the test above shall be executed for a duration of 7 minutes without any outside power connected to the UPS system. During the recharging period, the UPS output shall be monitored for output on line voltage and frequency regulation.

At the end of the 7th minute of the test or any time there after as determined by the UPS manufacturers, the following UPS condition shall be indicated at the UPS:

Load on UPS
UPS alarm conditions if any
Low battery reserve
Form C contact closure at the UPS.

Each test shall be a continuous trouble free operation. In the event that any component fails, the test must be performed again.

12-16.11 FIRE ALARM AND DETECTION SYSTEM

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing a complete and operational fire alarm and detection system in accordance with the details shown of the plans and these special provisions.

The fire alarm system shall conform to the California Electric Code (CEC) Article 760 and the California Fire Code (CFC) Section 1007.

Installation of the fire alarm system shall not start until detailed plans and specifications, including California State Fire Marshal listing numbers for each component of the system, have been approved by the California State Fire Marshal.

Upon completion of installation of the fire alarm system, a satisfactory test of the system shall be made in the presence of the State Fire Marshal.

The system shall include all materials, whether mentioned or not, but are necessary for the complete and operational fire alarm and detection system.

SYSTEM DESCRIPTION.--

Design Requirements.--The fire alarm and detection system shall be a low voltage, direct current, zoned, closed circuit, electrically supervised, and Class A fire alarm and detection system. The system shall consist of fire alarm control panel, manual pull stations, smoke detectors, duct smoke detectors, heat detectors, end-of-line resistors, audio-visual devices, and all other necessary appurtenances.

The alarm system components shall be listed by U.L. or F.M. and the California State Fire Marshal.

SUBMITTALS.--

Product data.--Manufacturer's descriptive information and installation instructions shall be submitted for approval.

Installation instructions shall include brand name and catalog reference of equipment supplied, wiring diagrams, battery calculations, voltage drop calculations, riser diagrams and floor plans showing all devices and conduit and conductor sizes.

PART 2.- PRODUCTS

Fire alarm control panel.--

Fire alarm control panel shall be surface-mounted, locking cabinet, completely self-contained control panel suitable for 120-volt (ac), input power with separate terminals for all external wires and end-of-line resistors installed within the control panel.

The control panel shall conform to the following requirements:

Compatible with Radionics 6000 or 6500 receiver or equivalent;
Minimum 12 zones, expandable;
Digital dialer communicator;
Audible trouble signal, silencing switch and trouble pilot light;
Solid state, modular construction;
Fan shut down relays;
24-hour standby batteries, battery charger with automatic transfer on loss of utility company power and retransfer upon restitution of utility power;
Indicating lights for normal power failure, battery power failure, audible alarm, and silencing switch;
Low battery reporting.

Manual pull station.--

Manual pull station shall be single-action, non-coded, closed circuit, pull down type pull station mounted on a standard electrical outlet box. The manual pull station actuating contact shall function continuously until reset. The pull station shall have provisions for fire drill and testing and shall have integral LED light to indicate operation of the pull station.

Smoke detector.--

Smoke detector shall be ionization type detector with dual chamber with sensitivity control and plug-in detector head. One chamber shall be for detection and the other for changes in ambient parameters. The smoke detector shall have integral LED light to indicate operation of the smoke detector.

Duct-mounted smoke detector.--

Duct-mounted smoke detector inside the building shall an ionization type detector supplied by the air conditioning unit manufacturer. The detector housing shall incorporate an airtight smoke chamber in compliance with UL standards for smoke detectors for duct applications. Detector utilize a twist-in, twist-out detector head for easy removal and cleaning. Duct mounted smoke detector for the toll booth duct shall be 32 volt (DC) and shall be similar to the space smoke detector except it shall have the following additional features:

Sampling tube;
Uniform sensitivity between 150 meters to 940 meters per minute air velocity;
Test jack.
Remote test switch

Heat detector.--

Heat detector for automatic detection of fire shall be of compact and rugged construction employing rate-of-rise and fixed temperature methods of detecting fires. The heat detectors shall have twist-and-lock type plug-in detector head, and low profile.

Audio-visual device.--

Audio-visual device shall be vibrating type horn with flashing light and adjustable volume control with maximum audible output of 90 dB at 3 meters from the horn. Frequency of audio visual flash shall be not less than one flash per second.

Fan shutdown control panel.--

Fan shutdown control panel shall be suitable for the application and immediate shutdown of the air conditioning units upon detection of the fire or smoke. The voltage rating of the control panel and ampere rating of the auxiliary switching relays shall be as required for the particular application.

PART 3.- EXECUTION.--

INSTALLATION.--

General.--The fire alarm system shall be installed in accordance with the manufacturer's recommendations. No modification of the recommended alarm system type, components type, or replacement shall be made without prior written approval from the Engineer.

Fire alarm panel zoning.--Fire alarm panel zoning shall be as follows:

Zone 1: Main floor-West area
Zone 2: Main floor-North-east area
Zone 3: Main floor-South-east area
Zone 4: Lower floor-West area
Zone 5: Lower floor-East area
Zone 6: East Elevator area
Zone 7: Tunnel
Zone 8: Elevator room in tunnel
Zone 9: Valve indicator for fire line
Zone 10: Backflow preventer for fire line

Conduit and conductors.--Fire alarm system wiring shall be installed in conduits conforming to the requirements of "Basic Materials and Methods" elsewhere in these special provisions. Conduit size shall be as recommended by the fire alarm system manufacturers except that conduits shall be not less than 16 mm diameter, trade size. Within the whole main floor and all rooms in the lower floor except rooms with exposed ceiling, conduits shall be concealed in ceiling or walls. Conduit system in the tunnel shall be exposed as shown on the plans.

Conductors and cables for the fire alarm system shall be as recommended by the fire alarm system manufacturer.

FIELD QUALITY CONTROL.--

Testing.--The operational test for the fire alarm system shall be performed by the Contractor in the presence of the Engineer. The operational tests shall demonstrate that all functions of the system operate in the manner described in the manufacturer's literature and that the system is stable under normal vibration and shocks to components. The Contractor shall notify the Engineer in writing not less than 10 days in advance of performing the operational tests.

Monitoring.--The Contractor shall provide monitoring services for the facility for one year after the acceptance of the contract. The services shall include a toll-free telephone line connecting to the 24-hour on call monitoring station. Monitoring station shall contact designated site representative in the event of alarm and dispatch an immediate on-site response to the alarm location if the site representative cannot be reached or verification of the cause of the alarm cannot be determined.

Monitoring services after the first year will be handled by the State.

DEMONSTRATION.--

Training.--The Contractor shall provide minimum 2 hours of on-site training on the use, operation, and, maintenance of the system for not more than 6 designated State employees. The Contractor shall notify the Engineer in writing not less than 10 days in advance of proposed training class.

12-16.12 INTRUSION ALARM SYSTEM

PART 1.- GENERAL

SUMMARY.--

Scope.--This work shall consist of furnishing and installing a complete and operational intrusion alarm system in accordance with the details shown on the plans and these special provisions.

The system shall include all materials, whether mentioned or not, that are necessary for a complete and operational intrusion alarm system.

SYSTEM DESCRIPTION.--

Design requirements.--The intrusion alarm system shall be a low voltage, direct current, zoned alarm system, and shall consist of a control panel, magnetic contact switches, combination detectors, glass break discriminators, and manual keypad stations. Each zone shall be "supervised, Class B circuit." The end of line resistor shall be installed in the control panel.

The alarm system shall self-test and report status of individual zones.

The alarm system shall provide an automatically rechargeable back-up power supply system in case of building power interruption.

The alarm system components shall be U.L. or F.M. Listed. The system proposed shall be approved by the Federal Communication Commission (FCC).

Related work.—Attention is directed to the requirements specified under "Finish Hardware" in Section 12-8, "Finish Hardware," of these special provisions regarding door hardware equipment to be connected to the electrical system.

SUBMITTALS.--

Product data.--Manufacturer's descriptive information and installation instructions shall be submitted for approval.

Installation instructions shall include manufacturer and catalog reference, and model number of equipment to be furnished, conduit and conductor sizes, wiring diagram, and floor plan showing locations of multiple switch contact monitor and devices.

QUALITY ASSURANCE.--

Installer qualification.--The installer of the security alarm system shall be licensed by the State Department of Consumer Affairs, Bureau of Collection and Investigative Services. License numbers and expiration dates shall be included on all correspondence.

PART 2.- PRODUCTS

Intrusion Alarm Control panel.--

The intrusion alarm control panel shall be a surface-mounted, locking cabinet, completely self-contained control panel suitable for 120-volt (ac), input power with separate terminals for all external wires.

The control panel shall meet the following requirements:

Compatible with Radionics 9412B control panel or equivalent;
Minimum 12 zones, expandable;

Digital dialer communicator;
12-volt auxiliary power supply;
Rechargeable battery (8 hour minimum);
Battery charger;
Low battery reporting;
Silent alarm signaling;
System connected to RJ31X or RJ38X telephone jack or equivalent;
Line test every twenty-four (24) hours;
120-volt (ac), input;
Front accessible control and indication digital keypad;
UL listed for commercial use;
Remote control identification.

Magnetic contact switch.--

Magnetic door switch for pedestrian door shall be a 2-section, self-lock mounting type switch, and shall be compatible with the material of the door on which it is installed. The switch shall be epoxied in the switch housing. Magnetic contact switches shall be the type capable of being concealed on the top of the door frame.

Magnetic contact switches for the overhead vehicle doors shall be 2-section, extra heavy-duty, floor mounting type switch with stainless steel armored cable.

Switch shall be housed in a non-magnetic case.

Glass break discriminator.--

Glass break discriminator shall be an acoustic glass break detector with advanced technology for sensing and reporting simultaneous sound and shock wave activity. Detector shall respond to energy of breaking windows using piezo-electric crystal microphone. Sensor coverage pattern shall be directional, detecting breakage of uncovered glass in a 10.5 meters wide area at a distance of 3.5 meters minimum. The sensor shall be housed in a fire retardant ABS housing.

Digital card reader.--

Card reader shall be weatherproof, surface mounted, low voltage (12 V DC/24 V DC), vandal resistant device compatible with the control panel

Door release push button for the lobby door and vehicle door.--

Door release push button for the lobby door and vehicle door shall be a heavy duty push button in a flush mounted enclosure. Door release push button shall be the appropriate model for the recommended application and shall be compatible with the door control system that is provided.

PART 3. EXECUTION.--

INSTALLATION.--

General.--The intrusion alarm system shall be installed in accordance with the manufacturer's recommendations.

The switch section without wires shall be recessed flush into the top edge of the door at the approximate center of the door, and the switch section with wires shall be recessed flush in the top section of the door frame. The two sections of the switch shall be mounted directly opposite each other to provide maximum sensitivity. The wiring from each magnetic switch shall be run to the control panel in the zone dedicated for the intrusion alarm circuit.

The switch section mounted on the bottom edge of the overhead door shall be without wires. The switch section with wire shall be mounted on the floor directly below the switch part without wires. Magnetic contact switches for overhead doors shall be mounted.

The glass break discriminator shall be mounted on the ceiling at locations shown on the plans.

Combination detector shall be mounted at not less than 2.3 meters above finished floor at locations shown on the plans.

The lobby door shall be equipped with electric strike. One push of the door release push button shall release the lobby door and shall prevent the intrusion alarm system of being activated.

One push of the door release push button for the vehicle door shall bypass the magnetic contact switch and shall prevent the intrusion alarm from being activated. The vehicle door can then be operated with its factory supplied door operator control station.

Intrusion alarm zoning.--Intrusion alarm panel zoning shall be as follows:

Zone 1: Pedestrian access door into Sally Port area to include: One magnetic contact switch-pedestrian(item No. 1), one electric door strike (item No. 2) and one emergency egress door bar release (item No. 3).

Zone 2: Pedestrian access double doors from Sally Port area into Facility to include: One door release push button (item No. 4), two magnetic contact switches-pedestrian (items No. 5 and No. 6), two electric door strikes (items No. 7 and No. 8), two digital card readers (items No. 9 and No. 10) and two emergency egress door bar release (items No. 11 and No. 12).;

Zone 3: Vehicle access door into Sally Port area to include one No. magnetic contact switch-vehicle(item No. 13).

Zone 4: Pedestrian access door to Ready Room to include: two card readers (items No. 14 and No. 15); one electric strike (item No. 16); one emergency egress door bar release (item No. 17); one magnetic contact switch-pedestrian (item No. 18) and three door release push buttons (item No. 19).

Zone 5: Pedestrian access near the Operation Center Break Room to include : one magnetic contact switch-pedestrian (item No. 20).

Zone 6: Glass break discriminators in the southside offices to include: five glass break discriminators (items No. 21, No. 22, No. 23, No. 24 and No. 25).

Zone 7: Glass break discriminators in the northside rooms to include: three glass break discriminators (items No. 26, No. 27 and No. 28).

Zone 8: Pedestrian access door into stairwell area to include: two digital card readers (items No. 29 and No. 30); one electric door strike (items No. 31), one magnetic contact switch (item No. 32) and one emergency egress door bar release (item No. 33).

Zone 9: Pedestrian access door on the east side to include one magnetic contact switch-pedestrian (item No. 34).

Zone 10: Vault access door to include one magnetic contact switch (item No. 35).

Zone 11: Pedestrian access door into Observation Gallery to include: two digital card readers (items No. 36 and No. 37); one electric door strike (items No. 38), one magnetic contact switch (item No. 39) and one emergency egress door bar release (item No. 40).

Conduit and conductors.--All intrusion alarm system wiring shall be installed in conduit system conforming to the requirements under "Basic Materials and Methods" elsewhere in these special provisions. Conduit size shall be as recommended by the intrusion alarm manufacturer, except that conduits shall be not less than 16 mm diameter. Conduits shall be concealed in ceiling or walls.

All conductors and cables for the intrusion alarm system wiring shall be as recommended by the intrusion alarm system manufacturer.

All points of protection shall be specifically identified by zone when reporting to the intrusion alarm control panel. All points of protection shall be transmitted to the UL listed reporting company.

FIELD QUALITY CONTROL.--

Testing.--The operational test for the intrusion alarm system shall be performed by the Contractor in the presence of the Engineer. The operational tests shall demonstrate that all functions of the system operate in the manner described in the manufacturer's literature and demonstrate system stability under normal vibration and shocks to components. The Contractor shall notify the Engineer in writing not less than 10 days in advance of performing the operational tests.

Monitoring.--The Contractor shall provide monitoring services for the facility for one year after the acceptance of the contract. The services shall include a toll-free telephone line connecting to the 24-hour on call monitoring station. Monitoring station shall contact designated site representative in the event of alarm and dispatch an immediate on-site response to the alarm location if the site representative cannot be reached or verification of the cause of the alarm cannot be determined.

Monitoring services after the first year will be handled by the State.

DEMONSTRATION.--

Training.--The Contractor shall provide minimum 2 hours of on-site training on the use, operation, and maintenance of the system for not more than 8 designated State employees. The Contractor shall notify the Engineer in writing not less than 10 days in advance of proposed training class.

12-16.13 CLOSED CIRCUIT TELEVISION SYSTEM-SECURITY

GENERAL.--This work shall consist of furnishing and installing the closed circuit television (CCTV) system for security and surveillance in accordance with the details shown on the plans and these special provisions.

Closed circuit television system shall be color type consisting of cameras, zoom lenses, pan and tilt units, camera enclosures, transmitter/receiver control boxes, fiber optic transmitter/receiver control boxes, video and data receivers, distribution units, microprocessor master control units, microprocessor remote control unit, preset modules, video matrix switcher, multiplexer, monitors, video cassette recorders, external power supply, cables, connectors, harnesses and such other appurtenant equipment required by the CCTV manufacturer to install a complete system.

SUBMITTALS.--Manufacturer's descriptive information, catalog cuts, block diagram and installation instructions shall be submitted for approval. Block diagram shall include all the cables and components used in the system.

PRODUCTS AND EXECUTION.--

Camera.--

The camera assemblies shall be assembled and tested in accordance with these specifications prior to delivery to the jobsite. Factory testing documentation shall be furnished to the Engineer. Camera assemblies shall be delivered to the jobsite as a complete unit.

The camera shall meet or exceed the following specifications:

a. High resolution, solid state, 12.7 mm solid-state CCD (charged coupled device) color camera
b. Signal format shall be compatible with all applicable National Television Standards Committee, NTSC, and have 525 lines per frame, interlaced 2:1 per EIA-170 A standard.
c. Color balance shall be of the through-the-lens type, with less than 10 IRE units unbalance from 2850 to 5800°K.
d. Imaging system shall have Charged Coupled Device (CCD) solid-state image sensor. The minimum number of picture elements (NTSC) shall be 768(H) by 494(V) pixels. The image area shall be 6.4 mm by 4.8 mm.
e. Video output shall be 1.0 volt peak-to-peak ±3.0 dB (75 Ω unbalanced).
f. Minimum scene illumination necessary for full video output shall be 13 lux and a minimum of 1.1 lux for 80 percent video measured at the faceplate.
g. Camera resolution (NTSC) shall be a minimum of 460 horizontal television lines and a minimum of 350 vertical television lines when measured from the camera video output.
h. Signal-to-noise ratio with Automatic Gain Control (AGC) off shall be equal to or greater than 56 dB, Committee Consultation International Radio (CCIR) weighting.
i. Gamma shall be 0.45.
j. Camera shall operate on 115 V (ac), 60 Hz.
k. Camera shall be equipped with a standard "C" type lens mount and shall be designed to operate and interconnect with industry standard auto iris lenses.
l. Automatic Gain Control (AGC) shall have a range of 0 to 16 dB with an internal peak-average adjustment.
m. Camera shall be capable of integrating multiple frames for increased sensitivity.

The camera shall be specifically designed to operate under low light conditions and shall function satisfactorily over a wide range of dynamic lighting conditions ranging from low light to full sunlight.

The weatherproof type cameras shall have a built-in programmable electronic circuit character generator capable of superimposing a written camera identification message over the video display. The fixed indoor cameras shall have ID generator located at the video switcher. The identification shall be programmable up to two lines of 24 characters per line. Text characters shall be white with a black border 28 horizontal TV lines in height. The camera identification shall be input via an RS-422 connector to the camera housing programmable from a computer. The character generator shall also superimpose a message indicating that the camera pressure is low if the pressure in the enclosure drops to 1400 kg per m^2 and below.

Camera lens.--

The camera lens for all fixed cameras shall meet the following requirements:

Standard "C" type mount, 12.7 mm format.
Focal length shall allow overall view of the room or area as shown on the plans.
Maximum aperture of no less than F1.2.

The camera zoom lenses shall be motorized with automatic iris and manual override. The iris shall be controlled directly by the camera in automatic mode and from the control receiver in manual mode. Each lens shall incorporate an intra-spot neutral density filter and shall meet the following requirements:

Standard "C" type mount, 12.7 mm format.
Focal length of 8 to 48 mm providing a 6:1 power zoom ratio.
Maximum aperture of no less than F1.2.
All lens motors shall be slipclutch protected to prevent damage due to overload.

Camera enclosure.--

All cameras outside the main floor administration building and outside the toll booth enclosures shall be provided with weatherproof type camera enclosure. The weatherproof type enclosure shall be environmental type and shall be a sealed and pressurized cylindrical enclosure. The enclosure shall be provided with a mounting for attachment to the pan and tilt unit. The enclosure shall be fabricated from corrosion resistant aluminum and finished in a beige or neutral color of weather resistant enamel. The front of the enclosure shall be tempered glass. The enclosure shall be purged of air and pressurized with dry nitrogen to 34 ± 6 kPA. A standard Schrader valve shall be located on the back plane of the environmental enclosure for pressurizing and purging. A decal shall be affixed permanently to the rear housing plate stating that the unit is pressurized and that safety precautions must be observed. A pressure relief valve, preset to 138 ± 34 kPA shall be located on the back plate of the environmental enclosure. A safety pressure release bolt shall be incorporated such that the enclosure may not be opened without first releasing the internal pressure. Each housing shall have one package of desiccant placed in the enclosure. The camera connector for the environmental housing shall mount on the rear plate and seal to the plate with an O-Ring.

The complete camera assembly shall meet or exceed the following environmental specifications:

Temperature	-40 to +50°C
Humidity	100% relative humidity
Vibration	Swept 5-60 Hz, 2 mm amplitude: (15 G's at 60 Hz) Random 60-1000 Hz 5 G's RMS
Shock	Up to 30 G's, any axis under nonoperating condiitons. MIL-E-5400T, para 3.2.24.6
Sand & Dust	MIL-E-5400T, para 3.2.24.7
Fungus Salt	MIL-E-5400T, para 3.2.24.8
Atmosphere	MIL-E-5400T, para 3.2.24.9
Explosion	MIL-E-5400T, para 3.2.24.10
EMI	FCC Rules, part 15, subpart J, for Class A devices
Acoustic Noise	+150 dB

A sunshield shall be supplied and installed on all the camera's installed outside the administration building to protect the camera from direct sunlight. It shall be constructed in such a way as to allow the free passage of air between the housing and the shield, but shall not form a "sail" to place an excessive load on the pan and tilt unit in high winds.

Pan and tilt unit.--

The Contractor shall furnish and install a weatherproof pan and tilt unit which integrates a pan and tilt and a receiver/driver into one package at each camera site where shown on the plans. The integrated receiver/driver, contained within the pan and tilt unit, communicates with multiprocessor control units. All camera and pan and tilt functions are operable via RS-422 serial communications.

The pan and tilt unit shall be designed for use in all outdoor weather conditions. The pan and tilt unit shall be compatible with the transmitter/receiver control box, camera enclosures and the camera and lens assemblies provided under this contract.

The pan and tilt drive shall be a medium-duty, counterbalanced unit designed for operation with loads up to 16 kg. It shall include drive motors with factory lubricated, hardened-steel gear trains that require no field lubrication, and quad ring

seals with Teflon wear surfaces for protection in severe conditions. Operational stability with minimum shall be provided by self energizing brakes integral with the drive motors, or by solenoid-operated brakes.

The pan and tilt unit shall meet the following specifications:

1. The travel angle of the pan and tilt drive unit shall be 350 degrees minimum in the horizontal plane and ± 90 degrees in the vertical plane. Position of camera stops shall be approved by the Engineer.
2. The pan and tilt unit shall provide positional feedback through an internal potentiometer to accommodate preset positions, controlled from the multiprocessor control units and transmitter/receiver control box.
3. The pan and tilt unit shall pan at a nominal speed of 3 to 5 degrees per second.
4. The pan and tilt unit shall have instantaneous reverse motor action. Dynamic braking shall also be incorporated to prevent drift.
5. Heavy duty roller bearings shall be used on all rotating surfaces. All rotor gears shall be made from hardened steel and low temperature lubricant shall be used. Gasket seals shall be incorporated to ensure all-weather protection. All internal parts shall be corrosion protected.
6. Provision shall be made for mounting the weatherproof outdoor enclosure with the camera assembly to the Pan and Tilt unit at the correct pivot point.
7. The Pan and Tilt unit shall be capable of supporting a maximum load of 16 kg.
8. The Pan and Tilt unit shall be of the adjustable worm gear final drive type, to prevent drift and minimize backlash.
9. The Pan and Tilt unit shall be powered and controlled from the transmitter/receiver control box.
10. Input shall be 115 V (ac). Input power shall be 21 VA pan, 21 VA tilt.

All parts shall be corrosion-protected steel or aluminum. Finish shall be off-white baked enamel. Pan bearings shall be heavy duty ball bearings. Tilt bearings shall be oil tight bronze bushing. Gears shall be hardened steel. Seals shall be quad ring and gasket seals for all weather environmental protection. Ambient temperature range shall be from -23°C to +49°C. Overload protection shall be motor thermal on tilt, motor clutch protection on pan.

Any mounting adapter, necessary cables, brackets, connectors, potting sleeves, potting materials, and auxiliary materials required to install the pan and tilt unit shall be provided to suit the units furnished.

Transmitter/receiver control box.--

Transmitter/receiver control box shall be the equipment required to interface with the pan and tilt unit, camera, camera lens, environmental enclosure and microprocessesor control units.

Remote control command shall be sent by the microprocessors over cables as shown on the plans.

The receiver assembly shall have the following features:

SIGNAL INPUT/OUTPUT: 1.00 V p-p composite video.

LENS OUTPUTS: 12 V DC switched on command from the remote transmitter so as to allow the zoom and focus lens functions to operate over their entire range at the command of the operator.

CONNECTORS: For pan and tilt unit and camera shall be 37 pin AMP type, for video BNC type.

SUPPLY VOLTAGE: 115 V (ac), 60 Hz (±10 percent).

CAMERA POWER: As required.

CONSTRUCTION: Weatherproof NEMA Type 4 enclosure.

The transmitter/receiver control box shall be capable of storing a minimum of ten preset camera positions in a battery backed, non-volatile Random Access Memory (RAM).

Fiber optic transmitter/receiver control box.--

The fiber optic transmitter/receiver control box shall similar to the transmitter/receiver control box except that it shall be a include a fiber optic video /data transmitter/receiver (transceiver).

All fiber optic video/data transceivers shall meet the following requirements:

- Asynchronous, full duplex RS-232 communications
- One-way full-motion uncompressed video transmission or reception

- Pulse frequency modulation multiplexing
- External ST compatible fiber optic connector
- External female DB-25, DB-9 or terminal block RS-232 connector
- External female video 75-Ω BNC connector
- External indicator LED's for video and control signals
- Operating wavelength: 1300 nm multi-mode or 1310 nm single-mode per project requirements:

    - Minimum 13 dB power budget
    - Comply with EIA/TIA 250C Medium Haul Video Transmission

- Transceiver unit meets NEMA TS1-1989 environmental standards for power interruption, temperature and humidity, power service transients, input-output terminal transients, nondestruct transients, vibration, and shock. Conformance with equivalent environmental standards by other entities may be submitted for consideration.

The fiber optic video/data transceiver shall be installed into and become an integral part of the control system.

Fiber optic video transmitter control box.--

Fiber optic video transmitter control box shall be similar to the fiber optic video/data transmitter/receiver control box except that it shall only include the video transmitter portion.

The fiber optic video transmitter shall be installed into and become an integral part of the control system.

Cables.--

Units or assemblies which require 120-volt AC power for operation shall be furnished with an one meter long, 3-conductor power cable permanently affixed to its chassis or enclosure at one end in a manner so that it is fully protected from contact with metal edges. The chassis or the enclosure shall have a strain relief device to prevent strain on each internal connection to the power cable.

CCTV cables shall be video cables, data cables, fiber optic cables, power and coax cable assembly and hybrid cable assembly as shown on the plans. Types of cables shown shall be as shown on the plans and as recommended by manufacturer.

Video cable shall be a coaxial cable Type RG-59 with nominal impedance from 73 Ω to 75 Ω. All coaxial cables shall have a polyethylene dielectric with copper braid shield having a minimum of 95 percent shield coverage and not greater than 3.4 dB attenuation per 31 m at 100 MHz.

Data cable for the CCTV system shall be Type RS-422 cable or the type recommended by the CCTV manufacturer.

Fiber optic cables shall be as specified under "Fiber Optic Cable," elsewhere in these special provisions.

Power and coax cable assembly shall provide conductors for video and power transmission for fixed cameras. The cable assembly shall be the type recommended by the CCTV camera manufacturer and shall contain video and power conductors as a minimum. The cable assembly shall provide interconnection for all camera video output and camera input power.

Hybrid cable assembly shall provide all the conductors for control, video and power transmission for all cameras with zoom lens and pan and tilt units. The hybrid cable assembly shall be the type recommended by the CCTV camera manufacturer and shall contain the following video, power and control conductors as a minimum. The cable assembly shall provide interconnection for all pan and tilt drive signals, positional feedback, pan and tilt input power, camera video output and camera input power.

Connectors and harnesses.--

All external connections shall be made by means of connectors. The connectors shall be keyed to preclude improper hookups. All wires to and from the connectors shall be color coded and/or appropriately marked. In order to assure compatibility and performance compliance, the cables from the camera and pan and tilt unit shall be assembled by the camera manufacturer.

Connecting harnesses of appropriate length and terminated with matching connectors shall be provided for interconnection with the CCTV system equipment.

All pins and mating connectors shall be plated to provide good electrical connection and resist corrosion. Connectors utilizing solder type connections shall have each soldered connection covered by a piece of heat shrink tubing securely shrunk to insure that it protects the connection.

All connectors shall be provided and installed which are compatible with the CCTV equipment interface. Connectors shall be used for connections at the camera/lens enclosure and pan and tilt positioning system. All connector pins and mating connectors shall be plated to ensure good electrical connection and resist corrosion. Pressure tight multi-conductor cable connectors shall be used for camera connections.

Coaxial cable used for making video connections between devices at the CCTV master console, at the CCTV auxiliary console, at the Operation Center and at the Observation Room shall be of the RG-59 type with nominal impedance from 73 Ω to 75 Ω.

Video connectors shall be the BNC die crimp type. Coax braid shall be neatly trimmed before crimping the connector to insure no possibility of contact between braid and inner connector. There shall be no nicks in the center conductor. Crimps shall be mechanically secure and made in such a way that no braid is left exposed or protrudes from the connector. The center pin shall be gold plated and shall be installed with the tip of the center pin flush with the front edge of the connector.

Cables shall be neatly dressed and bundled with nylon cable ties. Each cable shall be marked with a unique identification number at a point 150 mm from each end of the cable. Numbering shall be done by applying a hard plastic, clamp-on, identification band with machine printed permanent black figures on white background. Thermal or inked ribbon, computer printed labels are not satisfactory. Identification shall read upright when holding the cable horizontally with the connector to the left. The finished identification number shall be protected with a piece of clear shrinkable tubing shrunk tightly over the label and extending at least 10 mm either side of the label. Each cabinet or rack shall contain a typed list showing the cabinet identification and the numbers, descriptions, course and destinations of all cables in that cabinet. The cable list shall be heat laminated to protect it from moisture and dirt and then permanently mounted to the inside of the door. The system schematic shall clearly identify all cables by number.

CCTV master and auxiliary console.--

The CCTV master console and auxiliary console shall include equipment racks with CCTV equipment as shown on the plans. The console shall accommodate a standard 483 mm rack mounted chassis units, shall be at least 711 mm deep and shall provide at least 2134 mm of vertical rack space.

The equipment rack shall include both front and rear mounting rails.

All equipment provided with this project except monitor shall be mounted in the equipment rack on ball bearing type slide mechanisms. The CCTV equipment shall be modular in design to allow major portions to be readily replaced in field. Modules and assemblies shall be clearly identified with name, model number and serial number to facilitate equipment maintenance.

Any unused space on the front of the equipment rack shall be closed with one or more filler panels attached to the mounting rails.

Ventilating louvers shall be provided to keep the equipment cool.

Microprocessor camera control system.--

Microprocessor camera control system shall be a microprocessor based processing unit designed to control all the cameras, lenses, pan and tilt units, and monitors as shown on the plans. The microprocessor camera control system shall include the video and data receivers, distribution panels, video matrix switcher, external power supply systems, microprocessor master control unit, microprocessor camera control preset modules and microprocessor camera remote control units.

The video and data transceivers shall be the appropriate units required for the CCTV equipment that is connected with fiber optic cables.

The distribution panel shall be a rack mountable distribution unit with EIA232 ports required for the system.

The video matrix switcher shall be a microprocessor-based crosspoint matrix switcher capable of automatically routing video signals from a requested camera position to a specified monitor. The switcher cage includes a power supply, an output amplifier, and a mother board. The switcher card cage also accommodates removable printed circuit boards, featuring plug-in connectors. One switcher card cage should be able to accommodate up to 128 cameras and 8 monitors. The initial switcher shall be configured for 96 inputs x 16 outputs. Multiple cages may be cascaded to create larger switching systems. Video inputs can be cascadable in increments of eight, in the form of video switcher cards with individual capacity of eight inputs per card. The card cage can accommodate up to 16 switcher cards. Outputs to monitors are eight per card cage.

The video input shall be high impedance looping, 2 V p-p maximum. The video output shall be 1 V p-p nominal into a 75 Ω load. The bandwidth shall be typical range from 50 Hz to 10 MHz. The frequency response shall be from 100 Hz to 5 MHz within a +0.5 dB range. The crosstalk isolation shall be typical range from 40 dB to 47 dB. The gain shall be unity. The differential gain/phase shall be less than 1.5 percent per 5 degrees. The hum and noise shall be 50 dB below 1 V p-p at 5 MHz. The video switcher frame control logic input shall be 5 V TTL, eight data bits per monitor output. Maximum power consumption for a fully loaded card cage (including 16 switcher cards and an address decoder) shall not exceed 55 W.

The microprocessor master control unit, microprocessor remote control units and preset modules serve as operator control units. The master control unit shall control a minimum of 96 cameras and will also control the video switcher. The master control unit shall be provided with a digital keypad to enter monitor or camera selection, sequence programming, sequence or hold commands, and system parameter programming. A numeric keypad shall be provided for camera and monitor selections. Front panel numeric displays shall be provided to indicate the camera and monitor selections. When a camera station is addressed, one or more simultaneous function commands may be selected (example: Pan left, tilt down,

zoom out, focus far). The control panel shall have switches for all camera power, pan and tilt, reset and lens functions. LED indicators shall be used to display camera and control panel power status. All switches shall be momentary lever or push button type except the pan and tilt switches which shall be in the form of a joystick. The joy stick shall be capable of moving the camera to the left, right, up or down positions. The zoom lens control shall have the following: Zoom: tele/wide; Focus: near/far and Iris: open/close. All switch legends shall be clearly marked on the panel.

Ten preset positions shall be provided for each camera. Push-button switches shall be provided for operator call-up and programming of presets and preset status display using LED indicators. These switches may be integral with the control panel.

The preset module shall provide push buttons for operator call -up and programming presets. LED's shall display status of preset conditions.

Multiplexer.--

The multiplexer shall be a multiple-channel duplex multiplexer, compatible with the camera furnished complete with cable connectors with multiple cameras video inputs, multiple display monitors and multiple VCR output. Video output characteristic shall be 1.0 V p-p to drive 75 Ω load.

Monitor.--

The monitors shall be high quality, high performance, 508 mm color raster-scan displays built to international standards. The video monitors shall be of cubic style, solid state design, with the exception of the picture tube and shall meet the following requirements:

Color System: NTSC.
Video Input Lines A/B: Composite video 1 V p-p, sync negative, 75 Ω (switchable), loop-through BNC connector.
VTR: S video - mini DIN 4-pin.
Y (luminance signal) – 1V p-p, sync negative 75 Ω terminated.
C (chrominance signal) - 0.286 V p-p (burst signal) 75 Ω terminated.
Composite video: 1 V p-p, sync negative, 75 Ω terminated.
Horizontal Resolution: 450 lines or better.
Linearity: horizontal: +/- 5 percent, vertical: +/- 5 percent.
Scanning: 2:1 interlaced 525 lines/frame, 30 frames per second per EIA-170a standard, scanning rate 60 Hz vertical and 15,750 Hz horizontal.
Control functions: front touch panel controls, illuminated only in adjustment mode: power on/off, contrast, brightness, horizontal hold (if used), vertical hold (if used), color (chroma), hue (tint or phase), input signal source selection and volume sound control.

Integral means shall be provided for degaussing, either automatically at power-up or manually by means of an external push-button.

CCTV monitor at the Operation Center shall be ceiling mounted as shown on the plans. Mounting hardware and accessories necessary for proper mounting shall be provided. Monitor in the Duty Office shall be mounted in the master console. Monitor in all other locations shall be desk mounted.

Video cassette recorder.--

Video cassette recorder, VCR, shall be event-alarm, lapse time triple density recorder. The video cassette recorder shall meet the following electrical requirements:

Video recording system:
Rotary heads – 4 rotary heads, helical scan for standard recording and playback, 1 for special effect playback.
Luminance - FM recording.
Color - rotary phase, converted subcarrier, direct recording.
Selectable speeds (recording & playback): 6, 18 and 30 hours with T-120 tape.
Highspeed video scan: 6 hours x 3, x 5, x 7, x 9.
RS-232 port.

Video:
Signal format - EIA standard. 525 line, 60 fields/sec.
NTSC color/monochrome auto select.
Input - 1.0 V p-p, 75 Ω, unbalanced.
Output - 1.0 V p-p, 75 Ω, unbalanced.

Horizontal resolution:
Monochrome - 400 lines.
Color - 240 lines.
Signal to noise: better than 45 dB.

External power supply.--

External power supply shall be the type and size suitable for all the units mounted on the console. External power supply shall be rack mountable type.

Fiber distribution unit.--

Fiber distribution unit (FDU) shall be as specified under "Fiber Optic Cable," elsewhere in these special provisions.

INSTALLATION

CCTV system shall be installed as shown on the plans. Cameras and monitors shall be adjusted for both day and night operations. The Contractor shall submit the installation and mounting details of the cameras.

The system shall be installed at locations shown on the plans and by methods recommended by the manufacturers. The Contractor shall provide all supports, fasteners and other hardware necessary to support the units.

The equipment mounted in the master and auxiliary consoles shall be modular in design to allow major portions to be readily replaced in the field. Modules of unlike functions shall be mechanically keyed to prevent insertion into the wrong socket or connector. All modules and assemblies shall be clearly identified with name, model number serial number and any other pertinent information required to facilitate equipment maintenance.

TRAINING

The Contractor shall provide minimum 4 hours of on-site training on the use, operation, and maintenance of the system for not more than 8 designated State employees. The Contractor shall notify the Engineer in writing not less than 10 days in advance of proposed training class.

TESTING AND DOCUMENTATION

Prior to conducting any tests the Contractor shall provide the Engineer detailed test procedures for review and approval.

Documentation of all test results shall be provided to the Engineer for review and approval. System documentation shall incorporate test results for ongoing maintenance and performance measurements.

Factory tests.--All CCTV equipment furnished by the Contractor shall be tested and subjected to a nominal 48-hour burn-in period at the factory. The factory tests shall be in accordance with equipment manufacturer's standard procedures and quality assurance program. The system shall be bench tested as a whole system at the factory before shipping to the jobsite. The Contractor shall supply documentation showing all factory integration bench testing.

The Contractor shall provide documentation certifying and showing that each item supplied has passed factory inspection, burn-in and testing.

Post installation testing.--The Contractor shall test each item after installation to ensure that the equipment has been installed without damage and operates correctly.

CCTV system location tests.--The Contractor, after installation of each camera location with pan and tilt drive, shall verify the correct operation of the camera, lens, pan and tilt drive unit, and the weatherproof outdoor enclosure accessories from the cabinet location. These tests shall include:

1. Viewing video images as the lens focal lengths and apertures of the lens is varied. The Contractor shall verify that the camera is focused after each change.
2. Verifying the correct operation of the auto iris, power zoom and imager protection features.
3. Verifying the correct operation of the pan and tilt unit. The pan and tilt stops shall be such that the camera viewing coverage of the area is optimized as directed by the Engineer.

Multiprocessor camera control location tests.--The Engineer, after installation of the CCTV security, shall verify the correct operation of the camera, pan and tilt drive units, weatherproof housing accessories from the CCTV multiprocessor camera control locations. These tests shall be conducted at the Duty Office, Operation Center and Observation Room locations. These tests shall include:

1. Viewing video images as the lens focal lengths and apertures of the lens is varied from the multiprocessor camera control, master and remote locations. The Contractor shall verify that the camera is focused after each change.
2. Verifying the correct operation of the auto iris, power zoom and imager protection features from the multiprocessor camera control, master and remote locations.
3. Verifying the correct operation of the pan and tilt unit from the multiprocessor camera control, master and remote locations.
4. Verifying the correct operation of the preset panel. The multiprocessor camera control units shall position the corresponding cameras at the preset position.
5. Verifying the correct operation of the switcher. The switcher shall switch any of the chosen composite video input signals to any one of the chosen composite video outputs without blocking other users.

Final systems test.--In the presence of the Engineer, the Contractor shall conduct a final test of the CCTV system for security to verify the system is complete and fully operational. The Contractor shall conduct end to end performance tests on the CCTV system. These tests shall confirm the functional operation of all elements of the system and shall include measurements of the system performance.

Each camera shall be tested to measure the video signal received using a NTSC waveform monitor. The testing shall confirm video levels and signal to noise ratio specification compliance for daytime and nighttime operation at each of the camera locations. The pan and tilt shall be functionally tested over 350 degrees in the horizontal plane and ± 90 degrees in the vertical plane. Functional testing shall also confirm specification compliance for the lens operation, the auto and manual iris control, and the camera controller receiver and transmitter.

12-16.14 FIBER OPTIC CABLE FOR CLOSED CIRCUIT TELEVISION SECURITY SYSTEM

Fiber optic (FO) cable for closed circuit television (CCTV) security system shall conform to the details shown on the plans and these special provisions

GENERAL

Each fiber optic cable for fixed cameras at the toll booths, tunnel, courtyard canopy and toll booth canopy for this project shall be all dielectric, gel filled or water-blocking material, duct type, with loose buffer tubes and shall conform to these special provisions. Fiber optic cables shall be with singlemode fibers and shall contain 2 singlemode (SM) dual-window (1310 nm and 1550 nm) fibers unless otherwise specified. Fiber optic cables for cameras with zoom lens and pan and tilt unit at the toll booth canopy, tunnel and courtyard canopy shall be similar except it shall have 4 singlemode fibers. The optical fibers shall be contained within loose buffer tubes. The loose buffer tubes shall be stranded around an all dielectric central member. Aramid yarn and/or fiberglass shall be used as a primary strength member, and a polyethylene outside jacket shall provide for overall protection.

Fiber optic cable for connection in between the patch panel in the fiber distribution unit and the CCTV main console unit shall be similar except it shall be of the tight buffer construction type and each cable shall contain 60 single mode (SM) dual-window (1310 nm and 1550 nm) fibers.

All fiber optic (F/O) cable on this project shall be from the same manufacturer, who is regularly engaged in the production of this material.

The cable shall be qualified as compliant with RUS Federal Rule 7CFR1755.900.

CABLE TYPE	DESCRIPTION
A	2SMFO
B	4SMFO
C	6SMFO
D	8SMFO
E	12SMFO
F	24SMFO
G	36SMFO
H	48SMFO
J	60SMFO
K	72SMFO
L	144SMFO

Fiber Characteristics

Each optical fiber shall be glass and consist of a doped silica core surrounded by concentric silica cladding. All fibers in the buffer tube shall be usable fibers, and shall be sufficiently free of surface imperfections and occlusions to meet the optical, mechanical, and environmental requirements of these specifications. The required fiber grade shall reflect the maximum individual fiber attenuation, to guarantee the required performance of each and every fiber in the cable.

The coating shall be a dual layered, UV cured acrylate. The coating shall be mechanically or chemically strippable without damaging the fiber.

The cable shall comply with the optical and mechanical requirements over an operating temperature range of -40°C to +70°C. The cable shall be tested in accordance with EIA-455-3A (FOTP-3), "Procedure to Measure Temperature Cycling Effects on Optical Fiber, Optical Cable, and Other Passive Fiber Optic Components." The change in attenuation at extreme operational temperatures (-40°C to +70°C) for singlemode fiber shall not be greater than 0.20 dB/km, with 80 percent of the measured values no greater than 0.10 dB/km. The singlemode fiber measurement shall be made at 1550 nm.

For all fibers the attenuation specification shall be a maximum attenuation for each fiber over the entire operating temperature range of the cable.

Singlemode fibers within the finished cable shall meet the requirements in the following table:

Fiber Characteristics Table	
Parameters	Singlemode
Type	Step Index
Core diameter	8.3 µm (nominal)
Cladding diameter	125 µm ±1.0 µm
Core to Cladding Offset	≤0.8 µm
Coating Diameter	250 µm ±15 µm
Cladding Non-circularity defined as: [1-(min. cladding dia ÷max. cladding dia.)]x100	≤1.0%
Proof/Tensile Test	345 Mpa, min.
Attenuation: (-40(C to +70(C) @1310 nm @1550 nm	 ≤0.4 dB/km ≤0.3 dB/km
Attenuation at the Water Peak	≤2.1 dB/km @ 1383 ±3 nm
Chromatic Dispersion: Zero Dispersion Wavelength Zero Dispersion Slope	 1301.5 to 1321.5 nm ≤0.092 ps/(nm2*km)
Maximum Dispersion:	≤3.3 ps/(nm*km) for 1285 – 1330 nm <18 ps/(nm*km) for 1550 nm
Cut-Off Wavelength	<1260 1250 nm
Mode Field Diameter (Petermann II)	9.3 ±0.5 µm at 1300 nm 10.5 ±1.0 µm at 1550 nm

Color Coding

In buffer tubes containing multiple fibers, each fiber shall be distinguishable from others in the same tube by means of color coding according to the following:

1. Blue (BL)
2. Orange (OR)
3. Green (GR)
4. Brown (BR)
5. Slate (SL)
6. White (WT)
7. Red (RD)
8. Black (BK)
9. Yellow (YL)
10. Violet (VL)
11. Rose (RS)
12. Aqua (AQ)

Buffer tubes containing fibers shall also be color coded with distinct and recognizable colors according to the same table listed above for fibers.

These colors shall be targeted in accordance with the Munsell color shades and shall meet EIA/TIA-598 "Color Coding of Fiber Optic Cables."

The color formulation shall be compatible with the fiber coating and the buffer tube filling compound, and be heat stable. It shall not fade or smear or be susceptible to migration and it shall not affect the transmission characteristics of the optical fibers and shall not cause fibers to stick together.

Cable Construction

1. The fiber optic cable shall consist of, but not be limited to, the following components:

   A. Buffer tubes
   B. Central member
   C. Filler rods
   D. Stranding
   E. Core and cable flooding
   F. Tensile strength member
   G. Ripcord
   H. Outer jacket

2. Buffer Tubes

Clearance shall be provided in the loose buffer tubes between the fibers and the inside of the tube to allow for expansion without constraining the fiber. The fibers shall be loose or suspended within the tubes. The fibers shall not adhere to the inside of the buffer tube. Each buffer tube shall contain a maximum of 12 fibers.

The loose buffer tubes shall be extruded from a material having a coefficient of friction sufficiently low to allow free movement of the fibers. The material shall be tough and abrasion resistant to provide mechanical and environmental protection of the fibers, yet designed to permit safe intentional "scoring" and breakout, without damaging or degrading the internal fibers.

Buffer tube filling compound shall be a homogeneous hydrocarbon-based gel with anti-oxidant additives and used to prevent water intrusion and migration. The filling compound shall be non-toxic and dermatologically safe to exposed skin. It shall be chemically and mechanically compatible with all cable components, non-nutritive to fungus, non-hygroscopic and electrically non-conductive. The filling compound shall be free from dirt and foreign matter and shall be readily removable with conventional nontoxic solvents.

Buffer tubes shall be stranded around a central member by a method, such as the reverse oscillation stranding process, that will prevent stress on the fibers when the cable jacket is placed under strain.

3. Central Member

The central member which functions as an anti-buckling element shall be a glass reinforced plastic rod with similar expansion and contraction characteristics as the optical fibers and buffer tubes. To ensure the proper spacing between buffer tubes during stranding, a symmetrical linear overcoat of polyethylene may be applied to the central member to achieve the optimum diameter.

4. Filler Rods

Fillers may be included in the cable to maintain the symmetry of the cable cross-section. Filler rods shall be solid medium or high density polyethylene. The diameter of filler rods shall be the same as the outer diameter of the buffer tubes.

5. Stranding

Completed buffer tubes shall be stranded around the overcoated central member using stranding methods, lay lengths and positioning such that the cable shall meet mechanical, environmental and performance specifications. A polyester binding shall be applied over the stranded buffer tubes to hold them in place. Binders shall be applied with sufficient tension to secure the buffer tubes to the central member without crushing the buffer tubes. The binders shall be non-hygroscopic, non-wicking (or rendered so by the flooding compound), and dielectric with low shrinkage.

6. Core and Cable Flooding

The cable core interstices shall contain a water blocking material, to prevent water ingress and migration. The water blocking material shall be either a polyolefin based compound which fills the cable core interstices, or an absorbent polymer, which fills voids and swells to block the ingress of water. The flooding compound or material shall be homogeneous, non-hygroscopic, electrically non-conductive, and non-nutritive to fungus. The compound or material shall also be nontoxic, dermatologically safe and compatible with all other cable components.

7. Tensile Strength Member

Tensile strength shall be provided by high tensile strength aramid yarns and/or fiberglass which shall be helically stranded evenly around the cable core and shall not adhere to other cable components.

8. Ripcord

The cable shall contain at least one ripcord under the jacket for easy sheath removal.

9. Outer Jacket

The jacket shall be free of holes, splits, and blisters and shall be medium or high density polyethylene (PE), or medium density cross-linked polyethylene with minimum nominal jacket thickness of 1 mm ±0.076 mm. Jacketing material shall be applied directly over the tensile strength members and water blocking material and shall not adhere to the aramid strength material. The polyethylene shall contain carbon black to provide ultraviolet light protection and shall not promote the growth of fungus.

The jacket or sheath shall be marked with the manufacturer's name, the words "Optical Cable", the number of fibers, "SM", year of manufacture, and sequential measurement markings every meter. The actual length of the cable shall be within -0/+1 percent of the length marking. The marking shall be in a contrasting color to the cable jacket. The height of the marking shall be 2.5 mm ±0.2 mm.

General Cable Performance Specifications

The FO cable shall withstand water penetration when tested with a one meter static head or equivalent continuous pressure applied at one end of a one meter length of filled cable for one hour. No water shall leak through the open cable end. Testing shall be done in accordance with EIA-455-82 (FOTP-82), "Fluid Penetration Test for Fluid-Blocked Fiber Optic Cable."

A representative sample of cable shall be tested in accordance with EIA/TIA-455-81 (FOTP-81), "Compound Flow (Drip) Test for Filled Fiber Optic Cable". No preconditioning period shall be conducted. The cable shall exhibit no flow (drip or leak) at 70°C as defined in the test method.

Crush resistance of the finished FO cables shall be 220 N/mm applied uniformly over the length of the cable without showing evidence of cracking or splitting when tested in accordance with EIA-455-41 (FOTP-41), "Compressive Loading Resistance of Fiber Optic Cables". The average increase in attenuation for the fibers shall be ≤0.10 dB at 1550 nm (singlemode) for a cable subjected to this load. The cable shall not exhibit any measurable increase in attenuation after removal of load. Testing shall be in accordance with EIA-455-41 (FOTP-41), except that the load shall be applied at the rate of 3 mm to 20 mm per minute and maintained for 10 minutes.

The cable shall withstand 25 cycles of mechanical flexing at a rate of 30 ±1 cycles/minute. The average increase in attenuation for the fibers shall be ≤0.20 dB at 1550 nm (singlemode) at the completion of the test. Outer cable jacket cracking or splitting observed under 10x magnification shall constitute failure. The test shall be conducted in accordance with EIA-455-104 (FOTP-104), "Fiber Optic Cable Cyclic Flexing Test," with the sheave diameter a maximum of 20 times the outside diameter of the cable. The cable shall be tested in accordance with Test Conditions I and II of (FOTP-104).

The cable shall withstand 20 impact cycles, with a total impact energy of 5.9 N•m. Impact testing shall be conducted in accordance with TIA/EIA-455-25B (FOTP-25) "Impact Testing of Fiber Optic Cables and Cable Assemblies." The average increase in attenuation for the fibers shall be less than 0.20 dB at 1550 nm for singlemode fiber. The cable shall not exhibit evidence of cracking or splitting.

The finished cable shall withstand a tensile load of 2700 N without exhibiting an average increase in attenuation of greater than 0.20 dB (singlemode). The test shall be conducted in accordance with EIA-455-33 (FOTP-33), "Fiber Optic Cable Tensile Loading and Bending Test." The load shall be applied for one-half hour in Test Condition II of the EIA-455-33 (FOTP-33) procedure.

LABELING

General

The Contractor shall label all fiber optic cabling in a permanent consistent manner. All tags shall be of a material designed for long term permanent labeling of fiber optic cables and shall be marked with permanent ink on non-metal types, or embossed lettering on metal tags. Metal tags shall be constructed of stainless steel. Non-metal label materials shall be approved by the Engineer. Labels shall be affixed to the cable per the manufacturer’s recommendations and shall not be affixed in a manner which will cause damage to the fiber. Handwritten labels shall not be allowed.

Label Identification

Each cable shall display one unique identification, regardless of where the cable is viewed. The begin function and end function correspond to the end points of each cable. The order of the begin and end function follow a hierarchy as listed below, where the lowest number corresponding to the begin/end function is listed first.

Example : TB1FXCAM

This cable is identified as a singlemode fiber optic cable containing 6 fibers for toll booth 1, fixed camera. In this case, no additional digits are necessary for a unique ID. This is an example for a drop cable.

Patch Panels

The cable jackets shall be clearly labeled at entry to the patch panel in the fiber distribution unit in accordance with the unique identification code element method described elsewhere in these special provisions. In addition, each fiber shall be labeled with the fiber ID and pigtails shall be labeled at the connector with the fiber ID. The patch panel shall be clearly labeled with the cable ID on the face of the panel. If multiple cables are connected to the patch panel, each block of connectors relating to each individual cable shall be clearly identified by a single label with the cable ID. Individual connections shall be clearly marked on the face of the panel in the designated area with the fiber ID.

CABLE INSTALLATION

Installation procedures shall be in conformance with the procedures specified by the cable manufacturer for the specific cable being installed. The Contractor shall submit the manufacturer's recommended procedures for pulling fiber optic cable at least 20 working days prior to installing cable. Mechanical aids may be used provided that a tension measuring device, and a break away swivel are placed in tension to the end of the cable. The tension in the cable shall not exceed 2225 N or the manufacturer's recommended pulling tension, whichever is less.

During cable installation, the bend radius shall be maintained at a minimum of twenty times the outside diameter. The cable grips for installing the fiber optic cable shall have a ball bearing swivel to prevent the cable from twisting during installation.

FO cable shall be installed using a cable pulling lubricant recommended by the FO cable. Contractor's personnel shall be stationed at each camera location and FDU through which the cable is to be pulled to lubricate and prevent kinking or other damage.

FO cable shall be installed without splices.

FIBER OPTIC CABLE TERMINATIONS

General

Fiber optic cable entering the building shall be routed as described in these special provisions and as shown on the plans. The cable shall continue within the conduit to the patch panel in the fiber distribution unit as shown on the plans.

Cable Termination

At the FDU, the cable jacket of the cable entering the building shall be removed exposing the aramid yarn, filler rods, and buffer tubes. The exposed length of the buffer tubes shall be at least the length recommended by the FDU manufacturer which allows the tubes to be secured to the patch panel. Termination to the patch panel shall be as recommended by the manufacturer.

When applicable, moisture blocking gel shall be removed from the exposed buffer tubes and fibers. The transition from the buffer tube to the bundle of jacketed fibers shall be treated by an accepted procedure for sleeve tubing, shrink tube and silicone blocking of the transition to prevent future gel leak. Manufacturer directions shall be followed to ensure that throughout the specified temperature range gel will not flow from the end of the buffer tube. The individual fibers shall be stripped and prepared for splicing.

All fibers inside a fiber optic cable entering the fiber distribution unit (FDU) shall be terminated and labeled. A transition shall then be made, with flexible tubing, to isolate each fiber to protect the individual coated fibers. The final transition from bundle to individual fiber tube shall be secured with an adhesive heat shrink sleeve.

Fiber Distribution Unit

The Contractor shall install all components to terminate the incoming fiber optic communication cables.

The fiber distribution unit (FDU) shall include the following:

1. A patch panel to terminate the appropriate number of singlemode fibers
2. Connectors as required to complete the connection of the outside plant cables to the inside plant cables.

Cable connectors at the patch panel shall be the type recommended by the fiber optic cable manufacturer. Cable assemblies and connectors at each camera location shall be compatible with the terminations at the fiber optic video and data transmitter/receiver units provided by the CCTV system manufacturer.

Strain relief shall be provided for the incoming fiber optic cable. Cable accesses shall have rubber grommets or similar material to prevent the cable from coming in contact with bear metal. All fibers shall be terminated and individually identified in the FDU and on the patch panel.

The patch panel shall be hinged or have coupler plates to provide easy access and maintenance. Brackets shall be provided to spool the incoming fiber a minimum of two turns, each turn shall not be less than 300 mm, before separating out individual fibers to the splice tray.

The FDU shall be 482 mm rack mountable.

12-16.15 COMMUNICATION SYSTEM

GENERAL.--This work shall consist of furnishing and installing a communication system in accordance with the details shown on the plans and these special provisions.

The communication system shall be an intercom system, a private telephone system and a public telephone system as shown on the plans and specified in these special provisions.

The intercom system shall provide clear, noise-free 2-way communication between the master station located at the Operation Center and the speaker stations located as shown on the plans. The intercom system shall require power for operation only at the master station. Hands free operation shall be provided at each speaker station at the toll booths with the same loudspeaker used for message reception and talk-back.

The private telephone system shall be a completely self-contained system, providing automatic selection of 50 telephones. The private telephone switchboard will be State-furnished as provided under "State-Furnished Materials" in Section 8, "Materials," of these special provisions.

The public telephone system shall include outlets, conduits, cables and a telephone terminal board for connection to the public telephone and a future data system.

SUBMITTALS.--Manufacturer's descriptive information, catalog cuts and installation instructions shall be submitted for approval.

PRODUCTS.--

Intercom master station.--

Intercom master station shall be a minimum 40-call master station utilizing microprocessor technology. Power consumption shall be 45 watts maximum from a 120-V (ac), 60 Hz source. The master station shall be able to simultaneously call all speaker stations in the system. A booster amplifier shall be provided for increasing volume when all the stations are connected simultaneously. The master station shall be able to receive calls from any of the toll booth stations. Origination of a call from a toll booth to the master station shall be made by momentarily depressing a push button which will give an audible tone and a light emitting diode, LED, indication at the master intercom station. Each selector bar at the master station shall be identified. The audible tone shall sound only when the push button is depressed but the LED light shall remain on until the call is acknowledged. When contact is established with the station being called, it shall be impossible for any other station in the system to overhear or interrupt the conversation. The master intercom station shall be equipped with heavy duty switches for long life. The master intercom station shall be compatible with the 8-Ω speakers installed for the system.

Intercom push button.--

Intercom push buttons shall be a 120-volt, AC, 3-ampere momentary contact, normally open push button with screw terminals in a flush mounted NEMA Type 1 enclosure.

Speaker.--

Speakers in the toll booths and inside the building shall be a 102 mm diameter, 8-Ω flush mounted speaker with round recessed baffles. Power rating shall be 15-watt minimum. Speaker shall be equipped with factory-wired 25-volt transformer and recessed grilled.

The speaker recessed grille shall be fabricated from perforated, cold rolled steel and shall be matte black. The baffle housing shall be satin white. The baffle interior shall be coated with sound deadening material and lined with jute to prevent mechanical and acoustical resonance. Welded studs shall be provided to facilitate mounting of the speaker.

Speaker with push button.--

Speaker with push button on a post at Sally Port area shall be weatherproof type intercom station complete with speaker and push button. Intercom station shall have an environment-resistant, water sealed, 8-Ω compression driver and call switch for call-in capability. Push button shall be a momentary action, heavy duty push button with a contact rating of not less than 3 amperes. Push button shall be protected with a weather-resistant rubber boot. Power rating shall be 15-watt minimum with a 25-volt transformer to adjust power requirements.

Private telephone switchboard.--

Private telephone switchboard will be State-furnished as provided under "State-Furnished Materials" in Section 8, "Materials," of these special provisions. The State-furnished private telephone switchboard will be Mitel's Model Number SX-20.

Private telephone set.--

Private telephone set shall consist of a handset with coiled retractile cord, cradle and high efficiency transmitter and receiver of commercial quality. The handset shall be made of tough, thermoplastic material in a sand beige color with matching color retractile cord. The cradle shall be made of tough, thermoplastic material and shall contain the double-pole, double throw way action hookswitch assembly. The handset cradle shall be mounted on a flush-mounted steel plate with brushed-satin chrome finish. The private telephone handset shall be compatible with the State-furnished private telephone switchboard Mitel SX-20.

Public communication outlet and private telephone outlet boxes.--

Public communication outlet boxes and private telephone outlet boxes shall be 102 mm square boxes complete with plates with modular type communication outlets. Boxes on stud walls shall have plaster ring. Types of jacks for the communication outlet boxes shall be as shown on the plans. Data jacks shall be 8-wire, RJ45 unkeyed data jacks, Category 5 complaint TIA/EIA 568A standard pin out. Telephone jacks for the public telephone system shall be 8-wire, RJ11 jacks. Telephone jacks for the private telephone system shall be compatible with the private telephone handset provided. Blank outlets shall have blank covers.
Plates for flush mounting outlets in finished room shall be Type 430 stainless steel, 1 mm thick with satin finish.

Cables.--

All interconnecting cable for the intercom systems, speaker cables and intercom cables, shall be furnished and installed and contain an adequate number of wires to satisfactorily perform all the specified functions with the equipment supplied. A separate plastic-jacketed shielded cable shall be used to connect each speaker station to the master station, with individual color-coded insulated stranded tinned conductors not smaller than No. 18 AWG. Individual insulation shall be not less than 300-volt rating.

Telephone cable for the private telephone system and for telephone cable outside the Operations Building shall be 2-pair, No. 22 AWG stranded tinned copper with 0.203 mm minimum thickness polypropylene insulation. Each pair shall be individually shielded by an aluminum-polyester shield. The shielded pairs and a No. 24 AWG stranded tinned copper common drain wire shall be covered with a 0.483 mm minimum thickness vinyl jacket. Conductor pairs shall be color coded black-red and green-white.

Data cable for the future data system and telephone cable for the public telephone system inside the Operations Building shall be each a Category 5, 4-pair, No. 24 AWG, unshielded twisted pair, low loss, extended frequency data cable and shall conform to TIA/EIA 568A Commercial Telecommunications Building Standards, Horizontal Cable Section and be part of UL ® Law Certifications and Follow-up program. Application standards supported should include, but not limited to IEEE 802.3, 10BASE-T and IEEE 802.5 (4 or 16 Mbps). In addition, cables shall be capable of supporting evolving high-end applications such as 10BASE-T and 155 Mbps ATM systems and shall meet or exceed the electrical specifications listed below:

DC resistance	9.3 Ω/100 m, maximum
DC resistance unbalance	5 percent, maximum
Mutual capacitance at 1 kHz	4.6 nF/100 m, maximum
Capacitance unbalance (pair to ground	131.2 pF/100 m
Characteristic impedance	100 Ω +/- 15 Ω from 1 to 100 MHz

Telephone terminal boards.--

Private telephone terminal board and public telephone terminal board shall be 19 mm, APA plywood panels, C-D PLUGGED and touch-sanded, Exposure 1. Punchdown blocks shall be provided on the telephone terminal boards. Quantity of punchdown blocks shall be suitable for all the cables that are shown terminated plus at least 10 percent for future expansion.

EXECUTION.--

The system shall be installed at locations as shown on the plans and by methods recommended by the manufacturer. The Contractor shall provide all supports, fasteners and other hardware necessary to support the units.

FIELD QUALITY CONTROL.--

Testing.--The operational test for the communication system shall be performed by the Contractor in the presence of the Engineer. The operational tests shall demonstrate that all functions of the system operate in the manner described in the manufacturer's literature and demonstrate system stability under normal vibration and shocks to components. The Contractor shall notify the Engineer in writing not less than 10 days in advance of performing the operational tests.

State-furnished equipment that fail during the functional test period will be replaced or repaired by the State or, if directed by the Engineer, by the Contractor, and such work will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

12-16.16 SURVEILLANCE SYSTEM

GENERAL.--This work shall consist of furnishing and installing a surveillance system for toll booths in accordance with the details shown on the plans and these special provisions.

The surveillance system shall provide a monitoring system between the Observation Room and at each toll booth location. The surveillance system shall be a one-way live audio surveillance system. The surveillance system shall consists of a master surveillance station and microphones per each toll booth location.

PRODUCTS.--

Cables.--

Microphone cable for the surveillance system shall be 2-pair, No. 22 AWG stranded tinned copper with 0.203 mm minimum thickness polypropylene insulation. Each pair shall be individually shielded by an aluminum-polyester shield. The shielded pairs and a No. 24 AWG stranded tinned copper common drain wire shall be covered with a 0.483 mm minimum thickness chrome vinyl jacket.

Surveillance microphone.--

Surveillance microphone shall be ceiling mounted, omni directional, low impedance, electret condenser microphone with built-in preamplifier. Microphone element shall be mounted at the end of the extension cable and flush mounted at the toll booth ceiling. Normal pick-up pattern shall be approximately 4.5 m from the microphone location. The microphone shall be compatible with master station that is provided. The microphone shall comply with the following requirements:

Sensitivity (microphone element)	-65 dB +/- 4 dB
Frequency response	40 Hz to 15 kHz +/- 1 dB
Output impedance	600 Ω unbalanced
Current drain	4 mA
Line level output	0 dB at 1000 Ω

Surveillance master station.--

Surveillance master station shall include an audio base station and an amplifier for audio monitoring. Audio base station shall be a minimum 25 zone sound activated audio surveillance station. The base station shall be provided with push buttons for zone activation and power supply for the 12 V, DC power requirements for the microphones. The amplifier shall be a companion unit that is routinely advertised, guaranteed and supplied by the base station manufacturer. The amplifier shall comply with the following requirements:

Frequency response	100 Hz to 15 kHz +/- 3 dB
Output impedance	10 kΩ
Power input	120 V (ac), 2 A

The amplifier shall contain a 2-watt audio monitor with volume control. A headphone jack shall be provided for private listening. Input and output jacks shall be provided for connection to a future recorder.

EXECUTION.--The system shall be installed at locations as shown on the plans and by methods recommended by the manufacturer.

The Contractor shall provide all supports, fasteners and other hardware necessary to support the units.

FIELD QUALITY CONTROL.--

Testing.--The operational test for the surveillance system shall be performed by the Contractor in the presence of the Engineer. The operational tests shall demonstrate that all functions of the system operate in the manner described in the manufacturer's literature and demonstrate system stability under normal vibration and shocks to components. The Contractor shall notify the Engineer in writing not less than 10 days in advance of performing the operational tests.

12-16.17 CARBON MONOXIDE MONITORING SYSTEM

GENERAL.--This work shall consist of furnishing and installing a complete operational carbon monoxide (CO) monitoring system in accordance with the details shown on the plans and these special provisions.

The system shall include all materials, whether mentioned or not, that are necessary for a complete and operational carbon monoxide monitoring system.

SYSTEM DESCRIPTION.—The carbon monoxide monitoring system shall be minimum 24-point system and shall consist of carbon monoxide sensors, carbon monoxide control panel, calibration kit and recorders. Carbon monoxide control panel shall be mounted in a free standing NEMA Type 12 cabinet with front access, caster and leveling feet. Products shall include such accessories and appurtenances, not mentioned, that are required for the proper installation and the operation of the carbon monoxide monitoring system.

SUBMITTALS.--Manufacturer's descriptive information, catalog cuts and installation instructions shall be submitted for approval.

Installation instructions shall include installation layout, manufacturer and model number of equipment, and locations of carbon monoxide sensors. Submittals shall be approved prior to commencing the carbon monoxide monitoring system installation.

PRODUCTS.--

Carbon monoxide control panel.--

Carbon monoxide (CO) control panel shall be a microprocessor based, solid-state, fully programmable, 24 channels continuous carbon monoxide monitoring controller with the following characteristics:

1. The controller shall display and alarm for sensors remotely mounted up to 1210 meters.
2. Each channel shall have 2 alarm set points.
3. Controller shall monitor itself for open and short circuits.
4. Controller shall have digital display.
5. Controller shall have continuous LED (light emitting diode) display of CO concentration for all channels.
6. Controller shall operate on 120 V (ac).
7. Output shall be 4-20 mA each channel for recording purpose.
8. Controller shall have output relays for high and low alarm.
9. Controller shall have power supply to the sensors.
10. Controller shall have output range from 0 ppm to 300 ppm.
11. Controller shall be capable of interfacing with data network system.
12. Recorder shall be capable of printing reports on paper.

Output relays for high and low alarm shall be 120-V (ac) relays with one normally open and one normally closed contacts rated at not less than 3 A at 120 V (ac)/28 V DC.

Carbon monoxide sensor.--

Carbon monoxide sensor in the toll booths shall be remote, electrochemical, diffusion type sensing head and shall operate within temperature range from -10°C to 50°C and humidity from 10 to 90 percent. The carbon monoxide sensor shall have the following features:

1. Input power from 8 V to 30 V, DC, 30 mA.
2. Output from 4 mA to 20 mA analog output.
3. Response time less than 30 seconds to 90 percent of final value.
4. Monitoring range from 0 ppm to 300 ppm.
5. Life expectancy shall be not less than 24 months.

The CO gas sensor (sensing element) of the carbon monoxide sensor that are installed within the toll booths shall be located and mounted as shown on the plans. The CO gas sensor and CO control box shall be connected by the CO gas sensor cable that is supplied by the manufacturer. The CO control box shall include the toxics amplifier assembly.

Carbon monoxide sensor at the intake and in the tunnel shall have the same characteristics as the CO sensor in the toll booths except the sensor shall be in a NEMA Type 4X enclosure.

Calibration kit.--

Calibration kit shall consist of two cylinders of compressed (50 ppm and 200 ppm) calibration gas, cylinder regulator (total two), and calibration adapter kit.

Recorder.--

Recorder shall be a data-chart paperless recorder complete with a 5.8 mm x 10.9 mm LCD display and touch screen control. The recorder shall have the following features:

1. Recording rates are independently selectable in one second intervals for each channel and range between 4 per second to one every 10 minutes.
2. Each channel is sampled 4 times per second.
3. Data display update rates are selectable from 0.25 s to 60 s.
4. MSDOS compatible file system.
5. Real time or historical data review.
6. Display modes include graphic trend, bargraphs, digital meters, alarm and event summary and split screen combinations.
7. Status window include time and data, alarms, disk capacity used and menu.
8. Menu shall be selectable via intuitive touch screen control.
9. Recorder shall operate on 120 V (ac).
10. Operational temperature shall be from 5°C to 40°C.

Conduit and conductors.--

All carbon monoxide monitoring system wiring shall be installed in conduit system conforming to the requirements under “Basic Materials and Methods” elsewhere in these special provisions. All interconnecting cable for the carbon monoxide monitoring systems, CO cable, shall be furnished and installed and contain an adequate number of wires to satisfactorily perform all the specified functions with the equipment supplied. Each cable shall be not less than 2 No. 18 AWG twisted shielded pair with a drain wire. Cable shall be rated for 300-V (ac) and with a temperature range from -20°C to +80°C.

EXECUTION.—

The units shall be installed at locations as shown on the plans and by methods recommended by the manufacturer.
The Contractor shall provide all supports, fasteners, and other hardware necessary to support the units.

TRAINING.—

Before acceptance of contract, the Contractor shall provide 5 bound, identified copies of the carbon monoxide system operation and maintenance instructions. The Contractor shall provide a minimum 2 hours, on site training session on system use, operation and maintenance for not more than 8 designated Caltrans employees. The Contractor shall notify the Engineer in writing not less than 10 days in advance of proposed training class.

TESTING.—

The operational test for the carbon monoxide monitoring system shall be performed by the Contractor in the Engineer's presence. The operational tests shall demonstrate that all functions of the system operate in the manner described in the manufacturer's literature and demonstrate system stability under normal vibration and shocks to components. The Contractor shall notify the Engineer in writing not less than 10 days in advance of performing the operational test.

12-16.18 MASTER CLOCK SYSTEM

GENERAL.--This work shall consist of furnishing and installing the master clock system in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.--Manufacturer's descriptive information, catalog cuts and installation instructions shall be submitted for approval.

PRODUCTS.--

Master clock.--

Master clock shall be a wall mounted, microprocessor based, power line carrier, minute impulse clock with liquid crystal display to show the time, day of the week and the status of the 6 output circuits. The display shall also be used to view programming, editing and stored programs. The 6 output circuits shall be programmed through a keypad or be controlled by 6 manual override switches. The user shall be able to program from one to 4 independent schedules within the system. Changing between schedules shall be accomplished from the keyboard at any time. The input shall be 120 V (ac). The master clock shall be provided with a 7-day battery standby unit. The master clock shall be provided with an impulse module and temperature compensated crystal oscillator. The temperature compensated crystal module will provide a source of frequency reference to the central controller of the master clock. This module shall provide accuracy of +/-3 seconds per month for a temperature range from 0°C to 50°C. During loss of AC power the master clock shall accumulate missed minute impulses for 24 hours. Upon restoration of AC power, rapid correction pulses will be outputed to advance the impulse device to correct time.

Clock

Clock shall be electronic type, 260-mm round, surface mounted, analog clock. Clock shall be compatible with the master clock provided. Clock shall comply with UL Standard 863. A UL listed clock receptacle in a flush mounted outlet box shall be provided. Receptacle shall be complete with connectors suitable for the clock.

Conduit and conductors.--

All master clock conduit and conductor system wiring shall be installed in conduit system conforming to the requirements under "Basic Materials and Methods" elsewhere in these special provisions.

EXECUTION.--

The units shall be installed as shown on the plans and as recommended by the manufacturer.
The Contractor shall provide all supports, fasteners and other hardware necessary to support the units.

FIELD QUALITY CONTROL.--

Testing.--The operational test for the master clock system shall be performed by the Contractor in the presence of the Engineer. The operational tests shall demonstrate that all functions of the system operate in the manner described in the manufacturer's literature and demonstrate system stability under normal vibration and shocks to components. The Contractor shall notify the Engineer in writing not less than 10 days in advance of performing the operational tests.

12-16.19 ANNUNCIATION SYSTEM

GENERAL.--This work shall consist of furnishing and installing the annunciation system in accordance with the details shown on the plans and these special provisions.

The system shall include all materials, whether mentioned or not, that are necessary for a complete and operational annunciation system.

SUBMITTALS.--Manufacturer's descriptive information, catalog cuts and installation instructions shall be submitted for approval.

PRODUCTS.--

Annunciator panel display.—

Annunciator panel display shall be a 2-line, minimum 16 characters per line programmable message display capable of interfacing with the PLC.

Display shall be vacuum fluorescent type. Display shall be not less than 11 mm high characters. Display shall be housed in a NEMA Type 12 enclosure. Display shall operate on a 120 V (ac) source.

A programming software designed to work with an IBM or compatible computer shall be furnished with the annunciator panel display.

The annunciator panel display shall have 32 k EEPROM memory and shall be programmable for a minimum of 50 messages. Display shall be factory programmed for the messages as shown on the plans and connected to the proper output points of the programmable logic controller for displaying each pre-programmed message as the event occur.

The physical dimension of the annunciator display shall be not more than 120 mm high by 365 mm wide by 122 mm deep.

Acknowledge push button and reset push button.—

Acknowledge push button and reset push button shall be normally open push buttons mounted in two-gang box as shown on the plans.

Annunciator terminal cabinet.—

Annunciator terminal cabinet shall be a NEMA Type 1 enclosure mounted as shown on the plans. Cabinet shall include terminal blocks, buzzer, bell, fuses, power module complete with power supply and PLC interface system and other appurtenant devices required for the proper interface between the annunciator panel display and programmable logic controller, PLC1.

Buzzer.--

Buzzer shall be a heavy duty industrial type 24-volt, DC buzzer rated 62 dB at 30 m.

Bell.--

Bell shall be a general purpose type, 24-volt (DC) bell rated at 68 dB at 30 m.

Annunciator control cabinet.—

Annunciator control cabinet shall be a single exterior hinged door, NEMA Type 1 enclosure, containing an electrical mounting panel. The panel shall be made of 1.9 mm (14 gage) steel minimum with all seams continuously welded. The exterior door shall be maintained closed with door clamps. Security shall be provided by a hasp and staple for padlocking. The main breaker (MB), programmable logic controller (PLC1) complete with power supply, input and output modules, terminal blocks, power relay (R7) and all appurtenant devices shall be mounted on the mounting panel. Control cabinet shall be factory pre-wired.

Main breaker (MB).--

Main breaker shall be single pole, 120-volt, 100-ampere frame, 20-ampere trip, molded case circuit breaker mounted in the annunciator control cabinet. The interrupting capacity of the breaker shall be not less than 10,000 amperes (symmetrical) at 120 volts.

Programmable logic controller.--

Programmable logic controller, PLC1 shall be 120-volt, AC powered controller with power supply, central processor unit, input/output modules and communication modules as shown on the plans. PLC shall have a built-in 24 volt DC power supply for all the input and output requirements. The controller shall be capable of operating in the following environmental conditions:

1. Operating temperature range from 0°C to 60°C.
2. Humidity range from 15 to 95 per cent non-condensing.
3. Vibration range from 57 Hz to 150 Hz, constant acceleration at 2 g
4. Shock: 15 g, semisinusoidal 11 ms
5. Noise immunity: 1500 volts, NEMA showering arc.

A programming device shall be furnished for PLC1. The programming device shall be a minimum 700 MHz Pentium, an IBM compatible laptop computer with the following type of software: Windows 2000 or current version operating system, ladder logic programming, communications, word processing and spreadsheet programs that are compatible with the supervisory control and data acquisition (SCADA) system in a Windows environment. The laptop computer shall be furnished with all the necessary interfacing devices and cables to connect to the PLC for programming. Laptop computer shall have a 307 mm active matrix color display, serial and parallel ports, external or built in 56 k modem, 89 mm floppy drive, a ten giga bytes (or larger) hard drive, 128 mega-bytes (or larger) of RAM and PCMCIA card slot. Lap-top computer shall be Toshiba, IBM or AST.

The PLC1 shall be programmable with a ladder diagram consisting of relay symbols and function block. The program shall be stored in a non-volatile memory without the need for battery back-up. The central processor unit, CPU, shall support not less than the input/output units shown on the plans plus at least 25 per cent spare capacity. The CPU shall have enough timers, registers, counters and relays to provide the functions as shown on the plans. PLC1 shall be compatible with the annunciator display panel.

PLC1 shall be equipped with a computer link module allowing it to communicate with a personal computer through an RS-232 serial link for programming and monitoring. PLC1 shall incorporate password security protection against unauthorized user from changing the operation of the PLC1. A programming software designed to work with an IBM or IBM compatible computer shall be provided. The PLC1 shall be provided with a communication module and an interconnecting cable to the annunciator panel. Programmable logic controller shall be programmed to provide the functions as specified in these special provisions and as shown on the plans. Program shall be stored in non-volatile memory without the need of battery backup.

Whenever a signal that requires indication is received, a corresponding message is displayed and causes the buzzer to sound for a minimum of 5 seconds or until canceled by the operator by activating the reset push-button. Signal indication shall be from the carbon-monoxide control panel, toll booths security alarm push button, float switches in the elevator sump, PLC2 outputs and other systems as shown on the plans.

Input/output modules.—

Input/output modules (I/O) shall be the type as shown on the plans. I/O modules shall be capable of being plugged into expansion chassis in any slot as required. Each module shall have a keyed plug in terminal strip for each type of module for ease of replacement of the module without having to disturb the wiring connection. Each terminal strip shall have a marking strip under clear plastic cover for inscribing the wire identification number. Each I/O module shall have LED indicators to show when input is turned on or when an output occurs. Each I/O module shall operate at the voltage level of the connected devices and shall be optically isolated to the PLC. I/O modules shall operate at the voltage shown on the plans.

24-Volt DC power supply.—

DC power supply shall be 120-volt input, single voltage output, precise integrated regulated power supply unit designed for instrumentation and process control applications. The power supply shall be panel mounted,

convection cooled, completely protected and short circuit proof and shall be 24-volt, DC with voltage adjustment of ±5 percent minimum and shall be operable at temperatures range from 0˚C to 50˚C.

Power relay, R7.--

Power relay, R7 shall be a 3-pole, NEMA size 00, full voltage motor contactor with 120-volt AC coil. Motor contactor shall be mounted in the annunciator control cabinet.

Interconnection cables.--

All interconnection cables between the annunciator display panel and PLC1 shall be of the type recommended by the equipment manufacturer.

Detector loop.—

Detector loop shall be installed in the pavement at the location shown on the plans. The detector shall consist of 1.8 m loop, loop detector module and detector loop cable installed in accordance with the details shown on the plans, the provisions in Section 86-5, "Detectors," of the Standard Specifications and these special provisions.

The loop installation shall conform to the provisions in Section 86-5.01A(5), "Installation Details," of the Standard Specifications and "Type 2 Installation," Sheet ES-5A of the Standard Plans.

Loop detector module.—

The loop detector module shall be an inductive loop detector sensor unit conforming to the provisions in Section 86-5, "Detectors," of the Standard Specifications. Module shall have a normally open contact rated at not less than 24 V DC. Loop detector module shall be mounted in the loop sensor control panel. A normally open contact rated at not less than 3 A at 24 V, DC shall be provided.

Loop sensor control panel.—

The loop detector panel shall be a surface mounted NEMA Type 1 cabinet with a hinged door suitable to mount the loop detector module.

EXECUTION.--

The units shall be installed as shown on the plans and as recommended by the manufacturer.
The Contractor shall provide all supports, fasteners and other hardware necessary to support the units.

FIELD QUALITY CONTROL.--

Testing.--The operational test for the annunciation and PLC1 system shall be performed by the Contractor in the presence of the Engineer. The operational tests shall demonstrate that all functions of the system operate in the manner described in the manufacturer's literature and demonstrate system stability under normal vibration and shocks to components. The Contractor shall notify the Engineer in writing not less than 10 days in advance of performing the operational tests.

DEMONSTRATION.--

Training.--The Contractor shall provide a minimum 8 hours of on-site training on the use, operation, and maintenance of the annunciation and PLC1 system for not more than 6 designated State employees. The Contractor shall notify the Engineer in writing not less than 10 days in advance of proposed training class.

12-16.20 CONTROL SYSTEMS- HVAC TOLL BOOTHS

GENERAL.--This work shall consist of furnishing and installing a complete control system for the heating ventilation and air conditioning systems for the toll booths in accordance with the details shown on the plans and these special provisions.

The system shall include all materials, whether mentioned or not, that are necessary for a complete and operational HVAC control system.

DESCRIPTION OF OPERATION.—Automatic operation of the HVAC1, HVAC2, HVAC3, in-line (main) duct heater and in-line (toll booth) duct heater shall be controlled by the remote temperature controller, T1, transaction window door switches and PLC2.

Operation of the wall heaters, radiant heaters toll booth individual duct heaters shall be controlled by switches as shown on the plans and specified elsewhere in these special provisions.

SUBMITTALS.--Manufacturer's descriptive information, wiring diagrams, catalog cuts and installation instructions shall be submitted for approval.

PRODUCTS.--

HVAC power panel.--

HVAC power panel shall be a single exterior hinged door, NEMA Type 4 enclosure, containing an interior swing-out door and an electrical mounting panel. The panel shall be made of 1.9 mm (14 gage) steel minimum with all seams continuously welded. The exterior door shall be maintained closed with door clamps. Security shall be provided by a hasp and staple for padlocking. The main breaker, MB, circuit breakers, CB1 thru CB3, and current switches, CS1 thru CS3, shall be mounted in the panel. HVAC power panel shall be factory pre-wired in accordance with NEMA Class II, Type C wiring and shall be provided with power terminal blocks for power distribution form MB to the CB's and blower starter. Breaker handles shall be operable from the interior swing out door.

Main breaker (MB).--

Main breaker shall be three pole, 480-volt, 100-ampere frame, 70-ampere trip, molded case circuit breaker mounted in the HVAC power panel as shown on the plans. The interrupting capacity of the breaker shall be not less than 18000 amperes (symmetrical) at 480 volts.

Circuit breakers (CB1, CB2 and CB3).--

Circuit breakers, CB1, CB2 and CB3 shall be 480-volt, 100 ampere frame molded case circuit breaker mounted in the HVAC power panel as shown on the plans. Number of poles and trip rating shall be as shown on the plans or shall be the maximum size as recommended by the HVAC unit manufacturer. The interrupting capacity of the breaker shall be not less than 18000 amperes (symmetrical) at 480 volts.

Current Switches (CS1, CS2 and CS3).--

Current switches shall be self-powered, solid state, AC, current sensing switch mounted in the HVAC power panel as shown on the plans. Switch shall have a single-pole, normally open contact rated one-ampere at 240 volts, AC. Current sensing level shall be selectable between a low range from one to 15 amperes and a high range from 15 to 300 amperes. Switch shall have a thru-hole of 13 mm minimum diameter for sensing the AC current.
Conductors shall be looped around the hole as many turns as necessary to indicate a reading.

Blower Starter (ST1).--Blower starter, ST1, shall be NEMA Size 1, NEMA rated, 3-pole, line-voltage combination starter and motor circuit protector in a surface mounted enclosure. Starter shall have 120-volt coil, double-break silver contacts, and 3 manual-reset, thermal overloads set to trip between 115 and 125 percent of full load motor current, as quoted on the nameplate by the motor manufacturer. Enclosure shall be single exterior hinged door, NEMA Type 4 enclosure, containing an interior swing-out door and an electrical mounting panel. Starter shall be provided with a selector switch and a 50 VA control transformer complete with fuses as shown on the plans. Overload reset and selector switch shall be operable on the interior door only. Enclosure shall be lockable with a padlock.

Heater controller.--

Heater controller for the main in-line duct heater shall 3-pole, combination non-fusible disconnect and full voltage motor contactor. Controller shall have 120-volt coil and contacts rated at 30-ampere, 480-volt. Enclosure shall be single exterior hinged door, NEMA Type 4 enclosure, containing an interior swing-out door and an electrical mounting panel. Controller shall be provided with a selector switch and a 50 VA control transformer complete with fuse as shown on the plans. Selector switch shall be operable on the interior door only. Enclosure shall be lockable with a padlock.

Heater controller for the in-line duct heater at toll booth 9 shall be similar except it shall be in a NEMA Type 1 enclosure.

Selector Switch (SS1).--

Single-pole, 3-position, 10-ampere, 120-volt rotary switch mounted on interior door as shown on the plans. Switch contacts shall have an inductive pilot duty rating of 60 amperes (make), 6 amperes (break) and 10 amperes (continuous) at 120-volt and 35 percent power factor. Selector switches shall have legend plates marked "HAND-OFF-AUTO".

HVAC control panel.--

HVAC control panel shall be a single exterior hinged door, NEMA Type 1 enclosure, containing an electrical mounting panel. The panel shall be made of 1.9 mm (14 gage) steel minimum with all seams continuously welded. The exterior door shall be maintained closed with door clamps. Security shall be provided by a hasp and staple for padlocking. The circuit breakers, CB4 thru CB10, PLC2, input and output modules, relays, terminal blocks and other appurtenant devices shall be mounted on the mounting panel. Time meter shall be mounted on the exterior door. HVAC control panel shall be factory pre-wired in accordance with NEMA Class II, Type C wiring.

Circuit breakers (CB4 thru CB10).--

Circuit breakers, CB4, shall be 240-volt, 100-ampere frame molded case circuit breaker mounted in the HVAC control panel as shown on the plans Circuit breakers, CB5 thru CB10 shall be 120-volt, 100-ampere frame molded case circuit breaker mounted in the HVAC control panel as shown on the plans. Number of poles and trip rating shall be as shown on the plans. The interrupting capacity of each breaker shall be 10,000 amperes (symmetrical) at 120/240 volts.

Programmable logic controller.--

Programmable logic controller, PLC2 shall be 120-volt, AC powered controller with power supply, central processor unit, and input/output modules as shown on the plans. PLC shall have a built-in 24 volt DC power supply for all the input and output requirements. The controller shall be capable of operating in the following environmental conditions:

1. Operating temperature: Between 0°C and 60°C.
2. Humidity: from 15 to 95 per cent non-condensing.
3. Vibration: from 57 Hz to 150 Hz, constant acceleration at 2 g.
4. Shock: 15 g, semisinusoidal 11 ms.
5. Noise immunity: 1500 volts, NEMA showering arc.

PLC2 shall be programmed using the same programming device furnished for PLC1. Programming device for PLC1 shall be as specified elsewhere in these special provisions.

The PLC2 shall be programmable with a ladder diagram consisting of relay symbols and function block. The program shall be stored in a non-volatile memory without the need for battery back-up. The central processor unit, CPU, shall support not less than the input/output units shown on the plans plus at least 25 per cent spare capacity. The CPU shall have enough timers, registers, counters and relays to provide the functions as shown on the plans. PLC shall have relays for alarm and self diagnostics. Relay output shall have a 2-ampere, 5-ampere and 10-ampere contact ratings.

The PLC2 shall be equipped with a computer link module that shall allow the PLC2 to communicate with a personal computer through an RS-232 serial for programming and monitoring. PLC2 shall incorporate password security protection against unauthorized caller from changing the operation of the PLC. PLC shall be capable of initiating communication with a host computer or a telephone pager upon sensing any alarm conditions. A programming software designed to work with an IBM or IBM compatible computer shall be provided. Programmable logic controller shall be programmed to provide the functions as shown on the plans. Program shall be stored in non-volatile memory without the need of battery backup.

Input and output modules.--

The input and output (I/O) modules shall be the digital or analog type as shown on the plans. The I/O modules shall be capable of being plugged into the expansion chassis in any slot. Each module shall have a keyed plug in the

terminal strip for each type of module for ease of replacement of the module without having to disturb the wiring connection. Each terminal strip shall have a marking strip under a clear plastic cover inscribed with for inscribing the wire identification. Each I/O module shall have LED indicators to show when each input is turned on or when an output occurs. Each I/O module shall operate at the voltage level of the connected devices and shall be optically isolated to the PLC. I/O modules shall operate at the voltage shown on the plans.

24-Volt DC Power Supply.--

DC power supply shall be 120-volt, single voltage output, precise integrated regulated power supply unit designed for instrumentation and process control applications. The power supply shall be panel mounted, convection cooled, completely protected and short circuit proof and shall be 24-volts, DC with voltage adjustment of ±5 percent minimum and shall be operable at temperatures range from 0˚C to 50˚C.

Time Meters (TM1, TM2 and TM3).--

Running-time meter shall operate on 120-volt, 60-Hz with 0 to 99,999.9 hours range. Timer shall be mounted on the door of the HVAC control panel.

Control Relays (CR1, CR2 and CR3).--

Control relays shall operate on 120-volt, AC, be general purpose type relays with 2-pole, double-throw, 10-ampere contacts. Each relay shall be enclosed in a clear plastic with 8-pin plug base. Socket for the relay shall be barrier type, 8-contacts relay socket with 10-ampere contacts and screw terminals.

Relays (R1 thru R6).--

Relays shall be general purpose relays operate on 24-volt, DC coil, with 2-pole, double-throw, 10-ampere, 120 V, AC contacts. Relays shall be enclosed in a clear plastic with 8-pin plug base. Socket for the relays shall be barrier type, 8-contacts relay socket with 10-ampere contacts and screw terminals.

EXECUTION.—

The units shall be installed at locations as shown on the plans and by methods recommended by the manufacturer.
The Contractor shall provide all supports, fasteners, and other hardware necessary to support the units.

FIELD QUALITY CONTROL.--

Testing.--The operational test for the HVAC control system shall be performed by the Contractor in the presence of the Engineer. The operational tests shall demonstrate that all functions of the system operate in the manner described in the manufacturer's literature and demonstrate system stability under normal vibration and shocks to components. The Contractor shall notify the Engineer in writing not less than 10 days in advance of performing the operational tests.

DEMONSTRATION.--

Training.--The Contractor shall provide minimum 4 hours of on-site training on the use, operation, and maintenance of the annunciation and PLC2 system for not more than 8 designated State employees. The Contractor shall notify the Engineer in writing not less than 10 days in advance of proposed training class.

12-16.21 IRRIGATION CONTROLLER ENCLOSURE CABINET

Irrigation controller enclosure cabinets (CEC) shall be constructed and the equipment within the cabinets shall be installed in conformance with the details shown on Standard plan ES-3H, the provisions in the Standard Specifications, and these special provisions.

Irrigation controller enclosure cabinets shall be of metal construction conforming to the details for empty Type P signal cabinets shown on Standard Plans ES-3A and ES-3C, except that the fluorescent interior light, police panels, and shelves shall not be provided, unless otherwise shown on the plans. Cabinets shall be provided with cross ventilation, roof ventilation or a combination of both. The anchorage arrangement shall be inside the cabinet as shown on the plans. Dimensions of the cabinet shall be suitable for the equipment to be installed as shown on the plans and specified in these special provisions.

Attention is directed to the requirements specified in Section 10-2, "Highway Planting and Irrigation Systems," of these special provisions, regarding controllers to be mounted inside the irrigation controller enclosure cabinets.

Irrigation controller enclosure cabinets shall be fabricated in conformance with the provisions in Section 86-3.04A, "Cabinet Construction," of the Standard Specifications.

Irrigation controller enclosure cabinets shall be fabricated of cold rolled steel.

Irrigation controller enclosure cabinets fabricated of cold rolled steel shall be cleaned and painted in conformance with the provisions in Section 86-3.04A, "Cabinet Construction," of the Standard Specifications, except the finish color of the irrigation controller enclosure cabinets shall be green.

Irrigation controller enclosure cabinet doors shall not be furnished with integral door locks. Irrigation controller enclosure cabinet door handles shall have provisions for padlocking in the latched position. Padlocks will be State-furnished as provided under "Materials" of these special provisions.

The plywood mounting panel shall be 19-mm exterior AC grade veneer plywood. The panel shall be painted with one application of an exterior, latex based, wood primer and 2 applications of an exterior, vinyl acrylic enamel, white in color. The plywood panel shall be painted on all sides and edges prior to installation of the panel in the cabinet and equipment on the panel.

Inside of the doors shall have provisions for storage of the irrigation plans.

Duplex convenience receptacles shall have ground-fault circuit interruption as defined by the Code. Circuit interruption shall occur on 6 mA of ground-fault current and shall not occur on less than 4 mA. Receptacles shall be installed in a weatherproof housing with rainproof lift covers.

Equipment, except for field wiring, shall be installed in the cabinet in a shop prior to field installation.

12-16.22 AUTOMATED TOLL COLLECTION AND ACCOUNTING SYSTEM ELECTRICAL SYSTEM

PART 1.- GENERAL

SUMMARY.--

Scope.—The work shall consist of installing and connecting the automated toll collection and accounting system (ATCAS) equipment in accordance with the details shown on the “ATCAS Electrical System” plans and these special provisions.

ATCAS electrical system shall include furnishing all labor, materials and equipment and installing and connecting State-furnished ATCAS equipment required to construct the complete ATCAS electrical system as shown on the plans and as specified in these special provisions.

State-furnished ATCAS equipment will be as provided under "State Furnished Materials" of these special provisions. Cables, conductors, poles and other associated ATCAS equipment shall be as specified in these special provisions. Military type connectors for equipment connections will be State-furnished as provided under “State furnished Materials” of these special provisions.

The Contractor shall install each equipment at locations as shown on the plans and shall make all field wiring connections to all ATCAS equipment. Templates for State-furnished ATCAS equipment will be furnished to the Contractor as shown on the plans.

A listing of pin terminations, for ATCAS equipment will be furnished to the Contractor at the site of the work upon request. The Contractor shall make all pin connection to the appropriate cables.

SYSTEM DESCRIPTION.--

Summary--The ATCAS is a computerized electronic toll collection system, which allows bridge patrons to prepay their toll, eliminating the need to stop at the toll booths to make bridge toll payments. The system has three components. First, a transponder placed inside the patron’s vehicle starts the process when the vehicle approaches the toll plaza. Overhead antennas designed to read the transponder and communicate with the plaza computer are the second part of the system. (The computer records and charges the amount of the toll to the patron’s account). A video recording system, camera and a light located in each lane comprise the third part of the system, which identifies toll evaders.

The violation detection system (VDS) light sensor shall measure ambient light levels using a 120-volt AC input. Input and output conductors shall be connected to the sensor through a 7-pin connector. The output, through an RS-422 interface, shall report ambient light levels to the VDS system. The VDS system in turn will process the data received from the light-dark sensor and provide iris control to the cameras.

PART 2.- PRODUCTS

Antenna transmission cable.--

Antenna transmission cable shall be Type RG-8U, RF transmission cable, 50 Ω, 10 No. 23 AWG stranded copper conductors, with gas injected foam PE insulation, a 100 percent tinned copper braid shield and an outer polyvinyl chloride (PVC) jacket. This 50 Ω transmission cable shall be used to connect the toll system antennas.

Video transmission cable.--

Video transmission cable shall be Type RG 6U, broadband cable, 75 Ω, No. 18 AWG solid steel copper covered conductors, with gas injected PE insulation, a 60 percent aluminum braid shield and an outer PVC jacket. This 75 Ω broadband cable shall be used to connect ATCAS cameras.

VTDM cable.--

VTDM cable shall be Type RG-6U, broadband cable, 75 Ω, No. 18 AWG solid steel copper covered conductors, with gas injected PE insulation, a 60 percent aluminum braid shield and an outer PVC jacket.

Transceiver cable.--

Transceiver cable shall be 9 No. 22 AWG, rated at 300 V, 105°C, soft annealed or tinned copper conductor, with overall shield, PVC insulation and PVC jacket.

VDS light control cable.--

VDS light control cable shall be individually shielded twisted pair, No. 20 AWG, tinned stranded copper conductors, foil aluminum polyester overall shield, with No. 24 AWG stranded tinned copper drain wire. Cable shall have a chrome PVC jacket.

VDS light sensor cable.--

VDS light sensor cable shall be 3 individually shielded twisted pair, No. 20 AWG, tinned stranded copper conductors, foil aluminum polyester overall shield, with No. 24 AWG stranded tinned copper drain wire. Cable shall have a chrome PVC jacket.

Patron toll display (PTD) cable.--

PTD cable shall be 2 individually shielded twisted pairs, No. 22 AWG tinned stranded copper conductors, with aluminum-polyester shield and No. 24 AWG common stranded tinned drained wire and a chrome PVC jacket. Cable shall be rated at 300 V.

Control console power cable.--

Control console power cable shall be Type SO portable control cable with 6 No. 12 AWG, rated at minimum 600 V, 90°C, copper conductor, with rubber insulation and overall neoprene jacket.

Antenna FO cable.--

Antenna FO cable shall be 4 strands, 62.5/125 μm fiber optic cable. Cable shall be similar to the fiber optic cables as specified elsewhere in these special provisions except it shall be tight buffer construction type and riser and plenum rated.

Lane data FO cable.--

Lane data FO cable shall be 4 strands, 62.5/125 μm fiber optic cable. Cable shall be similar to the fiber optic cables as specified elsewhere in these special provisions except it shall be tight buffer construction type and riser and plenum rated.

CHP FO cable.--

CHP FO cable shall be 4 strands, 62.5/125 μm fiber optic cable. Cable shall be similar to the fiber optic cables as specified elsewhere in these special provisions except it shall be tight buffer construction type and riser and plenum rated. Number of strand shall be as shown on the plans.

Loop detector lead-in cable.--

Loop detector lead-in cable shall be a loop detector lead-in cable as specified under Section 86-5, "Detectors" of the Standard Specifications.

Treadle cable.--

Treadle cable will be part of the State-furnished axle treadle sensor as provided under "Materials" of these special provisions. The cable is a 2 conductor No. 16 AWG.

Light curtain control cable.--

Light curtain control cable shall be part of the State-furnished light curtain as provided under "Materials" of these special provisions. The cable is No. 24 AWG, 15 tinned copper stranded conductors, S-R PVC insulated with an overall foil aluminum shield, with stranded copper drain wire and a chrome PVC jacket. Cable is rated 300 V and 80°C.

Hybrid cable.--

Hybrid cable shall be 3 twisted pairs individually shielded No. 22 AWG tinned copper and 3 No. 22 AWG single conductor, teflon insulated conductors with an overall braided tinned copper shield rated at 300 V. Cable shall have an aluminum and polyester tape with an overall teflon jacket.

"J1 and J3" communication and control cable.--

Communication and control cables "J1 and J3" shall be 27 pairs No. 22 AWG tinned copper stranded conductors, color coded with PVC insulation with an aluminum/polyester tape shield (100 percent coverage). Cable shall have a stranded tinned copper drain wire and a PVC jacket. Cable shall be rated at 300 V and 80°C. Cable shall be terminated to one end of a connector plug to match the jack of the State-furnished control console A cabinet.

Network cable.--

Network cable shall be a No. 24 AWG stranded copper HDPE cable and shall comply with International Organization for Standardization/International Electrotechnical Commission (ISO/IEC) standards. Cable shall have Underwriters' Laboratories Inc./Environmental Technology Laboratory (UL/ETL) insulation and shall have Flame Retardant (FR)-Polyvinyl Chloride (PVC) jacket complying with T1/EIA-586 standards. Cable shall meet Category 5 standards.

Ethernet cable.--

Ethernet cable shall be a No. 24 AWG stranded copper HDPE cable and shall comply with ISO/IEC standards. Cable shall have UL/ETL insulation and shall have FR-PVC jacket complying with T1/EIA-586 standards. Cable shall meet Category 5 standards.

VDS light sensor.--

The VDS light sensor (VDS light sensor unit and VDS dark light sensor unit) shall consist of a glass dome, a reflector, a mirror in a black base designed to measure ambient light levels, using a 120-volt input. The glass dome shall be rain-tight, 155 mm in diameter, 255 mm high and shall be equipped with a 50-watt heater. The operating temperature shall be 7°C to 50°C, with cycling of +43°C to -23°C and a one hour temperature hold at both temperature extremes.

VTDM pole 1 and pole 2--

The VTDM Pole 1 and Pole 2 shall be a pole Type CCTV 25 per the Standard Plan ES-16A. Foundations for VTDM poles shall conform to the requirements of Section 86-2.03 "Foundations" of the Standard Specifications for reinforced cast-in-drilled hole concrete pile foundations for traffic signal and lighting standards.

Loop detector wires--

Loop detector wires shall conform to the provisions in Section 86-5 "Detectors," of the Standard specifications. Electronic sensor units, control units and amplifier units will be part of the State-furnished control consoles.

PART 3. EXECUTION.--

INSTALLATION.--

General.--All ATCAS equipment shall be installed at locations and in accordance with the details shown on the plans. The location of overhead equipment, antennas, violation detection system (VDS) lights, cameras and their dimensional relation to the location of the light curtains is critical to the proper operation of the ATCAS system. Exact location of the ATCAS equipment, conduits, junction boxes, and other devices is to be governed by the dimensions shown on the plans and structural conditions. ATCAS work shall be coordinated with the work of others.

The loop installations shall conform to the provisions in Section 86-5.01A(5), "Installation Details," of the Standard Specifications, ES-5A, ES-5B and ES-5E of the Standard Plans and as shown on the plans.

Splices in low voltage and communication cables shall be avoided. Any splices made to low voltage and communication cables shall be a soldered and watertight splice.

Fiber optic terminations and coax cable terminations shall be made using appropriate connectors. All BNC connectors for RG 6U shall be 75 Ω type. All BNC connectors for RG 8U shall be 50 Ω type. Fiber optic connectors shall be Type ST.

All cables shall be identified in a permanent consistent manner as specified under “Labeling” under “Fiber Optic Cable for CCTV (Security) System elsewhere in these special provisions.

FIELD QUALITY CONTROL.--

Testing.—After the State-furnished ATCAS equipment is installed and connected, testing will be performed by State personnel.

The tests will be conducted in the toll environment while the toll plaza lanes, one through 17, are rendered operational. The Engineer will conduct all activities relating to the tests. The performance of the State-furnished ATCAS equipment installed by the Contractor will be tested to insure accuracy and performance reliability under varying speed and environmental conditions.

The Engineer will be responsible for providing all test support personnel, and any device necessary for the tests. A test schedule will be available to the Contractor one week prior to the commencement of the tests. The test will focus on verifying proper system wide operation including computer equipment. A controlled set of charge accounts and manual transactions will be tested. Performance of the violation detection and processing systems will also be tested.

Should a test reveal that a system or subsystem is not operating properly, The Engineer will determine if the failure is due to software, malfunction, hardware malfunction or the incorrect placement or alignment of the in-lane or canopy level ATCAS equipment installed by the Contractor.

If a piece of State-furnished in-lane or canopy level equipment fails, the Engineer will provide a new unit to replace it. The Contractor will remove the faulty piece of equipment and all labor, equipment and materials necessary to remove the faulty unit and install a replacement unit will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications, when directed by the Engineer.

Should the malfunction be caused by improper alignment or improper location of the State-furnished in-lane and canopy level equipment installed by the Contractor, the Contractor at his own expense shall reinstall and realign the improperly installed State-furnished in-lane and canopy level equipment.

Should the malfunction be caused by cables or conductors installed by the Contractor, the Contractor at his own expense shall replace defective cables or conductors.

PAYMENT.--

Attention is directed to Section 12-1.07 “Schedule of Values” in these special provisions. The cost for installation of the ATCAS electrical system shall be included as a separate item of work in the Schedule of Values for the Toll Plaza.

SECTION 13. (BLANK)

SECTION 14. FEDERAL REQUIREMENTS FOR FEDERAL-AID CONSTRUCTION PROJECTS

GENERAL.—The work herein proposed will be financed in whole or in part with Federal funds, and therefore all of the statutes, rules and regulations promulgated by the Federal Government and applicable to work financed in whole or in part with Federal funds will apply to such work. The "Required Contract Provisions, Federal-Aid Construction Contracts, "Form FHWA 1273, are included in this Section 14. Whenever in said required contract provisions references are made to "SHA contracting officer", "SHA resident engineer", or "authorized representative of the SHA", such references shall be construed to mean "Engineer" as defined in Section 1-1.18 of the Standard Specifications.

PERFORMANCE OF PREVIOUS CONTRACT.—In addition to the provisions in Section II, "Nondiscrimination," and Section VII, "Subletting or Assigning the Contract," of the required contract provisions, the Contractor shall comply with the following:

The bidder shall execute the CERTIFICATION WITH REGARD TO THE PERFORMANCE OF PREVIOUS CONTRACTS OR SUBCONTRACTS SUBJECT TO THE EQUAL OPPORTUNITY CLAUSE AND THE FILING OF REQUIRED REPORTS located in the proposal. No request for subletting or assigning any portion of the contract in excess of $10,000 will be considered under the provisions of Section VII of the required contract provisions unless such request is accompanied by the CERTIFICATION referred to above, executed by the proposed subcontractor.

NON-COLLUSION PROVISION.—The provisions in this section are applicable to all contracts except contracts for Federal Aid Secondary projects.

Title 23, United States Code, Section 112, requires as a condition precedent to approval by the Federal Highway Administrator of the contract for this work that each bidder file a sworn statement executed by, or on behalf of, the person, firm, association, or corporation to whom such contract is to be awarded, certifying that such person, firm, association, or corporation has not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with the submitted bid. A form to make the non-collusion affidavit statement required by Section 112 as a certification under penalty of perjury rather than as a sworn statement as permitted by 28, USC, Sec. 1746, is included in the proposal.

PARTICIPATION BY MINORITY BUSINESS ENTERPRISES IN SUBCONTRACTING.—Part 23, Title 49, Code of Federal Regulations applies to this Federal-aid project. Pertinent sections of said Code are incorporated in part or in its entirety within other sections of these special provisions.

Schedule B—Information for Determining Joint Venture Eligibility

(This form need not be filled in if all joint venture firms are minority owned.)

1. Name of joint venture _____
2. Address of joint venture _____
3. Phone number of joint venture _____
4. Identify the firms which comprise the joint venture. (The MBE partner must complete Schedule A.) _____
   _____

   a. Describe the role of the MBE firm in the joint venture. _____
      _____
   b. Describe very briefly the experience and business qualifications of each non-MBE joint venturer: _____
      _____

5. Nature of the joint venture's business _____
   _____
6. Provide a copy of the joint venture agreement.
7. What is the claimed percentage of MBE ownership? _____
8. Ownership of joint venture: (This need not be filled in if described in the joint venture agreement, provided by question 6.).

   a. Profit and loss sharing.
   b. Capital contributions, including equipment.
   c. Other applicable ownership interests.

9. Control of and participation in this contract. Identify by name, race, sex, and "firm" those individuals (and their titles) who are responsible for day-to-day management and policy decision making, including, but not limited to, those with prime responsibility for:

   a. Financial decisions _____
   b. Management decisions, such as:

      (1) Estimating _____
      (2). Marketing and sales _____
      (3). Hiring and firing of management personnel _____
      _____
      (4) Purchasing of major items or supplies _____
      _____

   c. Supervision of field operations _____

Note.—If, after filing this Schedule B and before the completion of the joint venture's work on the contract covered by this regulation, there is any significant change in the information submitted, the joint venture must inform the grantee, either directly or through the prime contractor if the joint venture is a subcontractor.

Affidavit

"The undersigned swear that the foregoing statements are correct and include all material information necessary to identify and explain the terms and operation of our joint venture and the intended participation by each joint venturer in the undertaking. Further, the undersigned covenant and agree to provide to grantee current, complete and accurate information regarding actual joint venture work and the payment therefor and any proposed changes in any of the joint venture arrangements and to permit the audit and examination of the books, records and files of the joint venture, or those of each joint venturer relevant to the joint venture, by authorized representatives of the grantee or the Federal funding agency. Any material misrepresentation will be grounds for terminating any contract which may be awarded and for initiating action under Federal or State laws concerning false statements."

Name of Firm	Name of Firm
Signature	Signature
Name	Name
Title	Title
Date	Date

Date _____

State of _____

County of _____

On this ____ day of _____, 19 __, before me appeared (Name) _____, to me personally known, who, being duly sworn, did execute the foregoing affidavit, and did state that he or she was properly authorized by (Name of firm) _____ to execute the affidavit and did so as his or her free act and deed.

Notary Public _____

Commission expires _____

[Seal]

Date _____

State of _____

County of _____

On this ___ day of _____, 19 __, before me appeared (Name) _____ to me personally known, who, being duly sworn, did execute the foregoing affidavit, and did state that he or she was properly authorized by (Name of firm) _____ to execute the affidavit and did so as his or her free act and deed.

Notary Public _____

Commission expires _____

[Seal]

REQUIRED CONTRACT PROVISIONS
FEDERAL-AID CONSTRUCTION CONTRACTS

I. GENERAL

1. These contract provisions shall apply to all work performed on the contract by the contractor's own organization and with the assistance of workers under the contractor's immediate superintendence and to all work performed on the contract by piecework, station work, or by subcontract.

2. Except as otherwise provided for in each section, the contractor shall insert in each subcontract all of the stipulations contained in these Required Contract Provisions, and further require their inclusion in any lower tier subcontract or purchase order that may in turn be made. The Required Contract Provisions shall not be incorporated by reference in any case. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with these Required Contract Provisions.

3. A breach of any of the stipulations contained in these Required Contract Provisions shall be sufficient grounds for termination of the contract.

4. A breach of the following clauses of the Required Contract Provisions may also be grounds for debarment as provided in 29 CFR 5.12:

   Section I, paragraph 2;
   Section IV, paragraphs 1, 2, 3, 4, and 7;
   Section V, paragraphs 1 and 2a through 2g.

5. Disputes arising out of the labor standards provisions of Section IV (except paragraph 5) and Section V of these Required Contract Provisions shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the U.S. Department of Labor (DOL) as set forth in 29 CFR 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the DOL, or the contractor's employees or their representatives.

6. **Selection of Labor:** During the performance of this contract, the contractor shall not:

   a. discriminate against labor from any other State, possession, or territory of the United States (except for employment preference for Appalachian contracts, when applicable, as specified in Attachment A), or

   b. employ convict labor for any purpose within the limits of the project unless it is labor performed by convicts who are on parole, supervised release, or probation.

II. NONDISCRIMINATION

(Applicable to all Federal-aid construction contracts and to all related subcontracts of $10,000 or more.)

1. **Equal Employment Opportunity:** Equal employment opportunity (EEO) requirements not to discriminate and to take affirmative action to assure equal opportunity as set forth under laws, executive orders, rules, regulations (28 CFR 35, 29 CFR 1630, and 41 CFR 60) and orders of the Secretary of Labor as modified by the provisions prescribed herein, and imposed pursuant to 23 U.S.C. 140 shall constitute the EEO and specific affirmative action standards for the contractor's project activities under this contract. The Equal Opportunity Construction Contract Specifications set forth under 41 CFR 60-4.3 and the provisions of the American Disabilities Act of 1990 (42 U.S.C. 12101 et seq.) set forth under 28 CFR 35 and 29 CFR 1630 are incorporated by reference in this contract. In the execution of this contract, the contractor agrees to comply with the following minimum specific requirement activities of EEO:

   a. The contractor will work with the State highway agency (SHA) and the Federal Government in carrying out EEO obligations and in their review of his/her activities under the contract.

   b. The contractor will accept as his operating policy the following statement:

   "It is the policy of this Company to assure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, sex, color, national origin, age or disability. Such action shall

include: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship, preapprenticeship, and/or on-the-job training."

2. **EEO Officer:** The contractor will designate and make known to the SHA contracting officers an EEO Officer who will have the responsibility for and must be capable of effectively administering and promoting an active contractor program of EEO and who must be assigned adequate authority and responsibility to do so.

3. **Dissemination of Policy:** All members of the contractor's staff who are authorized to hire, supervise, promote, and discharge employees, or who recommend such action, or who are substantially involved in such action, will be made fully cognizant of, and will implement, the contractor's EEO policy and contractual responsibilities to provide EEO in each grade and classification of employment. To ensure that the above agreement will be met, the following actions will be taken as a minimum:

   a. Periodic meetings of supervisory and personnel office employees will be conducted before the start of work and then not less often than once every six months, at which time the contractor's EEO policy and its implementation will be reviewed and explained. The meetings will be conducted by the EEO Officer.

   b. All new supervisory or personnel office employees will be given a thorough indoctrination by the EEO Officer, covering all major aspects of the contractor's EEO obligations within thirty days following their reporting for duty with the contractor.

   c. All personnel who are engaged in direct recruitment for the project will be instructed by the EEO Officer in the contractor's procedures for locating and hiring minority group employees.

   d. Notices and posters setting forth the contractor's EEO policy will be placed in areas readily accessible to employees, applicants for employment and potential employees.

   e. The contractor's EEO policy and the procedures to implement such policy will be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.

4. **Recruitment:** When advertising for employees, the contractor will include in all advertisements for employees the notation: "An Equal Opportunity Employer." All such advertisements will be placed in publications having a large circulation among minority groups in the area from which the project work force would normally be derived.

   a. The contractor will, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employee referral sources likely to yield qualified minority group applicants. To meet this requirement, the contractor will identify sources of potential minority group employees, and establish with such identified sources procedures whereby minority group applicants may be referred to the contractor for employment consideration.

   b. In the event the contractor has a valid bargaining agreement providing for exclusive hiring hall referrals, he is expected to observe the provisions of that agreement to the extent that the system permits the contractor's compliance with EEO contract provisions. (The DOL has held that where implementation of such agreements have the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Executive Order 11246, as amended.)

   c. The contractor will encourage his present employees to refer minority group applicants for employment. Information and procedures with regard to referring minority group applicants will be discussed with employees.

5. **Personnel Actions:** Wages, working conditions, and employee benefits shall be established and administered, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff, and termination, shall be taken without regard to race, color, religion, sex, national origin, age or disability. The following procedures shall be followed:

   a. The contractor will conduct periodic inspections of project sites to insure that working conditions and employee facilities do not indicate discriminatory treatment of project site personnel.

b. The contractor will periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.

c. The contractor will periodically review selected personnel actions in depth to determine whether there is evidence of discrimination. Where evidence is found, the contractor will promptly take corrective action. If the review indicates that the discrimination may extend beyond the actions reviewed, such corrective action shall include all affected persons.

d. The contractor will promptly investigate all complaints of alleged discrimination made to the contractor in connection with his obligations under this contract, will attempt to resolve such complaints, and will take appropriate corrective action within a reasonable time. If the investigation indicates that the discrimination may affect persons other than the complainant, such corrective action shall include such other persons. Upon completion of each investigation, the contractor will inform every complainant of all of his avenues of appeal.

6. Training and Promotion:

a. The contractor will assist in locating, qualifying, and increasing the skills of minority group and women employees, and applicants for employment.

b. Consistent with the contractor's work force requirements and as permissible under Federal and State regulations, the contractor shall make full use of training programs, i.e., apprenticeship, and on-the-job training programs for the geographical area of contract performance. Where feasible, 25 percent of apprentices or trainees in each occupation shall be in their first year of apprenticeship or training. In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision.

c. The contractor will advise employees and applicants for employment of available training programs and entrance requirements for each.

d. The contractor will periodically review the training and promotion potential of minority group and women employees and will encourage eligible employees to apply for such training and promotion.

7. **Unions:** If the contractor relies in whole or in part upon unions as a source of employees, the contractor will use his/her best efforts to obtain the cooperation of such unions to increase opportunities for minority groups and women within the unions, and to effect referrals by such unions of minority and female employees. Actions by the contractor either directly or through a contractor's association acting as agent will include the procedures set forth below:

a. The contractor will use best efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minority group members and women for membership in the unions and increasing the skills of minority group employees and women so that they may qualify for higher paying employment.

b. The contractor will use best efforts to incorporate an EEO clause into each union agreement to the end that such union will be contractually bound to refer applicants without regard to their race, color, religion, sex, national origin, age or disability.

c. The contractor is to obtain information as to the referral practices and policies of the labor union except that to the extent such information is within the exclusive possession of the labor union and such labor union refuses to furnish such information to the contractor, the contractor shall so certify to the SHA and shall set forth what efforts have been made to obtain such information.

d. In the event the union is unable to provide the contractor with a reasonable flow of minority and women referrals within the time limit set forth in the collective bargaining agreement, the contractor will, through independent recruitment efforts, fill the employment vacancies without regard to race, color, religion, sex, national origin, age or disability; making full efforts to obtain qualified and/or qualifiable minority group persons and women. (The DOL has held that it shall be no excuse that the union with which the contractor has a collective bargaining agreement providing for exclusive referral failed to refer minority employees.) In the event the union referral practice prevents the contractor from meeting the obligations pursuant to Executive Order 11246, as amended, and these special provisions, such contractor shall immediately notify the SHA.

8. **Selection of Subcontractors, Procurement of Materials and Leasing of Equipment:** The contractor shall not discriminate on the grounds of race, color, religion, sex, national origin, age or disability in the selection and retention of subcontractors, including procurement of materials and leases of equipment.

   a. The contractor shall notify all potential subcontractors and suppliers of his/her EEO obligations under this contract.

   b. Disadvantaged business enterprises (DBE), as defined in 49 CFR 23, shall have equal opportunity to compete for and perform subcontracts which the contractor enters into pursuant to this contract. The contractor will use his best efforts to solicit bids from and to utilize DBE subcontractors or subcontractors with meaningful minority group and female representation among their employees. Contractors shall obtain lists of DBE construction firms from SHA personnel.

   c. The contractor will use his best efforts to ensure subcontractor compliance with their EEO obligations.

9. **Records and Reports:** The contractor shall keep such records as necessary to document compliance with the EEO requirements. Such records shall be retained for a period of three years following completion of the contract work and shall be available at reasonable times and places for inspection by authorized representatives of the SHA and the FHWA.

   a. The records kept by the contractor shall document the following:

      (1) The number of minority and non-minority group members and women employed in each work classification on the project;

      (2) The progress and efforts being made in cooperation with unions, when applicable, to increase employment opportunities for minorities and women;

      (3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minority and female employees; and

      (4) The progress and efforts being made in securing the services of DBE subcontractors or subcontractors with meaningful minority and female representation among their employees.

   b. The contractors will submit an annual report to the SHA each July for the duration of the project, indicating the number of minority, women, and non-minority group employees currently engaged in each work classification required by the contract work. This information is to be reported on Form FHWA-1391. If on-the-job training is being required by special provision, the contractor will be required to collect and report training data.

III. NONSEGREGATED FACILITIES

(Applicable to all Federal-aid construction contracts and to all related subcontracts of $10,000 or more.)

   a. By submission of this bid, the execution of this contract or subcontract, or the consummation of this material supply agreement or purchase order, as appropriate, the bidder, Federal-aid construction contractor, subcontractor, material supplier, or vendor, as appropriate, certifies that the firm does not maintain or provide for its employees any segregated facilities at any of its establishments, and that the firm does not permit its employees to perform their services at any location, under its control, where segregated facilities are maintained. The firm agrees that a breach of this certification is a violation of the EEO provisions of this contract. The firm further certifies that no employee will be denied access to adequate facilities on the basis of sex or disability.

   b. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, restrooms and washrooms, restaurants and other eating areas, time clocks, locker rooms, and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive, or are, in fact, segregated on the basis of race, color, religion, national origin, age or disability, because of habit, local custom, or otherwise. The only exception will be for the disabled when the demands for accessibility override (e.g. disabled parking).

c. The contractor agrees that it has obtained or will obtain identical certification from proposed subcontractors or material suppliers prior to award of subcontracts or consummation of material supply agreements of $10,000 or more and that it will retain such certifications in its files.

IV. PAYMENT OF PREDETERMINED MINIMUM WAGE

(Applicable to all Federal-aid construction contracts exceeding $2,000 and to all related subcontracts, except for projects located on roadways classified as local roads or rural minor collectors, which are exempt.)

1. General:

a. All mechanics and laborers employed or working upon the site of the work will be paid unconditionally and not less often than once a week and without subsequent deduction or rebate on any account [except such payroll deductions as are permitted by regulations (29 CFR 3)] issued by the Secretary of Labor under the Copeland Act (40 U.S.C. 276c) the full amounts of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment. The payment shall be computed at wage rates not less than those contained in the wage determination of the Secretary of Labor (hereinafter "the wage determination") which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor or its subcontractors and such laborers and mechanics. The wage determination (including any additional classifications and wage rates conformed under paragraph 2 of this Section IV and the DOL poster (WH-1321) or Form FHWA-1495) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers. For the purpose of this Section, contributions made or costs reasonably anticipated for bona fide fringe benefits under Section 1(b)(2) of the Davis-Bacon Act (40 U.S.C. 276a) on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of Section IV, paragraph 3b, hereof. Also, for the purpose of this Section, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs, which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in paragraphs 4 and 5 of this Section IV.

b. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein, provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed.

c. All rulings and interpretations of the Davis-Bacon Act and related acts contained in 29 CFR 1, 3, and 5 are herein incorporated by reference in this contract.

2. Classification:

a. The SHA contracting officer shall require that any class of laborers or mechanics employed under the contract, which is not listed in the wage determination, shall be classified in conformance with the wage determination.

b. The contracting officer shall approve an additional classification, wage rate and fringe benefits only when the following criteria have been met:

(1) the work to be performed by the additional classification requested is not performed by a classification in the wage determination;

(2) the additional classification is utilized in the area by the construction industry;

(3) the proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination; and

(4) with respect to helpers, when such a classification prevails in the area in which the work is performed.

c. If the contractor or subcontractors, as appropriate, the laborers and mechanics (if known) to be employed in the additional classification or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the DOL, Administrator of the Wage and Hour Division, Employment Standards Administration, Washington, D.C. 20210. The Wage and Hour Administrator, or an authorized

representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

d. In the event the contractor or subcontractors, as appropriate, the laborers or mechanics to be employed in the additional classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Wage and Hour Administrator for determination. Said Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary

e. The wage rate (including fringe benefits where appropriate) determined pursuant to paragraph 2c or 2d of this Section IV shall be paid to all workers performing work in the additional classification from the first day on which work is performed in the classification.

3. Payment of Fringe Benefits:

a. Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor or subcontractors, as appropriate, shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly case equivalent thereof.

b. If the contractor or subcontractor, as appropriate, does not make payments to a trustee or other third person, he/she may consider as a part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, provided, that the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

4. Apprentices and Trainees (Programs of the U.S. DOL) and Helpers:

a. Apprentices:

(1) Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the DOL, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State apprenticeship agency recognized by the Bureau, or if a person is employed in his/her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State apprenticeship agency (where appropriate) to be eligible for probationary employment as an apprentice.

(2) The allowable ratio of apprentices to journeyman-level employees on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any employee listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate listed in the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor or subcontractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman-level hourly rate) specified in the contractor's or subcontractor's registered program shall be observed.

(3) Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeyman-level hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator for the Wage and Hour Division determines that a different

practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination.

(4) In the event the Bureau of Apprenticeship and Training, or a State apprenticeship agency recognized by the Bureau, withdraws approval of an apprenticeship program, the contractor or subcontractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the comparable work performed by regular employees until an acceptable program is approved.

b. Trainees:

(1) Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the DOL, Employment and Training Administration.

(2) The ratio of trainees to journeyman-level employees on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed.

(3) Every trainee must be paid at not less than the rate specified in the approved program for his/her level of progress, expressed as a percentage of the journeyman-level hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman-level wage rate on the wage determination which provides for less than full fringe benefits for apprentices, in which case such trainees shall receive the same fringe benefits as apprentices.

(4) In the event the Employment and Training Administration withdraws approval of a training program, the contractor or subcontractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

c. Helpers**:**

Helpers will be permitted to work on a project if the helper classification is specified and defined on the applicable wage determination or is approved pursuant to the conformance procedure set forth in Section IV.2. Any worker listed on a payroll at a helper wage rate, who is not a helper under an approved definition, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed.

5. Apprentices and Trainees (Programs of the U.S. DOT):

Apprentices and trainees working under apprenticeship and skill training programs which have been certified by the Secretary of Transportation as promoting EEO in connection with Federal-aid highway construction programs are not subject to the requirements of paragraph 4 of this Section IV. The straight time hourly wage rates for apprentices and trainees under such programs will be established by the particular programs. The ratio of apprentices and trainees to journeymen shall not be greater than permitted by the terms of the particular program.

6. Withholding:

The SHA shall upon its own action or upon written request of an authorized representative of the DOL withhold, or cause to be withheld, from the contractor or subcontractor under this contract or any other Federal contract with the same prime contractor, or any other Federally-assisted contract subject to Davis-Bacon prevailing wage requirements which is held by the same prime contractor, as much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or

part of the wages required by the contract, the SHA contracting officer may, after written notice to the contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

7. **Overtime Requirements:**
No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers, mechanics, watchmen, or guards (including apprentices, trainees, and helpers described in paragraphs 4 and 5 above) shall require or permit any laborer, mechanic, watchman, or guard in any workweek in which he/she is employed on such work, to work in excess of 40 hours in such workweek unless such laborer, mechanic, watchman, or guard receives compensation at a rate not less than one-and-one-half times his/her basic rate of pay for all hours worked in excess of 40 hours in such workweek.

8. **Violation:**
Liability for Unpaid Wages; Liquidated Damages: In the event of any violation of the clause set forth in paragraph 7 above, the contractor and any subcontractor responsible thereof shall be liable to the affected employee for his/her unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory) for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer, mechanic, watchman, or guard employed in violation of the clause set forth in paragraph 7, in the sum of $10 for each calendar day on which such employee was required or permitted to work in excess of the standard work week of 40 hours without payment of the overtime wages required by the clause set forth in paragraph 7.

9. **Withholding for Unpaid Wages and Liquidated Damages:**
The SHA shall upon its own action or upon written request of any authorized representative of the DOL withhold, or cause to be withheld, from any monies payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other Federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph 8 above.

V. STATEMENTS AND PAYROLLS

(Applicable to all Federal-aid construction contracts exceeding $2,000 and to all related subcontracts, except for projects located on roadways classified as local roads or rural collectors, which are exempt.)

1. Compliance with Copeland Regulations (29 CFR 3):

   The contractor shall comply with the Copeland Regulations of the Secretary of Labor which are herein incorporated by reference.

2. Payrolls and Payroll Records:

   a. Payrolls and basic records relating thereto shall be maintained by the contractor and each subcontractor during the course of the work and preserved for a period of 3 years from the date of completion of the contract for all laborers, mechanics, apprentices, trainees, watchmen, helpers, and guards working at the site of the work.

   b. The payroll records shall contain the name, social security number, and address of each such employee; his or her correct classification; hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalent thereof the types described in Section 1(b)(2)(B) of the Davis Bacon Act); daily and weekly number of hours worked; deductions made; and actual wages paid. In addition, for Appalachian contracts, the payroll records shall contain a notation indicating whether the employee does, or does not, normally reside in the labor area as defined in Attachment A, paragraph 1. Whenever the Secretary of Labor, pursuant to Section IV, paragraph 3b, has found that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in Section 1(b)(2)(B) of the Davis Bacon Act, the contractor and each subcontractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, that the plan or program has been communicated in writing to the laborers or mechanics affected, and show the cost anticipated or the actual cost incurred in providing benefits. Contractors or subcontractors employing

apprentices or trainees under approved programs shall maintain written evidence of the registration of apprentices and trainees, and ratios and wage rates prescribed in the applicable programs.

c. Each contractor and subcontractor shall furnish, each week in which any contract work is performed, to the SHA resident engineer a payroll of wages paid each of its employees (including apprentices, trainees, and helpers, described in Section IV, paragraphs 4 and 5, and watchmen and guards engaged on work during the preceding weekly payroll period). The payroll submitted shall set out accurately and completely all of the information required to be maintained under paragraph 2b of this Section V. This information may be submitted in any form desired. Optional Form WH-347 is available for this purpose and may be purchased from the Superintendent of Documents (Federal stock number 029-005-0014-1), U.S. Government Printing Office, Washington, D.C. 20402. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors.

d. Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his/her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) that the payroll for the payroll period contains the information required to be maintained under paragraph 2b of this Section V and that such information is correct and complete;

(2) that such laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in the Regulations, 29 CFR 3;

(3) that each laborer or mechanic has been paid not less that the applicable wage rate and fringe benefits or cash equivalent for the classification of worked performed, as specified in the applicable wage determination incorporated into the contract.

e. The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph 2d of this Section V.

f. The falsification of any of the above certifications may subject the contractor to civil or criminal prosecution under 18 U.S.C. 1001 and 31 U.S.C. 231.

g. The contractor or subcontractor shall make the records required under paragraph 2b of this Section V available for inspection, copying, or transcription by authorized representatives of the SHA, the FHWA, or the DOL, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the SHA, the FHWA, the DOL, or all may, after written notice to the contractor, sponsor, applicant, or owner, take such actions as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

VI. RECORD OF MATERIALS, SUPPLIES, AND LABOR

1. On all Federal-aid contracts on the National Highway System, except those which provide solely for the installation of protective devices at railroad grade crossings, those which are constructed on a force account or direct labor basis, highway beautification contracts, and contracts for which the total final construction cost for roadway and bridge is less than $1,000,000 (23 CFR 635) the contractor shall:

a. Become familiar with the list of specific materials and supplies contained in Form FHWA-47, "Statement of Materials and Labor Used by Contractor of Highway Construction Involving Federal Funds," prior to the commencement of work under this contract.

b. Maintain a record of the total cost of all materials and supplies purchased for and incorporated in the work, and also of the quantities of those specific materials and supplies listed on Form FHWA-47, and in the units shown on Form FHWA-47.

c. Furnish, upon the completion of the contract, to the SHA resident engineer on Form FHWA-47 together with the data required in paragraph 1b relative to materials and supplies, a final labor summary of all contract work indicating the total hours worked and the total amount earned.

2. At the prime contractor's option, either a single report covering all contract work or separate reports for the contractor and for each subcontract shall be submitted.

VII. SUBLETTING OR ASSIGNING THE CONTRACT

1. The contractor shall perform with its own organization contract work amounting to not less than 30 percent (or a greater percentage if specified elsewhere in the contract) of the total original contract price, excluding any specialty items designated by the State. Specialty items may be performed by subcontract and the amount of any such specialty items performed may be deducted from the total original contract price before computing the amount of work required to be performed by the contractor's own organization (23 CFR 635).

   a. "Its own organization" shall be construed to include only workers employed and paid directly by the prime contractor and equipment owned or rented by the prime contractor, with or without operators. Such term does not include employees or equipment of a subcontractor, assignee, or agent of the prime contractor.

   b. "Specialty Items" shall be construed to be limited to work that requires highly specialized knowledge, abilities, or equipment not ordinarily available in the type of contracting organizations qualified and expected to bid on the contract as a whole and in general are to be limited to minor components of the overall contract.

2. The contract amount upon which the requirements set forth in paragraph 1 of Section VII is computed includes the cost of material and manufactured products which are to be purchased or produced by the contractor under the contract provisions.

3. The contractor shall furnish (a) a competent superintendent or supervisor who is employed by the firm, has full authority to direct performance of the work in accordance with the contract requirements, and is in charge of all construction operations (regardless of who performs the work) and (b) such other of its own organizational resources (supervision, management, and engineering services) as the SHA contracting officer determines is necessary to assure the performance of the contract.

4. No portion of the contract shall be sublet, assigned or otherwise disposed of except with the written consent of the SHA contracting officer, or authorized representative, and such consent when given shall not be construed to relieve the contractor of any responsibility for the fulfillment of the contract. Written consent will be given only after the SHA has assured that each subcontract is evidenced in writing and that it contains all pertinent provisions and requirements of the prime contract.

VIII. SAFETY: ACCIDENT PREVENTION

1. In the performance of this contract the contractor shall comply with all applicable Federal, State, and local laws governing safety, health, and sanitation (23 CFR 635). The contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions as it determines, or as the SHA contracting officer may determine, to be reasonably necessary to protect the life and health of employees on the job and the safety of the public and to protect property in connection with the performance of the work covered by the contract.

2. It is a condition of this contract, and shall be made a condition of each subcontract, which the contractor enters into pursuant to this contract, that the contractor and any subcontractor shall not permit any employee, in performance of the contract, to work in surroundings or under conditions which are unsanitary, hazardous or dangerous to his/her health or safety, as determined under construction safety and health standards (29 CFR 1926) promulgated by the Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 333).

3. Pursuant to 29 CFR 1926.3, it is a condition of this contract that the Secretary of Labor or authorized representative thereof, shall have right of entry to any site of contract performance to inspect or investigate the matter of compliance with the construction safety and health standards and to carry out the duties of the Secretary under Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 333).

IX. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

In order to assure high quality and durable construction in conformity with approved plans and specifications and a high degree of reliability on statements and representations made by engineers, contractors, suppliers, and workers on Federal-aid highway projects, it is essential that all persons concerned with the project perform their functions as carefully, thoroughly, and honestly as possible. Willful falsification, distortion, or misrepresentation with respect to any facts related to the project is a violation of Federal law. To prevent any misunderstanding regarding the seriousness of these and similar acts, the following notice shall be posted on each Federal-aid highway project (23 CFR 635) in one or more places where it is readily available to all persons concerned with the project:

Notice To All Personnel Engaged On Federal-Aid Highway Projects

18 U.S.C. 1020 READS AS FOLLOWS:

"Whoever being an officer, agent, or employee of the United States, or any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of the material used or to be used, or the quantity or quality of the work performed or to be performed, or the cost thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction on any highway or related project submitted for approval to the Secretary of Transportation; or

Whoever knowingly makes any false statement, false representation, false report or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or

Whoever knowingly makes any false statement or false representation as to material fact in any statement, certificate, or report submitted pursuant to provisions of the Federal-aid Roads Act approved July 1, 1916, (39 Stat. 355), as amended and supplemented;

Shall be fined not more that $10,000 or imprisoned not more than 5 years or both."

X. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT

(Applicable to all Federal-aid construction contracts and to all related subcontracts of $100,000 or more.)

By submission of this bid or the execution of this contract, or subcontract, as appropriate, the bidder, Federal-aid construction contractor, or subcontractor, as appropriate, will be deemed to have stipulated as follows:

1. That any facility that is or will be utilized in the performance of this contract, unless such contract is exempt under the Clean Air Act, as amended (42 U.S.C. 1857 et seq., as amended by Pub.L. 91-604), and under the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251 et seq., as amended by Pub.L. 92-500), Executive Order 11738, and regulations in implementation thereof (40 CFR 15) is not listed, on the date of contract award, on the U.S. Environmental Protection Agency (EPA) List of Violating Facilities pursuant to 40 CFR 15.20.

2. That the firm agrees to comply and remain in compliance with all the requirements of Section 114 of the Clean Air Act and Section 308 of the Federal Water Pollution Control Act and all regulations and guidelines listed thereunder.

3. That the firm shall promptly notify the SHA of the receipt of any communication from the Director, Office of Federal Activities, EPA, indicating that a facility that is or will be utilized for the contract is under consideration to be listed on the EPA List of Violating Facilities.

4. That the firm agrees to include or cause to be included the requirements of paragraph 1 through 4 of this Section X in every nonexempt subcontract, and further agrees to take such action as the government may direct as a means of enforcing such requirements.

XI. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

1. Instructions for Certification - Primary Covered Transactions:

(Applicable to all Federal-aid contracts - 49 CFR 29)

a. By signing and submitting this proposal, the prospective primary participant is providing the certification set out below.

b. The inability of a person to provide the certification set out below will not necessarily result in denial of participation in this covered transaction. The prospective participant shall submit an explanation of why it cannot provide the certification set out below. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective primary participant to furnish a certification or an explanation shall disqualify such a person from participation in this transaction.

c. The certification in this clause is a material representation of fact upon which reliance was placed when the department or agency determined to enter into this transaction. If it is later determined that the prospective primary participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause of default.

d. The prospective primary participant shall provide immediate written notice to the department or agency to whom this proposal is submitted if any time the prospective primary participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

e. The terms "covered transaction," "debarred," "suspended," "ineligible," "lower tier covered transaction," "participant," "person," "primary covered transaction," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the department or agency to which this proposal is submitted for assistance in obtaining a copy of those regulations.

f. The prospective primary participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency entering into this transaction.

g. The prospective primary participant further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," provided by the department or agency entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.

h. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the nonprocurement portion of the "Lists of Parties Excluded From Federal Procurement or Nonprocurement Programs" (Nonprocurement List) which is compiled by the General Services Administration.

i. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

j. Except for transactions authorized under paragraph f of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default.

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion — Primary Covered Transactions

1. The prospective primary participant certifies to the best of its knowledge and belief, that it and its principals:

a. Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;

b. Have not within a 3-year period preceding this proposal been convicted of or had a civil judgement rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

c. Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph 1b of this certification; and

d. Have not within a 3-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

2. Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

2. Instructions for Certification - Lower Tier Covered Transactions:

(Applicable to all subcontracts, purchase orders and other lower tier transactions of $25,000 or more - 49 CFR 29)

a. By signing and submitting this proposal, the prospective lower tier is providing the certification set out below.

b. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

c. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous by reason of changed circumstances.

d. The terms "covered transaction," "debarred," "suspended," "ineligible," "primary covered transaction," "participant," "person," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations.

e. The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.

f. The prospective lower tier participant further agrees by submitting this proposal that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.

g. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the Nonprocurement List.

h. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is

not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

i. Except for transactions authorized under paragraph e of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion — Lower Tier Covered Transactions

1. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.

2. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

XII. CERTIFICATION REGARDING USE OF CONTRACT FUNDS FOR LOBBYING

(Applicable to all Federal-aid construction contracts and to all related subcontracts which exceed $100,000 - 49 CFR 20)

1. The prospective participant certifies, by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

   a. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

   b. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

2. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

3. The prospective participant also agrees by submitting his or her bid or proposal that he or she shall require that the language of this certification be included in all lower tier subcontracts, which exceed $100,000 and that all such recipients shall certify and disclose accordingly.

FEDERAL-AID FEMALE AND MINORITY GOALS

In accordance with Section II, "Nondiscrimination," of "Required Contract Provisions Federal-aid Construction Contracts" the following are the goals for female utilization:

Goal for Women (applies nationwide).....(percent) 6.9

The following are goals for minority utilization:

CALIFORNIA ECONOMIC AREA

		Goal (Percent)
174	**Redding, CA:**	
	Non-SMSA Counties	6.8
	CA Lassen; CA Modoc;CA Plumas;CA Shasta; CA Siskiyou; CA Tehama.	
175	**Eureka, CA**	
	Non-SMSA Counties	6.6
	CA Del Norte; CA Humboldt; CA Trinity.	
176	**San Francisco-Oakland-San Jose, CA:**	
	SMSA Counties:	
	7120 Salinas-Seaside-Monterey, CA	28.9
	CA Monterey.	
	7360 San Francisco-Oakland	25.6
	CA Alameda; CA Contra Costa; CA Marin; CA San Francisco; CA San Mateo.	
	7400 San Jose, CA	19.6
	CA Santa Clara.	
	7485 Santa Cruz, CA.	14.9
	CA Santa Cruz.	
	7500 Santa Rosa, CA	9.1
	CA Sonoma.	
	8720 Vallejo-Fairfield- Napa, CA	17.1
	CA Napa; CA Solano	
	Non-SMSA Counties	23.2
	CA Lake; CA Mendocino; CA San Benito	
177	**Sacramento, CA**:	
	SMSA Counties:	
	6920 Sacramento, CA	16.1
	CA Placer; CA Sacramento; CA Yolo.	
	Non-SMSA Counties	14.3
	CA Butte; CA Colusa; CA El Dorado; CA Glenn; CA Nevada; CA Sierra; CA Sutter; CA Yuba.	
178	**Stockton-Modesto, CA:**	
	SMSA Counties:	
	5170 Modesto, CA	12.3
	CA Stanislaus.	
	8120 Stockton, CA	24.3
	CA San Joaquin.	
	Non-SMSA Counties	19.8
	CA Alpine; CA Amador; CA Calaveras; CA Mariposa;CA Merced; CA Tuolumne.	

		Goal (Percent)
179	**Fresno-Bakersfield, CA**	
	SMSA Counties:	
	0680 Bakersfield, CA	19.1
	CA Kern.	
	2840 Fresno, CA	26.1
	CA Fresno.	
	Non-SMSA Counties	23.6
	CA Kings; CA Madera; CA Tulare.	
180	**Los Angeles, CA:**	
	SMSA Counties:	
	0360 Anaheim-Santa Ana-Garden Grove, CA	11.9
	CA Orange.	
	4480 Los Angeles-Long Beach, CA	28.3
	CA Los Angeles.	
	6000 Oxnard-Simi Valley-Ventura, CA	21.5
	CA Ventura.	
	6780 Riverside-San Bernardino-Ontario, CA.	19.0
	CA Riverside; CA San Bernardino.	
	7480 Santa Barbara-Santa Maria-Lompoc, CA	19.7
	CA Santa Barbara.	
	Non-SMSA Counties	24.6
	CA Inyo; CA Mono; CA San Luis Obispo.	
181	**San Diego, CA:**	
	SMSA Counties	
	7320 San Diego, CA.	16.9
	CA San Diego.	
	Non-SMSA Counties	18.2
	CA Imperial.	

In addition to the reporting requirements set forth elsewhere in this contract the Contractor and subcontractors holding subcontracts, not including material suppliers, of $10,000 or more, shall submit for every month of July during which work is performed, employment data as contained under Form FHWA PR-1391 (Appendix C to 23 CFR, Part 230), and in accordance with the instructions included thereon.

FEDERAL REQUIREMENT TRAINING SPECIAL PROVISIONS

As part of the Contractor's equal employment opportunity affirmative action program, training shall be provided as follows:

The Contractor shall provide on-the-job training to develop full journeymen in the types of trades or job classification involved.

The goal for the number of trainees or apprentices to be trained under the requirements of this special provision will be 18.

In the event the Contractor subcontracts a portion of the contract work, he shall determine how many, if any, of the trainees or apprentices are to be trained by the subcontractor, provided however, that the Contractor shall retain the primary responsibility for meeting the training requirements imposed by this special provision. The Contractor shall also insure that this Training Special Provision is made applicable to such subcontract. Where feasible, 25 percent of trainees or apprentices in each occupation shall be in their first year of apprenticeship or training.

The number of trainees or apprentices shall be distributed among the work classifications on the basis of the Contractor's needs and the availability of journeymen in the various classifications within a reasonable area of recruitment. Prior to commencing work, the Contractor shall submit to the Department for approval the number of trainees or apprentices to be trained in each selected classification and training program to be used. Furthermore, the Contractor shall specify the starting time for training in each of the classifications. The Contractor will be credited for each trainee or apprentice employed by him on the contract work who is currently enrolled or becomes enrolled in an approved program and will be reimbursed for such trainees or apprentices as provided hereinafter.

Training and upgrading of minorities and women toward journeymen status is a primary objective of this Training Special Provision. Accordingly, the Contractor shall make every effort to enroll minority and women trainees or apprentices (e.g., by conducting systematic and direct recruitment through public and private sources likely to yield minority and women trainees or apprentices) to the extent such persons are available within a reasonable area of recruitment. The Contractor will be responsible for demonstrating the steps that he has taken in pursuance thereof, prior to a determination as to whether the Contractor is in compliance with this Training Special Provision. This training commitment is not intended, and shall not be used, to discriminate against any applicant for training, whether a member of a minority group or not.

No employee shall be employed as a trainee or apprentice in any classification in which he has successfully completed a training course leading to journeyman status or in which he has been employed as a journeyman. The Contractor should satisfy this requirement by including appropriate questions in the employee application or by other suitable means. Regardless of the method used the Contractor's records should document the findings in each case.

The minimum length and type of training for each classification will be as established in the training program selected by the Contractor and approved by both the Department and the Federal Highway Administration. The Department and the Federal Highway Administration will approve a program if it is reasonably calculated to meet the equal employment opportunity obligations of the Contractor and to qualify the average trainee or apprentice for journeyman status in the classification concerned by the end of the training period. Furthermore, apprenticeship programs registered with the U.S. Department of Labor, Bureau of Apprenticeship and Training, or with the State of California, Department of Industrial Relations, Division of Apprenticeship Standards recognized by the Bureau and training programs approved but not necessarily sponsored by the U.S. Department of Labor, Manpower Administration, Bureau of Apprenticeship and Training shall also be considered acceptable provided it is being administered in a manner consistent with the equal employment obligations of Federal-aid highway construction contracts. Approval or acceptance of a training program shall be obtained from the State prior to commencing work on the classification covered by the program. It is the intention of these provisions that training is to be provided in the construction crafts rather than clerk-typists or secretarial-type positions. Training is permissible in lower level management positions such as office engineers, estimators, timekeepers, etc., where the training is oriented toward construction applications. Training in the laborer classification may be permitted provided that significant and meaningful training is provided and approved by the division office. Some offsite training is permissible as long as the training is an integral part of an approved training program and does not comprise a significant part of the overall training.

Except as otherwise noted below, the Contractor will be reimbursed 80 cents per hour of training given an employee on this contract in accordance with an approved training program. As approved by the Engineer, reimbursement will be made for training of persons in excess of the number specified herein. This reimbursement will be made even though the Contractor receives additional training program funds from other sources, provided such other source does not specifically prohibit the Contractor from receiving other reimbursement. Reimbursement for offsite training indicated above may only be made to the Contractor where he does one or more of the following and the trainees or apprentices are concurrently employed on a Federal-aid project; contributes to the cost of the training, provides the instruction to the trainee or apprentice or pays the trainee's or apprentice's wages during the offsite training period.

No payment shall be made to the Contractor if either the failure to provide the required training, or the failure to hire the trainee or apprentice as a journeyman, is caused by the Contractor and evidences a lack of good faith on the part of the Contractor in meeting the requirements of this Training Special Provision. It is normally expected that a trainee or apprentice will begin his training on the project as soon as feasible after start of work utilizing the skill involved and remain on the project as long as training opportunities exist in his work classification or until he has completed his training program. It is not required that all trainees or apprentices be on board for the entire length of the contract. A Contractor will have fulfilled his responsibilities under this Training Special Provision if he has provided acceptable training to the number of trainees or apprentices specified. The number trained shall be determined on the basis of the total number enrolled on the contract for a significant period.

Only trainees or apprentices registered in a program approved by the State of California's State Administrator of Apprenticeship may be employed on the project and said trainees or apprentices shall be paid the standard wage specified under the regulations of the craft or trade at which they are employed.

The Contractor shall furnish the trainee or apprentice a copy of the program he will follow in providing the training. The Contractor shall provide each trainee or apprentice with a certification showing the type and length of training satisfactorily completed.

The Contractor will provide for the maintenance of records and furnish periodic reports documenting his performance under this Training Special Provision.