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Note: Addenda information is NOT included with the electronic documents available via electronic file transfer. Only bidder or non-bidder package holders listed with the Caltrans Plans and Bid Documents section as described above will receive addenda information.



STATE OF CALIFORNIA

DEPARTMENT OF TRANSPORTATION

**NOTICE TO CONTRACTORS
AND**

SPECIAL PROVISIONS

FOR CONSTRUCTION ON STATE HIGHWAY IN

**SAN MATEO AND ALAMEDA COUNTIES IN AND NEAR SAN MATEO, FOSTER CITY AND HAYWARD AT
VARIOUS LOCATIONS FROM ROUTE 101 TO ROUTE 880.**

DISTRICT 04, ROUTE 92

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

CONTRACT NO. 04-150404

04-SM,Ala-92-R19.8/R30.3,R0.0/10.1

Bids Open: August 29, 2000
Dated: July 17, 2000

OSD

IMPORTANT SPECIAL NOTICES

- **SURETY 2000**

Caltrans is conducting a pilot program in cooperation with Surety 2000, to test electronic bond verification systems. The purpose of the pilot program is to test the use of Surety 2000 for verifying a bidder's bond electronically.

Surety 2000 is an Internet-based surety verification and security system, developed in conjunction with the surety industry. Surety agents may contact Surety 2000 at 1-800-660-3263.

Bidders are encouraged to participate in the pilot program. To participate, the bidder is asked to provide the "Authorization Code" provided by Surety 2000, on a separate sheet, together with the standard bidder's bond required by the specifications. The bidder's surety agent may obtain the "Authorization Code" from Surety 2000.

The Department will use the "Authorization Code" to access the Surety 2000 database, and independently verify the actual bidder's bond and document the functioning of the Surety 2000 system.

"Authorization Codes" will be used only to verify bidder's bonds, and only as part of the pilot program. The use of "Authorization Codes" will not be accepted in lieu of the bidder's bond or other bidder's security required in the specifications during the pilot study.

The function of the Surety 2000 system is to provide an easier way for Contractors to protect their bid security, and to discourage fraud. This system is available to all California admitted sureties and surety agents.

The results of the pilot study will be tabulated, and at some time in the future, the Department may consider accepting electronic bidder's bond verification in lieu of the bidder's bond specified.

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STANDARD PLANS LIST

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

A10A	Abbreviations
A10B	Symbols
A73C	Delineators, Channelizers and Barricades
A77A	Metal Beam Guard Railing – Typical Wood Post With Wood Block
A77B	Metal Beam Guard Railing - Standard Hardware
A77C	Metal Beam Guard Railing – Wood Post and Wood Block Details
A77E	Metal Beam Guard Railing – Typical Layouts
A77F	Metal Beam Guard Railing – Typical Embankment Widening for End Treatments
A77G	Metal Beam Guard Railing – End Treatment, Terminal Anchor Assembly (Type SFT)
A77H	Metal Beam Guard Railing - Anchor Cable and Anchor Plate Details
A77I	Metal Beam Guard Railing – End Treatment, Terminal Anchor Assembly (Type CA)
A77L	Metal Beam Guard Railing and Single Faced Barrier Railing - End Treatment
T1A	Temporary Crash Cushion, Sand Filled (Unidirectional)
T2	Temporary Crash Cushion, Sand Filled (Shoulder Installations)
T3	Temporary Railing (Type K)
T7	Construction Project Funding Identification Signs
T10	Traffic Control System for Lane Closure On Freeways and Expressways
T14	Traffic Control System for Ramp Closure
B2-6	Pile Details-Class 400C and Class 625C
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-2A	Signal, Lighting and Electrical Systems - Service Equipment
ES-2C	Signal, Lighting and Electrical Systems - Service Equipment Notes, Type III Series
ES-2D	Signal, Lighting and Electrical Systems - Service Equipment and Typical Wiring Diagram Type III-A Series
ES-2F	Signal, Lighting and Electrical Systems - Service Equipment and Typical Wiring Diagram Type III-C Series
ES-3B	Signal, Lighting and Electrical Systems - Controller Cabinet Details
ES-3C	Signal, Lighting and Electrical Systems - Controller Cabinet Details
ES-3F	Signal, Lighting and Electrical Systems - Telephone Demarcation Cabinet Details, Type C
ES-3G	Signal, Lighting and Electrical Systems – Telephone Demarcation Cabinet, Type C Details
ES-5A	Signal, Lighting and Electrical Systems - Detectors
ES-5B	Signal, Lighting and Electrical Systems - Detectors
ES-7P	Signal, Lighting and Electrical Systems - Pedestrian Barricades
ES-8	Signal, Lighting and Electrical Systems - Pull Box Details
ES-9B	Signal, Lighting and Electrical Systems - Electrical Details, Structure Installations
ES-11	Signal, Lighting and Electrical Systems - Foundation Installations
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-15C	Sign Illumination - Sign Illumination Equipment
ES-16A	Closed Circuit Television Pole Details
ES-16B	Closed Circuit Television Pole Details - Overhead Sign Mounted

DEPARTMENT OF TRANSPORTATION

NOTICE TO CONTRACTORS

**CONTRACT NO. 04-150404
04-SM,Ala-92-R19.8/R30.3,R0.0/10.1**

Sealed proposals for the work shown on the plans entitled:

STATE OF CALIFORNIA; DEPARTMENT OF TRANSPORTATION; PROJECT PLANS FOR CONSTRUCTION ON STATE HIGHWAY IN SAN MATEO AND ALAMEDA COUNTIES IN AND NEAR SAN MATEO, FOSTER CITY AND HAYWARD AT VARIOUS LOCATIONS FROM ROUTE 101 TO ROUTE 880.

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 August 29, 2000, at which time they will be publicly opened and read in Room 0100 at the same address.

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

STATE OF CALIFORNIA; DEPARTMENT OF TRANSPORTATION; PROPOSAL AND CONTRACT FOR CONSTRUCTION ON STATE HIGHWAY IN SAN MATEO AND ALAMEDA COUNTIES IN AND NEAR SAN MATEO, FOSTER CITY AND HAYWARD AT VARIOUS LOCATIONS FROM ROUTE 101 TO ROUTE 880.

General work description: Traffic Operations System.

This project has a goal of 3 percent disabled veteran business enterprise (DVBE) participation.

No prebid meeting is scheduled for this project.

Bids are required for the entire work described herein.

At the time this contract is awarded, the Contractor shall possess either a Class A license or a Class C-10 license.

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

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

Preference will be granted to bidders properly certified as a "Small Business" as determined by the Department of General Services, Office of Small Business Certification and Resources at the time of bid opening in conformance with the provisions in Section 2-1.05, "Small Business Preference," of the special provisions, and Section 1896 et seq, Title 2, California Code of Regulations. A form for requesting a "Small Business" preference is included with the bid documents. Applications for status as a "Small Business" must be submitted to the Department of General Services, Office of Small Business Certification and Resources, 1531 "I" Street, Second Floor, Sacramento, CA 95814, Telephone No. (916) 322-5060.

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

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 not available.

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

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

DEPARTMENT OF TRANSPORTATION

Deputy Director Transportation Engineering

Dated July 17, 2000

JRG

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

04-150404

Item	Item Code	Item	Unit of Measure	Estimated Quantity	Unit Price	Item Total
1	070010	PROGRESS SCHEDULE (CRITICAL PATH)	LS	LUMP SUM	LUMP SUM	
2	070018	TIME RELATED OVERHEAD	WDAY	210		
3	019199	LEAD COMPLIANCE PLAN	LS	LUMP SUM	LUMP SUM	
4	019005	TEMPORARY CONCRETE WASHOUT FACILITY	LS	LUMP SUM	LUMP SUM	
5 (S)	120090	CONSTRUCTION AREA SIGNS	LS	LUMP SUM	LUMP SUM	
6 (S)	120100	TRAFFIC CONTROL SYSTEM	LS	LUMP SUM	LUMP SUM	
7	157560	BRIDGE REMOVAL (PORTION)	LS	LUMP SUM	LUMP SUM	
8	192001	STRUCTURE EXCAVATION	M3	37		
9	193001	STRUCTURE BACKFILL	M3	26		
10	490759	FURNISH PILING (CLASS 400C)	M	152		
11	490760	DRIVE PILE (CLASS 400C)	EA	8		
12 (F)	510502	MINOR CONCRETE (MINOR STRUCTURE)	M3	4.6		
13	515072	CORE CONCRETE (0 - 50 MM)	M	6		
14 (F)	520102	BAR REINFORCING STEEL (BRIDGE)	KG	1120		
15 (F)	560218	FURNISH SIGN STRUCTURE (TRUSS)	KG	17 500		
16 (S-F)	560219	INSTALL SIGN STRUCTURE (TRUSS)	KG	17 500		
17 (S)	561007	610 MM CAST-IN-DRILLED-HOLE CONCRETE PILE (SIGN FOUNDATION)	M	13		
18	561008	760 MM CAST-IN-DRILLED-HOLE CONCRETE PILE (SIGN FOUNDATION)	M	2		
19 (S)	561012	1220 MM CAST-IN-DRILLED-HOLE CONCRETE PILE (SIGN FOUNDATION)	M	6		
20 (F)	750501	MISCELLANEOUS METAL (BRIDGE)	KG	7620		

Item	Item Code	Item	Unit of Measure	Estimated Quantity	Unit Price	Item Total
21	832003	METAL BEAM GUARD RAILING (WOOD POST)	M	40		
22 (F)	839401	CONCRETE BARRIER	M	3		
23	019006	CONCRETE MEDIAN BARRIER	M	15		
24	839568	TERMINAL ANCHOR ASSEMBLY (TYPE SFT)	EA	5		
25	839565	TERMINAL SYSTEM (TYPE SRT)	EA	5		
26	860101	FOUNDATION CONCRETE	M3	12		
27	019007	ANALOG DATA STATION TERMINATION UNIT	EA	8		
28	019008	CAMERA UNIT	EA	14		
29	019009	PAN AND TILT	EA	14		
30	019010	CAMERA CONTROL UNIT	EA	14		
31	019011	VIDEO ENCODER UNIT	EA	14		
32	019112	INTEGRATED SERVICES DIGITAL NETWORK TERMINAL ADAPTER UNIT	EA	15		
33	019013	COLOR CLOSED CIRCUIT TELEVISION MONITOR	EA	3		
34	019014	FIBER OPTIC TRANSMITTER	EA	16		
35	019015	FIBER OPTIC RECEIVER	EA	16		
36	019016	MICROWAVE VEHICULAR DETECTION SENSOR	EA	57		
37	019017	CLUSTER CONTROLLER	EA	13		
38	019018	FIBER OPTIC COMMUNICATIONS SYSTEM AND SCADA COMMUNICATIONS CABLE	LS	LUMP SUM	LUMP SUM	
39	019019	STEEL BRIDGE COMMUNICATION SYSTEM	LS	LUMP SUM	LUMP SUM	
40	019020	CONCRETE TRISTLE COMMUNICATION SYSTEM	LS	LUMP SUM	LUMP SUM	

Item	Item Code	Item	Unit of Measure	Estimated Quantity	Unit Price	Item Total
41	019021	TOLL PLAZA COMMUNICATION SYSTEM	LS	LUMP SUM	LUMP SUM	
42	019022	WIRELESS RADIO MODEM AND ANTENNA	EA	28		
43	019023	HUB DATA	LS	LUMP SUM	LUMP SUM	
44	019024	HUB ANALOG VIDEO	LS	LUMP SUM	LUMP SUM	
45	019025	TRAFFIC OPERATIONS SYSTEM (LOCATION 1)	LS	LUMP SUM	LUMP SUM	
46	019026	TRAFFIC OPERATIONS SYSTEM (LOCATION 2)	LS	LUMP SUM	LUMP SUM	
47	019027	TRAFFIC OPERATIONS SYSTEM (LOCATION 3)	LS	LUMP SUM	LUMP SUM	
48	019028	TRAFFIC OPERATIONS SYSTEM (LOCATION 4)	LS	LUMP SUM	LUMP SUM	
49	019029	TRAFFIC OPERATIONS SYSTEM (LOCATION 5)	LS	LUMP SUM	LUMP SUM	
50	019030	TRAFFIC OPERATIONS SYSTEM (LOCATION 6)	LS	LUMP SUM	LUMP SUM	
51	019031	TRAFFIC OPERATIONS SYSTEM (LOCATION 7)	LS	LUMP SUM	LUMP SUM	
52	019032	TRAFFIC OPERATIONS SYSTEM (LOCATION 8)	LS	LUMP SUM	LUMP SUM	
53	019033	TRAFFIC OPERATIONS SYSTEM (LOCATION 9)	LS	LUMP SUM	LUMP SUM	
54	019034	TRAFFIC OPERATIONS SYSTEM (LOCATION 10)	LS	LUMP SUM	LUMP SUM	
55	019035	TRAFFIC OPERATIONS SYSTEM (LOCATION 11)	LS	LUMP SUM	LUMP SUM	
56	019036	TRAFFIC OPERATIONS SYSTEM (LOCATION 12)	LS	LUMP SUM	LUMP SUM	
57	019037	TRAFFIC OPERATIONS SYSTEM (LOCATION 13)	LS	LUMP SUM	LUMP SUM	
58	019038	TRAFFIC OPERATIONS SYSTEM (LOCATION 14)	LS	LUMP SUM	LUMP SUM	
59	019039	TRAFFIC OPERATIONS SYSTEM (LOCATION 15)	LS	LUMP SUM	LUMP SUM	
60	019040	TRAFFIC OPERATIONS SYSTEM (LOCATION 16)	LS	LUMP SUM	LUMP SUM	

Item	Item Code	Item	Unit of Measure	Estimated Quantity	Unit Price	Item Total
61	019041	TRAFFIC OPERATIONS SYSTEM (LOCATION 17)	LS	LUMP SUM	LUMP SUM	
62	019042	TRAFFIC OPERATIONS SYSTEM (LOCATION 18)	LS	LUMP SUM	LUMP SUM	
63	019043	TRAFFIC OPERATIONS SYSTEM (LOCATION 19)	LS	LUMP SUM	LUMP SUM	
64	019044	TRAFFIC OPERATIONS SYSTEM (LOCATION 20)	LS	LUMP SUM	LUMP SUM	
65	019045	TRAFFIC OPERATIONS SYSTEM (LOCATION 21)	LS	LUMP SUM	LUMP SUM	
66	019046	TRAFFIC OPERATIONS SYSTEM (LOCATION 22)	LS	LUMP SUM	LUMP SUM	
67	019047	TRAFFIC OPERATIONS SYSTEM (LOCATION 23)	LS	LUMP SUM	LUMP SUM	
68	019048	TRAFFIC OPERATIONS SYSTEM (LOCATION 24)	LS	LUMP SUM	LUMP SUM	
69	019049	TRAFFIC OPERATIONS SYSTEM (LOCATION 25)	LS	LUMP SUM	LUMP SUM	
70	019050	TRAFFIC OPERATIONS SYSTEM (LOCATION 26)	LS	LUMP SUM	LUMP SUM	
71	019051	TRAFFIC OPERATIONS SYSTEM (LOCATION 27)	LS	LUMP SUM	LUMP SUM	
72	019052	TRAFFIC OPERATIONS SYSTEM (LOCATION 28)	LS	LUMP SUM	LUMP SUM	
73	019053	TRAFFIC OPERATIONS SYSTEM (LOCATION 29)	LS	LUMP SUM	LUMP SUM	
74	019054	TRAFFIC OPERATIONS SYSTEM (LOCATION 30)	LS	LUMP SUM	LUMP SUM	
75	999990	MOBILIZATION	LS	LUMP SUM	LUMP SUM	

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISIONS

Annexed to Contract No. 04-150404

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.

Amendments to the Standard Specifications set forth in these special provisions shall be considered as part of the Standard Specifications for the purposes set forth in Section 5-1.04, "Coordination and Interpretation of Plans, Standard Specifications and Special Provisions," of the Standard Specifications. Whenever either the term "Standard Specifications is amended" or the term "Standard Specifications are amended" is used in the special provisions, the indented text 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.

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.

SECTION 2. PROPOSAL REQUIREMENTS AND CONDITIONS

2-1.01 GENERAL

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

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

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

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.

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.

2-1.02 DISABLED VETERAN BUSINESS ENTERPRISE (DVBE)

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

It is the policy of the Department that Disabled Veteran Business Enterprise (DVBE) shall have the maximum opportunity to participate in the performance of contracts financed solely with state funds. The Contractor shall ensure that DVBEs have the maximum opportunity to participate in the performance of this contract and shall take all necessary and reasonable steps for this assurance. The Contractor shall not discriminate on the basis of race, color, national origin, or sex in the award and performance of subcontracts. Failure to carry out the requirements of this paragraph shall constitute a breach of contract and may result in termination of this contract or other remedy the Department may deem appropriate.

Bidder's attention is directed to the following:

- A. "Disabled Veteran Business Enterprise" (DVBE) means a business concern certified as a DVBE by the Office of Small Business Certification and Resources, Department of General Services.
- B. A DVBE may participate as a prime contractor, subcontractor, joint venture partner with a prime or subcontractor, or vendor of material or supplies.
- C. Credit for DVBE prime contractors will be 100 percent.
- D. A DVBE joint venture partner must be responsible for specific contract items of work, or portions thereof. Responsibility means actually performing, managing and supervising the work with its own forces. The DVBE joint venture partner must share in the ownership, control, management responsibilities, risks and profits of the joint venture. The DVBE joint venturer must submit the joint venture agreement with the Caltrans Bidder DVBE Information form required in Section 2-1.04, "Submission of DVBE Information," elsewhere in these special provisions.
- E. A DVBE must perform a commercially useful function, i.e., must be responsible for the execution of a distinct element of the work and must carry out its responsibility by actually performing, managing and supervising the work.
- F. Credit for DVBE vendors of materials or supplies is limited to 60 percent of the amount to be paid to the vendor for the material unless the vendor manufactures or substantially alters the goods.
- G. Credit for trucking by DVBEs will be as follows:
 - 1. One hundred percent of the amount to be paid when a DVBE trucker will perform the trucking with his/her own trucks, tractors and employees.
 - 2. Twenty percent of the amount to be paid to DVBE trucking brokers who do not have a "certified roster."
 - 3. One hundred percent of the amount to be paid to DVBE trucking brokers who have signed agreements that all trucking will be performed by DVBE truckers if credit is toward the DVBE goal, a "certified roster" showing that all trucks are owned by DVBEs, and a signed statement on the "certified roster" that indicates that 100 percent of revenue paid by the broker will be paid to the DVBEs listed on the "certified roster."
 - 4. Twenty percent of the amount to be paid to trucking brokers who are not a DVBE but who have signed agreements with DVBE truckers assuring that at least 20 percent of the trucking will be performed by DVBE truckers if credit is toward the DVBE goal, a "certified roster" showing that at least 20 percent of the number of trucks are owned by DVBE truckers, and a signed statement on the "certified roster" that indicates that at least 20 percent of the revenue paid by the broker will be paid to the DVBEs listed on the "certified roster."

The "certified roster" referred to herein shall conform to the requirements in Section 2-1.04, "Submission Of DVBE Information," elsewhere in these special provisions.

- H. DVBEs and DVBE joint venture partners must be certified DVBEs as determined by the Department of General Services, Office of Small Business Certification and Resources, 1531 "I" Street, Second Floor, Sacramento, CA 95814, on the date bids for the project are opened before credit may be allowed toward the DVBE goal. It is the Contractor's responsibility to verify that DVBEs are certified.
- I. Noncompliance by the Contractor with these requirements constitutes a breach of this contract and may result in termination of the contract or other appropriate remedy for a breach of this contract.

2-1.03 DVBE GOAL FOR THIS PROJECT

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

Disabled Veteran Business Enterprise (DVBE): 3 percent.

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

The Office of Small Business Certification and Resources, Department of General Services, may be contacted at (916) 322-5060 or visit their internet web site at <http://www.osmb.dgs.ca.gov/> for program information and certification status. The Department's Business Enterprise Program may also be contacted at (916) 227-9599 or the internet web site at <http://www.dot.ca.gov/hq/bep/>.

2-1.04 SUBMISSION OF DVBE INFORMATION

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

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

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

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

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

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

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

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

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

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

2-1.05 SMALL BUSINESS PREFERENCE

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

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

Bidders who wish to be classified as a Small Business under the provisions of those laws and regulations, shall be certified as Small Business by the Department of General Services, Office of Small Business Certification and Resources, 1531 "I" Street, Second Floor, Sacramento, CA 95814.

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

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

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

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

2-1.06 CALIFORNIA COMPANY PREFERENCE

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

This work shall be diligently prosecuted to completion before the expiration of **210 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 \$1300 per day, for each and every calendar day's delay in finishing the work in excess of the number of working days prescribed above.

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 Division of Structure Design, the drawings shall be submitted to: Division of Structure Design, Documents Unit, Mail Station 9, 1801 30th Street, Sacramento, CA 95816, Telephone 916 227-8252.

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.

5-1.02 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.

5-1.04 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.

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

The requirements of this section shall apply to 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.

5-1.08 SUBCONTRACTOR AND DVBE RECORDS

The Contractor shall maintain records of all subcontracts entered into with certified DVBE subcontractors and records of materials purchased from certified DVBE suppliers. The records shall show the name and business address of each DVBE subcontractor or vendor and the total dollar amount actually paid each DVBE subcontractor or vendor.

Upon completion of the contract, a summary of these records shall be prepared on Form CEM-2402 (S) and certified correct by the Contractor or the Contractor's authorized representative, and shall be furnished to the Engineer.

5-1.086 PERFORMANCE OF DVBE SUBCONTRACTORS AND SUPPLIERS

The DVBEs listed by the Contractor in response to the provisions in Section 2-1.04, "Submission of DVBE Information," and Section 3, "Award and Execution of Contract," of these special provisions, which are determined by the Department to be certified DVBEs, shall perform the work and supply the materials for which they are listed, unless the Contractor has received prior written authorization to perform the work with other forces or to obtain the materials from other sources.

Authorization to utilize other forces or sources of materials may be requested for the following reasons:

- A. The listed DVBE, after having had a reasonable opportunity to do so, fails or refuses to execute a written contract, when the written contract, based upon the general terms, conditions, plans and specifications for the project, or on the terms of the subcontractor's or supplier's written bid, is presented by the Contractor.
- B. The listed DVBE becomes bankrupt or insolvent.
- C. The listed DVBE fails or refuses to perform the subcontract or furnish the listed materials.
- D. The Contractor stipulated that a bond was a condition of executing a subcontract and the listed DVBE subcontractor fails or refuses to meet the bond requirements of the Contractor.
- E. The work performed by the listed subcontractor is substantially unsatisfactory and is not in substantial conformance with the plans and specifications or the subcontractor is substantially delaying or disrupting the progress of the work.
- F. The listed DVBE subcontractor is not licensed pursuant to the Contractor's License Law.
- G. It would be in the best interest of the State.

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

5-1.09 SUBCONTRACTING

Attention is directed to the provisions in Section 8-1.01, "Subcontracting," of the Standard Specifications, Section 2, "Proposal Requirements and Conditions," Section 2-1.04, "Submission of DVBE Information," and Section 3, "Award and Execution of Contract," of these special provisions and these special provisions.

Pursuant to the provisions in Section 1777.1 of the Labor Code, the Labor Commissioner publishes and distributes a list of contractors ineligible to perform work as a subcontractor on a public works project. This list of debarred contractors is available from the Department of Industrial Relations web site at:

<http://www.dir.ca.gov/DLSE/Debar.html>.

The DVBE information furnished under Section 3-1.01A, "DVBE Information," of these special provisions is in addition to the subcontractor information required to be furnished in Section 8-1.01, "Subcontracting," and Section 2-1.054, "Required Listing of Proposed Subcontractors," of the Standard Specifications.

Section 10115 of the Public Contract Code requires the Department to implement provisions to establish a goal for Disabled Veteran Business Enterprise (DVBE) participation in highway contracts that are State funded. As a part of this requirement:

- A. No substitution of a DVBE subcontractor shall be made at any time without the written consent of the Department, and
- B. If a DVBE subcontractor is unable to perform successfully and is to be replaced, the Contractor shall make good faith efforts to replace the original DVBE subcontractor with another DVBE subcontractor.

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

5-1.10 PROMPT PROGRESS PAYMENT TO SUBCONTRACTORS

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

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.

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

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

The establishment of a "Partnering" relationship will not change or modify the terms and conditions of the contract and will not relieve either party of the legal requirements of the contract.

5-1.12 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.

5-1.13 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.

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. Miscellaneous Bridge Metal
- B. Piling
- C. Railings
- D. Metal Sign Structures

5-1.14 SOUND CONTROL REQUIREMENTS

Sound control shall conform to the provisions in Section 7-1.01I, "Sound Control Requirements," of the Standard Specifications and these special provisions.

The noise level from the Contractor's operations, between the hours of 9:00 p.m. and 6:00 a.m., shall not exceed 86 dbA at a distance of 15 m. This requirement shall not relieve the Contractor from responsibility for complying with local ordinances regulating noise level.

The noise level requirement shall apply to the equipment on the job or related to the job, including but not limited to trucks, transit mixers or transient equipment that may or may not be owned by the Contractor. The use of loud sound signals shall be avoided in favor of light warnings except those required by safety laws for the protection of personnel.

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

5-1.15 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.

5-1.16 UTILITIES

The Contractor may use electrical power, water, and compressed air from existing State outlets within the toll bridge 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.

STATE-OWNED SCAFFOLDS

On the steel box girder portion of the San Mateo-Hayward Bridge, there are State owned scaffolds that will be available for the Contractor's use when not being used by the State forces or by other Contractors.

Attention is directed to "Cooperation" elsewhere in these special provisions.

The Contractor shall notify the Engineer in writing 5 working days in advance of his intended use of a scaffold. If a State owned scaffold is not available for use by the Contractor at the time of intended use, and the Contractor cannot reschedule his work to provide for judicious handling of his forces, the Contractor will be granted a time extension commensurate with the delay in accordance with the provisions in Section 8-1.07, "Liquidated Damages," of the Standard Specifications. The Contractor shall have no claim against the State for loss of efficiency as a result of the unavailability of a State owned scaffold.

The State will furnish air lines and all other equipment necessary to operate the scaffolds. Air lines and equipment lost or damaged shall be replaced at the Contractor's expense.

State maintenance personnel will instruct Contractor's personnel on how to operate the scaffolds. Thereafter, operation of the scaffolds for contract work will be the responsibility of the Contractor. Upon completion of the contract, scaffolds shall be returned to a location designated by the Engineer.

The scaffolds were designed to support maintenance personnel using small tools and equipment and painting equipment only. The Contractor shall not impose any greater loads upon the scaffolds than what is intended by the scaffold design.

5-1.17 SANITARY PROVISIONS

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

5-1.18 BRIDGE TOLLS

Toll-free passage on the San Mateo-Hayward 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.

5-1.19 ACCESS TO PROJECT SITE

Prospective bidders may make arrangements to visit the project site by contacting the Bridge Manager, San Mateo-Hayward Bridge, at telephone (510) 286-0732.

5-1.20 DRAWINGS

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

Working drawings shall be submitted to the Engineer in conformance with the provisions in Section 55-1.02, "Drawings," of the Standard Specifications.

5-1.21 PERMITS AND LICENSES

Attention is directed to Section 7-1.04, "Permits and Licenses," of the Standard Specifications and these special provisions.

The Department has obtained the following permits for this project:

San Francisco Bay Conservation and Development Commission

Copies of these permits can be obtained at the Department of Transportation, Plans and Bid Documents Section, MS 26, 1120 N Street, Room 200, Sacramento, CA 95814, Telephone (916) 654-4490 or may be seen at the office of the District Director of Transportation at 111 Grand Avenue, Oakland, California, P. O. Box 23660, Oakland, California 94623-0660.

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

SECTION 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 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 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 as 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.

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	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 PLAIN WIRE REINFORCEMENT, ASTM Designation: A 82

METRIC SIZE SHOWN ON THE PLANS mm ²	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

SUBSTITUTION TABLE FOR BAR REINFORCEMENT

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

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.

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

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 SHEETS (GALVANIZED)	
METRIC THICKNESS SHOWN ON THE PLANS	EQUIVALENT US STANDARD GAGE	METRIC THICKNESS SHOWN ON THE PLANS	EQUIVALENT GALVANIZED SHEET GAGE
mm	inch	mm	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	-----	-----

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 PIPE PILES

METRIC SIZE SHOWN ON THE PLANS mm x mm	EQUIVALENT IMPERIAL SIZE 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 inches (T") represents an exact conversion of the metric thickness in millimeters (T).

CONVERSION 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	EQUIVALENT NOMINAL US SIZE 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

CONVERSION 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	EQUIVALENT IMPERIAL SIZE 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

CONVERSION 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	EQUIVALENT NOMINAL US SIZE 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

8-1.02 APPROVED TRAFFIC PRODUCTS

The Department maintains the following list of Approved Traffic Products. The Engineer shall not be precluded from sampling and testing products on the list of Approved Traffic Products.

The manufacturer of products on the list of Approved Traffic Products 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.

Signing and delineation materials and products shall not be used in the work unless the material or product is on the list of Approved Traffic Products.

Materials and products may be added to the list of Approved Traffic Products 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

- A. Apex, Model 921 (100 mm x 100 mm)
- B. Ray-O-Lite, Models SS (100 mm x 100 mm), RS (100 mm x 100 mm) and AA (100 mm x 100 mm)
- C. Stimsonite, Models 88 (100 mm x 100 mm), 911 (100 mm x 100 mm), 953 (70 mm x 114 mm)
- D. 3M Series 290 (89 mm x 100 mm)

Retroreflective With Abrasion Resistant Surface (ARS)

- A. Ray-O-Lite "AA" ARS (100 mm x 100 mm)
- B. Stimsonite, Models 911 (100 mm x 100 mm), 953 (70 mm x 114 mm)
- C. 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. Apex Universal (Ceramic)
- B. Apex Universal, Model 929 (ABS)
- C. Elgin Molded Plastics, "Empco-Lite" Model 900 (ABS)
- D. Highway Ceramics, Inc. (Ceramic)
- E. Hi-Way Safety, Inc., Models P20-2000W and 2001Y (ABS)
- F. Interstate Sales, "Diamond Back" (ABS) and (Polypropylene)
- G. Alpine Products, D-Dot (ABS)
- H. Road Creations, Model RCB4NR (Acrylic)

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. Davidson Plastics Corp., Model 3.0 (100 mm x 100 mm)
- C. Elgin Molded Plastics, "Empco-Lite" Model 901 (100 mm x 100 mm)
- D. Road Creations, Model R41C (100 mm x 100 mm)
- E. 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. 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 MATERIALS

Permanent Traffic Striping and Pavement Marking Tape

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

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

- A. Brite-Line, Series 100
- B. P.B. Laminations, Aztec, Grade 102
- C. Swarco Industries, "Director-2"
- D. 3M, "Stamark," Series 620
- E. 3M Series A145 Removable Black Line Mask
(Black Tape: For use only on Asphalt Concrete Surfaces)
- F. Advanced Traffic Marking Black "Hide-A-Line"
(Black Tape: For use only on Asphalt Concrete Surfaces)

Preformed Thermoplastic (Heated in place)

- A. Flint Trading, "Premark" and "Premark 20/20 Flex"
- B. Pavemark, "Hotape"

Removable Traffic Paint

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

CLASS 1 DELINEATORS

One Piece Driveable Flexible Type, 1700 mm

- A. Carsonite, Curve-Flex CFRM-400
- B. Carsonite, Roadmarker CRM-375
- C. Davidson Plastics, "Flexi-Guide Models 400 and 566"
- D. FlexStake, Model 654TM
- 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 754TM

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. Davidson Plastics, Flex-Guide Models FG300LD and FG300UR
- E. FlexStake, Surface Mount, Models 703 and 753TM
- 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. Roadmaker Company "Stacker"
- D. Traffix Devices "Grabber"

OBJECT MARKERS

Type "K", 450 mm

- A. Carsonite, Model SMD-615
- B. FlexStake, Model 701KM
- C. Repo, Models 300 and 400
- D. Safe-Hit, Model SH718SMA
- E. The Line Connection, Model DP21-4K

Type "K-4" / "Q", 600 mm

(Shown as Type "Q" in the Traffic Manual)

- 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. 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

THREE BEAM BARRIER MARKERS

(For use to the left of traffic)

- A. Duraflex Corp., "Railrider"
- B. 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, places top of reflective element at 1200 mm)

- A. Davidson Plastics, Model PCBM T-16
- B. Safe-Hit, Model SH216RBM

CONCRETE BARRIER-MOUNTED MINI-DRUM (260 mm x 360 mm x 570 mm)

- A. Stinson Equipment Company "SaddleMarker"

SOUND WALL DELINEATOR

(Applied to a vertical surface. Top of reflective element at 1200 mm)

- A. Davidson Plastics, PCBM S-36

GUARD RAILING DELINEATOR

(Top of reflective element at 1200 mm above plane of roadway)

Wood Post Type, 686 mm

- A. Carsonite, Model 427
- B. 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, AR-1000 Abrasion Resistant Coating
- F. Stimsonite, Series 6200 (For rigid substrate devices only)

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 "Conformalite"

Barrels and Drums

- A. Reflexite, "Super High Intensity" or "High Impact Drum Sheeting"
- B. 3M Series 3810

Barricades: Type I, Engineer Grade

- A. American Decal, Adcolite
- B. Avery Dennison, 1500 and 1600
- C. 3M, Scotchlite, Series CW

Barricades: Type II, Super Engineer Grade

- A. Avery Dennison, "Fasign" 2500 Series
- B. Kiwalite Type II
- C. Nikkalite 1800 Series

Signs: Type II, Super Engineer Grade

- A. Avery Dennison, "Fasign" 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. Stimsonite Series 6200

Signs: Type VII, High-Intensity Prismatic Grade

- A. 3M Series 3900

Signs: Type VI, Roll-Up Signs

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

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:

- A. Model 2070 controller assemblies, including controller unit, completely wired controller cabinet, and inductive loop detector sensor units.
- B. Model 500 changeable message sign system with control cables and controller isolation assemblies.
- C. Highway advisory radio equipment (antenna, transmitter and lightning arrestor only).

Completely wired controller cabinets, with auxiliary equipment but without controller unit, and highway advisory radio equipment will be furnished to the Contractor at the Caltrans Maintenance Station, 30 Rickard Street, San Francisco, CA 94134.

Model 500 changeable message sign, wiring harness, and controller assembly, including the controller unit and completely wired cabinet, will be furnished to the Contractor at Caltrans Maintenance Station, 30 Rickard Street, San Francisco, CA 94134.

The Contractor shall notify the Engineer not less than 48 hours before State-furnished material is to be picked up by the Contractor. A full description of the material and the time the material will be picked up shall be provided.

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.

Unless the use of a mineral admixture is prohibited, whenever the word "cement" is used in the Standard Specifications or the special provisions, it shall be understood to mean "cementitious material" when both of the following conditions are met:

- A. The cement content of portland cement concrete is specified, and
- B. Section 90, "Portland Cement Concrete," of the Standard Specifications is referenced.

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

90-1.01 DESCRIPTION

- Portland cement concrete shall be composed of cementitious material, fine aggregate, coarse aggregate, admixtures if used, and water, proportioned and mixed as specified in these specifications.
- Unless otherwise specified, cementitious material to be used in portland cement concrete shall conform to the provisions for cement and mineral admixtures in Section 90-2, "Materials," and shall be either: 1) "Type IP (MS) Modified" cement or 2) a combination of "Type II Modified" portland cement and mineral admixture.
- Concrete for each portion of the work shall comply with the provisions for the Class, cementitious material content in kilograms per cubic meter, 28-day compressive strength, minor concrete or commercial quality concrete, as shown on the plans or specified in these specifications or the special provisions.
 - Class 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/m ³)
Concrete which is 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 considered to be designated by compressive strength. If the plans show a 28-day compressive strength which is 31 MPa or greater, an additional 7 days will be allowed to obtain the specified strength. The 28-day compressive strengths shown on the plans which are 25 MPa or less are shown for design information only and are not to be considered a requirement for acceptance of the concrete.

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

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

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

• Compliance with cementitious material content requirements will be verified in 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 used in the work has a cementitious material content, consisting of cement, mineral admixture, or cement plus mineral admixture, which is less than the minimum required for the work, the concrete shall be removed. However, if the Engineer determines that the concrete is structurally adequate, the concrete may remain in place and the Contractor shall pay to the State \$0.55 for each kilogram of cement, mineral admixture, or cement plus mineral admixture which is less than the minimum required for the work. The Department may deduct the amount from 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 for cementitious material content will be made based on the results of California Test 518.

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

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

90-2.01 PORTLAND CEMENT

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

• "Type IP (MS) Modified" cement shall conform to the specifications for Type IP (MS) cement in ASTM Designation: C 595, and shall be comprised of an intimate mixture of Type II cement and not more than 25 percent of a mineral admixture. The type and minimum amount of mineral admixture used in the manufacture of "Type IP (MS) Modified" cement shall be in 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 alkalis, calculated as the percentage of Na₂O plus 0.658 times the percentage of K₂O, 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.
- 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.

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

- Type III and Type V portland cements shall conform to the 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.

The third paragraph in Section 90-2.01, "Portland Cement," of the Standard Specifications is deleted.

The twelfth paragraph in Section 90-2.02, "Aggregates," of the Standard Specifications is deleted.

The first paragraph in Section 90-2.03, "Water," of the Standard Specifications is amended to read:

90-2.03 WATER

- In conventionally reinforced concrete work, the water for curing, for washing aggregates, and for mixing shall be free from oil and shall not contain more than 1,000 parts per million of chlorides as Cl, nor more than 1,300 parts per million of sulfates as SO₄. In prestressed concrete work, the water for curing, for washing aggregates, and for mixing shall be free from oil and shall not contain more than 650 parts per million of chlorides as Cl, nor more than 1,300 parts per million of sulfates as SO₄. 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.

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

90-2.04 ADMIXTURE MATERIALS

- Admixture materials shall conform to the requirements 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.
- Mineral admixtures shall be used in conformance with the provisions in Section 90-4.08, "Required Use of Mineral Admixtures."

The first paragraph in Section 90-3.03, "Fine Aggregate Grading," is amended to read:

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

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

90-4.02 MATERIALS

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

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

90-4.05 OPTIONAL USE OF CHEMICAL ADMIXTURES

- The Contractor will be permitted to use Type A or F, water-reducing; Type B, retarding; or Type D or G, water-reducing and retarding admixtures as described in ASTM Designation: C 494 to conserve cementitious material or to facilitate 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.
 - 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.

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

90-4.07 OPTIONAL USE OF AIR-ENTRAINING ADMIXTURES

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

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

90-4.08 REQUIRED USE OF MINERAL ADMIXTURES

- Unless otherwise specified, mineral admixture shall be combined with cement to make cementitious material for use in portland cement concrete.
 - The calcium oxide content of mineral admixtures shall not exceed 10 percent and the available alkali, as sodium oxide equivalent, shall not exceed 1.5 percent when determined in conformance with the requirements in ASTM Designation: C618.
 - The amounts of cement and mineral admixture used in cementitious material for portland cement concrete shall be sufficient to satisfy the minimum cementitious material content requirements specified in Section 90-1.01, "Description," or Section 90-4.05, "Optional Use of Chemical Admixtures," and shall conform to the following:
 - 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, as determined in conformance with the requirements in ASTM Designation: C618 and the provisions in Section 90-2.04, "Admixture Materials," 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, as determined in conformance with the requirements in ASTM Designation: C618 and the provisions in Section 90-2.04, "Admixture Materials," 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 is used, which conforms to the provisions for silica fume in Section 90-2.04, "Admixture Materials," 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. If more than the required amount of cementitious material is used, the additional cementitious material in the mix may be either cement, a mineral admixture conforming to the provisions in Section 90-2.04, "Admixture Materials," or a combination of both; however, the maximum 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.

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

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

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

- Mineral admixtures shall be protected from exposure to moisture until used. Sacked material shall be piled to permit access for tally, inspection, and identification for each shipment.
- Adequate facilities shall be provided to assure that mineral admixtures meeting the specified requirements are kept separate from other mineral admixtures in order to prevent any but the specified mineral admixtures from entering the work. Safe and suitable facilities for sampling mineral admixtures shall be provided at the weigh hopper or in the feed line immediately in advance of the hopper.
- Mineral admixtures shall be incorporated into concrete using equipment conforming to the requirements for cement weigh hoppers, and charging and discharging mechanisms in ASTM Designation: C 94, in Section 90-5.03, "Proportioning," and in this Section 90-4.11.
- When interlocks are required for cement and mineral admixture charging mechanisms by Section 90-5.03A, "Proportioning for Pavement," and cement and mineral admixtures are weighed cumulatively, their charging mechanisms shall be interlocked to prevent the introduction of mineral admixture until the mass of cement in the cement weigh hopper is within the tolerances specified in Section 90-5.02, "Proportioning Devices."
- Mineral admixture used in concrete for exposed surfaces of like elements of a structure shall be from the same source and of the same percentage.

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

90-5.02 PROPORTIONING DEVICES

- Weighing, measuring or metering devices used for proportioning materials shall conform to the provisions in Section 9-1.01, "Measurement of Quantities," and this Section 90-5.02. In addition, automatic weighing systems used shall comply with the provisions for automatic proportioning devices in Section 90-5.03A, "Proportioning for Pavement." These automatic devices shall be automatic to the extent that the only manual operation required for proportioning the aggregates, cement, and mineral admixture for one batch of concrete is a single operation of a switch or starter.
- Proportioning devices shall be tested at the expense of the Contractor as frequently as the Engineer may deem necessary to insure their accuracy.
- Weighing equipment shall be insulated against vibration or movement of other operating equipment in the plant. When the plant is in operation, the 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 a 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.
 - 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.
 - 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.

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

90-5.03 PROPORTIONING

- Proportioning shall consist of dividing the aggregates into the specified sizes, each stored in a separate bin, and combining them with cement, mineral admixture, and water as provided in these specifications. Aggregates shall be proportioned by 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 that conforms to the provisions in Section 90-2.01, "Portland Cement," shall be weighed in an individual hopper and shall be kept separate from the aggregates until the ingredients are released for discharge into the mixer.
 - Bulk cement to be blended with mineral admixture for use in portland cement concrete for pavement and structures may be weighed in separate, individual weigh hoppers or may be weighed in the same weigh hopper with mineral admixture 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 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 scale and weigh hopper for bulk weighing cement, mineral admixture, and cement plus mineral admixture shall be separate and distinct from the aggregate weighing equipment.
 - When the source of an aggregate is changed for concrete structures, the Contractor shall adjust the mix proportions and submit in writing to the Engineer a copy of the mix design before using such aggregates. When the source of an aggregate is changed for other concrete, the Engineer shall be allowed sufficient time to adjust the mix and such aggregates shall not be used until necessary adjustments are made.
 - For 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.

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

90-5.03A PROPORTIONING FOR PAVEMENT

- Aggregates and bulk cement, mineral admixture, and cement plus mineral admixture for use in pavement shall be proportioned by mass by means of automatic proportioning devices of approved type conforming to the provisions in this Section 90-5.03A.
- The Contractor shall install and maintain in operating condition an electrically actuated moisture meter that will indicate, on a readily visible scale, changes in the moisture content of the fine aggregate as it is batched within a sensitivity of 0.5 percent by 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 which are within the tolerances specified in Section 90-5.02, "Proportioning Devices."
- The discharge gate on the cement and mineral admixture hoppers or the cement plus mineral admixture hopper shall be designed to permit regulating the flow of cement, mineral admixture or cement plus mineral admixture into the aggregate as directed by the Engineer.
- When separate weigh boxes are used for each size of aggregate, the discharge gates shall permit regulating the flow of each size of aggregate as directed by the Engineer.
- Material discharged from the several bins shall be controlled by gates or by mechanical conveyors. The means of withdrawal from the several bins, and of discharge from the weigh box, shall be interlocked so that not more than one bin can discharge at a time, and that the weigh box cannot be tripped until the required quantity from each of the several bins has been deposited therein. Should a separate weigh box be used for each size of aggregate, all may be operated and discharged simultaneously.
- When the discharge from the several bins is controlled by gates, each gate shall be actuated automatically so that the required 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.

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

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

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

- The batch shall be so charged into the mixer that some water will enter in advance of cementitious materials and aggregates. All water shall be in the drum by the end of the first one-fourth of the specified mixing time.
- Cementitious materials shall be batched and charged into the mixer by means that will not result either in loss of cementitious materials due to the effect of wind, or in accumulation of cementitious materials on surfaces of conveyors or hoppers, or in other conditions which reduce or vary the required quantity of cementitious material in the concrete mixture.

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

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

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

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

- When non-agitating hauling equipment is used for transporting concrete to the delivery point, discharge shall be completed within one hour after the addition of the cement to the aggregates. Under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 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 job site shall be accompanied by a weight 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 weight 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.
- Weight 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 90-mm diskette with a capacity of at least 1.4 megabytes. Captured data, for the ingredients represented by each batch shall be LFCR (one line, separate record) with allowances for sufficient fields to satisfy the amount of data required by these specifications.
- The Contractor may furnish a weight certificate that is accompanied by a separate certificate which lists the actual batch masses or measurements for a load of concrete provided that both certificates are 1) imprinted with the same non-repeating load number that is unique to the contract and 2) delivered to the job site with the load.
- Weight certificates furnished by the Contractor shall conform to the provisions in Section 9-1.01, "Measurement of Quantities," of the Standard Specifications.

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

90-6.05 HAND-MIXING

- Hand-mixed concrete shall be made in batches not more than one-fourth cubic meter 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.

The table in the first paragraph in Section 90-6.06, "Amount of Water and Penetration," of the Standard Specifications is replaced with the following table:

Type of Work	Nominal Penetration (mm)	Maximum Penetration (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	75-100	115
Cast-in-place concrete piles	65-90	100

The first paragraph following the table of penetration ranges in Section 90-6.06, "Amount of Water and Penetration," of the Standard Specifications is amended to read:

- The amount of free water used in concrete shall not exceed 183 kg/m³, plus 20 kg for each required 100 kg of cementitious material in excess of 325 kg/m³.

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

- Where there are adverse or difficult conditions which affect the placing of concrete, the above specified penetration and free water content limitations may be exceeded providing the Contractor is granted permission by the Engineer in writing to increase the cementitious material content per cubic 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.

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

90-9.01 GENERAL

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

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

- When concrete compressive strength is specified as a prerequisite to applying loads or stresses to a concrete structure or member, test cylinders for other than steam cured concrete will be cured in 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 by 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 which 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 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 cubic meters.

- When a precast concrete member is steam cured, the compressive strength of the concrete will be determined from test cylinders which have been handled and stored in 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.

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

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

- Trial batch test reports, in order to be acceptable, must indicate that the average compressive strength of 5 consecutive concrete cylinders, taken from a single batch, at not more than 28 days (or the maximum age allowed) after molding shall be at least 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 which were produced within one year of the proposed use of specified strength concrete in the project. Whenever air-entrainment is required, the air content of trial batches shall be equal to or greater than the air content specified for the concrete without reduction due to tolerances.

- 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 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 concrete cylinders tested.

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

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

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

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

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

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

90-10.02A CEMENTITIOUS MATERIAL

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

The fifth paragraph in Section 90-10.02B, "Aggregate," of the Standard Specifications is deleted.

Section 90-10.03, "Production," of the Standard Specifications is amended to read:

90-10.03 PRODUCTION

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

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

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

- Discharge of ready-mixed concrete from the transporting vehicle shall be made while the concrete is still plastic and before 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 as conditions contributing to the quick stiffening of concrete. The Contractor shall take whatever action is necessary to eliminate quick stiffening, except that the addition of water will not be permitted.
- The required mixing time in stationary mixers shall be not less than 50 seconds 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 weight certificate which shall be delivered to the Engineer at the discharge location of the concrete, unless otherwise directed by the Engineer. The weight 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.

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

- Should the Engineer order the Contractor to incorporate admixtures into the concrete when their use is not required by these specifications or the special provisions, furnishing the admixtures and adding them to the concrete will be paid for as extra work as provided in Section 4-1.03D.
- Should the Contractor use admixtures 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 in the concrete at the Contractor's expense and no additional compensation will be allowed therefor.

SECTION 8-3. WELDING

8-3.01 WELDING ELECTRODES

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

8-3.02 WELDING QUALITY CONTROL

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

Welding quality control shall apply when any work is welded in conformance with the provisions in Section 49, "Piling," Section 52, "Reinforcement," Section 55, "Steel Structures," Section 56-1, "Overhead Sign Structures," Section 75-1.035, "Bridge Joint Restrainer Units," or Section 86-2.04, "Standards, Steel Pedestals and Posts," of the Standard Specifications.

In addition, welding quality control shall apply when welding is performed for the following work:

- A. Miscellaneous Metal (Bridge)

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

All requirements of the AWS welding codes shall apply unless specified otherwise in the Standard Specifications, on the plans or in these special provisions. Wherever the abbreviation AWS is used, it shall be equivalent to the abbreviations ANSI/AWS or ANSI/AASHTO/AWS.

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

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

The QCM shall 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. This condition shall apply only for work welded in conformance with the provisions in Section 56-1, "Overhead Sign Structures" or Section 86-2.04, "Standards, Steel Pedestals and Posts," of the Standard Specifications.

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, penetrometer 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. Except for steel piling, the Engineer shall be allowed 7 days to review the report and respond in writing after a complete Welding Report has been received. The review time for steel piling shall be as specified in "Piling" of these special provisions. 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 1.1, Sections 7.1.1 and 7.1.2 of AWS D 1.4, and Sections 6.1.1.1 through 6.1.3.3 of AWS D 1.5 are replaced with the following:

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

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

Quality Assurance (QA) is the prerogative of the Engineer. The QA Inspector is the duly designated person who acts for and on behalf of the Engineer.

All QC Inspectors shall be responsible for quality control acceptance or rejection of materials and workmanship, and shall be currently certified as AWS Certified Welding Inspectors (CWI) in 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 1.1, Section 7.7.6, "Personnel Qualification," of AWS D 1.4, and Section 6.1.3.4, "Personnel Qualification," of AWS D 1.5 are replaced with the following:

Personnel performing 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 and Section 7.5.4 of AWS D 1.4 are 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.

Section 6.5.4 of AWS D 1.5 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 QC Inspector shall examine the work to make certain that it meets the requirements of section 3 and 9.21. The size and contour of welds shall be measured using suitable gages. Visual inspection for cracks in welds and base metal, and for other discontinuities should be aided by strong light magnifiers, or such other devices as may be helpful. Acceptance criteria different from those specified in this code may be used when approved by the Engineer.

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

A sufficient number of QC Inspectors shall be provided to ensure continuous inspection when any welding is being performed. Continuous inspection, as a minimum, shall include (1) having QC Inspectors continually present on all shifts when any welding is being performed, or (2) having a QC Inspector within such close proximity of all welding operations that inspections by the QC Inspector of each operation, at each welding location, shall not lapse for a period exceeding 30 minutes.

Inspection and approval of the joint preparation, assembly practice, welding techniques, and performance of each welder, welding operator, and tack welder shall be documented by the QC Inspector on a daily basis for each day that welding is performed.

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

Except for noncritical weld repairs, base metal repairs, or any other type of repairs not submitted in the 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 5 working days to review these procedures. No remedial

work shall begin until the repair procedures are approved in writing by the Engineer. Should the Engineer fail to complete the review within this time allowance and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in reviewing the proposed repair procedures, the delay will be considered a right of way delay 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, Section 6.6.5 of AWS D 1.4 and Section 6.6.5 of AWS D 1.5 shall not apply.

For any welding, the Engineer may direct the Contractor to perform NDT that is in addition to the visual inspection or NDT specified in the AWS welding codes, in the Standard Specifications or in these special provisions. Additional NDT required by the Engineer, will be paid for as extra work 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.

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

SECTION 9. DESCRIPTION OF BRIDGE WORK

The bridge work to be done consists, in general, of constructing platforms for electrical control cabinets and pedestals for mounting closed circuit television cameras as shown on the plans for the San Mateo-Hayward Bridge (Bridge No. 35-0054).

SECTION 10. CONSTRUCTION DETAILS

SECTION 10-1. GENERAL

10-1.01 CONSTRUCTION PROJECT INFORMATION SIGNS

Before any major physical construction work readily visible to highway users is started on this contract, the Contractor shall furnish and erect 2 Type 2 Construction Project Information signs at the locations designated by the Engineer.

The signs and overlays shall be of a type and material consistent with the estimated time of completion of the project and shall conform to the details shown on the plans.

The sign letters, border and the Department's construction logos shall conform to the colors (non-reflective) and details shown on the plans, and shall be on a white background (non-reflective). The colors blue and orange shall conform to PR Color Number 3 and Number 6, respectively, as specified in the Federal Highway Administration's Color Tolerance Chart.

The sign message to be used for fund types shall consist of the following, in the order shown:

STATE HIGHWAY FUNDS

The sign message to be used for type of work shall consist of the following:

HIGHWAY IMPROVEMENT

The sign message to be used for the Year of Completion of Project Construction will be furnished by the Engineer. The Contractor shall furnish and install the "Year" sign overlay within 10 working days of notification of the year date to be used.

The letter sizes to be used shall be as shown on the plans. The information shown on the signs shall be limited to that shown on the plans.

The signs shall be kept clean and in good repair by the Contractor.

Upon completion of the work, the signs shall be removed and disposed of outside the highway right of way in conformance with the provisions in Section 7-1.13 of the Standard Specifications.

Full compensation for furnishing, erecting, maintaining, and removing and disposing of the construction project information signs shall be considered as included in the contract lump sum price paid for construction area signs and no additional compensation will be allowed therefor.

10-1.02 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 first order of work shall be to place the order for the traffic operations system equipment. The Engineer shall be furnished a statement from the vendor that the order for the traffic signal equipment has been received and accepted by the vendor.

No above ground electrical work shall be performed on any system within the project site until all Contractor-furnished electrical materials for that individual system have been tested and delivered to Contractor.

The order of the electrical work shall be in the following sequence:

1. The Contractor shall not do any work between the east end of the bridge and Route 880 until all the work between Route 101 and the east end of the bridge have been completed and tested.
2. For locations between the east end of the bridge and Route 880, the sequence shall be as follows:
 - a. The Contractor shall have all the electrical equipment installed, complete in place, and tested at Locations 28, 29 and 30.
 - b. The Contractor shall have all the electrical equipment installed, complete in place, and tested at Locations 25, 26 and 27.
 - c. The Contractor shall have all the electrical equipment installed, complete in place, and tested at Locations 23 and 24.
 - d. The Contractor shall have all the electrical equipment installed, complete in place, for Locations 21, 22 and HUB Building.

At those locations exposed to public traffic where guard railings are to be constructed, the Contractor shall schedule operations so that at the end of each working day there shall be no post holes open nor shall there be any railing posts installed without the blocks and rail elements assembled and mounted thereon.

10-1.03 MATERIAL CONTAINING AERIALY DEPOSITED LEAD

This work shall consist of handling soil contaminated by aerially deposited lead in conformance with the Standard Specifications and these special provisions.

Aerially deposited lead is typically found within the top 0.6-m of material in unpaved areas within the highway right of way. Levels of lead found near the project limits range from less than ND to 1,100 mg/kg total lead, as analyzed by EPA Test Method 6010 or EPA Test Method 7000 series.

After the Contractor has completed handling materials containing aerially deposited lead, in conformance with the plans, Standard Specifications, and these special provisions, the Contractor shall have no responsibility for such materials in place and shall not be obligated for further cleanup, removal, or remedial actions for such materials.

Handling material containing aerially deposited lead shall be in conformance with all the rules and regulations of agencies including, but not limited to, the following:

California Division of Occupational Safety and Health Administration (Cal-OSHA)
California Regional Water Quality Control Board, Region 2.

The Contractor shall procure all permits and licenses, pay all charges and fees, except as otherwise provided in these special provisions, and give all notices necessary and incidental to the due and lawful prosecution of the work.

Full compensation for conforming to the requirements of this section, (except for the Lead Compliance Plan) 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.

HEALTH AND SAFETY

The Contractor shall prepare a project specific Lead Compliance Plan to prevent or minimize worker exposure to lead contamination in soil. Attention is directed to Title 8, California Code of Regulations, Section 1532.1, "Lead," for specific Cal-OSHA requirements when working with lead.

The Lead Compliance Plan shall contain all of the elements listed in Title 8, California Code of Regulations, Section 1532.1(e)(2)(B). Before submission to the Engineer, the Lead Compliance Plan shall be approved by an Industrial Hygienist certified in Comprehensive Practice by the American Board of Industrial Hygiene. The Plan shall be submitted to the Engineer at least 7 days prior to beginning work in areas containing aurally deposited lead.

Prior to performing work in areas containing lead, personnel who have no prior training, including State personnel, shall complete a safety training program provided by the Contractor, that meets the requirements of Title 8, California Code of Regulations, Section 1532.1, "Lead," and the Contractor's Lead Compliance Program.

Personal protective equipment, training, washing facilities, and medical surveillance required by the Contractor's Lead Compliance Plan shall be supplied to State personnel by the Contractor. The number of State personnel will be 5.

Lead Compliance Plan will be paid as a lump sum.

The contract lump sum price paid for Lead Compliance Plan shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in preparing the Lead Compliance Plan, including paying the Certified Industrial Hygienist, and for providing personal protective equipment, training and medical surveillance, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

SOIL HANDLING

Handling of soils containing aurally deposited lead shall result in no visible dust migration. The Contractor shall have a dust palliative available at all times while handling soils in work areas containing aurally deposited lead.

The Contractor shall separate soil from vegetation and the soils shall remain on site.

Surplus soil excavated from areas containing aurally deposited lead shall remain in the area of soil disturbance. The surplus soil shall not be disposed of outside the highway right of way.

Full compensation for handling soil contaminated with aurally deposited lead, except as otherwise provided, 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.

10-1.04 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 Construction Contractor's Guide and Specifications of the Caltrans Storm Water Quality Handbooks, dated April 1997, and addenda thereto issued up to and including the date of advertisement of the project, hereafter referred to as the "Handbook." Copies of the Handbook may be obtained from the Department of Transportation, Material Operations Branch, Publication Distribution Unit, 1900 Royal Oaks Drive, Sacramento, California 95815, Telephone: (916) 445-3520.

Copies of the Handbook are also available for review at 111 Grand Avenue Oakland, California 94601. Please call the Construction office Duty Senior, telephone number (510) 286-5209 to reserve a copy of the documents at least 24 hours in advance.

The Contractor shall know and fully comply with the applicable provisions of the Handbook 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 Handbook 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 Handbook, 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 15 days after the approval of the contract, the Contractor shall submit 3 copies of the WPCP to the Engineer. The Engineer will have 5 days to review the WPCP. If revisions are required, as determined by the Engineer, the Contractor shall revise and resubmit the WPCP within 5 days of receipt of the Engineer's comments. The Engineer will have 5 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 practices;
- B. Sediment control practices;
- C. Sediment tracking control practices;
- D. Wind erosion control practices; and
- E. Nonstorm water management and waste management and disposal control practices.

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

The Contractor shall consider the objectives and minimum requirements presented in the Handbook for each of the above categories. The special minimum requirements listed below supersede the minimum requirements listed in the Handbook for the same category. When minimum requirements are listed for any category, the Contractor shall incorporate into the WPCP, and implement on the project, the listed minimum controls. In addition, the Contractor shall consider other control measures presented in the Handbook 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 Handbook. The following special minimum requirements are established:

Category	Minimum Requirement(s)
Sediment control practices	CD40(2)-Storm Drain Inlet Protection
Wind erosion control practices	CD26B(2)-Geotextiles, Mats/Plastic Covers
Non-storm water management and waste management and disposal control practices	CB8(2)-Paving Operations CD10(2)-Material Delivery CD11(2)-Material Use CD12(2)-Spill Prevention and Control CD13(2)-Solid Waste Management CD15(2)-Contaminated Soil Management CD16(2)-Concrete Waste Management CD17(2)-Sanitary/Septic Waste Management CD18(2)-Vehicle and Equipment Cleaning CD19(2)-Vehicle and Equipment Fueling

* Water Facilitated Construction Operations- Construction operations which use water or slurries to facilitate work that include, but are not limited to, drilling, saw cutting, grinding, boring, jacking, pressure washing, and hydro-demolition, shall manage the discharge. Control measures may include the use of vacuum machines, settling tanks, desilting basins, and off-hauling of material to a disposal site. Whenever possible, the quantity of slurry or water reclaimed during operation will be minimized to reduce the discharge of pollutants. Untreated slurry or water discharge shall not be allowed to enter storm drains or receiving waters. Employees and subcontractors shall be trained in the use of best management practices regarding water facilitated construction operations.

The following contract items of work, where shown on the project plans, shall be incorporated into the WPCP as critical temporary control measures: Temporary Concrete Washout Facility. 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 Handbook:

- 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 Handbook and these special provisions.

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

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 winter season or upon start of applicable construction activities for projects which begin either during or within 20 days of the winter season.

Throughout the winter season, the active, soil-disturbed area of the project site shall be not more than 1.0 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 winter 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 winter season or within 20 days thereof shall be fully protected with soil stabilization practices and sediment control measures within 10 days of the discontinuance of soil disturbing activities or prior to the onset of precipitation, whichever is first to occur.

Throughout the winter season, active soil-disturbed areas of the project site shall be fully protected at the end of each day with soil stabilization practices and sediment control measures unless fair weather is predicted through the following work day. The weather forecast shall be monitored by the Contractor on a daily basis. The National Weather Service forecast shall be used. 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 sediment tracking, wind erosion, nonstorm water management, and waste management and disposal.

The Engineer may order the suspension of construction operations which create water pollution if the Contractor fails to conform to the 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 Handbook 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 winter 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 which are shown on the plans and 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.

10-1.05 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.

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

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

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

Contract No. 04-045024. At Ala 92 in Alameda County in Hayward at the San Mateo-Hayward Bridge Toll Plaza, to construct mini toll plaza. Construction is expected to begin in January 2000 and end in November 2002. (3.7/4.3 KP).

Contract No. 04-045034. At Ala 92 in Alameda County in Hayward from 0.1 km west of the San Mateo-Hayward Bridge Toll Plaza to 0.2 km west of Route 880/92 Separation. This project is to widen Route 92. Construction is expected to begin in April 2000 and end in April 2002.

Contract No. 04-0436V4. At SM-92 in San Mateo County in Foster City on the San Mateo-Hayward Bridge. This is a bridge retrofit project and is now under construction. Construction is expected to complete in June 2002. (R14.4/16.5 KP).

Contract No. 04-045044. At Ala 92 in Alameda County in Hayward at Breakwater Way/Pt Eden Way. This project is to construct pedestrian overcrossing. Construction expecting to begin in January 2002 and end in November 2002. (5.9/6.9 KP).

Work by State forces will also be in progress within the contract limits of this project. The Contractor shall notify and coordinate all work on the San Mateo-Hayward Bridge with the Regional Manager for Toll Bridges at Telephone: (510) 286-3922. The Contractor shall participate in weekly work planning discussions with bridge operations and maintenance personnel for the purpose of coordinating his work with other contractors and State forces, and to reach agreement on the time and location of lane closures for each following week's work.

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

Attention is directed to section "Closure Requirements and Conditions" elsewhere in these special provisions regarding to closure schedule.

10-1.06 PROGRESS SCHEDULE (CRITICAL PATH)

Progress schedules will be required for this contract and shall conform to the requirements of these special provisions. Progress schedules shall utilize the Critical Path Method (CPM). Attention is directed to "Cooperation" and "Obstructions" of these special provisions. Nothing in these special provisions shall be construed as relieving the Contractor from the responsibilities specified in Section 7, "Legal Relations and Responsibility," of the Standard Specifications.

DEFINITIONS

The following definitions shall apply to these special provisions:

- A. Activity.—A task or item of work that shall be performed in order to complete a project.
- B. Baseline Schedule.—The initial CPM progress schedule as accepted by the Engineer representing the Contractor's original work plan.
- C. Concurrent Delay.—Two or more delays on the critical path that occur at the same time.
- D. Contract Completion Date.—The date the Contractor is contractually obligated to complete the project, including any authorized adjustments, as specified in Section 8-1.06, "Time of Completion," of the Standard Specifications.
- E. Contractor Delay.—A delay that extends the time required to complete a controlling operation caused by and within the control of the Contractor, subcontractors at any tier or suppliers.
- F. Controlling Operation.—A feature of work or activity on the critical path.
- G. Critical Path.—In a project network, the sequence of activities yielding the longest path in a CPM analysis necessary to complete the project.
- H. Critical Path Method (CPM).—A mathematical calculation using the sequence of activities and their interrelationships, interdependencies, resources, and durations to determine the critical path that shows the expected time to complete a project.

- I. Data Date.—The day after the date through which progress updates have been calculated; everything occurring earlier than the data date is "As-Built"; and everything on or after the data date is "Planned."
- J. Early Completion Time.—The difference in time between the contract completion date and the current State-accepted scheduled completion date.
- K. 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.
- L. Free Float.—The amount of time an activity can be delayed before delaying a subsequent activity.
- M. Fragnet.—A section or fragment of the network diagram comprised of a group of activities.
- N. 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 and zero resources, but will otherwise function in the network as if the milestone were an activity.
- O. Narrative Report.—A report that identifies potential problem areas, current and anticipated delaying factors and their impact, actions taken or proposed, proposed changes in schedule logic, extension or contraction of activities, proposed addition or deletion of activities, explanation for changes in the critical path, explanation for changes in scheduled completion date, out of sequence work, and other topics related to job progress or scheduling.
- P. Near Critical Path.—A path having 10 working days or less of total float.
- Q. Punch List.—A list of details needing attention to complete task or work for both contract item and extra work.
- R. Schedule Revision.—A change in the future portion of the schedule that modifies logic; alters construction sequences such as performing sequential activities concurrently or concurrent activities sequentially; adds or deletes activities or significantly alters activity durations, as determined or accepted by the Engineer.
- S. Scheduled Completion Date.—The Contractor's scheduled completion date as shown on the accepted baseline schedule as modified by subsequent accepted schedule updates and revisions.
- T. State Owned Float Activity.—The activity documenting time saved on the critical path by contract changes or other actions of the State, except contract change orders that result from significant Contractor development and investment.
- U. Time Impact Analysis.—An analysis demonstrating the estimated time impact of a contract change order, delay or other event on the scheduled completion date.
- V. Total Float.—The amount of time that an activity may be delayed without delaying the scheduled completion date.
- W. Update.—The routine modification of the CPM progress schedule through a regular monthly review to incorporate actual past progress to date by activity, projected completion dates and approved time adjustments.
- X. Excusable Delay.—A delay as defined in Section 8-1.07, "Liquidated Damages," of the Standard Specifications where the Contractor may be granted an extension of time commensurate with the provisions in Section 8-1.06, "Time of Completion," of the Standard Specifications with no entitlement for adjustment in compensation.
- Y. State Delay.—A delay that is attributable solely to the State, is beyond the control of the Contractor, and extends the time required to complete a controlling operation.

MATERIALS (COMPUTER SYSTEM)

The Contractor shall provide a computer system for the State's exclusive possession and use for CPM progress schedules. The minimum computer system to be furnished shall be complete with keyboard, mouse, monitor, printer and plotter. The system shall be from those identified by the Gartner Group as Tier 1 and shall conform to the following requirements:

- A. Latest industry-available Intel Pentium processor, Motorola RISC processor or equivalent.
- B. Latest computer operating system software compatible with the selected processor, either Windows or MACINTOSH.
- C. Minimum of 128 megabytes of random access memory (RAM).
- D. Internal drives, including: one 4-gigabyte minimum hard disk drive, one 1.44-megabyte 90 mm (3.5-inch) floppy disk drive, one Iomega Jaz drive with 2 one gigabyte minimum cartridges, and one 32x speed CD-ROM drive.
- E. Internal fax/modem, latest speed and software version of U.S. Robotics, 3COM or equivalent.
- F. A 430 mm (17-inch) minimum, color monitor capable of at least 1,024 x 768 pixels.
- G. A color-ink-jet-type, E-size plotter with a minimum 8 megabytes RAM, 12 dots per millimeter (300 dots per inch) color, 24 dots per millimeter (600 dots per inch) monochrome, or equivalent, compatible with the selected system capable of plotting, in color, fully legible time-scaled logic diagrams, network diagrams, and bar charts. The plotter shall have the capability of being connected to or networked with a minimum of 5 computers.
- H. A color-ink-jet-type, B-size plotter compatible with the selected system capable of printing fully legible, time-scaled charts, network diagrams and reports.
- I. A manual parallel cable switching device, with connecting cables, allowing the user to alternate printing between the plotters.

- J. CPM software shall be compatible with the hardware provided, shall be the latest version of Primavera Project Planner for Windows, SureTrak for Windows, or equal, and shall be able to create files that can easily be imported into the latest version of Primavera.
- K. General software shall be the latest versions of Microsoft Office Professional and McAfee VirusScan virus protection. The general software shall be compatible with the hardware provided.
- L. Upgrades to the CPM and general software shall be provided, as the upgrades become available.

The computer hardware and software furnished by the Contractor shall be compatible with that used for the production of the CPM progress schedule required by these special provisions, including original instruction manuals and other documentation normally provided with the CPM and general software. Before delivery and setup of the computer system, the Contractor shall submit, for approval of the Engineer, a detailed list of the computer hardware and software the Contractor proposes to furnish, including an itemized schedule of costs for the system.

The Contractor shall furnish, install, set up, maintain, and repair the computer system ready-for-use, and provide plotter supplies as necessary during the course of the project at a location determined by the Engineer. The first submittal of the baseline schedule will not be considered complete until the hardware and software are installed and ready for use with the submitted baseline schedule. The Contractor shall instruct and assist the Engineer in the use of the hardware and software. When requested by the Engineer, the Contractor shall provide one 8-hour session of outside commercial training in the use of the CPM software for a maximum of 2 project staff at a location acceptable to the Engineer. Hardware repairs shall be made within 48 hours of notification by the Engineer, or replacement equipment shall be furnished and installed by the Contractor until repairs have been completed.

Computer hardware and software furnished shall remain the property of the Contractor and shall be removed by the Contractor upon acceptance of the contract if no claims involving contract progress are pending. If contract claims involving contract progress are pending, computer hardware or software shall not be removed until the final estimate has been submitted to the Contractor.

GENERAL

Early completion time shall be considered a resource for the exclusive use of the Contractor. The Contractor may increase early completion time by increasing production or reallocating resources to be more efficient, or by proposing, and the State accepting, contract change orders that are the result of significant Contractor development and investment or from an appropriate share of an accepted Cost Reduction Incentive Proposal.

State owned float shall be considered a resource for the exclusive use of the State. The Engineer may either accrue State owned float to mitigate past or anticipated future State delays, or reduce contract working days. The State may reduce contract working days if the action is the result of a contract change order other than those that result from significant Contractor development and investment. The Engineer will document State owned float by directing the Contractor in writing to update the State owned float activity and the activity relative to the State action that created the float. The Contractor shall conduct a time impact analysis to determine the effect of the change in the same manner described in "Schedule Time Adjustment" specified herein, and shall include the impacts acceptable to the Engineer in the next update or revision. The Contractor shall include a log of the action in the State owned float activity and include a discussion of the action in the narrative report of the next schedule update.

Contractor delays that are concurrent with State delays may be excusable, but are not compensable. Other Contractor delays are not excusable. Changes or delays that do not affect the controlling operation or operations on the critical path will not be considered as the basis for a time adjustment.

The State will be responsible for the impacts of: the State delays; the State's action or lack of action; utility companies who perform work on the project or impact the project schedule in conformance with the provisions in Section 8-1.10, "Utility and Non-Highway Facilities," of the Standard Specifications; and other contractors working directly for the State who impact the project or project schedule as specified in "Cooperation" of these special provisions. The Contractor shall mitigate these delays and impacts and shall minimize the costs of these delays and impacts. If an unanticipated State delay or project impact results in an increased cost to the Contractor, the Contractor will be entitled to an adjustment in compensation in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

The Contractor shall be responsible for assuring that the work sequences are logical and the network shows a coordinated plan for complete performance of the work. Failure of the Contractor to include in the schedule any element of work required for the performance of the contract shall not relieve the Contractor from completing the work within the time limit specified in the contract. If the Contractor or the Engineer discovers an undefined element of work, activity or logic, it shall be corrected by the Contractor in a schedule revision, as specified in these special provisions. If a planned activity requires greater-than-normal daily resources to accomplish, schedule revision submittals shall include a narrative describing the activity, and the amount and use of the extraordinary resources.

The Baseline Schedule or Schedule Update submitted for acceptance shall not show variances from the requirements of these special provisions unless approved by the Engineer. The Contractor shall make specific mention of the variations in the letter of transmittal and shall make the associated adjustments to the project schedule. The Contractor will not be relieved of the responsibility for executing the work in strict conformance with the provisions in the requirements of these special provisions. In the event of a conflict between the requirements of these special provisions and the information provided or shown on an accepted schedule, the requirements of these special provisions shall take precedence.

Each schedule submitted to the Engineer shall comply with the limits imposed by these special provisions, with the specified intermediate milestones and completion dates, and with the constraints, restraints or sequences included in these special provisions, except that after the Engineer accepts the baseline schedule, the Contractor may show a late scheduled completion date on subsequent updates or revisions. The degree of detail shall include factors to the satisfaction of the Engineer, 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 these special provisions, the planned substantial completion date, and the final completion date;
- C. Type of work to be performed, the sequences and the activities to be performed by subcontractors;
- D. Procurement, submittal, submittal review, manufacture, test, delivery, and installation of major materials and equipment that require approval;
- E. Preparation, submittal and approval of shop or working drawings and material samples showing time, as specified in these special provisions for the Engineer's review;
- F. Identification of interfaces and dependencies with preceding, concurrent and follow-on contractors, railroads, and utilities as indicated in these special provisions;
- G. Identification of each utility relocation or interface as a separate activity;
- H. Batch plant erection and plant certification;
- I. Erection and removal of falsework or shoring;
- J. Submission and approval of reports or results for major tests, such as that for pile loading or traffic controllers;
- K. Indicate long-term ramp and connector closing and opening events, traffic switches, and opening and closing of pavements to traffic as separate one day activities;
- L. Punch-list and final clean-up;
- M. State-owned float as the last activity in the schedule, at the end of which is the Scheduled Completion Date;
- N. Activity coding conventions shall include the following:

	Code	Value	Description
(1) Responsibility	RESP	CT	Caltrans
		UTIL	Utility Company
		RAIL	Railroad
		xxxx	Contractor
		xxxx	Subcontractor
		xxxx	others, as needed
(2) Stage	STGE	1	Stage 1
		2	Stage 2
		other designations	other descriptions, as needed
(3) Phase	PHAS	1	Phase 1
		2	Phase 2
		other phases	other phases, as needed
(4) Utilities	UTIL	PGE	Pacific Gas & Electric
		BELL	Pacific Bell
		GTE	GTE
		SCE	Southern California Edison
		other utilities	other utilities, as needed
The Contractor may include additional coding conventions, such as Ramps (RAMP), Facilities (FAC), and Events (EVNT).			

The work shall be executed in the sequence indicated in the accepted baseline schedule and subsequent accepted updates and revisions. Once the Engineer accepts a CPM schedule, the Contractor shall neither artificially improve the progress nor artificially change the quantity of float in any part of the schedule by artificially adding or deleting activities, revising

schedule logic restraints, or changing planned activity durations. Schedule changes of planned work shall be documented in a properly submitted revision. The Contractor may improve the progress by performing sequential activities concurrently or by performing activities more quickly than planned. In the case of multiple critical paths, float generated by early completion of one or a sequence of activities will be considered in determining if that sequence of activities remains on the critical path.

The schedule shall be modified to reflect actual events and conditions, including non-work days, as these events and conditions occur for historical purposes and for use in time impact analysis. Submittals and Engineer review time shall be shown in the progress schedule, including CPM schedule updates and revisions. The duration of the Engineer review activity shall be 15 days unless specified otherwise in these special provisions.

The Contractor shall be allowed to show an early or late scheduled completion date on schedule updates and revisions. The Engineer will use the most current, accepted schedule update and revision, and Contractor-provided cause, time-impact and schedule-delay analysis that is acceptable to the Engineer to determine apparent impacts.

The Engineer shall have 20 days to review and accept or reject the baseline schedule. The Engineer shall have 15 days to review and accept or reject any updated or revised schedule. Rejected schedules shall be resubmitted to the Engineer within 5 days, at which time a new review period of 5 days will begin. After the baseline schedule is accepted, schedules that are not accepted or rejected within the required review period will be deemed to have been accepted by the Engineer. Acceptance of a schedule does not relieve the Contractor of the responsibility of submitting complete and accurate information.

PRE-CONSTRUCTION SCHEDULING CONFERENCE

The Contractor shall schedule, and the Engineer will conduct, a Pre-construction Scheduling Conference with the Contractor's Project Manager and Construction Scheduler within 10 days after approval of the contract. At this meeting, the Engineer will review the requirements of this section of the special provisions with the Contractor. The Contractor shall submit a general time-scaled logic diagram displaying the major activities and sequence of planned operations and shall be prepared to discuss the proposed work plan and schedule methodology that complies with the requirements of these special provisions. If the Contractor proposes deviations to the construction staging of the project, the Contractor shall submit a general time-scaled logic diagram displaying the deviations and resulting time impacts and shall be prepared to discuss the proposal. At this meeting, the Contractor shall additionally submit the alpha-numeric coding structure and the activity identification system for labeling the work activities. To easily identify relationships, each activity description shall indicate its associated scope or location of work by including such terms as quantity of material, type of work, Bridge Number, Station to Station location, side of highway (such as left, right, northbound, southbound), lane number, shoulder, ramp name, ramp line descriptor or mainline. The Engineer will review and comment on the logic diagram, the coding structure and activity identification system within 15 days after submission by the Contractor. The Contractor shall make modifications to the time-scaled logic diagram, the coding structure, and activity identification system that the Engineer requests and shall employ that coding structure and identification system. The Contractor shall include the Engineer-requested modifications in the baseline schedule.

NETWORK DIAGRAM AND PROJECT SCHEDULE REPORTS

Schedules submitted to the Engineer, including the baseline schedule, shall include originally-plotted time-scaled network diagram(s). Network diagrams shall be based on early start and early finish dates of activities shown. The network diagrams submitted to the Engineer shall also be accompanied by the CPM software-generated tabular reports for each activity included in the project schedule. Three different report sorts shall be provided: Early Start, Total Float, and Activity Number which shall show the predecessors and successors for each activity. Tabular reports, 215 mm x 280 mm size (8 1/2" x 11"), shall be submitted to the Engineer and shall include at a minimum, the following:

- A. Data date;
- B. Predecessor and successor activity numbers and descriptions;
- C. Activity number and description;
- D. Activity code(s);
- E. Scheduled, or actual and remaining durations for each activity;
- F. Earliest start date (by calendar date);
- G. Earliest finish date (by calendar date);
- H. Actual start date (by calendar date);
- I. Actual finish date (by calendar date);
- J. Latest start date (by calendar date);
- K. Latest finish date (by calendar date);
- L. Free Float, in work days;
- M. Total Float, in work days;

- N. Percentage of activity complete and remaining duration for incomplete activities;
- O. Lag(s); and
- P. Imposed constraints.

The networks shall be drafted time-scaled to show a continuous flow of information from left to right. The primary path(s) of criticality shall be clearly and graphically identified on the network(s). The network diagram shall be prepared on E-size sheets, 860 mm x 1120 mm (34" x 44"), and 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 Engineer's approval.

The narrative report shall be organized as follows:

- A. Contractor's Transmittal Letter;
- B. Work completed during the period;
- C. Identification of unusual resources: manpower, material, or equipment restrictions or use, including multiple shifts, 6-day work weeks, specified overtime, or work at times other than regular days or hours;
- D. Description of the current critical path;
- E. Changes to the critical path since the last schedule submittal;
- F. Description of problem areas;
- G. Current and anticipated delays:
 - 1. Cause of delay,
 - 2. Impact of delay on other activities, milestones and completion dates,
 - 3. Corrective action and schedule adjustments to correct the delay;
- H. Pending items and status thereof:
 - 1. Permits,
 - 2. Change Orders,
 - 3. Time Adjustments,
 - 4. Non-Compliance Notices;
- I. Contract completion date(s) status:
 - 1. Ahead of schedule and number of days,
 - 2. Behind schedule and number of days,
 - 3. If date changes, explain the cause;
- J. Attached Updated Network Diagram and Reports.

Schedule network diagrams, tabular reports and narrative reports shall be submitted to the Engineer for acceptance in the following quantities:

- A. Two sets of originally-plotted, time-scaled network diagram(s);
- B. Two copies of each of the three sorts of the CPM software-generated tabular reports 215 mm x 280 mm size (8 1/2" x 11");
- C. One 1.44-megabyte 89 mm (3.5 inch) floppy diskette containing the schedule data;
- D. Two copies of the narrative report.

BASELINE SCHEDULE REQUIREMENTS

Within 30 days after approval of the contract, the Contractor shall submit a baseline schedule to the Engineer. The baseline project schedule shall have a data date of the first working day of the contract and shall not include any completed work to-date. The baseline schedule shall be practicable; include the entire scope of work; meet interim target dates, milestones, stage construction requirements, and internal time constraints; show logical sequence of activities; and shall not extend beyond the number of working days originally provided in these special provisions. An early completion schedule will be acceptable provided that the schedule meets the requirements of these special provisions and the Standard Specifications.

The baseline CPM progress schedule submitted by the Contractor shall have a sufficient number of activities to assure adequate planning of the project, 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 the activities that define the critical path. Multiple critical paths and near-critical paths shall be kept to a minimum, as determined by the Engineer. A total of not more than 50 percent of the baseline schedule activities shall be critical or near-critical, unless otherwise approved by the Engineer.

Activities shall have a duration of not less than one working day nor more than 20 working days, unless otherwise approved by the Engineer. The activities in the baseline 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 or negative lag to an activity.

MONTHLY SCHEDULE UPDATES

On or before the first calendar day of each month, the Contractor shall meet with the Engineer to review contract progress. At the monthly progress meeting the Contractor shall submit to the Engineer an update of the network diagram and project schedule reports as defined above. Update schedules shall have a data date of the twenty-first calendar day of the month, or other date as established by the Engineer, and shall include the information available up to that date. Durations for work that has been completed will be shown on the schedule as the work actually occurred, including Engineer submittal review and Contractor resubmittal times.

SCHEDULE REVISIONS

When the Contractor proposes a revision to an accepted schedule, the Contractor shall state in writing the reasons for the change, as well as the specifics, such as, but not limited to, revisions to activities, logic, durations, and other matters pertinent to the proposed revisions. If the Engineer considers a schedule revision to be of a major nature, the Engineer may require the Contractor to revise and submit for acceptance the affected portion(s) of the project schedule and an analysis to show the effect on the entire project. In addition to the revision submittal, the Contractor shall submit a schedule update with the same data date as the revision which is to reflect the project condition just prior to implementing the revision. The Contractor shall discuss contemplated revisions with the Engineer prior to the submittal.

Within 15 days, the Contractor shall submit a revised CPM network for approval when requested by the Engineer, or when any of the following occurs:

- A. There is a significant change in the Contractor's operations that affects the critical or near critical path(s).
- B. The scheduled completion date of the current submitted updated CPM schedule indicates that the contract progress is 20 days or more behind the current accepted schedule or revision.
- C. The Contractor or the Engineer considers that an approved or anticipated change will impact the critical or near critical path or contract progress.

SCHEDULE TIME ADJUSTMENT

When the Contractor requests a time adjustment due to contract change orders or delays, or if the Contractor or the Engineer considers that an approved or anticipated change will impact the critical path or contract progress, the Contractor shall submit a written time impact analysis to the Engineer illustrating the impacts of each change or delay on the current scheduled completion date or milestone completion date. The analysis shall use the currently accepted schedule that has a data date closest to and prior to the event. If the Engineer determines that the currently accepted schedule does not appropriately represent the conditions prior to the event, the schedule shall be updated to the day before the event being analyzed. An additional analysis shall be performed after the completion of the event. If the event is on the critical path at the time of its completion, then the difference between the scheduled completion dates of these 2 analyses shall be equal to the adjustment in time. The time impact analysis shall include one or more fragnet(s) demonstrating how the Contractor proposes to incorporate the event(s) into the schedule, including logic and duration of the proposed activities. Until such time that the Contractor provides the analysis, the Engineer may, at his option, construct and utilize the project as-built schedule or other recognized method to determine adjustments in contract time.

Time impact analyses shall be submitted in duplicate within 15 days of a delay and shall be used in determining contract change order days. Approval or rejection of each time impact analysis by the Engineer will be made within 15 days after receipt of the time impact analysis. In the event the Contractor does not agree with the decision of the Engineer regarding the impact of a change or delay, notice shall be given in conformance with the provisions in Section 9-1.04, "Notice of Potential Claim," of the Standard Specifications. The third paragraph of Section 4-1.03A of the Standard Specifications shall not apply.

FINAL SCHEDULE UPDATE

Within 30 days after acceptance of the contract by the Director, the Contractor shall submit a final update of the schedule (as-built schedule) with actual start and actual finish dates for the activities. The Contractor shall submit a written certificate with this submittal signed by the Contractor's Project Manager and an officer of the company stating "To the best of my

knowledge, the enclosed final update of the project schedule reflects the actual start and completion dates of the actual activities for the project contained herein." An officer of the company may delegate in writing the authority to sign the certificate to a responsible manager. Submittal of the final schedule update and the certification shall be a condition precedent to the release of any retained funds under the contract.

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, material (including computer hardware and software), tools, equipment, and incidentals; and for doing all the work involved in preparing, furnishing, updating, and revising progress schedules; maintaining and repairing the computer hardware; and instructing and assisting 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 the progress schedule (critical path) contract item will be made as follows:

- A. A total of 50 percent of the progress schedule (critical path) contract item amount will be made upon achieving all of the following: 5 percent of all work completed, accepted baseline, all accepted required schedule updates and revisions, and required CPM training.
- B. A total of 60 percent of the progress schedule (critical path) contract item amount will be made upon achieving all of the following: 25 percent of all work completed, accepted baseline, and all accepted required schedule updates and revisions.
- C. A total of 75 percent of the progress schedule (critical path) contract item amount will be made when 50 percent of all work completed, accepted baseline, and all accepted required schedule updates and revisions.
- D. A total of 100 percent of the progress schedule (critical path) contract item amount will be made when 100 percent of all work completed, accepted baseline, all accepted required schedule updates and revisions, and a completed and certified Final Schedule Update.

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 progress schedule (critical path) will not be made for any increased or decreased work ordered by the Engineer in furnishing progress schedules.

RETENTION

The Department will retain an amount equal to 25 percent of the estimated value of the work performed during each estimate period in which the Contractor fails to submit pre-construction scheduling documents, an acceptable baseline, acceptable updated schedule, or acceptable revised progress schedule (critical path) conforming to the requirements of these special provisions as determined by the Engineer. Retentions for failure to submit acceptable CPM progress schedules shall be in addition to other retentions provided for in the contract. Retentions for failure to submit progress schedules (critical path) will be released for payment on the next monthly estimate for partial payment following the date that pre-construction scheduling documents and acceptable progress schedules (critical path) are submitted to the Engineer, and no interest will be due the Contractor.

10-1.07 OVERHEAD

Overhead shall conform to the provisions of this section, "Overhead," of these special provisions. The Contractor will be compensated for time-related overhead in accordance 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. Such 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:

1. suspensions of work ordered in conformance with the provisions in Section 8-1.05, "Temporary Suspension of Work," of the Standard Specifications, except:
 - a. suspensions ordered due to weather conditions being unfavorable for the suitable prosecution of the controlling operation or operations; or
 - b. 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
 - c. any other suspensions mutually agreed upon between the Engineer and the Contractor.
2. 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
3. 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 calendar 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:

1. are allowable in conformance with the requirements of the Federal Acquisition Regulations, 48 CFR, Chapter 1, Part 31;
2. are adequately supported by reliable documentation; and
3. 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 acceptance of the contract pursuant to the provisions in Section 7-1.17, "Acceptance of Contract," of the Standard Specifications, the amount of the total contract item price for time-related overhead not yet paid, will be included for payment in the first estimate made after acceptance of the contract in conformance with the provisions in Section 9-1.07, "Payment After Acceptance," of the Standard Specifications.

10-1.08 OBSTRUCTIONS

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

Attention is directed to the existence of certain underground facilities that may require special precautions be taken by the Contractor to protect the health, safety and welfare of workers and of the public. Facilities requiring special precautions include, but are not limited to: conductors of petroleum products, oxygen, chlorine, and toxic or flammable gases; natural gas in pipelines greater than 150 mm in diameter or pipelines operating at pressures greater than 415 kPa (gage); underground electric supply system conductors or cables, with potential to ground of more than 300 V, either directly buried or in a duct or conduit which do not have concentric grounded or other effectively grounded metal shields or sheaths.

If these facilities are not located on the plans in both alignment and elevation, no work shall be performed in the vicinity of the facilities, except as provided herein for conduit to be placed under pavement, until the owner, or the owner's representative, has located the facility by potholing, probing or other means that will locate and identify the facility. Conduit to be installed under pavement in the vicinity of these facilities shall be placed by the trenching method in conformance with the provisions in "Conduit" of these special provisions. If, in the opinion of the Engineer, the Contractor's operations are delayed or interfered with by reason of the utility facilities not being located by the owner or the owner's representative, the State will compensate the Contractor for the delays to the extent provided in Section 8-1.09, "Right of Way Delays," of the Standard Specifications, and not otherwise, except as provided in Section 8-1.10, "Utility and Non-Highway Facilities," of the Standard Specifications.

The Contractor shall notify the Engineer and the appropriate regional notification center for operators of subsurface installations at least 5 working days, 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

10-1.09 MOBILIZATION

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

10-1.10 CONSTRUCTION AREA SIGNS

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

Attention is directed to the provisions in "Approved Traffic Products" of these special provisions. Type II retroreflective sheeting shall not be used on construction area sign panels.

Attention is directed to "Construction Project Information Signs" of these special provisions regarding the number and type of construction project information signs to be furnished, erected, maintained, and removed and disposed of.

The Contractor shall notify the appropriate regional notification center for operators of subsurface installations at least 2 working days, but not more than 14 calendar days, prior to commencing excavation for construction area sign posts. The regional notification centers include, but are not limited to, the following:

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

Excavations required to install construction area signs shall be performed by hand methods without the use of power equipment, except that power equipment may be used if it is determined there are no utility facilities in the area of the proposed post holes.

Sign substrates for stationary mounted construction area signs may be fabricated from fiberglass reinforced plastic as specified under "Approved Traffic Products" of these special provisions.

"Advance information signs" shown on the plans shall be placed at least 7 days before ramps are to be closed to public traffic. The signs shall show the dates and time of ramp closures.

10-1.11 MAINTAINING TRAFFIC

Attention is directed to Sections 7-1.08, "Public Convenience," 7-1.09, "Public Safety," and 12, "Construction Area Traffic Control Devices," of the Standard Specifications and to the provisions in "Public Safety" of these special provisions and these special provisions. Nothing in these special provisions shall be construed as relieving the Contractor from the responsibilities specified in Section 7-1.09.

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

Local streets that do not have closure charts shall not be closed.

All lane closures on the San Mateo-Hayward Bridge shall be coordinated with the Regional Manager for Toll Bridges at Telephone: (510) 286-3922.

Personal vehicles of the Contractor's employees shall not be parked on the traveled way or shoulders including any section closed to public traffic. Personal vehicles of the Contractor's employees will be allowed to park in either the east or west parking lots of the San Mateo-Hayward Bridge. This needs to be coordinated with the Toll Plaza Captain at Telephone: (510) 286-1369.

The Contractor shall notify local authorities of the Contractor's intent to begin work at least 5 days before work is begun. The Contractor shall cooperate with local authorities relative to handling traffic through the area and shall make arrangements relative to keeping the working area clear of parked vehicles.

Whenever vehicles or equipment are parked on the shoulder within 1.8 m of a traffic lane, the shoulder area shall be closed as shown on the plans.

Lanes shall be closed only during the hours shown on the charts included in this section "Maintaining Traffic." Except work required under Sections 7-1.08 and 7-1.09, work that interferes with public traffic shall be performed only during the hours shown for lane closures.

Designated legal holidays are: January 1st, the third Monday in February, the last Monday in May, July 4th, the first Monday in September, November 11th, Thanksgiving Day, and December 25th. When a designated legal holiday falls on a Sunday, the following Monday shall be a designated legal holiday. When November 11th falls on a Saturday, the preceding Friday shall be a designated legal holiday.

Minor deviations from the requirements of this section concerning hours of work which do not significantly change the cost of the work may be permitted upon the written request of the Contractor, if in the opinion of the Engineer, public traffic will be better served and the work expedited. These deviations shall not be adopted by the Contractor until the Engineer has approved the deviations in writing. All other modifications will be made by contract change order.

Chart No. 1																									
Multilane Lane Requirements																									
Location: EB Route 92 Connector from SB Route 101 (Location 1).																									
FROM HOUR TO HOUR	a.m.											p.m.													
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9		10	11
Mondays through Thursdays	1	1	1	1	1	1																			1
Fridays	1	1	1	1	1	1																			
Saturdays	1	1	1	1	1	1	1	1	1																1
Sundays	1	1	1	1	1	1	1	1	1	1	1													1	1
Day before designated legal holiday	1	1	1	1	1	1																			
Designated legal holidays	1	1	1	1	1	1	1	1	1	1	1													1	1
Legend:																									
<input type="checkbox"/> 1 Provide at least one traffic lane.																									
<input type="checkbox"/> No lane closure allowed																									
REMARKS:																									

Chart No. 2																									
Multilane Lane Requirements																									
Location: EB on Rte. 92-From EB Rte 92/SB Rte. 101 connector to NB Rte 101/EB Rte 92 connector (Loc 1).																									
FROM HOUR TO HOUR	a.m.											p.m.													
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9		10	11
Mondays through Thursdays	1	1	1	1	1	1																			
Fridays	1	1	1	1	1	1																			
Saturdays		1	1	1	1	1	1																		
Sundays		1	1	1	1	1	1	1	1																
Day before designated legal holiday	1	1	1	1	1	1																			
Designated legal holidays		1	1	1	1	1	1	1	1																
Legend:																									
<input type="checkbox"/> 1 Provide at least one traffic lane.																									
<input type="checkbox"/> No lane closure allowed																									
REMARKS:																									

Chart No. 3																										
Multilane Lane Requirements																										
Location: EB on Rte. 92-From east of Foster City Blvd to PM R16.5 on San Mateo Bridge (Loc 5 through 12).																										
FROM HOUR TO HOUR	a.m.												p.m.													
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	
Mondays through Thursdays	1	1	1	1	1	1						2	2	2	2	2						2	2	2	2	1
Fridays	1	1	1	1	1	1						2	2	2	2							2	2	2	2	1
Saturdays	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Sundays	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	
Day before designated legal holiday	1	1	1	1	1	1						2	2	2	2							2	2	2	2	1
Designated legal holidays	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	

Legend:

1	Provide at least one traffic lane.
2	Provide at least two traffic lanes.
	No lane closure allowed

REMARKS:

Chart No. 4																									
Multilane Lane Requirements																									
Location: Eastbound on Rte 92 - On San Mateo Bridge (PM SM R16.5 to Ala R2.4) (Loc 13 through 22).																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	1	1	1	1	1	1																			1
Fridays	1	1	1	1	1	1																			1
Saturdays	1	1	1	1	1	1	1	1																	
Sundays	1	1	1	1	1	1	1	1	1	1														1	1
Day before designated legal holiday	1	1	1	1	1	1																			1
Designated legal holidays	1	1	1	1	1	1	1	1	1	1														1	1

Legend:

1	Provide at least one traffic lane.
	No lane closure allowed

REMARKS:

Chart No. 5																									
Multilane Lane Requirements																									
Location: Eastbound on Rte 92 - From end of San Mateo Bridge to Clawiter Rd. OC (Loc 22 through 25).																									
FROM HOUR TO HOUR	a.m.											p.m.													
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9		10	11
Mondays through Thursdays	1	1	1	1	1	1																			1
Fridays	1	1	1	1	1	1																			
Saturdays	1	1	1	1	1	1	1																		
Sundays	1	1	1	1	1	1	1	1	1																1
Day before designated legal holiday	1	1	1	1	1	1																			
Designated legal holidays	1	1	1	1	1	1	1	1	1	1															1
Legend:																									
<input type="checkbox"/> 1 Provide at least one traffic lane.																									
<input type="checkbox"/> No lane closure allowed																									
REMARKS:																									

Chart No. 6 (EB on Rte.92)																									
Multilane Lane Requirements																									
Location: From 0.8 km west of Industrial Blvd. off-ramp to on-ramp from Industrial Blvd. (Loc 26 & 27).																									
FROM HOUR TO HOUR	a.m.											p.m.													
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9		10	11
Mondays through Thursdays	1	1	1	1	1	1																			1
Fridays	1	1	1	1	1	1																			
Saturdays	1	1	1	1	1	1	1	1																	
Sundays	1	1	1	1	1	1	1	1	1	1															1
Day before designated legal holiday	1	1	1	1	1	1																			
Designated legal holidays	1	1	1	1	1	1	1	1	1	1															1
Legend:																									
<input type="checkbox"/> 1 Provide at least one traffic lane.																									
<input type="checkbox"/> No lane closure allowed																									
REMARKS:																									

Chart No. 7																									
Multilane Lane Requirements																									
Location: EB on Rte 92-The two lane section between Hesperian Blvd OC& west of Rte 92/880 I/C (Loc 30).																									
FROM HOUR TO HOUR	a.m.											p.m.													
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9		10	11
Mondays through Thursdays	1	1	1	1	1	1																			
Fridays	1	1	1	1	1	1																			
Saturdays	1	1	1	1	1	1	1																		
Sundays	1	1	1	1	1	1	1	1	1																
Day before designated legal holiday	1	1	1	1	1	1																			
Designated legal holidays	1	1	1	1	1	1	1	1	1																

Legend:

1 Provide at least one traffic lane.

No lane closure allowed

REMARKS:

Chart No. 8																									
Multilane Lane Requirements																									
Location: EB on Rte 92-The three lane section between Hesperian Blvd OC & west of Rte 92/880 I/C (Loc 30).																									
FROM HOUR TO HOUR	a.m.											p.m.													
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9		10	11
Mondays through Thursdays	1	1	1	1	1	1																	2	2	2
Fridays	1	1	1	1	1	1																	2	2	2
Saturdays	1	1	1	1	1	1	1	2	2	2	2														2
Sundays	1	1	1	1	1	1	1	1	1	2	2	2	2	2						2	2	2	2	2	2
Day before designated legal holiday	1	1	1	1	1	1																	2	2	2
Designated legal holidays	1	1	1	1	1	1	1	1	1	2	2	2	2	2						2	2	2	2	2	2

Legend:

1 Provide at least one traffic lane.

2 Provide at least two traffic lanes.

No lane closure allowed

REMARKS:

Chart No. 9																									
Multilane Lane Requirements																									
Location: WB Route 92 - On the WB Route 92 to NB Route 101 Connector (Loc 1).																									
FROM HOUR TO HOUR	a.m.											p.m.													
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9		10	11
Mondays through Thursdays	1	1	1	1	1																1	1	1	1	1
Fridays	1	1	1	1	1																	1	1	1	1
Saturdays	1	1	1	1	1	1	1	1	1													1	1	1	1
Sundays	1	1	1	1	1	1	1	1	1	1											1	1	1	1	1
Day before designated legal holiday	1	1	1	1	1																	1	1	1	1
Designated legal holidays	1	1	1	1	1	1	1	1	1	1											1	1	1	1	1
Legend:																									
<input type="checkbox"/> 1 Provide at least one traffic lane.																									
<input type="checkbox"/> No lane closure allowed																									
REMARKS:																									

Chart No. 10																									
Multilane Lane Requirements																									
Location: WB on Rte 92-From WB Rte 92/NB Rte 101 Connector to WB Rte 92/SB Rte 101 Connector (Loc 1)																									
FROM HOUR TO HOUR	a.m.											p.m.													
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9		10	11
Mondays through Thursdays	1	1	1	1	1																	2	2	2	1
Fridays	1	1	1	1	1																	2	2	2	2
Saturdays	1	1	1	1	1	1	2	2	2												2	2	2	2	1
Sundays	1	1	1	1	1	1	1	1	2	2											2	2	2	2	1
Day before designated legal holiday	1	1	1	1	1																	2	2	2	2
Designated legal holidays	1	1	1	1	1	1	1	1	2	2											2	2	2	2	1
Legend:																									
<input type="checkbox"/> 1 Provide at least one traffic lane.																									
<input type="checkbox"/> 2 Provide at least two traffic lanes.																									
<input type="checkbox"/> No lane closure allowed																									
REMARKS:																									

**Chart No. 11
Multilane Lane Requirements**

Location: WB on Rte 92-From PM R16.5 on San Mateo Bridge to east of Foster City Blvd. (Loc 5 through 12).

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

Legend:

1 Provide at least one traffic lane.

2 Provide at least two traffic lanes.

No lane closure allowed

REMARKS:

**Chart No. 12
Multilane Lane Requirements**

Location: WB on Rte 92 - On San Mateo-Hayward Bridge (PM Ala R2.4 to SM R16.5) (Loc 13 through 22).

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

Legend:

1 Provide at least one traffic lane.

No lane closure allowed

REMARKS:

**Chart No. 13
Multilane Lane Requirements**

Location: WB on Rte 92-From w/o Clawiter Rd. OC to beginning of San Mateo Bridge (Loc 22 through 25).

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

Legend:

1 Provide at least one traffic lane.

2 Provide at least two traffic lanes.

No lane closure allowed

REMARKS:

**Chart No. 14
Multilane Lane Requirements**

Location: WB on Rte 92 - From Industrial Blvd Off-Ramp to 0.8 km west of Industrial Blvd On-Ramp (Loc 27).

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

Legend:

1 Provide at least one traffic lane.

No lane closure allowed

REMARKS:

**Chart No. 15 (WB on Rte. 92)
Multilane Lane Requirements**

Location: The two lane section from west of Rte 92/880 I/C to the On-Ramp from Hesperian Blvd. (Loc 29).

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

Legend:

1 Provide at least one traffic lane.

No lane closure allowed

REMARKS:

**Chart No. 16 (WB on Rte. 92)
Multilane Lane Requirements**

Location: The three lane section between west of Rte 92/880 I/C to Hesperian Blvd. OC. (Loc 30).

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

Legend:

1 Provide at least one traffic lane.

2 Provide at least two traffic lanes.

No lane closure allowed

REMARKS:

Chart No. 17																								
Ramp Lane Requirements																								
Location: EB on Rte 92 - EB On-Ramp from Mariners Island Blvd. (Loc 2).																								
FROM HOUR TO HOUR	a.m.												p.m.											
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Mondays through Thursdays	X	X	X	X	X	X			X	X	X	X	X	X					X	X	X	X	X	
Fridays	X	X	X	X	X	X			X	X	X	X	X	X					X	X	X	X	X	
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Day before designated legal holiday	X	X	X	X	X	X			X	X	X	X	X	X					X	X	X	X	X	
Designated legal holidays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Legend:																								
<input checked="" type="checkbox"/>		Ramp may be completely closed and traffic detoured.																						
<input type="checkbox"/>		No work that interferes with public traffic will be allowed																						
REMARKS: See Detour Plan #2. Simultaneous closure of two consecutive ramps, in either EB or WB direction, will not be permitted at anytime.																								

Chart No. 18																								
Ramp Lane Requirements																								
Location: EB Rte 92 - EB Off-ramp to Clawiter Rd. (Loc 25).																								
FROM HOUR TO HOUR	a.m.												p.m.											
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Mondays through Thursdays	X	X	X	X	X	X															X	X	X	X
Fridays	X	X	X	X	X	X															X	X	X	X
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Day before designated legal holiday	X	X	X	X	X	X															X	X	X	X
Designated legal holidays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Legend:																								
<input checked="" type="checkbox"/>		Ramp may be completely closed and traffic detoured to next exit.																						
<input type="checkbox"/>		No ramp closure allowed.																						
REMARKS: Simultaneous closure of two consecutive ramps, in either EB or WB direction, will not be permitted at anytime.																								

Chart No. 19																									
Ramp Lane Requirements																									
Location: EB Rte. 92 - EB On-ramp from Clawiter Road/Eden Landing Rd. (Loc. 25).																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X															X	X	X	X	X
Fridays	X	X	X	X	X	X															X	X	X	X	X
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Day before designated legal holiday	X	X	X	X	X	X															X	X	X	X	X
Designated legal holidays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Legend:																									
<input checked="" type="checkbox"/> Ramp may be completely closed and traffic detoured.																									
<input type="checkbox"/> No ramp closure allowed.																									
REMARKS: See Detour Plan #3. Simultaneous closure of two consecutive ramps, in either EB or WB direction, will not be permitted at anytime.																									

Chart No. 20																									
Ramp Lane Requirements																									
Location: Eastbound Rte. 92 - EB Off-ramp to Industrial Blvd. (Loc 27).																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X															X	X	X	X	X
Fridays	X	X	X	X	X	X															X	X	X	X	X
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Day before designated legal holiday	X	X	X	X	X	X															X	X	X	X	X
Designated legal holidays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Legend:																									
<input checked="" type="checkbox"/> Ramp may be completely closed and traffic detoured to next exit.																									
<input type="checkbox"/> No ramp closure allowed.																									
REMARKS: Simultaneous closure of two consecutive ramps, in either EB or WB direction, will not be permitted at any time.																									

Chart No. 21																									
Ramp Lane Requirements																									
Location: Eastbound Rte. 92 - EB On-Ramp from Industrial Blvd. (Loc. 27).																									
FROM HOUR TO HOUR	a.m.											p.m.													
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X																X	X	X	X
Fridays	X	X	X	X	X	X																X	X	X	X
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Day before designated legal holiday	X	X	X	X	X	X																X	X	X	X
Designated legal holidays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Legend:

Ramp may be completely closed and traffic detoured.

No ramp closure allowed.

REMARKS: See Detour Plan #4. Simultaneous closure of two consecutive ramps, in either EB or WB direction, will not be permitted at anytime.

Chart No. 22																									
Ramp Lane Requirements																									
Location: Eastbound Rte. 92 - EB Off-Ramp to Hesperian Blvd. (Loc 28).																									
FROM HOUR TO HOUR	a.m.											p.m.													
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X																X	X	X	X
Fridays	X	X	X	X	X	X																X	X	X	X
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Day before designated legal holiday	X	X	X	X	X	X																X	X	X	X
Designated legal holidays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Legend:

Ramp may be completely closed and traffic detoured.

No ramp closure allowed.

REMARKS: See Detour Plan #5. Simultaneous closure of two consecutive ramps, in either EB or WB direction, will not be permitted at anytime.

Chart No. 23																									
Ramp Lane Requirements																									
Location: Eastbound Rte. 92 - EB On-Ramp from Hesperian Blvd. (Loc 29).																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X																		X	X
Fridays	X	X	X	X	X	X																			X
Saturdays	X	X	X	X	X	X	X	X																	X
Sundays	X	X	X	X	X	X	X	X	X														X	X	X
Day before designated legal holiday	X	X	X	X	X	X																			X
Designated legal holidays	X	X	X	X	X	X	X	X	X														X	X	X

Legend:

Ramp may be completely closed and traffic detoured.

No ramp closure allowed.

REMARKS: See Detour Plan #6. Simultaneous closure of two consecutive ramps, in either EB or WB direction, will not be permitted at anytime.

Chart No. 24																									
Ramp Lane Requirements																									
Location: Westbound Rte. 92 - EB On-Ramp from Clawiter Rd/Eden Landing Road (Loc 26).																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X															X	X	X	X	X
Fridays	X	X	X	X	X	X															X	X	X	X	X
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Day before designated legal holiday	X	X	X	X	X	X															X	X	X	X	X
Designated legal holidays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Legend:

Ramp may be completely closed and traffic detoured.

No ramp closure allowed.

REMARKS: See Detour Plan #7. Simultaneous closure of two consecutive ramps, in either EB or WB direction, will not be permitted at anytime.

Chart No. 25																									
Ramp Lane Requirements																									
Location: Westbound Rte. 92 - WB Off-Ramp to Clawiter Rd./Eden Landing Road (Loc 26).																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X															X	X	X	X	X	X
Fridays	X	X	X	X	X															X	X	X	X	X	X
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Day before designated legal holiday	X	X	X	X	X															X	X	X	X	X	X
Designated legal holidays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Legend: <input checked="" type="checkbox"/> Ramp may be completely closed and traffic detoured. <input type="checkbox"/> No ramp closure allowed.																									
REMARKS: See Detour Plan #8. Simultaneous closure of two consecutive ramps, in either EB or WB direction, will not be permitted at anytime.																									

Chart No. 26																									
Ramp Lane Requirements																									
Location: Westbound Rte. 92 - WB On-Ramp from Industrial Blvd. (Loc 27).																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X															X	X	X	X	X	X
Fridays	X	X	X	X	X															X	X	X	X	X	X
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Day before designated legal holiday	X	X	X	X	X															X	X	X	X	X	X
Designated legal holidays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Legend: <input checked="" type="checkbox"/> Ramp may be completely closed and traffic detoured. <input type="checkbox"/> No ramp closure allowed.																									
REMARKS: See Detour Plan #9. Simultaneous closure of two consecutive ramps, in either EB or WB direction, will not be permitted at anytime.																									

Chart No. 27 Ramp Lane Requirements																									
Location: Westbound Rte. 92 - WB Off-Ramp to SB Industrial Blvd. (Loc 27).																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X															X	X	X	X	X	X
Fridays	X	X	X	X	X															X	X	X	X	X	X
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Day before designated legal holiday	X	X	X	X	X															X	X	X	X	X	X
Designated legal holidays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Legend:																									
<input checked="" type="checkbox"/> Ramp may be completely closed and traffic detoured to next exit.																									
<input type="checkbox"/> No ramp closure allowed.																									
REMARKS: Simultaneous closure of two consecutive ramps, in either EB or WB direction, will not be permitted at anytime.																									

Chart No. 28 Ramp Lane Requirements																									
Location: Westbound Rte. 92 - WB Off-Ramp to SB Hesperian Blvd. (Loc 29).																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X																	X	X	X
Fridays	X	X	X	X	X	X																	X	X	X
Saturdays	X	X	X	X	X	X	X	X	X	X										X	X	X	X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X										X	X	X	X	X	X
Day before designated legal holiday	X	X	X	X	X	X																	X	X	X
Designated legal holidays	X	X	X	X	X	X	X	X	X	X	X									X	X	X	X	X	X
Legend:																									
<input checked="" type="checkbox"/> Ramp may be completely closed and traffic detoured to next exit.																									
<input type="checkbox"/> No ramp closure allowed.																									
REMARKS: Simultaneous closure of two consecutive ramps, in either EB or WB direction, will not be permitted at anytime.																									

Chart No. 29																									
Ramp Lane Requirements																									
Location: Westbound Rte. 92 - WB Off-Ramp to NB Hesperian Blvd. (Loc 29).																									
FROM HOUR TO HOUR	a.m.											p.m.													
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9		10	11
Mondays through Thursdays	X	X	X	X	X	X																		X	X
Fridays	X	X	X	X	X	X																		X	X
Saturdays	X	X	X	X	X	X	X	X	X														X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X													X	X	X
Day before designated legal holiday	X	X	X	X	X	X																		X	X
Designated legal holidays	X	X	X	X	X	X	X	X	X	X													X	X	X

Legend:

Ramp may be completely closed and traffic detoured to next exit.

No ramp closure allowed.

REMARKS: Simultaneous closure of two consecutive ramps, in either EB or WB direction, will not be permitted at anytime.

Chart No. 30																									
Ramp Lane Requirements																									
Location: Westbound Rte. 92 - WB On-Ramp from Hesperian Blvd. (Loc 28).																									
FROM HOUR TO HOUR	a.m.											p.m.													
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9		10	11
Mondays through Thursdays	X	X	X	X	X	X														X	X	X	X	X	X
Fridays	X	X	X	X	X	X														X	X	X	X	X	X
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Day before designated legal holiday	X	X	X	X	X	X														X	X	X	X	X	X
Designated legal holidays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Legend:

Ramp may be completely closed and traffic detoured.

No ramp closure allowed.

REMARKS: See Detour Plan #10. Simultaneous closure of two consecutive ramps, in either EB or WB direction, will not be permitted at anytime.

Chart No. 31																								
Ramp Lane Requirements																								
Location: Westbound Rte. 92 - WB On-Ramp from SB Rte. 880 (Loc 30).																								
FROM HOUR TO HOUR	a.m.												p.m.											
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Mondays through Thursdays	X	X	X	X	X																			X
Fridays	X	X	X	X	X																			X
Saturdays	X	X	X	X	X	X	X																	X
Sundays	X	X	X	X	X	X	X	X	X															X
Day before designated legal holiday	X	X	X	X	X																			X
Designated legal holidays	X	X	X	X	X	X	X	X	X															X

Legend:
 Ramp may be completely closed and traffic detoured.
 No ramp closure allowed.

REMARKS: See Detour Plan #11. Simultaneous closure of two consecutive ramps, in either EB or 'WB direction, will not be permitted at anytime.

Chart No. 32																								
Multilane Lane Requirements																								
Location: Eastbound Rte. 92 - EB Connector from NB Rte. 101 (Loc 1).																								
FROM HOUR TO HOUR	a.m.												p.m.											
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Mondays through Thursdays	1	1	1	1	1	1																		1
Fridays	1	1	1	1	1	1																		
Saturdays	1	1	1	1	1	1	1																	
Sundays	1	1	1	1	1	1	1	1																1
Day before designated legal holiday	1	1	1	1	1	1																		
Designated legal holidays	1	1	1	1	1	1	1	1																1

Legend:
 Connector may be completely closed and traffic detoured.
 No connector closure allowed.

REMARKS: See Detour Plan #1 on plan sheet CS-2

10-1.12 CLOSURE REQUIREMENTS AND CONDITIONS

Lane closures shall conform to the provisions in "Maintaining Traffic" of these special provisions and these special provisions.

The term closure, as used herein, is defined as the closure of a traffic lane or lanes, including ramp or connector lanes, within a single traffic control system.

CLOSURE SCHEDULE

By noon Monday, the Contractor shall submit a written schedule of planned closures for the following week period, defined as Friday noon through the following Friday noon.

The Closure Schedule shall show the locations and times when the proposed closures are to be in effect. The Contractor shall use the Closure Schedule request forms furnished by the Engineer. Closure Schedules submitted to the Engineer with

incomplete, unintelligible or inaccurate information will be returned for correction and resubmittal. The Contractor will be notified of disapproved closures or closures that require coordination with other parties as a condition of approval.

Amendments to the Closure Schedule, including adding additional closures, shall be submitted to the Engineer, in writing, at least 3 working days in advance of a planned closure. Approval of amendments to the Closure Schedule will be at the discretion of the Engineer.

The Contractor shall confirm, in writing, all scheduled closures by no later than 8:00 a.m. 3 working days prior to the date on which the closure is to be made. Approval or denial of scheduled closures will be made no later than 4:00 p.m. 2 working days prior to the date on which the closure is to be made. Closures not confirmed or approved will not be allowed.

Confirmed closures that are cancelled due to unsuitable weather may be rescheduled at the discretion of the Engineer for the following working day.

CONTINGENCY PLAN

The Contractor shall prepare a contingency plan for reopening closures to public traffic. The Contractor shall submit the contingency plan for a given operation to the Engineer within one working day of the Engineer's request.

LATE REOPENING OF CLOSURES

If a closure is not reopened to public traffic by the specified time, work shall be suspended in conformance with the provisions in Section 8-1.05, "Temporary Suspension of Work," of the Standard Specifications. The Contractor shall not make any further closures until the Engineer has accepted a work plan, submitted by the Contractor, that will insure that future closures will be reopened to public traffic at the specified time. The Engineer will have 2 working days to accept or reject the Contractor's proposed work plan. The Contractor will not be entitled to any compensation for the suspension of work resulting from the late reopening of closures.

For each 10-minute interval, or fraction thereof past the time specified to reopen the closure, the Department will deduct \$2,700 per interval from moneys due or that may become due the Contractor under the contract.

COMPENSATION

The Contractor shall notify the Engineer of any delay in the Contractor's operations due to the following conditions, and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of those conditions, and the Contractor's loss due to that delay could not have been avoided by rescheduling the affected closure or by judicious handling of forces, equipment and plant, the delay will be considered a right of way delay within the meaning of Section 8-1.09, "Right of Way Delays," and compensation for the delay will be determined in conformance with the provisions in Section 8-1.09:

- A. The Contractor's proposed Closure Schedule is denied and his planned closures are within the time frame allowed for closures in "Maintaining Traffic" of these special provisions, except that the Contractor will not be entitled to any compensation for amendments to the Closure Schedule that are not approved.
- B. The Contractor is denied a confirmed closure.

Should the Engineer direct the Contractor to remove a closure prior to the time designated in the approved Closure Schedule, any delay to the Contractor's schedule due to removal of the closure will be considered a right of way delay within the meaning of Section 8-1.09, "Right of Way Delays," and compensation for the delay will be determined in conformance with the provisions in Section 8-1.09.

10-1.13 TRAFFIC CONTROL SYSTEM FOR LANE CLOSURE

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

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

Each vehicle used to place, maintain and remove components of a traffic control system on multilane highways shall be equipped with a Type II flashing arrow sign which shall be in operation when the vehicle is being used for placing, maintaining or removing components. Vehicles equipped with Type II flashing arrow sign not involved in placing, maintaining or removing components when operated within a stationary lane closure shall only display the caution display mode. The sign shall be controllable by the operator of the vehicle while the vehicle is in motion. The flashing arrow sign shown on the plans shall not be used on vehicles which are being used to place, maintain and remove components of a traffic control system and shall be in place before a lane closure requiring its use is completed.

If components in the traffic control system are displaced or cease to operate or function as specified, from any cause, during the progress of the work, the Contractor shall immediately repair the components to the original condition or replace the components and shall restore the components to the original location.

When lane and ramp closures are made for work periods only, at the end of each work period, components of the traffic control system, except portable delineators placed along open trenches or excavation adjacent to the traveled way, shall be removed from the traveled way and shoulder. If the Contractor so elects, the components may be stored at selected central locations designated by the Engineer within the limits of the highway right of way.

The contract lump sum price paid for traffic control system shall include full compensation for furnishing all labor, materials (including signs), tools, equipment, and incidentals, and for doing all the work involved in placing, removing, storing, maintaining, moving to new locations, replacing, and disposing of the components of the traffic control system shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The adjustment provisions in Section 4-1.03, "Changes," of the Standard Specifications shall not apply to the item of traffic control system. Adjustments in compensation for traffic control system will be made only for increased or decreased traffic control system required by changes ordered by the Engineer and will be made on the basis of the cost of the increased or decreased traffic control necessary. The adjustment will be made on a force account basis as provided in Section 9-1.03, "Force Account Payment," of the Standard Specifications for increased work and estimated on the same basis in the case of decreased work.

Traffic control system required by work which is classed as extra work, as provided in Section 4-1.03D of the Standard Specifications, will be paid for as a part of the extra work.

10-1.14 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" and "Order of Work" of these special provisions.

GENERAL

Whenever the work or the Contractor's operations establishes a fixed obstacle, the exposed fixed obstacle shall be protected with a sand filled temporary crash cushion. The sand filled temporary crash cushion shall be in place prior to opening the lanes adjacent to the fixed obstacle to public traffic.

Sand filled temporary crash cushions shall be maintained in place at each location, including times when work is not actively in progress. Sand filled temporary crash cushions may be removed during a work period for access to the work provided that the exposed fixed obstacle is 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.

MATERIALS

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 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 (Northern): Traffic Control Service, Inc., 8585 Thys Court, Sacramento, CA 95828, Telephone 1-800-884-8274, FAX 1-916-387-9734
 2. Distributor (Southern): Traffic Control Service, Inc., 1881 Betmor Lane, Anaheim, CA 92805, Telephone 1-800-222-8274, FAX 1-714-937-1070.
- B. Fitch Inertial Modules, manufactured by Roadway Safety Service, Inc., 1050 North Rand Road, Wauconda, IL 60084, Telephone 1-800-426-0839, FAX 1-847-487-9820.
 1. Distributor (Northern): Traffic Control Service, Inc., 8585 Thys Court, Sacramento, CA 95828, Telephone 1-800-884-8274, FAX 1-916-387-9734
 2. Distributor (Southern): Traffic Control Service, Inc., 1881 Betmor Lane, Anaheim, CA 92805, Telephone 1-800-222-8274, FAX 1-714-937-1070.

- C. 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. Russ Enterprises, Inc., 1533 Berger Drive, San Jose, CA 95112, Telephone 1-408-287-4303, FAX 1-408-287-1929.
 2. Statewide Safety, 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.

INSTALLATION

Temporary crash cushion modules shall be placed on movable pallets or frames conforming to the dimensions shown on the plans. The pallets or frames shall provide a full bearing base beneath the modules. The modules and supporting pallets or frames shall not be moved by sliding or skidding along the pavement or bridge deck.

A Type R or P marker panel shall be attached to the front of the crash cushion as shown on the plans, when the closest point of 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.

MEASUREMENT AND PAYMENT

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.

Plans of the existing bridges may be requested by fax from the Office of Structure Maintenance and Investigations, 1801 30th Street, Sacramento, California, Fax (916) 227-8357.

Plans of the existing bridges available to the Contractor are reproductions of the original contract plans with significant changes noted and working drawings and do not necessarily show normal construction tolerances and variances. Where dimensions of new construction required by this contract are dependent on the dimensions of the existing bridges, the Contractor shall verify the controlling field dimensions and shall be responsible for adjusting dimensions of the work to fit existing conditions.

The existing paint systems on San Mateo-Hayward Bridge, Bridge Number 35-0054, consist of the following: zinc rich paint, vinyl wash, vinyl finish, water base undercoat and water base topcoat. The paint system predominately contains the following metals: zinc, aluminum and chromium. There are detectable amounts of the following metals on the bridge: antimony, barium, cobalt, copper, cadmium, vanadium, nickel and lead.

Any work that disturbs the existing paint system will expose workers to health hazards and will (1) produce debris containing heavy metal in amounts that exceed the thresholds established in Titles 8 and 22 of the California Code of Regulations or (2) produce toxic fumes when heated. All debris produced when the existing paint system is disturbed shall be contained.

DEBRIS CONTAINMENT AND COLLECTION PROGRAM

Prior to starting work, the Contractor shall submit a debris containment and collection program to the Engineer in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications, for debris

produced when the existing paint system is disturbed. The program shall identify materials, equipment, and methods to be used when the existing paint system is disturbed and shall include working drawings of any containment system, loads applied to the bridge by any containment structure, and provisions for ventilation and air movement for visibility and worker safety.

If the measures being taken by the Contractor are inadequate to provide for the containment and collection of debris produced when the existing paint system is disturbed, the Engineer will direct the Contractor to revise the operations and the debris containment and collection program. The directions will be in writing and will specify the items of work for which the Contractor's debris containment and collection program are inadequate. No further work shall be performed on the items until the debris containment and collection programs are adequate and, if required, a revised program has been approved for the containment and collection of debris produced when the existing paint system is disturbed.

The Engineer will notify the Contractor of the approval or rejection of any submitted or revised debris containment and collection program within 2 weeks of submittal of the Contractor's program or revised program.

The State will not be liable to the Contractor for failure to approve all or any portion of an originally submitted or revised debris containment and collection program, nor for any delays to the work due to the Contractor's failure to submit acceptable programs.

SAFETY AND HEALTH PROVISIONS

Attention is directed to Section 7-1.06, "Safety and Health Provisions," of the Standard Specifications. Work practices and worker health and safety shall conform to the Construction Safety Orders Title 8, of the California Code of Regulations including Section 1532.1, "Lead."

The Contractor shall furnish the Engineer a written Code of Safe Practices and shall have an Injury and Illness Prevention Program and a Hazard Communication Program in conformance with the provisions of Construction Safety Orders 1509 and 1510.

Prior to starting work that disturbs the existing paint system and at such times when revisions to the program are required by Section 1532.1, "Lead," the Contractor shall submit the compliance programs required in subsection (e)(2), "Compliance Program," of Section 1532.1, "Lead," of the Construction Safety Orders to the Engineer in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. The compliance programs shall include the data specified in subsections (e)(2)(B) and (e)(2)(C) of Section 1532.1, "Lead." Approval of the compliance programs by the Engineer will not be required. The compliance programs shall be reviewed and signed by a Certified Industrial Hygienist (CIH) who is certified in comprehensive practice by the American Board of Industrial Hygiene (ABIH). Copies of all air monitoring or jobsite inspection reports made by or under the direction of the CIH in conformance with Section 1532.1, "Lead," shall be furnished to the Engineer within 10 days after date of monitoring or inspection.

DEBRIS HANDLING

Debris produced when the existing paint system is disturbed shall not be temporarily stored on the ground. Debris accumulated inside the containment system shall be removed before the end of each work shift. Debris shall be stored in approved leak proof containers and shall be handled in such a manner that no spillage will occur.

Disposal of debris produced when the existing paint system is disturbed shall be performed in conformance with all applicable Federal, State and Local hazardous waste laws. Laws that govern this work include:

- A. Health and Safety Code, Division 20, Chapter 6.5 (California Hazardous Waste Control Act).
- B. Title 22; California Code of Regulations, Chapter 30 (Minimum Standard for Management of Hazardous and Extremely Hazardous Materials).
- C. Title 8, California Code of Regulations.

Except as otherwise provided herein, debris produced when the existing paint system is disturbed shall be disposed of by the Contractor at an approved Class 1 disposal facility in conformance with the requirements of the disposal facility operator. The debris shall be hauled by a transporter currently registered with the California Department of Toxic Substances Control using correct manifesting procedures and vehicles displaying current certification of compliance. The Contractor shall make all arrangements with the operator of the disposal facility and perform any testing of the debris required by the operator.

At the option of the Contractor, the debris produced when the existing paint system is disturbed may be disposed of by the Contractor at a facility equipped to recycle the debris, subject to the following requirements:

- A. Copper slag abrasive blended by the supplier with a calcium silicate compound shall be used for blast cleaning.
- B. The debris produced when the existing paint system is disturbed shall be tested by the Contractor to confirm that the solubility of the heavy metals is below regulatory limits and that the debris may be transported to the recycling facility as a non-hazardous waste.

- C. The Contractor shall make all arrangements with the operator of the recycling facility and perform any testing of the debris produced when the existing paint system is disturbed that is required by the operator.

PAYMENT

Full compensation for the containment system, protective work clothing and access to hygiene facilities for State personnel, and handling of debris produced when the existing paint system is disturbed, including testing, hauling, treatment, disposal fees and local taxes, shall be considered as included in the contract price paid for the item of work requiring the disposal of the debris produced when the existing paint system is disturbed and no additional compensation will be allowed therefor.

BRIDGE REMOVAL (PORTION)

Removing portions of bridges shall conform to the provisions in Section 15-4, "Bridge Removal," of the Standard Specifications and these special provisions.

Bridge removal (portion) shall consist of removing portions of the existing railing and existing concrete barrier as shown on the plans.

All removed materials that are not to be salvaged or used in the reconstruction shall become the property of the Contractor and shall be disposed 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.

10-1.16 EARTHWORK

Earthwork shall conform to the provisions in Section 19, "Earthwork," of the Standard Specifications and these special provisions.

Attention is directed to "Material Containing Aerially Deposited Lead" elsewhere in these special provisions.

All material excavated from areas containing aerially deposited lead shall be used as backfill or dispersed within the project limits in accordance with Section 19-2.06, "Surplus Material," of the Standard Specifications. None of these materials shall be disposed of outside the highway right of way.

Excavation, transportation, placement and handling of soils contaminating with aerially deposited lead shall result in no visible dust. The Contractor shall have a water truck available at all times while performing earthwork, excavation or grubbing activities in work areas containing aerially deposited lead.

Full compensation for conforming to the requirements of this section involving materials containing aerially deposited lead, except as otherwise specifically provided in these special provisions, shall be considered as included in the contract prices paid for the various contract items of work involved and no additional compensation will be allowed therefor.

10-1.17 PILING

Piling shall conform to the provisions in Section 49, "Piling," of the Standard Specifications, and these special provisions.

Foundation recommendations are included in the "Information Handout" available to the Contractor as provided for in Section 2-1.03, "Examination of Plans, Specifications, Contract, and Site of Work," of the Standard Specifications.

Attention is directed to "Welding Quality Control" of these special provisions.

STEEL PIPE PILING

General

Steel pipe piling shall consist of unfilled steel pipe piling, steel shells for open and closed ended cast-in-steel-shell concrete piling, and permanent steel casing for cast-in-drilled-hole concrete piling.

Wherever reference is made to the following American Petroleum Institute (API) specifications in the Standard Specifications, on the project plans, or in these special provisions, the year of adoption for these specifications shall be as follows:

API Codes	Year of Adoption
API 2B	1990
API 5L	1995

Only steel pipe pile seam welds may be made by the electric resistance welding method. Such welds shall be welded in conformance with the requirements in API 5L and any amendments to API 5L in the Standard Specifications or these special provisions.

Seams in steel pipe piles made by submerged arc welding may be welded in conformance with the requirements in API 5L and any amendments to API 5L in the Standard Specifications or these special provisions.

Handling devices may be attached to steel pipe piling. Welds attaching these devices shall be aligned parallel to the axis of the pile and shall conform to the requirements for field welding specified herein. Permanent bolted connections shall be corrosion resistant. Prior to making attachments, the Contractor shall submit a plan to the Engineer that includes the locations, handling and fitting device details, and connection details. Attachments shall not be made to the steel pipe piling until the plan is approved in writing by the Engineer. The Engineer shall have 7 days to review the plan. Should the Engineer fail to complete the review within 7 days, 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 plan, 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.

Each length of steel pipe piling shall be marked in conformance with the requirements in ASTM Designation: A 252.

For steel pipe piling, including bar reinforcement in the piling, the Engineer shall be allowed 72 hours to review the "Welding Report," specified in "Welding Quality Control" of these special provisions, and respond in writing after the required items have been received. No field welded steel pipe piling shall be installed, and no reinforcement in the piling shall be encased in concrete until the Engineer has approved the above requirements in writing. 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.

At the Contractor's option, a steel pipe pile may be re-tapped to prevent pile set-up; however, the field welded splice shall remain at least one meter above the work platform until that splice is approved in writing by the Engineer.

Manufactured Steel Pipe

Manufactured steel pipe is defined as pipe produced at a permanent facility where an automatic welding process, electric resistance welder, or seamless pipe operation is used in conformance with ASTM Designations: A 252, A 53, A 135, A 139, API 5L, or AWWA C200; where this steel pipe can be produced in lengths at least 9 m long without a circumferential splice; and where this manufacturing can be done on a daily basis. Manufactured steel pipe is not a specifically engineered product. (i.e. Manufactured steel pipe is an off-the-shelf item.)

Manufactured steel pipe used for steel pipe piling shall conform to the following requirements:

- A. The outside circumference of the steel pipe piling end shall not vary by more than 10 mm from that corresponding to the diameter shown on the plans.
- B. The maximum allowable misalignment for adjacent steel pipe pile edges to be welded shall be 0.1875 times the wall thickness, but not more than 1.6 mm.
- C. Steel pipe pile straightness shall conform to the requirements in API 5L, Section 7.6, "Straightness."
- D. Welds made at a permanent manufacturing facility shall be made by either an automatic welding process or an electric resistance welding process.

Fabricated Steel Pipe

Fabricated steel pipe is defined as pipe produced at a permanent facility where a variety of steel fabrication including roll forming and welding steel plate into pipe is performed, where this pipe is at least 19 mm in wall thickness, where this pipe is produced in conformance with API 2B, and where this fabrication can be done on a daily basis. Fabricated steel pipe is a specifically engineered product. (i.e. Fabricated steel pipe is engineered for a specific project.)

Fabricated steel pipe used for steel pipe piling shall conform to API 2B and the following requirements:

- A. An API site license and API monogram are not required.
- B. Weld filler metal shall conform to the requirements of AWS D1.5 for the welding of ASTM Designation: A 709, Grade 50 steel, except that the qualification, pretest, and verification test requirements need not be conducted if certified test reports are provided for the consumables to be used.

Field Welding

Field welding of steel piling is defined as welding performed after the certificate of compliance has been furnished by the manufacturer or fabricator and shall conform to the following requirements:

- A. Match marking of pipe ends at the manufacturing or fabrication facility is recommended for piling to ensure weld joint fit-up. Prior to positioning any 2 sections of steel pipe to be spliced by field welding, including those that have been match marked at the manufacturing or fabrication facility, the Contractor shall equalize the offsets of the pipe ends to be joined and match mark the pipe ends.
- B. Welds made in the flat position or vertical position (where the longitudinal pipe axis is horizontal) shall be single-vee groove welds. Welds made in the horizontal position (where the longitudinal pipe axis is vertical) shall be

single-bevel groove welds. Joint fit-ups shall conform to the requirements for tubular sections in AWS D1.1 and these special provisions.

- C. The minimum thickness of the backing ring shall be 6 mm, and the ring shall be continuous. Splices in the backing ring shall be made by complete penetration welds. These welds shall be completed and inspected prior to final insertion into a pipe end. Attachment of backing rings to pipe ends shall be done using the minimum size and spacing of tack welds that will securely hold the backing ring in place. Tack welding shall be done in the root area of the weld splice. Cracked tack welds shall be removed and replaced prior to subsequent weld passes. The gap between the backing ring and the steel pipe piling wall shall be no greater than 2 mm. One localized portion of the splice, that is equal to or less than a length that is 20 percent of the outside circumference of the pipe, as determined by the Engineer, may be offset by a gap equal to or less than 6 mm provided that this localized portion is first seal welded using shielded metal arc E7016 or E7018 electrodes. The Contractor shall mark this localized portion so that it can be referenced during any required nondestructive testing (NDT). Backing rings shall have a minimum width of 1 1/2 times the thickness of the pile to be welded so that they will not interfere with the interpretation of the NDT.
- D. For steel pipe with an outside diameter greater than 1.1 m, and with a wall thickness greater than 25.4 mm, the root opening tolerances may be increased to a maximum of 5 mm over the specified tolerances.
- E. Weld filler metal shall conform to the requirements shown in AWS D1.5 for the welding of ASTM Designation: A 709, Grade 50 steel, except that the qualification, pretest, and verification test requirements need not be conducted if certified test reports are provided for the consumables to be used.
- F. For field welding, including attaching backing rings and making repairs, the preheat and interpass temperature shall be in conformance with AWS D1.1, Section 3.5, "Minimum Preheat and Interpass Temperature Requirements," and with Table 3.2, Category C; and the minimum preheat and interpass temperature shall be 66°C, regardless of the pipe pile wall thickness or steel grade. In the event welding is disrupted, preheating to 66°C must occur before welding is resumed.
- G. Welds shall not be water quenched. Welds shall be allowed to cool unassisted.

MEASUREMENT AND PAYMENT (PILING)

Measurement and payment for the various types and classes of piles shall conform to the provisions in Sections 49-6.01, "Measurement," and 49-6.02, "Payment," of the Standard Specifications and these special provisions.

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

- Timber, steel, and precast prestressed concrete piles, and cast-in-place concrete piles consisting of driven shells filled with concrete, will be paid for at the contract price per meter for furnish piling and the contract unit price for drive pile.

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

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

Full compensation for conforming to the provisions in "Steel Pipe Piling" of these special provisions 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.

10-1.18 CONCRETE STRUCTURES

Portland cement concrete structures shall conform to the provisions in Section 51, "Concrete Structures," of the Standard Specifications and these special provisions.

GENERAL

The foundations for the closed circuit television cameras at the refuge bays shall conform to the provisions of Section 51-1.02, "Minor Structures," of the Standard Specifications.

The existing concrete surface at the CCTV pole pedestal shall be roughened to a full amplitude of approximately 6 mm by abrasive blasting, water blasting or mechanical equipment.

Shotcrete shall not be used as an alternative construction method for reinforced concrete members unless otherwise specified.

DRILL AND BOND DOWELS

Drilling and bonding dowels shall conform to the details shown on the plans, the provisions in Section 83-2.02D(1), "General," of the Standard Specifications, and these special provisions.

Dowels shall conform to the provisions for bar reinforcement in "Reinforcement" of these special provisions.

If reinforcement is encountered during drilling before the specified depth is attained, the Engineer shall be notified. Unless the Engineer approves coring through the reinforcement, the hole will be rejected and a new hole, in which reinforcement is not encountered, shall be drilled adjacent to the rejected hole to the depth shown on the plans.

Unless otherwise provided, dowels to be bonded into drilled holes will be paid for as bar reinforcing steel (bridge).

MEASUREMENT AND PAYMENT

Measurement and payment for concrete in structures shall conform to the provisions in Section 51-1.22, "Measurement," and Section 51-1.23, "Payment," of the Standard Specifications and these special provisions.

Full compensation for roughening existing concrete surfaces to a full amplitude of approximately 6 mm shall be considered as included in the contract price paid per cubic meter for minor concrete (minor structure) and no separate payment will be made therefor.

Full compensation for drilling holes, including coring through reinforcement when approved by the Engineer, and bonding dowels shall be considered as included in the contract price paid per cubic meter for minor concrete (minor structure) and no separate payment will be made therefor.

10-1.19 CORE CONCRETE

Coring concrete shall consist of coring holes through reinforced concrete bridge members as shown on the plans and in conformance with these special provisions.

The holes shall be cored by methods that will not shatter or damage the concrete adjacent to the holes.

Water for core drilling operations shall be from the local domestic water supply or shall not contain more than 1000 parts per million of chlorides as Cl, nor more than 1300 parts per million of sulfates as SO₄, nor shall the water contain any impurities in a sufficient amount that would cause discoloration of the concrete or produce etching of the surface.

Water from core drilling operations shall not be permitted to fall on public traffic, to flow across shoulders or lanes occupied by public traffic, or to flow into the waterway below.

Coring concrete will be measured by the meter as core concrete of the sizes listed in the Engineer's Estimate. The cored concrete will be measured along the centerline of the hole without deduction for expansion joints.

The contract price paid per meter for core concrete of the sizes listed in the Engineer's Estimate shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in coring the holes, including control of water from core drilling, as shown on the plans, as specified in the standard specifications and these special provisions, and as directed by the Engineer.

Full compensation for coring a 76 mm x 38 mm deep countersink at each cored hole location shall be considered as included in the contract price paid per meter for core concrete (0 – 50 mm) and no additional compensation will be allowed therefor.

10-1.20 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.

A sign shall be installed as shown on the plans adjacent to each washout facility to inform concrete equipment operators to utilize the proper facilities.

Temporary concrete washout facilities shall be constructed above grade or below grade at the option of the Contractor. The minimum quantity of concrete washouts required for this project shall be one.

Temporary concrete washout facilities shall be constructed and maintained in sufficient quantity and size to contain all liquid and concrete waste generated by washout operations for all concrete wastes. 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.
- B **ROCK BAG.**—Rock bag fabric shall be nonwoven polypropylene, with a minimum unit weight of 250 g/m². The fabric shall have a mullen burst strength of at least 2500 kPa, in conformance with the requirements in ASTM Designation: D 3786 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 capable of containing a weighted mass of 13 kg to 22 kg. Rock bag fill material shall be non-cohesive, gravel, free from deleterious material. Rock bags shall be filled and the opening 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.

TEMPORARY CONCRETE WASHOUT FACILITY (TYPE ABOVE GRADE)

Temporary concrete washout facility (type above 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 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 above 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.

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 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 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 contract lump sum price paid for temporary concrete washout facility shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing, maintaining and removing temporary concrete washout facilities, complete in place, including straw bales, plastic lining, sign, portable delineators, lath and flagging, and excavation and backfill, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.21 REINFORCEMENT

Reinforcement shall conform to the provisions in Section 52, "Reinforcement," of the Standard Specifications.

A Certificate of Compliance conforming to the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications 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 Bar Reinforcement," of the Standard Specifications. The Certificate of Compliance shall include all 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.

10-1.22 SIGN STRUCTURES

Sign structures and foundations for overhead signs shall conform to the provisions in Section 56-1, "Overhead Sign Structures," of the Standard Specifications and these special provisions.

Before commencing fabrication of sign structures, the Contractor shall submit 2 sets of working drawings to the Engineer in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings." The working drawings shall include sign panel dimensions, span lengths, post heights, anchorage layouts, proposed splice locations, a snugging and tensioning pattern for anchor bolts and high strength bolted connections, and details for permanent steel anchor bolt templates. The working drawings shall be supplemented with a written quality control program that includes methods, equipment, and personnel necessary to satisfy the requirements specified herein and in the special provisions.

Working drawings shall be 559 mm x 864 mm or 279 mm x 432 mm in size and each drawing and calculation sheet shall include the State assigned designations for the contract number, sign structure type and reference as shown on the contract plans, District-County-Route-Kilometer Post, and contract number.

The Engineer shall have 20 working days to review the sign structure working drawings after a complete submittal has been received. No fabrication or installation of sign structures shall be performed until the working drawings are approved in writing by the Engineer.

Should the Engineer fail to complete the review within the time allowance and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in reviewing the sign structure working drawings, the delay will be considered a right of way delay in conformance with the provisions in Section 8-1.09, "Right of Way Delays."

The third paragraph of Section 56-1.01, "Description," of the Standard Specifications shall not apply.

A permanent steel template shall be used to maintain the proper anchor bolt spacing.

One top nut, one leveling nut, and 2 washers shall be provided for the upper threaded portion of each anchor bolt.

Surfaces of base plates which are to come in contact with concrete, grout, or washers and leveling nuts shall be flat to within 3 mm tolerance in 305 mm, and to within 5 mm tolerance overall. Faying surfaces of plates in high-strength bolted connections including flange surfaces of field splices, chord joints, and frame junctures, and contact surfaces of plates used for breakaway slip base assemblies shall be flat to within 2 mm tolerance in 305 mm, and within 3 mm tolerance overall.

Thermally cut holes made in tubular members of sign supports, other than holes in base and flange plates, shall initially be made a minimum of 2 mm undersized, and then be mechanically enlarged by reaming or grinding to the final required size and shape. All edges shall have a surface roughness of not greater than 6.35 μm . Round holes may be drilled to the exact final diameter. No holes shall be made in members unless the holes are shown on the plans or are approved in writing by the Engineer.

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.
- 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.

Steel members used for overhead sign structures shall receive nondestructive testing (NDT) in conformance with AWS D1.1 and the following:

A.

Weld Location	Weld Type	Minimum Required NDT
Welds for butt joint welds in tubular sections, nontubular sections, and posts	CJP groove weld with backing ring	100% UT or RT
Longitudinal seam welds*	PJP groove weld	25% MT
	CJP groove weld	100% UT or RT
Welds for base plate, flange plate, or end cap to post or mast arm	CJP groove weld	25% UT or RT
	Fillet weld	25% MT
* Longitudinal seam welds shall have 60% minimum penetration, except that within 150 mm of any circumferential weld, longitudinal seam welds shall be CJP groove welds.		

- B. A written procedure approved by the engineer shall be used when performing UT on material less than 8 mm thick. Contoured shoes shall be used when performing UT on round tubular sections under 1270 mm in diameter.
- C. When less than 100 percent of a weld is specified for NDT, and if defects are found during this inspection, additional NDT shall be performed. This additional NDT shall be performed on 25 percent of the total weld for all similar welds, as determined by the Engineer, produced for sign structures in the project. If any portion of the additional weld inspected is found defective, 100 percent of all similar welds produced for sign structures in the project, as determined by the Engineer, shall be tested.

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

Full compensation for furnishing anchor bolt templates and for testing of welds shall be considered as included in the contract price paid per kilogram for furnish sign structure and no additional compensation will be allowed therefor.

10-1.23 MISCELLANEOUS METAL (BRIDGE)

Miscellaneous metal (bridge) shall conform to the provisions for miscellaneous bridge metal in Section 75, "Miscellaneous Metal," of the Standard Specifications and these special provisions.

Attention is directed to "Welding Quality Control" of these special provisions.

Miscellaneous metal (bridge) shall consist of the miscellaneous bridge metal items listed in Section 75-1.03, "Miscellaneous Bridge Metal," of the Standard Specifications, and the following:

- A. Steel bars, pipes, shapes, and plates
- B. Anchor bolts, bolts, HS bolts, and associated hardware
- C. Forged eye pin with stainless steel chain

Cast-in-place inserts shall be the ferrule loop type.

All metal parts of anchorage devices shall be fabricated from stainless steel conforming to the requirements of ASTM Designation: A 276, Type 304 or 316.

Existing contact surfaces of high strength bolted connections, including the inside surfaces of new bolt holes when required, shall be cleaned in conformance with the requirements in Surface Preparation Specification No. 1, "Solvent Cleaning," of the SSPC: The Society for Protective Coatings.

The inside surfaces of new bolt holes on the existing bridge shall be painted with one application of a zinc rich primer (organic vehicle type).

10-1.24 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.

Attention is directed to "Order of Work" of 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/m³, 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 as manufactured by Syro, Inc., a Trinity Industries Company, and shall include all the items detailed for terminal system (Type SRT) shown on the plans.

Arrangements have been made to insure that any successful bidder can obtain the SRT-350 Slotted Rail Terminal from the manufacturer, Syro, Inc., a Trinity Industries Company, 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, FOB Centerville, Utah is \$865.00, not including sales tax.

The above price will be firm for orders placed on or before December 31, 2000, 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. At the Contractor's option, steel foundation tubes with soil plates attached, shall be 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.

10-1.25 CONCRETE BARRIER

Concrete barriers shall conform to the provisions in Section 83-2, "Barriers," of the Standard Specifications.

SECTION 10-2. (BLANK)

SECTION 10-3. ELECTRICAL SYSTEMS

10-3.01 DESCRIPTION

Traffic operations system (TOS) shall conform to the provisions in Section 86, "Signals, Lighting and Electrical Systems," of the Standard Specifications and these special provisions.

TOS shall consist of:

1. Changeable message sign (CMS) system.
2. Closed circuit television (CCTV) system.
3. Hub systems.
4. Extinguishable message sign (EMS) system.

5. Traffic monitoring system including microwave vehicular detection sensor (MVDS) system, micro magnetic loop detector (MMLD) system and inductive loop detectors.
6. Highway advisory radio (HAR) system.
7. Fiber optic system including SCADA communication cable and communication cable cabinet.

10-3.02 COST BREAK-DOWN

Cost break-downs shall conform to the provisions in Section 86-1.03, "Cost Break-Down," of the Standard Specifications and these special provisions.

The Engineer shall be furnished a cost break-down for each contract lump sum item of work described in this Section 10-3.

The cost break-down shall be submitted to the Engineer for approval within 30 days after the contract has been approved. The cost break-down shall be approved, in writing, by the Engineer before any partial payment for the items of electrical work will be made.

The cost breakdown shall include the following items in addition to those listed in the Standard Specifications:

- A. TRENCH AND BACKFILL - list by depth and ground conditions (without conduit)
- B. EXCAVATE AND BACKFILL - list by depth and ground conditions (without conduit)
- C. JACKING - list by conduit size (without conduit)
- D. CABLES - each size and type
- E. INNERDUCT
- F. JUNCTION BOX - each type
- G. CHANNEL STRUT
- H. CONDUIT CLAMP -each type
- I. TESTING
- J. TRAINING
- K. DOCUMENTATION AND MANUALS

10-3.03 ABBREVIATIONS

The following abbreviations are added to those listed in Section 1-1.02, "Abbreviations," of the Standard Specifications:

BNC	Bayonet Nut Connector
CCD	Charge Coupled Device
CCITT	International Telegraph and Telephone Consultative Committee
DLCI	Data Link Control Identifier
FCC	Federal Communications Commission
GFCI	Ground Fault Current Interrupter
IDC	Insulation Displacement Connector
IPCEA	Insulated Power Cable Engineering Association
ISDN	Integrated Services Digital Network
NEC	National Electric Code
NTSC	National Television Systems Committee
OSHA	Occupational Safety and Health Administration
OSI	Open Systems Interconnect
PVC	Polyvinyl Chloride
REA	Rural Electrification Administration
SCADA	Supervisory Control And Data Acquisition
SDLC	Serial Data Link Control
TIA	Telecommunications Industry Association
TELCO	Telephone company

10-3.04 CODES

All work performed and material installed on the contract shall conform to Section 86-1.02 "Regulations and Code" and the following codes:

1. California Administrative Code, Title 24, Part 3 Basic Electrical Regulations.
2. National Fire Protection Association Standards.

10-3.05 STANDARDS

The materials to be furnished and work to be performed shall conform to Section 86-1.02 "Regulations and Code" and the following standards subject to the modifications and additional requirements in these special provisions:

1. REA Standard, "Fully Color-Coded, Polyethylene-Insulated, Polyethylene-Jacketed Telephone Cable," shall apply to telephone communication conductors and cables.
2. IPCEA No. A-61-402, NEMA WC-5, "Thermoplastic-Insulated Wire and cable for the Transmission and Distribution of Electrical Energy," shall apply to high voltage cable and 600-V class conductors.

10-3.06 EQUIPMENT LIST AND DRAWINGS

Equipment list and drawings shall conform to the provisions in Section 86-1.04, "Equipment List and Drawings," of the Standard Specifications and these special provisions.

The Contractor shall submit within 60 calendar days after approval of the contract, a complete list of equipment which he proposes to install, manufacturer's catalog information, shop drawings of custom fabricated units and such other data as required by the Engineer.

Drawings submitted by the Contractor shall be approximately the same size as the contract plans (600 mm x 900 mm).

The list shall include all items identified on the plans or in these special provisions by the manufacturer's designation. The list shall be complete as to the manufacturer's name, catalog number, address, and telephone number. The catalog information shall contain information such as physical size, weight, rating and such additional data as may be required by the Engineer. All data submitted shall be clearly identified by the name of the project and shall be made in quadruplicate.

The list of equipment to be submitted by the Contractor shall include but is not limited to the following:

1. Cables, conductors and conduits.
2. Electrical equipment for changeable message sign system, closed circuit television system, and hub systems.
3. Electrical components.

The Contractor shall furnish the equipment list and drawings in a manual. The manuals shall include, but shall not be limited to the following information:

- (a) Specifications
- (b) Design characteristics
- (c) General operation theory
- (d) Function of all controls
- (e) Trouble shooting procedure (diagnostic routine)
- (f) Block circuit diagram
- (g) Geographical layout of components
- (h) Schematic diagrams
- (i) List of replaceable component parts with stock numbers

The equipment manuals shall be in addition to any instructions or parts lists packed with or attached to the equipment when delivered.

Manuals and other data shall be printed on heavy, first quality paper, 212.5 mm x 275 mm size with standard 3-hole punching. Drawings and diagrams shall be reduced to 212.5 mm x 275 mm or 275 mm x 425 mm. Where reduction is not practicable, large drawings shall be folded separately and placed in envelopes which are bound into the manuals. Each envelope shall bear suitable identification on the outside.

Three preliminary copies of each manual, temporarily bound in heavy paper covers bearing suitable identification, shall be submitted to the Engineer for approval prior to the date of shipment of the equipment. After approval by the Engineer, three final copies of each operation and maintenance manual shall be prepared and delivered to the Engineer no later than 30 days prior to placing the equipment in operation. Final manuals and all parts lists and information shall be assembled in a heavy duty, permanent, 3-ring or 3-post binders. As much as possible, material shall be assembled and bound in the same order as specified, and each volume shall have a table of contents and suitable index tabs.

All material shall be marked with project identification; inapplicable information shall be marked out or deleted. Installation of equipment will not be considered complete until all required manuals and data have been received.

10-3.07 CONDUIT

Conduit to be installed underground shall be Type 1 or Type 3 unless otherwise specified. Detector termination conduits shall be Type 3 or Type 4.

The conduit in a foundation and between a foundation and the nearest pull box shall be Type 1.

Conduit sizes shown on the plans and specified in the Standard Specifications and these special provisions are referenced to metallic type conduit. When rigid non-metallic conduit is required or allowed, the nominal equivalent industry size shall be used as shown in the following table:

Size Designation for Metallic Type Conduit	Equivalent Size for Rigid Non-metallic Conduit
21	20
27	25
41	40
53	50
63	65
78	75
103	100

When a standard coupling cannot be used for joining Type 1 conduit, a UL listed threaded union coupling conforming to the provisions in Section 86-2.05C, "Installation," of the Standard Specifications, or a concrete-tight split coupling, or concrete-tight set screw coupling shall be used.

When Type 3 conduit is placed in a trench (not in pavement or under portland cement concrete sidewalk), after the bedding material is placed and the conduit is installed, the trench shall be backfilled with commercial quality concrete, containing not less than 250 kg of portland cement per cubic meter, to not less than 100 mm above the conduit before additional backfill material is placed.

After conductors have been installed, the ends of conduits terminating in pull boxes, service equipment enclosures, and controller cabinets shall be sealed with an approved type of sealing compound.

At those locations where conduit is required to be installed under pavement and existing underground facilities require special precautions in conformance with the provisions in "Obstructions" of these special provisions, conduit shall be placed by the "Trenching in Pavement Method" in conformance with the provisions in Section 86-2.05C, "Installation," of the Standard Specifications.

At other locations where conduit is required to be installed under pavement and if a delay to vehicles will not exceed 5 minutes, conduit may be installed by the "Trenching in Pavement Method."

At the option of the Contractor, the final 0.6-m of conduit entering a pull box in a reinforced concrete structure may be Type 4.

10-3.08 INNERDUCT

The Contractor shall install three innerducts in conduits unless otherwise shown on the contract plans. Innerduct shall consist of an extruded flexible annealed polyethylene tubing. Innerduct shall be continuous without splices or joints between pull boxes and between pull boxes and trunkline splice cabinets.

Unless otherwise shown on the plans, innerduct for this project shall be nominal 32 mm inside diameter, with wall thickness of 2.3mm +/-0.8 mm, and shall meet the following requirements:

1. Polyethylene for innerduct shall have a density of 0.955±0.005 gm/cm³ (ASTM Standard D-1505), and shall conform to the applicable portions of ASTM Designations "D 3485," "D 3035," "D 2239," "D 2447," and the applicable portions of NEMA TC7 and TC2.
2. Tensile yield strength shall be 3,625 psi., minimum (ASTM D-638).
3. Walls shall be smooth, corrugated or ribbed.

The polyethylene forming of one of the innerducts shall be the color yellow to indicate single-mode fibers, the other two shall be one color orange for future multi-mode fibers and one color violet for SCADA cable.

The exterior of the duct shall be marked with sequential measurement markings every meter. The innerduct shall be shipped on reels marked with the manufacturer, the contract number, and the size and length of the innerduct. The product on reels shall be covered with aluminized material to protect colors from ultraviolet deterioration during shipment and storage.

Installation procedures shall conform to the procedures specified by the innerduct manufacturer.

10-3.09 PULL BOXES

Grout shall not be placed in the bottom of new or existing pull boxes.

10-3.10 METAL JUNCTION BOXES

Specialty metal junction boxes shall conform to the details shown on the plans and as specified in these special provisions.

Boxes, unless otherwise indicated, shall be fabricated from 3 mm steel and shall be hot dip galvanized after fabrication.

All junction boxes to be installed in wet or outdoor locations shall meet NEMA Standard for Type 3R (Weather Resistant) enclosures and those for indoor locations shall conform to NEMA Standards for Type 12 (General Purpose) enclosures. Junction boxes shall also conform to JIC Standards for pull boxes. All junction boxes to be installed in wet or outdoor locations shall be fastened to the structure with stainless steel screws.

All junction boxes shall be provided with removable front covers secured with 10 mm diameter bolts, cap screws or studs and nuts which shall be of brass, stainless steel or other non-corroding material.

Provisions for drainage of water caused by condensation shall be provided for each specialty metal junction box installed outdoors.

The Contractor shall submit shop drawings to the Engineer for review before fabricating the junction boxes.

10-3.11 CONDUCTORS AND WIRING

Splices shall be insulated by "Method B."

The minimum insulation thickness, at any point, for Type USE, RHH or RHW wire shall be 1.0 mm for conductor sizes No. 14 to No. 10, inclusive, and 1.3 mm for No. 8 to No. 2, inclusive. The minimum insulation thickness, at any point, for Type THW and TW wires shall be 0.69 mm for conductor sizes No. 14 to No. 10, inclusive, 1.02 mm for No. 8, and 1.37 mm for No. 6 to No. 2, inclusive.

Conductors shall be stranded copper and shall meet the following specifications unless noted otherwise on the plans or other sections of these special provisions:

1. Conductors Type TW as specified in UL Standard 83 shall not be used.
2. Power tray cables shall be UL listed Type TC with THHN conductors in dry locations and THWN conductors in wet locations, and shall meet applicable UL Standard 83 and UL Standard 1277 specifications.

Type TW insulation shall not be used for the CMS service feeder, or for the CMS branch circuit conductors between the service pedestal and the CMS.

10-3.12 CLOSED CIRCUIT TELEVISION CABLES

Television control (TVC) cable shall consist of 15 No. 18 conductors, unshielded and with an outer jacket. Each conductor shall have a minimum of 16 tinned copper strands with a minimum of 400 μ m insulation. Individual conductor insulation shall be chrome PVC with a nominal thickness of 1 mm. The outside diameter of the jacket shall not exceed 14 mm.

Color code for TVC cable shall be:

1. Black
2. White
3. Red
4. Green
5. Orange
6. Blue
7. White/ Black
8. Red/ Black
9. Green/ Black
10. Orange/ Black
11. Blue/ Black
12. Black/ White
13. Red/ White
14. Green/ White
15. Blue/ White

Television power (TVP) conductors shall be 3 No. 14 (120 VAC, AC-, equipment ground) individually insulated, stranded copper conductors in conformance with Section 86-2.08, "Conductors" of the Standard Specifications. The conductors shall be color coded black, white, and green respectively.

Television control power (TVCP) cable shall consist of 12 No. 18 conductors, unshielded and with an outer jacket. Each conductor shall have a minimum of 16 tinned copper strands with a minimum of 400 µm insulation. Individual conductor insulation shall be polyvinyl chloride (PVC), rated for 300 V (see color code below). The jacket shall be chrome PVC with a nominal thickness of 1 mm. The outside diameter of the jacket shall not exceed 12 mm.

Color code for TVCP cable shall be:

1. Black
2. White
3. Red
4. Green
5. Orange
6. Blue
7. White/ Black
8. Red/ Black
9. Green/ Black
10. Orange/ Black
11. Blue/ Black
12. Black/ White

Television video (TVL) cable shall consist of an RG-6/U coaxial cable. Each cable shall be provided with a solid No. 18 copper clad steel center conductor and shall conform to the following requirements:

Electrical	TVL
Capacitance (picofarads/m nominal)	54.1
Impedance (ohms-nominal)	75
Velocity of propagation (nominal)	84%
D.C. loop resistance (ohms/100 m)	11.7

Attenuation at 20°C:

Frequency (MHz)	TVL (Nominal dB/ 100 m)
5.0	1.90
30	3.64
108	6.40

Physical Specifications	TVL Nominal O.D. (mm)
Copper-clad steel center conductor	1.00
Foam polyethylene dielectric	4.57
Sealed APA tape with 1.6 mm overlap	4.75
Woven aluminum braid	5.39
Sealed APA tape with 1.6 mm overlap	5.49
Woven aluminum braid	6.12
Flooding compound	
PVC outer jacket	7.55

(APA = Aluminum polyolefin and aluminum with adhesive)

TVL cable shall be terminated with BNC plug connector at both ends.

COAXIAL CABLE CONNECTORS (TVL COAXIAL CABLES)

Coaxial cable connectors for attaching Type TVL coaxial cable shall meet the following requirements:

1. **Electrical:**

Impedance	75 nominal
Return loss	30 dB minimum (5 MHz to 300 MHz)
Rated working voltage	500 V rms

2. **Mechanical:**

Type of construction	Integral sleeve BNC
Method of attachment	Crimp-crimp
Composition	Bodies - alloy Finish - chromate conversion, silver plating, or other corrosion resistant metal

3. **Environmental:**

Temperature	-10°C to +50°C
Moisture	Weather resistance design

The mating connector for TVL cable in junction box shall be provided. The center contact of this jack shall be beryllium copper.

TESTING

Testing of TVL cables and connectors shall be performed in accordance with provisions in Section 86-2.14B, "Field Testing" of the Standard Specifications and these special provisions.

Cable lengths found to have faults shall be replaced and retested. The removed faulty cable shall be disposed of by the Contractor.

Prior to the beginning of work, each length of coaxial cable shall be tested for attenuation and faults to ensure compliance with specifications contained herein using a time domain reflectometer (TDR). For the purpose of these special provisions, a fault in a long length of cable is defined by one or more of the following:

- a. Return loss measurements indicating that attenuation exceeds 3 dB at 5 MHz to 30 MHz in a portion of cable less than 3 m long.
- b. A return loss measurement indicating that there is a short in the cable.
- c. A return loss measurement indicating a cut or open circuit in the cable.
- d. A visual inspection which reveals exposure of or damage to the cable shielding.

10-3.13 TELEPHONE CABLE

The telephone cable (TC) shall consist of 6 pairs of No. 19 solid copper conductors. Conductors shall be twisted in pairs. Each conductor shall be insulated with a high molecular weight, heat stabilized, color coded polyethylene material. The insulation shall be 440 µm nominal.

Color code for TC cable shall be as follows:

1. White/Blue
2. White/Orange
3. White/Green
4. White/Brown
5. White/Gray
6. Red/Blue

The core shall be protected by a non-hygroscopic polyester film with a single longitudinally applied 120 µm thick corrugated copper shield (or 190 µm thick plastic coated aluminum shield). A moisture barrier of petrolatum-polyethylene compound shall be applied over the core tape and over and under the cable shield to fill all cable interstices.

The cable shall be provided with an outer jacket of extruded, black, high molecular weight, heat stabilized polyethylene material. The outer jacket shall have a thickness of 1.5 mm nominal. The outer diameter of the cable shall be 15.25 mm maximum.

Splices will not be allowed, except where shown on the plans.

All conductors shall be terminated inside the telephone demarcation cabinet and the controller cabinet as shown on the plans. All connections from the TBO terminal block to the 8-position connecting block shall be via a cable consisting of 2 pairs of No. 22 solid conductors and shall meet the same specifications as the TC cable.

10-3.14 FIBER OPTIC COMMUNICATIONS TRUNKLINE CABLE

General.--The fiber optic communications trunkline cable (FCT) shall be all dielectric, gel filled, duct type, with loose buffer tubes and shall conform to these special provisions. The FCT shall contain 24 single-mode (SM) dual-window (1310 nm and 1550 nm) 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.

The entire length of the FCT used, shall be from the same manufacturer.

The FCT shall comply with all the requirements of the United States Department of Agriculture, Rural Electrification Administration specifications REA-PE-90.

Fiber characteristics.--Each optical fiber shall be glass and consist of a doped silica core surrounded by concentric silica cladding. Each fiber in the buffer tube shall be usable, and shall be sufficiently free of surface imperfections and inclusions to meet the optical, mechanical, and environmental requirements of these special provisions. 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, ultraviolet cured acrylate. The coating shall be mechanically or chemically strippable without damaging the fiber.

Each fiber within the finished cable shall meet the following requirements:

Parameters:	
Type	Step Index
Core diameter	8.3 μm (nominal)
Cladding diameter	125 $\mu\text{m} \pm 1.0 \mu\text{m}$
Core to Cladding Offset	1.0 μm
Coating Diameter	250 $\mu\text{m} \pm 15 \mu\text{m}$
Cladding Non-circularity defined as: $[1 - (\text{min. cladding dia} \div \text{max cladding dia})] \times 100$	2.0%
Proof/Tensile Test	350 MPa
Attenuation:	
@ 1310 nm	0.4 dB/km
@ 1550 nm	0.4 dB/km
Attenuation at the Water Peak	2.1 dB/km @ 1383 \pm 3 nm
Chromatic Dispersion:	
Zero Dispersion Wavelength	1301.5 nm to 1321.5 nm
Zero Dispersion Slope	0.092 ps/(nm ² *km)
Maximum Dispersion:	3.3 ps/(nm*km) for 1285 - 1330 nm <18 ps/(nm*km) for 1550 nm
Cut-Off Wavelength	<1250 nm
Mode Field Diameter (Petermann II)	9.3 \pm 0.5 μm at 1300 nm 10.5 \pm 1.0 μm at 1550 nm

Color coding.--Optical fibers shall be color coded according to the following:

1. Blue (BL)
2. Orange (OR)
3. Green (GR)
4. Brown (BR)

5. Slate (SL)
6. White (WT)

Buffer tubes containing fibers shall also be color coded with distinct and recognizable colors according to the following:

1. Blue (BL)
2. Orange (OR)
3. Green (GR)
4. Brown (BR)
5. Slate (SL)
6. White (WT)

The colors shall be targeted in accordance with the Munsell color shades and shall meet EIA/TIA-598, "Color Coding of Fiber Optic Cables."

The color formulation shall be compatible with the fiber coating and the buffer tube filling compound, and be heat stable. It shall not fade or smear or be susceptible to migration and it shall not affect the transmission characteristics of the optical fibers and shall not cause fibers to stick together.

Construction.--The FCT shall consist of the following components:

1. Buffer tubes
2. Central member
3. Filler rods
4. Stranding
5. Core and cable flooding
6. Tensile strength member
7. Ripcord
8. Outer jacket

1. Buffer tubes - Loose buffer tubes shall provide clearance between the fibers and the inside of the tube to allow for expansion without constraining the fiber. The fibers shall be loose or suspended within the tubes and shall not adhere to the inside of the tube. Each buffer tube shall contain six fibers.

The loose buffer tubes shall be made 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 homogenous 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 non-toxic solvents.

Buffer tubes shall be stranded around a central member by a method, such as the reverse oscillation stranding process that will prevent stress on the fibers when the cable jacket is placed under strain.

2. Central member - The central member, which functions as an anti-buckling element, shall be a glass reinforced plastic rod with similar expansion and contraction characteristics as the optical fibers and buffer tubes. To provide the proper spacing between buffer tubes during stranding, a linear overcoat of polyethylene may be applied to the central member to achieve the optimum diameter.

3. Filler rods - Filler rods shall be included in the cable to lend symmetry to the cable cross-section where needed. Filler rods shall be solid, medium or high-density polyethylene. The diameter of each filler rod shall be the same as the outer diameter of the buffer tubes.

4. Stranding - Buffer tubes shall be stranded around the overcoated central member using stranding methods, lay lengths and positioning, such that the cable shall meet mechanical, environmental and performance specifications. A polyester binding shall be applied over the stranded buffer tubes to hold them in place. Binders shall be applied with sufficient tension to secure the buffer tubes to the central member without crushing the buffer tubes. The binders shall be non-hygroscopic, non-wicking (or rendered so by the flooding compound), and dielectric with low shrinkage.

5. Core and cable flooding - The cable core interstices shall be filled with a polyolefin based compound to prevent water ingress and migration. The flooding compound shall be homogeneous, non-hygroscopic, electrically non-conductive, and non-nutritive to fungus. The compound shall also be non-toxic, dermatologically safe and compatible with all other cable components.

6. Tensile strength member - Tensile strength shall be provided by high tensile strength aramid yarns and/or fiberglass which shall be helically stranded evenly around the cable core and shall not adhere to other cable components.

7. Ripcord - The cable shall contain at least one ripcord under the jacket for easy sheath removal.

8. Outer jacket - The jacket shall be free of holes, splits, and blisters and shall be medium or high-density polyethylene, or medium-density cross-linked polyethylene with minimum nominal jacket thickness of 1 mm \pm 0.05 mm. Jacketing material shall be applied directly over the tensile strength members and flooding compound and shall not adhere to the aramid strength material. The polyethylene shall contain carbon black to provide ultraviolet light protection and shall not promote the growth of fungus.

The jacket or sheath shall be marked with the Manufacturer's name, the words "Optical Cable", the number of fibers, "SM", year of manufacture, and sequential measurement markings every meter. The actual length of the cable shall be within \pm 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 approximately 2.5 mm.

Physical specifications.--The FCT 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-455-81A (FOTP-81), "Compound Flow (Drip) Test for Filled Fiber Optic Cable". No preconditioning period shall be conducted. The cable shall exhibit no flow (drip or leak) at 80°C as defined in the test method.

The crush resistance of each finished FCT shall be 220 N/cm 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 each fiber shall be 0.10 dB at 1550 nm 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 ten minutes.

The cable shall withstand 25 cycles of mechanical flexing at a rate of 30 \pm 1 cycles/minute. The average increase in attenuation for the fibers shall be 0.20 dB at 1550 nm 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 be tested in accordance with EIA-455-25 (FOTP-25), "Impact Testing of Fiber Optic Cables and Cable Assemblies." The average increase in attenuation for the fibers shall be 0.20 dB at 1550 nm. The cable jacket shall not exhibit evidence of cracking or splitting. The finished cable shall withstand a tensile load of 2700 N (275 Kg.) without exhibiting an average increase in attenuation of greater than 0.20 dB. 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.

Packaging and shipping requirements.--Documentation of compliance to the required specifications shall be provided to the Engineer prior to ordering the material.

Attention is directed to "Fiber Optic Testing," elsewhere in these special provisions.

The finished cable shall be packaged for shipment on reels. The cable shall be wrapped in a weather and temperature resistant covering. Both ends of the cable shall be sealed to prevent the ingress of moisture.

Each end of the cable shall be securely fastened to the reel to prevent the cable from coming loose during transit. One and eight tenth meters of cable length on each end of the cable shall be accessible for testing.

Each cable reel shall have a durable weatherproof label or tag showing the manufacturer's name, the cable type, the actual length of cable on the reel, the Contractor's name, the contract number, and the reel number. A shipping record shall also be included in a weatherproof envelope showing the above information and also include the date of manufacture, cable characteristics (size, attenuation and bandwidth), factory test results, cable identification number and any other pertinent information.

The minimum HUB diameter of the reel shall be at least thirty times the diameter of the cable. The FCT cable shall be in one continuous length per reel with no factory splices in the fiber. Each reel shall be marked to indicate the direction the reel should be rolled to prevent loosening of the cable.

Installation procedures and technical support information shall be furnished at the time of delivery.

Factory testing.--Verification of the fiber specifications as listed in the Fiber Characteristics Table shall be supplied by the manufacturer with the appropriate documentation. After cabling, before shipment but while on the shipping reel, 100 percent of all fibers shall be tested for attenuation. Copies of the results shall be:

1. Maintained on file by the manufacturer with a file identification number for a minimum of 7 years.
2. Attached to the cable reel in a waterproof pouch.
3. Submitted to the Contractor and to the Engineer.

10-3.15 SCADA COMMUNICATION CABLE

The SCADA communication cable (SCC) shall conform to REA Specification PE-39, and shall consist of 25 pair No. 19 AWG solid, soft drawn, annealed copper and insulated with either solid, virgin high density polyethylene or polypropylene. The core assembly shall be twisted into pairs with varying lays to minimize cross talk. The SCC cable shall be shielded with a .127 mm thick corrugated solid copper tape applied longitudinally with an overlap to provide 100 percent electrical shielding coverage. The SCC cable shall have an outer jacket of black, low density, high molecular weight virgin polyethylene, constructed to withstand sunlight and temperature variations. The entire cable within the outer jacket shall be flooded with a petrolatum-polyethylene gel filling compound to eliminate moisture migration or ingress.

Color Code for the SCC cable shall be:

PAIR	COLOR CODE (T--R)
1	White/Blue--Blue/White
2	White/Orange--Orange/White
3	White/Green--Green/White
4	White/Brown--Brown/White
5	White/Gray--Gray/White
6	Red/Blue--Blue/Red
7	Red/Orange--Orange/Red
8	Red/Green--Green/Red
9	Red/Brown--Brown/Red
10	Red/Gray--Gray/Red
11	Black/Blue--Blue/Black
12	Black/Orange--Orange/Black
13	Black/Green--Green/Black
14	Black/Brown--Brown/Black
15	Black/Gray--Gray/Black
16	Yellow/Blue--Blue/Yellow
17	Yellow/Orange--Orange/Yellow
18	Yellow/Green--Green/Yellow
19	Yellow/Brown--Brown/Yellow
20	Yellow/Gray--Gray/Yellow
21	Violet/Blue--Blue/Violet
22	Violet/Orange--Orange/Violet
23	Violet/Green--Green/Violet
24	Violet/Brown--Brown/Violet
25	Violet/Gray--Gray/Violet

10-3.16 ASSORTED CABLES

SERIAL CABLE.--The serial cable shall be a NEC type CM cable and shall meet UL-1581 test requirements. The serial cable shall have six conductors. Each conductor shall be No. 24 AWG, stranded tinned copper with good crush resistance and light weight insulation. The core shall be covered with an overall aluminum-polyester foil plus 65 percent minimum tinned copper braid shield for 100 percent shield coverage. The cable shall have an outer chrome PVC jacket. The cable shall have a No. 24 AWG stranded tinned copper drain wire. The nominal capacitance between conductors shall be 29.4 pF/m , and between one conductor and other conductors connected to the shield shall be 72 pF/m .

The type of connector at each end of the cable shall be as required by the equipment, as shown on the plans, or as specified in these special provisions.

DTMF CABLE.--The DTMF cable shall be a NEC Type CM cable. The cable shall consist of two twisted pairs of No. 24 AWG solid tinned copper conductors. Each conductor shall be insulated with a PVC material with a minimum thickness of 10-mils. The outer jacket shall be made of PVC material with a minimum thickness of 32-mils.

CABLE MANAGEMENT.--Cable ties, wire mounting devices and fixed diameter clamps shall be used in the closets, Caltrans telephone closet (CTC) , distribution equipment cabinets (DECs), and console to avoid physical interference between cables and adjacent equipment. Wire management brackets shall be used every 0.6 meter at the cabinets and console to route cable. Cables and wire management system components shall allow equipment to be removed from cabinets without physical interference and keep terminal blocks clearly visible.

Installation Practices.--Installation of equipment for DTMF services shall be compliant with EIA-570. Installation of equipment for integrated services digital network (ISDN) and frame relay services shall be compliant with EIA-568, EIA-569, and TIA-607.

10-3.17 SERVICE

Type III service equipment enclosures shall be the aluminum type.

Circuit breakers shall be the cable-in/cable-out type, mounted on non-energized clips. All circuit breakers shall be mounted vertically with the up position of the handle being the "ON" position.

Circuits with Model 500 changeable message signs shall have service equipment enclosures which have main busses and terminal lugs rated for 100 A, minimum, and a No. 2 bare copper ground wire.

Type H service shall consist of a conduit and conductors with length and size as required by the serving utility company.

The neutral conductor shall run from the service equipment enclosure to the controller cabinet without splicing to any other neutral conductor.

The bottom of the lowest circuit breaker shall be 600 mm minimum above the bottom of the service equipment enclosure.

10-3.18 SIGN DISCONNECTS

Sign disconnects shall be fused switches.

10-3.19 NAMEPLATES

Nameplates shall be installed on equipment as shown on the plans.

Nameplates shall be laminated phenolic plastic, black front and back with white core. Lettering shall be etched through the outer covering, indicating the function of device or assembly unit. The character size shall be 7 mm, unless noted otherwise.

The nameplates shall be fastened to the enclosures' exterior surface using stainless steel rivets or stainless steel screws.

10-3.20 EQUIPMENT GROUNDING

All non-current-carrying metal parts of fixed, portable, and mobile equipment and associated fences, housings, enclosures, and supporting structures shall be grounded. Grounding methods shall meet the requirements of NEC Article 250.

10-3.21 NUMBERING ELECTRICAL EQUIPMENT

The placement of numbers on electrical equipment will be done by others.

10-3.22 STATE-FURNISHED CONTROLLER ASSEMBLIES

The Model 2070 controller assemblies, including controller unit, completely wired controller cabinet and inductive loop detector sensor units, but without anchor bolts, will be State-furnished as provided under "Materials" of these special provisions.

The Contractor shall construct each controller cabinet foundation as shown on the plans for Type 332 and 334 cabinets (including furnishing and installing anchor bolts), shall install the controller cabinet on the foundation, and shall make field wiring connections to the terminal blocks in the controller cabinet.

A listing of field conductor terminations, in each State-furnished controller cabinet, will be furnished free of charge to the Contractor at the site of the work.

State forces will maintain controller assemblies. The Contractor's responsibility for controller assemblies shall be limited to conforming to the provisions in Section 6-1.02, "State-Furnished Materials," of the Standard Specifications.

10-3.23 TELEPHONE DEMARCATION CABINET

The Contractor shall install the analog data station termination (ADST) unit, specified elsewhere in these specifications, inside the telephone demarcation cabinet (TDC) as shown on the plans and as directed by the Engineer. Installation of the ADST shall be in accordance with the suggested manufacturer's installation procedure.

The Contractor shall install all cable assemblies, punch block, and connecting blocks inside the TDC, except those that are provided by the telephone company (TELCO), as shown on the plans and as directed by the Engineer.

Ground rod shall meet the requirements of NEC Article 250-84.

Padlockable drawer latch shall be padlock hasp.

Backboard C shall be secured by a retaining screw.

Duplex outlet and GFCI duplex outlet shall be separately connected to the main circuit breaker.

The bottom plate for TDC shall be 3.2 mm aluminum.

10-3.24 ANALOG DATA STATION TERMINATION UNIT

GENERAL --Each analog data station termination unit (ADST) shall provide data phone digital service (DDS) transmission reliability for modems operating on voice grade special access service. The ADST shall meet or exceed the following requirements and specifications.

NETWORK INTERFACE --A one-meter cable assembly with one end terminated with spade lugs and the other end terminated with RJ48 modular plug shall be included with each ADST. Network signal connections to the ADST shall be made via a barrier strip with spade lug end of the cable assembly. The receive data pair from the network shall connect to the terminals labeled RT and RR, and the transmit data pair to the network shall connect to the terminals labeled TT and TR in accordance with the RJ48S interface code. The modular plug end of the cable assembly shall be connected via the RJ48 jack provided by the telephone company. The network interface shall conform to the following:

Line	4 wire (TX pair & RX pair)
Operating Mode	Baseband, full duplex
Data Rate	72 kbps
Signal Format	Bipolar, return to zero, 50% duty cycle
TX Source Impedance	135 ±20%
RX Input impedance	135 ±20%
RX Input impedance	0 to 45 dB loop loss measured at 36 kHz
Maximum Distance	5480 m, No. 26 wire at 21°C

CUSTOMER INTERFACE --The Contractor shall furnish and install the cable assembly from the customer interface jack of the ADST to the punch block as shown on the plans. The customer interface shall conform to the following:

Line	4-wire (TX pair RX pair)
RX and TX Impedance	600 ±20%
TX Input	0 dBm (from customer)
RX Output	-16 dBm (to customer)

CONTROLS AND INDICATORS --

Indicators	Power LED Loopback LED Loss of sealing current LED
Controls	Multipoint junction unit (MJU) -MJU option enable/disable

VOICE FREQUENCY (VF) CHANNEL CHARACTERISTICS --

Loss of Deviation	± 0.5 dB
3 - Tone Slope 404 and 2804 Hz	± 0.5 dB
Attenuation Distortion	
504 to 2804 Hz	- 0.5 to 0.0 dB
404 to 2804 Hz	- 0.5 to 1.0 dB
304 to 3004 Hz	- 0.5 to 1.5 dB
Envelope Delay Distortion	
1004 to 2604 Hz	75 µs
804 to 2804 Hz	130 µs
604 to 2604 Hz	250 µs
504 to 2804 Hz	350 µs
504 to 3004 Hz	450 µs

MECHANICAL --

- a. Each ADST installed at the telephone demarcation cabinet (TDC) shall be provided with stand-alone housing.
- b. Each ADST shall have a nominal size of 142 mm (wide) x 36 mm (high) x 152 mm (deep) and shall not weigh more than 230 grams.
- c. The ADST shall be installed in accordance with manufacturers suggested procedure.

POWER --

- a. Power shall be provided to the ADST via AC three-prong power cord.
- b. A green indicator shall be provided for power "on".
- c. The unit shall be fused by a 0.1 A SLO BLO fuse.

ENVIRONMENTAL --

Operating temperature	0°C to 50°C
Storage temperature	-40°C to 85°C
Relative humidity	Up to 95% non-condensing

For the purpose of payment, the analog data station termination unit shall include the ADST and testing of the ADST before the units are to be delivered to the job site for installation.

Payment for the installation of the analog data station termination unit is included in the contract lump sum price paid for traffic operations system at the location involved.

10-3.25 DETECTORS

Loop detector sensor units will be State-furnished in conformance with the provisions in "Materials" of these special provisions.

The depth of loop sealant above the top of the uppermost loop wire in the sawed slots shall be 50 mm, minimum.

10-3.26 EXTINGUISHABLE MESSAGE SIGN

Each extinguishable message sign shall be an internally illuminated weathertight and dust tight unit which will produce a clearly visible message only when internally illuminated and shall conform to these special provisions.

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 approval by the Engineer.

Six sets of shop drawings shall be submitted to the Engineer for review prior to performing work on the signs.

HOUSING

The housing shall be ruggedly constructed, shall be rigid, weathertight, dust tight and 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 acrylic plastic 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.

BALLASTS, CONTROL RELAYS AND TERMINAL BLOCKS

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.

LAMP HOLDERS AND LAMPS

Lamp holders 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.

LUG DISCONNECT

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

Tests shall verify that the following conditions exist:

- A. Transformer output voltage: 480 V (ac) \pm 10 percent.
- B. Sign input current (daytime level): 4 A maximum.
- C. Lamp current each (daytime level): 1.4 A \pm 15 percent (nighttime level) 30 mA \pm 15 percent.
- D. Cathode filament voltage: 3.6 V (ac) \pm 10 percent and shall be supplied from a steady (non-flashing) source.

SIGN 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.

Full compensation for extinguishable message sign shall be considered as included in the contract lump sum price paid for traffic operations system at the locations involved and no separate payment will be made therefor.

10-3.27 EXTINGUISHABLE MESSAGE SIGN RADIO CONTROLLER ASSEMBLY

Each extinguishable message sign (EMS) radio controller assembly shall consist of an AM radio receiver unit with antenna and a DTMF decoder unit completely wired as a stand alone assembly.

Radio receiver unit shall conform to the following specifications:

Frequency range	530-1710 kHz
Modulation type	AM
IF rejection	60 dB
Image rejection	60 dB
Selectivity	60 dB
Signal-to-noise (S/N) ratio	50 dB
Usable sensitivity	20 μ V (20 dB S/N)
Power source	12 VDC Negative Ground
Tone control effects	10 to 22 dB at 10 kHz
Speaker output impedance	4 or 8
Output power	8W (4 W per channel)

DTMF decoder unit shall consist of a MT8870 DTMF Decoder integrated circuit (IC). The audio signal is coupled to MT8870 with a capacitor-resistor network. The capacitor-resistor network will provide DC blocking and input biasing to the MT8870. The MT8870 DTMF Decoder shall decode all 16 DTMF tones and shall compensate for "twist." (Each tone is made up of one higher frequency tone and one lower frequency tone. "Twist" on radio link is caused by the fact that the higher frequencies travel through the air at a different speed than the lower frequencies).

The MT8870 Decoder gives a binary output on pins 11, 12, 13, and 14. The output is stored in a non-volatile Electrically Erasable Programmable Read Only Memory (EEPROM). The output relay shall have a nominal rating of 20 A at 120 VAC per output contact.

DTMF shall have the following codes:

Low Frequency (Hz)	High Frequency (Hz)	Digit
697	1209	1
697	1336	2
697	1477	3
770	1209	4
770	1336	5
770	1477	6
852	1209	7
852	1336	8
852	1477	9
941	1336	0
941	1209	*
941	1477	#
697	1633	A
770	1633	B
852	1633	C
941	1633	D

Front Panel.--

The front panel of the EMS radio controller assembly shall have the following controls, display, battery tray, and output jack:

1. A "STORE" push button switch which shall be used to teach the DTMF Decoder the code that will be used to energize the output relay.
2. A "STOP" push button switch which shall be used to manually de-energize the output relay.
3. A manual/automatic control switch which activates output relay ON/OFF while in manual mode, and tone remote control in automatic mode.
4. A audio level control nub.
5. A frequency selection nub.
6. A LED display panel which shall always display AM radio frequency in a minimum of four digits.
7. A 9 V battery tray which holds one 9 V battery to maintain the radio receiver frequency selection during a power outage.
8. An audio output jack which is used to monitor the radio reception and DTMF tone storage.

Rear Panel.--

The rear panel of the EMS radio controller assembly shall provide antenna connection, power connection, and a fuse holder with a 2 A fuse.

Full compensation for extinguishable message sign radio controller assembly shall be considered as included in the contract lump sum price paid for traffic operations system at the locations involved and no separate payment will be made therefor.

10-3.28 MICROWAVE VEHICLE DETECTION SENSOR WIRELESS COMMUNICATION SYSTEM

The microwave vehicle detection sensor wireless communication system (MVDSWCS) shall consist of the following components, to function as described herein, as shown on the plans and as directed by the Engineer.

- Microwave vehicle detection sensor (MVDS).
- Wireless radio modem and antenna.
- Cluster controller (as needed).

MICROWAVE VEHICLE DETECTION SENSOR

The MVDS signal shall emulate the response of an inductive loop detector. The MVDS units shall be tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. Each MVDS unit shall operate independently and not interfere with other MVDS units.

The microwave sensor unit shall operate in the frequency band of 10.525 GHz \pm 25 MHz. The transmitter power shall be a maximum of 10 mW.

The MVDS field of view shall be covered by a maximum detection range defined as follows:

Elevation beam-width	45 degrees
Azimuth beam-width	15 degrees
Range	3 to 60 meters

Each MVDS unit shall have the capability of providing a minimum of 8 detection zones within each beam footprint. The size of each zone shall be user definable with a maximum range resolution of 2 meters. The minimum footprint shall be greater than or equal to 1.8 meters.

The time of events shall be measured in a maximum of 10 millisecond resolution.

Measurement accuracy shall be better than 95 percent certainty for vehicle presence.

Each MVDS unit shall be supplied with a connectorized MVDS cable harness with appropriate cable length for each installation. The MVDS cable shall consist of 15 unshielded twisted pairs of No. 20 conductors with an overall shield. Each conductor shall have a minimum of 19 tinned copper strands with a minimum of 1.60 mm PVC insulation rated for 300 V at 105°C. The outer jacket shall be chrome PVC with minimum thickness of 1.60 mm. The outside diameter of the cable shall not exceed 19.2 mm. A minimum of four meters slack of MVDS cable is required in each Type 334 cabinet.

The connector shall be MS3476W18-32S or equivalent. This connector shall include contacts for powering the sensor unit, RS-232 serial data communications and contact pairs for each detection zone. The connector pinout is as follows:

No.	Pin No.	Designation	Signal	Remark
1	A	Contact Closure	Opto 1	
2	B	Contact Closure	Opto 1 Return	
3	C	Contact Closure	Opto 2	
4	D	Contact Closure	Opto 2 Return	
5	E	Contact Closure	Opto 3	
6	F	Contact Closure	Opto 3 Return	
7	G	Contact Closure	Opto 4	
8	H	Contact Closure	Opto 4 Return	
9	J	Contact Closure	Opto 5	
10	K	Contact Closure	Opto 5 Return	
11	L	Contact Closure	Opto 6	
12	M	Contact Closure	Opto 6 Return	
13	N	Contact Closure	Opto 7	
14	P	Contact Closure	Opto 7 Return	
15	R	Contact Closure	Opto 8	
16	S	Contact Closure	Opto 8 Return	
17	d	Contact Closure	Opto 9	
18	e	Contact Closure	Opto 9 Return	
19	f	DC Power	12-24 VDC +	
20	g	DC Power	12-24 VDC -	
21	h	AC Power	115 VAC +	Not Used
22	j	AC Power	115 VAC -	Not Used
23	V	RS-232 p2	TX	
24	T	RS-232 p3	RX	
25	U, W	RS-232 p5	Signal Ground	
26	b	Auxiliary	+5VDC Out	Not Used
27	c	Auxiliary	+5VDC Out Return	Not Used
28-32				Spares

The Contractor shall wire the MVDS cable harness and power conductors to the 10 position DIN rail mounted terminal blocks in the Model 334 cabinet as directed by the Engineer. The RS-232 serial data communication output conductors shall be terminated at the service panel terminal block, TB-0. The contact pair output conductors shall be terminated at the input panel terminal block, TB-2. The ends of all unused and spare conductors shall be taped to prevent accidental contact to other circuits.

All software for testing and set-up procedures shall be supplied with the MVDS unit. The software shall test the MVDS unit performance and provide diagnostic information.

Operational Requirements.—The Contractor shall provide a certification from the manufacturer that the MVDS unit will interface and operate with a Model 170 controller and wireless radio modem. In addition, the MVDS unit shall meet the following requirements:

- a. Electrical.—The unit shall operate with 12-24 VDC at 0.5 A power source. The unit shall have a feature of automatic recovery after a power failure.
- b. Physical.—The unit shall be encased in a weatherproof NEMA-3R enclosure. The unit shall not exceed 160 mm x 240 mm x 250 mm in size and shall not weigh more than 4.5 kg. The unit shall operate over a temperature range from -37° to +74° C, up to 95 percent relative humidity.
- c. Installation and Testing.—Prior to installing any MVDS units, the Contractor shall perform functional tests to verify that all MVDS units comply with these specifications. The MVDS units shall be installed as shown on the plans and in accordance with the manufacturer's recommended installation procedures. The Contractor shall confirm equipment placement with the Engineer before installing any equipment. The Contractor shall test the MVDS units for the following functions:
 1. Presence and passage at all ramp and connector metering locations.
 2. Speed, volume and occupancy for all mainline monitoring locations.
 3. Correct speed and count readings of mainline traffic with a portable detection equipment.

The Contractor shall make sure that the MVDS system will not cause harmful interference to radio communication. If the operation of the MVDS system in a residential area is to cause harmful interference, the Contractor will be required to correct the interference at the Contractor's expense.

Physical Requirements.--

The assembly shall not exceed 49 mm x 176 mm x 134 mm in size and shall not weight more than 1.5 kg.

Environmental Requirements.--

The assembly shall operate over a temperature range from -37°C to +74°C, with up to 95 percent relative humidity.

For the purpose of payment, the microwave vehicle detection sensor shall include the sensor, mounting bracket as required and testing of microwave vehicle detection sensors before the units are to be delivered to the job site for installation.

Payment for the installation of the microwave vehicle detection sensor is included in the contract lump sum price paid for traffic operations system at the location involved.

WIRELESS RADIO MODEM AND ANTENNA

General.—Acceptable wireless radio modem shall meet all qualifying specifications identified herein, and is at least equivalent in functionality to Metricom Ricochet ICR-900 modem, and has the adaptability to the Metricom Ricochet wide-area wireless network.

The wireless radio modem shall utilize spread-spectrum, packet switching data technology. The modem shall operate within the FCC license-free Radio Frequency (RF) range of 902-928 MHz.

Each radio modem shall work with wide-area wireless network which employs frequency-hopping spreading technique using 162 channels, with each channel having a bandwidth of 160 kHz. The hopping shall be asynchronous and pseudo-random. Raw RF data rate shall be 100 kbps, minimum.

The communication protocol shall emulate existing State specified point-to-multipoint communication polling scheme. Each modem shall be polled by a Front-End Processor (FEP) every 30 seconds and the maximum latency shall be 4 seconds.

Each modem and software shall be designed to provide a migration path to an upgrade communication protocol in conjunction with an IP Gateway.

Radio modem.—Each radio modem shall meet the following specifications:

Receiver	
Type	Double Conversion Superheterodyne
Dynamic Range	-98 to 0 dBm
Packet Error Rate	1×10^{-2} (1×10^{-6} BER)
Frequency Stability	± 2.5 ppm

Transmitter	
RF Output Min. (at antenna connection)	+27 dBm
RF Output Typical	+30 dBm (1.0 W)
Out-of-Band Spurious Radiation	FCC 15.205
Deviation	± 37.5 kHz
Modulation Bandwidth	160 kHz
Modulation type	Gaussian Frequency-Shift Keying (GFSK)
Output Impedance	50 Ohms
Frequency Stability	± 2.5 ppm

Processing	
CPU	SH1-RISC
Clock Speed	16 MHz, Min.
DRAM Memory	2 Mbytes, Min.
FLASH ROM Memory	512 Mbytes, Min.

Data Port	
Serial interface	EIA-232
Data Rate	1200 bps to 115 kbps, Asynchronous
Parity	Odd, Even or None
Data Bits	7 or 8
Stop Bits	1 or 2
Duplex	Full Duplex

Electrical	
Voltage	12.0 VDC (10.0 - 24.0 VDC operating range)
RX Input Current at 12 VDC (avg.)	400 mA
TX Input Current at 12 VDC	1 A
Fuse	Internal thermal resettable
Voltage Line Protection	Reverse Polarity

Mechanical	
Interface Connections:	
Power	2-Pin Amp Mate-N-Lock
Data Port	DB-9, Female, DCE
Antenna	N-Type, Female
Status Indicator	LED
Case	Aluminum
Weight	0.5 kg
Size	136 mm (wide) x 202 mm (deep) x 50 mm (high)

Environmental	
Operating Range	-37° to +74°C
Operating Vibration	Mil std. 810E, Mobile
Operating Shock	20 g, 11ms, Half Sine per Mil. Std. 802
Humidity	Mil. Std. 202F, Method 106 Modified, 10 Days

EMI and Power/Control Susceptibility	
Electromagnetic Radiation	FCC Class B, Part 15.247
Electromagnetic Susceptibility	ANSI C37.90.2 Modified
Surge Withstanding Capability	ANSI C37.90.1, FT and SWC
Electrostatic Discharge	Mil Handbook 263 and IEC 801.2

The radio modem shall be certified meeting FCC Certified Part 15.247.

A serial cable assembly shall be provided to terminate the radio modem to the terminal blocks in the wireless radio modem enclosure. All connector pins shall be crimp-type.

The radio modem shall be compatible with State specified serial communication protocol via EIA-232 interface. The EIA-232 serial interface shall be the standard three-wire interface consisting of transmit, receive and signal ground. No handshaking shall be required.

Antenna.—Each radio modem shall be provided with an antenna including cable, connectors and mounting accessories. The type of antenna installed on top of a controller cabinet shall be a low-profile radome antenna and shall meet the following specifications:

Electronic	
WSWR at resonant point	1.5:1 or less
Nominal Impedance	50 Ohms
Gain	3 dB, Min.
Radiation Pattern	Omni-Directional
Polarization	Vertical
Maximum Power Input	125 Watts
Frequency	890 - 950 MHz

Mechanical	
Height	16 mm
Top Diameter	76 mm
Base Diameter	108 mm
Radome	rugged, high-impact plastic with black finish

The type of antenna installed on CCTV post shall be a whip antenna as recommended by the radio modem manufacturer.

The antenna shall be mounted on the top of a metallic enclosure with a waterproof adhesive. The adhesive shall be resistant to exposure in the temperature range of -37° to 149°C. The adhesive shall not degrade with minor temporary exposure to gasoline, JP-4, mineral spirits, motor oil, acetone, or methyl ethyl Icetone.

The antenna shall come with an antenna cable; 0.5 m in length made from RG58/U coax cable with a Type N, male connector on the end. The antenna cable shall be routed through a waterproof cord-grip box (CGB) connector into the metallic enclosure.

Warranty.—The wireless radio modem shall include a minimum one-year warranty during which the manufacturer or supplier shall replace or repair any units that proven to be defective at no additional cost to the State. The warranty period shall start on the date the modem is registered with network name server after its installation has been accepted in the field. The Contractor shall provide the Engineer a copy of the warranty before the wireless radio modem will be approved by the Engineer.

For the purpose of payment, the wireless radio modem and antenna shall include the wireless radio modem, antenna and testing of the wireless radio modem before the units are to be delivered to the job site for installation.

Payment for the installation of the wireless radio modem and antenna is included in the contract lump sum price paid for traffic operations system at the location involved.

CLUSTER CONTROLLER

The cluster controller shall be provided by the same supplier or manufacturer of the microwave vehicle detection sensor (MVDS) system. The cluster controller shall process the data from two or more microwave vehicle detection sensors at a given location and be installed in the Model 334 controller cabinet. The cluster controller and installation method shall be as recommended by the MVDS manufacturer and as approved by the Engineer.

For the purpose of payment, the cluster controller shall include the controller and testing of the cluster controller before the units are to be delivered to the job site for installation.

Payment for the installation of the cluster controller is included in the contract lump sum price paid for traffic operations system at the location involved.

10-3.29 MICRO MAGNETIC LOOP DETECTOR

Micro magnetic loop detector (MMLD) shall fit in 25 mm diameter holes and shall be installed vertically 500 mm to 600 mm below the roadway surface.

MMLD shall be capable to operate in high iron environments.

MMLD shall have the following operating parameters:

- a. Earth's vertical magnetic field shall be 0.4 to 0.8 oersted
- b. Inductance (between probe output cables) shall be 22+/- μH per probe plus 65 μH per 100 meters of probe or home run cable.
- c. DC resistance (between probe output cables) shall be 0.5 Ω per probe plus 100 Ω per 100 meters of probe or home run cable.
- d. MMLD peak to peak voltage shall be 0.25 to 1.0 volts across each probe.

The Contractor shall provide sensor units and home run cables as recommended by the MMLD manufacturer. The probe cables shall be spliced to home run cables as recommended by the MMLD manufacturer.

The sensor units shall be compatible with 2070 controller assembly.

Full compensation for micro magnetic loop detector shall be considered as included in the contract lump sum price paid for traffic operations system at the locations involved and no separate payment will be made therefor.

10-3.30 MODEL 500 CHANGEABLE MESSAGE SIGN SYSTEM

Model 500 changeable message sign (CMS) systems consist of a Model 500 changeable message sign, a Model 2070 controller assembly in a completely wired Type 1 or similar cabinet and the required wiring and auxiliary equipment required to control the CMS shown on the plans and in conformance with these special provisions.

The Model 500 changeable message signs, wiring harness and Model 2070 controller assembly including controller unit and completely wired cabinet, but without anchor bolts, will be State-furnished in conformance with the provisions in "Materials" of these special provisions.

Model 500 changeable message sign system components will conform to the requirements in "Specifications for Changeable Message Sign System," issued by the State of California, Department of Transportation, and to the addendums thereto current at the time of project advertising. Model 2070 controller assemblies will conform to the requirements in "Traffic Signal Control Equipment Specifications," issued by the State of California, Department of Transportation, and to the addendums thereto current at the time of project advertising.

Attention is directed to "Sign Structures" of these special provisions.

The sign assembly shall be installed on the sign structure. The controller cabinet foundation shall be constructed as shown on the plans for Type 334 cabinets (including furnishing and installing anchor bolts), the controller cabinet shall be installed on the foundation, and the field wiring connections shall be made to the terminal blocks in the sign assembly and in the controller cabinet.

Field conductors No. 12 and smaller shall terminate with spade terminals. Field conductors No. 10 and larger shall terminate in spade or ring terminals.

A listing of field conductor terminations, in each State-furnished changeable message sign and controller cabinet, will be furnished free of charge to the Contractor at the site of the work.

The location of the foundation for each controller cabinet will be determined by the Engineer.

State forces will maintain the sign assemblies. The Contractor's responsibility shall be limited to conformance with the provisions in Section 6-1.02, "State-Furnished Materials," of the Standard Specifications.

Full compensation for Model 500 changeable message sign system shall be considered as included in the contract lump sum price paid for traffic operations system at the locations involved and no separate payment will be made therefor.

10-3.31 CHANGEABLE MESSAGE SIGN (CMS) SAFETY SWITCH

Each CMS shall have a disconnect switch, which shall be a UL-listed 100 Ampere, 2 pole, non-fusible switch rated for 600 V maximum. It shall have an electrical interlock to prevent accidental operation and a line terminal shield to prevent accidental contact with the terminals. It shall be housed in a NEMA 3R enclosure with a door latch and provisions for a padlock. The housing shall have a front-operated handle for provisions to lock the handle in the OFF position. The housing shall be mounted 1.8 m high on the exterior of the sign post facing oncoming traffic.

Full compensation for changeable message sign safety switch shall be considered as included in the contract lump sum price paid for traffic operations system at the locations involved and no separate payment will be made therefor.

10-3.32 CAMERA STATION

Furnishing of the camera unit, pan and tilt unit, camera control unit, video encoder unit, integrated services digital network terminal adapter unit and fiber optic transmitter system are covered elsewhere in these special provisions and under separate bid items. Furnishing and installing the closed circuit television pole, short haul modem and all other items required for the proper installation and operation of the camera station shall be considered as part of the traffic operations system at various locations.

GENERAL.--Each camera station shall consist of the following components, to function as described herein and as shown on the plans:

1. One camera unit
2. One pan and tilt unit.
3. One junction box (JB).
4. One camera control unit (CCU).
5. Connectors and fittings as required.
6. One JCB stubs harness.

At locations 3, 22, 23, 25, 27, 29 and 30 the camera station shall consist of the following additional equipment:

1. One video encoder unit (VEU).
2. One integrated services digital network terminal adapter (ISDN TA).

At locations 6, 8, 10, 13, 15, 17 and 19 the camera station shall consist of the following additional equipment:

1. One fiber optic transmitter system (FOTS).

INSTALLATION OF CAMERA STATION.--The work to be done at each camera mount, as shown on the plans, shall consist of the following:

1. Attach camera mount to the pole depending upon location.
2. Attach pan/tilt unit to the camera mount.
3. Attach camera unit to the pan/tilt unit.
4. Drill and tap a 7 mm-20 threaded hole in the camera pole before JCB installation.
5. Install Type JCB junction box.
6. Install conduits and pull boxes from the camera pole to the controller cabinet.
7. Terminate television control cable (TVC) and television power cable (TVP) inside Type JCB junction box.
8. Terminate television video cable (TVL) inside Type JCB junction box with a BNC connector.
9. Install camera harness.
10. Connect television control power cable (TVCP) to the pan/tilt unit via a connector.
11. Adjust limit stops of the pan/tilt unit as directed by the Engineer.
12. Adjust camera unit to provide the optimum picture for the full range of daylight and night time conditions as directed by the Engineer.
13. Configure, install and terminate the JCB stubs harness.
14. Install a watertight strain-relief box connector at the hole for the TVCP.

The work to be done between the control cabinet and camera pole, as shown on the plans, as a minimum, shall consist of installing conduits, TVL, TVP, TVC, TVCP and pull boxes.

The work to be done at each control cabinet, as shown on the plans, as a minimum, shall consist of the following:

1. Install CCU.
2. Terminate TVC, TVCP, TVP and TVL to their respective connectors, as shown on the plans.
3. Connect TVC, TVCP, TVP, and TVL connectors to CCU.

At locations 3, 22, 23, 25, 27, 29, and 30 the following additional work, as shown on the plans, shall be performed at each control cabinet:

1. Install VEU.
2. Install ISDN TA.
3. Connect CCU to VEU.
4. Connect ISDN TA to VEU.

At locations 6, 8, 10, 13, 15, 17, and 19, the following additional work, as shown on the plans, shall be performed at each control cabinet.

1. Connect FOTS to CCU.

CABLES AND CONNECTORS

The camera unit cable assembly box mounting connector shall be mounted on one side of the JCB and shall be prewired to the 20 position terminal block as shown on the plans. The video signal pins of the camera unit cable assembly box mounting connector shall be terminated to a Bayonet Nut Connector (BNC) jack connector via Type RG-59/U coaxial cable stub.

The television control cable (TVC) and television power conductors (TVP) shall be wired to the 20 position terminal block as shown on the plans. The television control power (TVCP) cable shall go through but does not terminate inside the JCB. A watertight strain-relief box connector shall be installed at the JCB hole for the TVCP cable.

ACCEPTANCE TESTING OF CAMERA STATION.--Upon completion of work, each camera station shall be subject to evaluation and testing as directed by the Engineer. The testing shall consist of 5 consecutive days of continuous satisfactory operation of each camera station. Any unsatisfactory performance due to neglect or workmanship shall be corrected by the Contractor and the camera station shall be re-tested until 5 consecutive days of continuous satisfactory

operation is obtained. Unsatisfactory performance due to a power loss caused from damage by public travel, or an interruption in P.G. & E. service or failure of existing facilities shall not constitute discontinuity.

CAMERA UNIT MOUNTING.--The bolts and nuts securing the camera unit to the pan-and-tilt unit shall be hex head and made of stainless steel. Before each bolt is fastened, a locking type coating shall be applied to the threads. The coating shall lock the bolt and nut in place, making it impossible to turn the bolt or nut without tools. This coating shall be effective through at least 10 insertions and withdrawals of the bolt or nut.

Payment for the furnishing and installing camera station equipment, not covered by other bid items, shall be included in the contract lump sum price paid for traffic operations system at the location involved.

10-3.33 CAMERA UNIT

Each camera unit shall consist of a camera, lens, environmental housing and camera unit cable assembly. The camera, lens and environmental housing, combined, shall not weigh more than 6.8 kg. Each camera unit shall be interchangeable with the existing camera units already installed on various traffic operations system (TOS) projects without changes or adjustments to either the system or the camera unit.

Each camera unit shall be assembled, inspected, and tested in accordance with these special provisions prior to delivery to the job site. Installation, operations and maintenance manuals shall also be submitted at the time of delivery.

Applicable Documents - The following documents of the U.S. Military Specification (MIL-SPEC), Underwriters' Laboratory, Inc. (UL), Electronics Industries Association (EIA) Standards, and other Standards form parts of the specification to the extent specified in these standards. In the event of a conflict between the content of this section and the content of the specification, the standards defined in this section shall supersede.

Military Specification Documents	
MIL-I-45208A	Inspection System Requirements, Dec. 16, 1963
MIL-C-45662	Calibration System Requirements, June 10, 1980
MIL-STD-416A	Electromagnetic Interface Characteristics Requirements for Equipment, Subsystems & Systems, Aug. 1, 1968
MIL-E-5400T	Electronic Equipment, Airborne General Specification
MIL-STD-810	Environmental Test Methods, 19 July 1983
MIL-C-5541	Chemical Conversion Coatings on Aluminum Alloys, June 3, 1970

Underwriters' Laboratory, Inc. and other documents	
UL-796	Printed Circuit Boards
EIA-170A	Electrical Performance Standards Color Television Studio Facilities
EIA RS-330	Electrical Performance Standards for Closed Circuit Television (CCTV) Camera 525/60 Interlaced

CAMERA

Approved Camera - The cameras listed below have been approved by the Engineer. Further information such as the source of the cameras can be provided upon demand. Any camera submitted by the Contractor that is not one of the approved cameras listed below shall be stringently compared to the specifications set forth in these special provisions before it is approved by the Engineer.

Approved Cameras:

- Cohu 8240
- Sony SSC-C374
- Burle/Philips TC293C-Z0P2X596

1. General -

- a. Each camera shall be self-contained and designed for continuous unattended 24-hour operation.
- b. Camera performance shall meet or exceed EIA-170A standards.
- c. Each camera shall have automatic sensitivity and black level control so that it operates without further adjustment when illumination ranges from the minimum specified herein to that of full daylight.
- d. Each active electronic device within the camera shall be solid-state.

- e. Each camera shall have a switch selectable electronic shutter. The shutter speed shall range from 1/60 of a second (off) to 1/10,000 of a second in 8 steps. The control of the electronic shutter rate shall be accessible through a side panel opening. Remote on/off control of the shutter shall be accomplished via an output connector on the rear of the environmental housing.

2. Light sensitivity - At a scene with 50 percent light reflectivity and with light level on the scene measured to be 10 lux and greater, each camera with its 10:1 zoom lens shall generate a picture on the monitor specified in these special provisions which resolves all 10 shades of gray on the EIA Television Test Chart. Not every camera shall be required to resolve the same gray scale when the light level on the same scene is measured to be less than one lux.

3. Electrical Power - Each camera shall operate when the applied voltage is between 95 to 130 VAC, 60 Hz \pm 0.3 Hz, single phase. The power consumption of camera shall not exceed 10 W. All camera circuitry shall be powered by a regulated, over-voltage protected DC power supply contained in the camera.

4. Synchronization -

- a. Each camera shall generate synchronization signals by means of a single integrated circuit.
- b. Each camera shall operate with the internal EIA-170A crystal as the sync reference source with the field rate of 59.94 Hz.
- c. Each camera shall have the capability of synchronizing to an external input source.
- d. The synchronization signal at the video output shall conform to EIA-170A.

5. Scanning - Each camera's mode of scanning shall be two-to-one interlaced at 525 lines, 60 fields per second, as specified by EIA-170A.

6. Video Processing -

- a. The video output level shall be maintained to within 3 dB for changes in scene brightness of 0.17 to 109 600 cd/m² using a motorized iris lens having a transmission range of F/1.2 to F/1200.
- b. Each camera shall have a black-level control system.
- c. Each camera shall have an automatic white (color) balance control to maintain proper color rendition by automatically referencing to white areas of the scene. Manual control of the white balance shall be accessible through side panel or remotely controlled via the rear connector on the environmental enclosure.
- d. Automatic gain control (AGC). The switch selectable fixed gain response shall maintain the output video level to 90 percent video when the light level on the image sensor falls too low to maintain full video output. The video out will be maintained at 90 percent peak-average setting to optimize video output under varying lighting conditions. The controls for the on/off and peak average adjustments shall be accessible through the side panel of the camera.
- e. One 75 Ω (\pm 1 percent) source-terminated, single-ended video output jack shall be provided.
- f. An adjustable white clipper shall be provided to limit highlight brightness.
- g. The video output level shall be 1.0 V peak-to-peak composite (0.7 V video, 0.3 V sync) signal, polarity black negative, across a 75 Ω load impedance.
- h. The minimum signal-to-noise ratio shall be 50 dB at 25°C.

7. Imager -

- a. Each camera shall be designed to use a 12.7 or 16.9 mm format solid-state, color, interline transfer charged-coupled device (CCD) imager.
- b. The imager shall have a minimum resolution of 768 horizontal by 493 vertical active picture elements.
- c. When provided with 6.89 lux of highlight illumination on the environmental housing window, the camera shall provide the following resolution with AGC off:
 - i. Horizontal center resolution shall be 460 TV lines minimum.
 - ii. Vertical resolution shall be 350 TV lines minimum in the center and all corners simultaneously.

8. Mechanical -

- a. All camera circuitry shall be on a printed circuit board which shall be removable and replaceable using no more than common hand tools.
- b. Test points and adjustment identifications shall be etched or silk-screened on the boards.

- c. Each camera shall be self-supporting and operable when removed from the environmental housing and shall have a lens adapter ring which accommodates a standard 16 mm C-mount. A back focal distance adjustment shall be provided.
- d. Each camera shall utilize the rigidity of the environmental housing for strength against shock and vibration.

9. Environmental Operation -

- a. Each camera within its environmental housing shall withstand the following requirements:
 - i. Operate over an ambient temperature range on -10°C to +50°C with the use of heaters.
 - ii. Peak random vibration of 5 g from 60 to 1000 Hz, with camera in operation.
 - iii. Shock up to 15 g in all axes under non-operating conditions.
 - iv. Exposure to sand, dust, fungus, and salt atmosphere as per MIL-E-5400T paragraphs 3.2.24.7, 3.2.24.8, 3.2.24.9, and 3.2.24.10.
 - v. Up to 100 percent relative humidity as per MIL-E-5400T, paragraph 3.2.24.2.

10. Picture Quality -

- a. The quality of the picture shall be such that most objects in low light levels can be distinguished without excess interference from undesirable picture attributes.
- b. Undesirable picture attributes include blooming, transfer smear, vertical register shifting.

LENS

1. General -

- a. Each lens shall be fully compatible with the camera provided.
- b. Each lens shall have a maximum aperture of no less than f/1.2, and a minimum range of f/1.2 to f/1200.
- c. Each lens shall be a 16 mm C-mount.
- d. Each lens shall have a minimum zoom range of 10 to 1. The lens focal length for a 16.9-mm CCD camera shall be 10-100 mm, 10.5-105 mm or 11-110 mm. The lens focal length for a 12.7 mm CCD camera shall be 8-80 mm. A 1.5-X extender shall be included with the lens.
- e. Each lens shall be equipped with a motorized zoom and focus control.
- f. Each lens shall have an automatic, motor-driven iris with manual override. The iris shall be controlled directly through the camera in automatic mode and from the camera control unit in the manual mode. The automatic iris shall provide continuous aperture adjustments of the lens as determined by the amount of light reaching the camera imager. The power supply and electronics for iris motor shall be contained within the environmental housing.
- g. Each lens shall be fitted with an intra-spot neutral density filter.
- h. Each lens must be able to respond to the following inputs from camera control unit (CCU) for lens control:

Focus near	+9.0VDC @ 100 mA
Focus far	-9.0VDC @ 100 mA
Zoom in	+9.0VDC @ 100 mA
Zoom out	-9.0VDC @ 100 mA
Iris closed	+9.0VDC @ 100 mA
Iris open	-9.0VDC @ 100 mA

- i. The travel time for the upper limit stop to the lower limit stop for zoom and focus shall be from 5 seconds minimum to 10 seconds maximum.
- j. Each lens shall have the capability of at least 10 pre-positioning positions.

2. Environmental Operation -

- a. Each lens within its pressurized environmental enclosure shall withstand the following requirements:
 - i. Operate over an ambient temperature range on -10°C to +50°C with the use of heaters.
 - ii. Peak random vibration of 5 g from 60 to 1000 Hz, with lens in operation.
 - iii. Shock up to 15 g in all axes under non-operating conditions.

- iv. Exposure to sand, dust, fungus, and salt atmosphere as per MIL-E-5400T paragraphs 3.2.24.7, 3.2.24.8, 3.2.24.9, and 3.2.24.10.
- v. Up to 100 percent relative humidity as per MIL-E-5400T, paragraph 2.24.2.

ENVIRONMENTAL HOUSING

1. General -

- a. Each camera and lens shall be mounted in a sealed, cylindrical, environmental housing which shall not exceed 165 mm in diameter and 560 mm in length.
- b. The housing shall be fabricated of seamless aluminum tubing Type 6061-T6 and shall be finished with heat reflecting, weather resisting enamel. The rear plate shall be fabricated of Type 6061-T6 aluminum.
- c. The front of the housing shall be closed with a clear optically flat glass or Lexan window.
- d. The housing shall include a sun shroud which shall be strapped to the housing bindings in such a manner as to minimize heat conduction by maintaining air space between shroud and housing. The shroud shall shield the entire top portion of the housing from the sun, and shall extend a minimum of 76 mm in front of the housing's glass plate.
- e. The housing shall not interfere with the widest viewing angle of the lens.
- f. The housing shall include a thermostatically controlled heating pad rated at 115 VAC, 100 W maximum.
- g. The backplate, which is an integral part of the housing, shall have a nameplate attached bearing the manufacturer's camera assembly model number and serial number.
- h. Camera connector -
 - i. The camera connector shall be designed to MIL-C-28462 Series 1 specifications with solder contacts. It shall be PT-07C-20-39 P, the male counterpart to PT-06A-20-39 S SR.
 - ii. The connector shall be made of the same shell material and pin arrangement as the PT-06A-20-39 S SR connector on the end of the wiring harness.
 - iii. The pinout of the connector shall be as shown on the plans.
 - iv. Each camera connector shall be mounted on the rear plate with an airtight connection and a watertight seal for each conductor on its connecting cable.
- i. Each camera shall be designed for operating with the housing purged of air and filled with dry nitrogen to 35 kPa.
- j. Valves -
 - i. The housing shall have two valves, both on the rear end plate of the housing.
 - ii. One valve shall be a standard Schrader valve. It shall have a tube running from the valve to the front end of the housing.
 - iii. The other valve shall be an air escape/pressure relief valve preset to 140 kPa.
 - iv. The two valves shall be arranged such that filling with dry nitrogen from the Schrader valve will force gas to flow from front end of the housing to the rear end and vent through the air escape valve.
 - v. The leakage rate with both valves closed and the housing pressurized to 70 kPa, shall leak less than 7 kPa per year, and less than 0.7 kPa per month.
- k. The enclosure shall be factory pressurized to 35 kPa with dry nitrogen.
- l. The notation "CAUTION PRESSURIZED" shall be printed on the rear plate of the enclosed.
- m. A safety pressure release bolt shall be incorporated such that the enclosure may not be opened without first releasing the internal pressure.
- n. A low-pressure (LP) sensor with related circuitry shall be provided to send an LP alarm (dry contact closure) via the camera connector. The LP sensor threshold shall be preset to activate the LP alarm at 14 kPa.
- o. Two units of desiccant shall be placed inside the housing but will not obstruct the camera view or operation.
- p. A humidity level indicator strip with discrete indications for 10, 20 and 30 percent humidity, shall be installed inside the housing in a position that allows inspection, while facing directly, through the window without obstructing the view of the camera at the widest viewing angle of the lens.

2. Mounting Base -

- a. A mounting base shall surround the enclosure to provide a tamper-resistant attachment of the environmental housing to the pan/tilt unit and securely hold the housing in either an upright or inverted position. The combined height of

camera housing and mounting base shall be less than 254 mm. The mounting base attachment shall be as shown on the plans.

- b. All fasteners and nuts used in attaching the mounting base to the environmental housing shall be of grade 18-8 stainless steel.
- c. Each camera unit shall be provided with three stainless steel hex head bolts to secure the camera unit to the pan/tilt unit.

CAMERA UNIT CABLE ASSEMBLY

1. General - Each camera unit cable assembly shall consist of box mounting socket connector and a wiring harness.
2. Box Mounting Socket Connector -
 - a. Each box mounting socket connector shall be MS-3102E-28-21S-F80.
 - b. One full set of crimp contacts shall be provided with each box mounting socket connector.
 - c. The pinout of the connector shall be as shown on the plans.
3. Wiring Harness -
 - a. The camera unit cable assembly wiring harness shall be 3 m long and shall be COHU AC27E or other cable approved by the Engineer. The coaxial cables' impedance shall be 75 . One end of each wiring harness shall be type PT06A-20-39S (SR) and shall mate with the camera connector. It shall have a 90-degree end bell, Bendix 10-25997-203 or equal, for strain relief. The end bell shall be positioned such that the opening is 180 degrees from the main key on the connector. The other end of each wiring harness shall be type MS-3106E-28-21P and shall mate with the box mounting socket connector.
 - b. All connectors shall be potted with an appropriate potting compound for environmental sealing.
4. All connectors' pinout shall be as shown on the plans.

For the purpose of payment, the camera unit shall include the testing of the camera unit before the units are to be delivered to the job site for installation.

Payment for the installation of the camera units is included in the contract lump sum price paid for traffic operations system at the location involved.

10-3.34 PAN AND TILT UNIT

General

- a. Each pan/tilt unit, with camera unit attached, shall pan 355 degrees minimum in either direction, and tilt 60 degrees minimum from horizontal position to either up or down positions.
- b. Each pan/tilt unit shall be capable of minimum ten preset positions for each pan and tilt operation.

Electrical

- a. Each pan/tilt unit shall operate with input voltage of 115 VAC, 60 Hz ± 0.3 Hz.
- b. Each pan/tilt unit shall not exceed 200 W power consumption.
- c. The motors shall be impedance overload protected, two phase induction type, rated for continuous duty and shall be instantaneous reversing.
- d. The limit switches shall be rated 5 A, 10 million cycles and with external adjustments.
- e. Each pan/tilt unit shall be provided with box-mounting type connector.
- f. One mating connector with full set of crimp contacts and strain relief shall be provided with the box-mounting connector.

Mechanical

- a. The maximum load shall be 45 kg at 127 mm from tilt table to center of gravity in both upright and inverted position.
- b. Each pan/tilt unit shall have maximum dimensions of 400 mm high, 355 mm wide and 230 mm deep.
- c. Each pan/tilt unit shall not exceed the maximum weight of 27 kg.
- d. Each pan/tilt unit shall be constructed in aluminum casting and plate. All internal parts shall be corrosion protected.

- e. Each pan/tilt shall have textured semi-gloss beige enamel finish.
- f. All bearings shall be heavy duty ball or roller bearing.
- g. All gears shall be hardened steel.
- h. All gasket seals shall be designed for all weather protection.
- i. Each pan/tilt unit shall have a mounting hole pattern as shown on the plans.
- j. Each pan/tilt unit shall have a minimum pan torque rating of 34 N·m and an instantaneous minimum tilt torque of 68 N·m.
- k. The pan speed at no load shall be 6 to 8 degrees per second, nominal.
- l. The tilt speed at no load shall be 3 to 4 degrees per second, nominal.

Environmental

- a. Ambient operating temperature shall be from -10°C to 50°C.
- b. It shall be able to withstand vibration of 760 µm total excursion from 5 to 30 Hz and a peak random vibration of 5 g from 30 to 1000 Hz.
- c. It shall be able to withstand shock up to 15 g in all axes under non-operating conditions, conforming to MIL-E-5400R, Para. 3.2.24.6.
- d. It shall be able to operate in atmospheres up to 95 percent relative humidity, conforming to MIL-E-5400R, Para 3.2.24.4.
- e. It shall be able to withstand exposure to sand, dust, fungus, and salt atmosphere, conforming to MIL-E-5400R, Para 3.2.24.7, 3.2.24.8 and 3.2.24.9.

Pan and tilt unit mounting

The nuts and bolts securing the pan and tilt unit to the camera platform shall be hex head and made of stainless steel. Before each bolt is fastened, a locking type coating shall be applied to the threads. The coating shall lock the bolts and nuts in place making it impossible to turn bolt or nut without tools. This coating shall last and be effective through at least 10 insertions and withdrawals of the bolt or nut.

For the purpose of payment, the pan and tilt unit shall include the testing of the pan and tilt unit before the units are to be delivered to the job site for installation.

Payment for the installation of the pan and tilt units is included in the contract lump sum price paid for traffic operations system at the location involved.

10-3.35 CAMERA JUNCTION BOX

The camera junction box (JCB) shall be constructed as shown on the plans and described in these special provisions. All seams shall be continuously welded. All JCB mounting Hex head stainless steel nuts and bolts shall be 6 mm -20 x 25 mm. Steel surfaces on which JCB is to be mounted shall be drilled and tapped 6 mm -20 thread. Each JCB shall be fabricated from 14-gage sheet steel. Two 8-32 threaded studs for terminal strip mounting shall be welded on the bottom of the box as shown on the plans. After fabrication the JCB shall be hot-dip galvanized.

A twenty position terminal block with No. 8 lugs and cover shall be mounted on the bottom of the box. Permanent terminal position markings shall be used. A laminated wiring schematic shall be permanently attached to the inside of box cover showing wiring from the camera unit box mounting connector to the terminal block.

10-3.36 INTEGRATED SERVICES DIGITAL NETWORK TERMINAL ADAPTER UNIT

General

- a. Each integrated services digital network terminal adapter (ISDN TA) unit shall provide an interface between data terminal equipment (DTE) such as the video encoder unit (VEU) or video decoder unit (VDU) and ISDN.
- b. Each ISDN TA unit shall include an internal network termination Type 1 device (NT1) interface and include Terminal Adapter functionality. No external NT1 shall be allowed.
- c. A prototype unit is not acceptable.
- d. Each ISDN TA unit shall be of the current standard production units.
- e. Each ISDN TA unit shall be new and not previously used.
- f. The Contractor shall provide a manual for each unit supplied.

Qualifying specifications

a. Operation --

- i. Each ISDN TA shall support ISDN basic rate interface (BRI) service and shall provide three digital channels capable of simultaneous data and voice transmission via a standard telephone line. The three channels shall include two Bearer (B) channels at 64 kbps and one Data (D) channel at 16 kbps (2B+D).
- ii. Leased operation shall support 1B (64 kbps) or 2B (128 kbps) clear channel synchronous configurations.
- iii. At data rates over 64 kbps, the BONDING delay equalization protocol shall synchronize data over the two B channels.

b. Data rates --

- i. Synchronous: 2.4, 4.8, 9.6, 19.2, 38.4, 48, 56, 64, 112, 128 kbps; selectable.
- ii. Asynchronous: 0.3, 1.2, 2.4, 4.8, 9.6, 19.2, 38.4, 57.6, 115.2 kbps; selectable.

c. Interoperability -- The ISDN TA unit shall support communications with public switched 56 kbps services and switched 56 kbps channel service unit/data service unit (CSU/DSU) as well as other ISDN TA, ISDN terminal equipment, and BONDING compatible inverse multiplexers.

d. D-Channel switch compatibility -- AT&T 5ESS, NTI DMS-100, National ISDN-1.

e. Dialing --Dialing shall be supported in the following ways:

- i. Manually from a front panel keypad.
- ii. Automatically from up to ten stored numbers.
- iii. Automatically through an RS-366 parallel dial port.
- iv. Dialing over the DTE interface using the asynchronous AT command set.
- v. V.25 bis in-band dialing over the DTE interface using V.25 bis commands.

f. DTE interface -- The ISDN TA shall provide both EIA-530A and V.35 interfaces. The interface to be used shall be selectable. A three meter male/female EIA-530 interface cable shall be provided with each ISDN TA.

g. Network interface -- Network termination shall be designed into the ISDN unit thereby eliminating the need for an external NT1. Connection to the network shall be made by a telephone company provided 2-wire and/or 4-wire 2B1Q U-interface which is connected directly to an eight-pin RJ45 modular jack on the rear panel of the ISDN TA unit. The ISDN TA unit shall provide two RJ45 modular jacks, where one jack shall be designated for dial-up ISDN and the other jack designated for leased ISDN. The dial-up ISDN and leased ISDN operational modes may be integrated on a single RJ45 jack if the operational modes are user selectable.

h. Local control facilities --Local operator control of all essential features of the ISDN TA unit shall be accomplished by the use of necessary discrete front panel controls.

i. Remote control facilities -- Remote configuration and control of the ISDN TA unit shall be possible using the AT command set in-band over the DTE interface. Remote call setup and termination shall also be possible using V.25 bis in-band dialing.

j. Diagnostics requirements -- Each ISDN TA unit shall be able to perform a variety of tests that allow problems to be identified and isolated. Testing shall be supported manually from the front panel, or in-band from either the network provider or distant end unit. Internal error checking shall be available for both the local and a remote activated digital loopback.

k. Physical --

- i. Each ISDN TA unit shall be secured and mounted on a shelf assembly.
- ii. Each shelf assembly shall provide for a minimum of four mounting screws in order to mount the shelf assembly in 89 mm (2 rack units) of EIA-310 rack space.

l. Electrical --

- i. Power input voltage shall be 115 VAC \pm 10 percent, 60 Hz.
- ii. Power dissipation shall not be greater than 8 W.

m. Environmental --

- i. Operating temperature: 0°C to 50°C, minimum.
- ii. Storage temperature: -20°C to 70°C, minimum.
- iii. Relative humidity: 0 to 95 percent, non-condensing.

For the purpose of payment, the integrated services digital network terminal adapter unit shall include the testing of the integrated services digital network terminal adapter unit before the units are to be delivered to the job site for installation.

Payment for the installation of the integrated services digital network terminal adapter unit is included in the contract lump sum price paid for traffic operations system at the location involved.

10-3.37 CAMERA CONTROL UNIT

General

Each part of each camera control unit (CCU) shall be electrically and physically interchangeable with the like part in any other CCU furnished under this contract.

Mechanical

- a. Each CCU shall mount in 133 mm of EIA-310 rack space with a maximum depth of 356 mm.
- b. The front panel shall be white gloss color Number 17886 as per Federal Standard Color Chart 595a.
- c. The front and rear panel lettering shall be black color Number 17986 as per Federal Standard Color Chart 595a.
- d. A high-impedance panel jack BNC (Bayonet Nut connector) connector shall be installed on the front panel as shown on the plans. This connector shall provide video input to a test monitor without affecting the remainder of the CCTV system. This connector shall be directly connected to the video input on the rear panel.
- e. A glass type, size 6.35 mm x 31.75 mm (AG) slow blow fuse shall be installed on the front panel. The fuse shall be replaceable from the outside of the front panel.
- f. Switches shall protrude no more than 25 mm from the front panel and shall be mounted as shown on the plans.
- g. The rear panel connectors shall be mounted as shown on the plans and shall meet the following requirements:
 - i. Connectors C1-C3 shall be of the following type or equivalent:

C1	AMP 206430-1
C2	AMP 206043-1
C3	AMP 206306-1

- ii. The pin and socket contacts for connectors C1-C3 shall be constructed with brass contact body material and with stainless steel spring that are sub-plated with 1.27 µm nickel and plated with 0.762 µm gold. Pin diameter shall be 1.575 mm. Contact size shall be 16.
 - iii. Each C1, C2 and C3 connector shall use the AMP No. 601105-1 or No. 91002-1 contact insertion and the AMP No. 305183 contact extraction tool.
 - iv. One mating connector with a full set crimp contacts and strain relief shall be supplied with connectors C1, C2 and C3.
 - v. The connectors C4 and C5 shall be a DB-25 socket connector.
- h. Serial cable assemblies (SCA1 and SCA2) with length of 3 m shall be provided to mate with C4 and C5, respectively.
 - i. Pin and socket contacts for DB-25 connectors shall be copper alloy body; finished with 0.762 µm gold over 1.27 µm nickel.
 - j. The rear and front panel BNC connectors shall be of copper material with bright nickel (tarnish resistant) finish for the body and silver finish for the contact.
 - k. Each printed circuit board shall be vertically installed.
 - l. Each LED shall be equal to Hewlett Packard High Intensity Red Untinted, Non-diffused LED (Part Number HLMP-D105). Each LED shall be mounted as shown on the plans.
 - m. A front panel on/off switch shall turn the CCU on/off and shall also control AC power to the rear panel power output connector (C1). The indicator used for AC power shall be green when energized.
 - n. One coaxial cable labeled "AVO" (Analog Video Output) terminated with BNC plug connectors on each end shall be provided. This cable shall be RG-59/U with overall length of one meter.

Electrical

- a. Each CCU shall have auto-iris override.
- b. Each CCU shall have circuitry to detect the absence and presence of video sync on its video input. Each CCU shall also have circuitry to monitor the low-pressure alarm contact closure from the camera unit. A local/remote control switch shall be provided to override the lens and pan/tilt controls through C4 when the switch is in local mode. When in local mode, the local control alarm shall be active. Alarm status shall be constantly monitored and updated. Upon receipt of a "status query" message, the CCU shall send alarm status message with data as follows:

"0"	None of the alarms active.
"1"	Local Control (LC) alarm active.
"2"	Low Pressure (LP) alarm active.
"3"	LP/LC alarms active.
"4"	Video Sync Absence (VSA) alarm active.
"5"	VSA/LC alarms active.
"6"	VSA/LP alarms active.
"7"	VSA/LP/LC alarms active.

The front panel alarm light shall be lit if any the alarms are active.

- c. Each CCU shall have circuitry for a source character generator. The source character generator shall display 16 alphanumeric characters superimposed on the video image. Each character shall be 28 TV lines high and shall be derived from a standard 5 x 7 dot matrix. The programmed characters shall be stored in a non-volatile memory. Upon receipt of "Set ID" message, the CCU shall position from the camera ID in the video image as follows:

"1"	Upper 15% limit of the left viewing area
"2"	Upper 15% limit of the right viewing area
"3"	Lower 15% limit of the left side viewing area
"4"	Lower 15% limit of the right side viewing area

The characters shall be superimposed on the video signal using non-additive mixing techniques.

- d. Each CCU shall be designed to prevent simultaneous operation of pan right/left, tilt up/down, zoom in/out, focus near/far or iris open/close.
- e. Each CCU shall have power supply(ies) for camera zoom, focus, motors, control and interface circuits. The voltage for zoom, focus and iris shall be selectable internally by one jumper for 12.0 VDC, 9.0 VDC or 5.0 VDC at 100 mA. The CCU shall be pre-configured with the voltage jumper select set to 9.0 VDC. The operation of zoom, focus and iris shall be as follows:

Zoom in	+VDC
Zoom out	-VDC
Focus near	+VDC
Focus far	-VDC
Iris close	+VDC
Iris open	-VDC

- f. The maximum power consumption for the CCU shall not exceed 450 W. Power consumption of equipment attached to pin 1 of connector C1 shall not exceed 100 W. Power consumption of equipment attached to pin 12 of connector C2 shall not exceed 200 W.
- g. Each CCU shall have eight independently operating 24 VDC relays (options 1 to 8). Each relay shall be single pole, double throw (SPDT), with contacts rated 1.25 A at 120 VAC.
- h. Each CCU shall be capable of a minimum of ten presets and capable of controlling camera units and pan/tilt units equipped with pre-positioning feedback potentiometers. Each CCU shall have circuitry to filter out any electrical noise interference on each of the pre-positioning feedback voltage signal for the camera unit and pan/tilt unit.
- i. A system reset switch shall be a momentary-pushbutton type and be mounted on the front panel to function as external reset input to the microprocessor. System reset shall not cause existing pan/tilt and lens positions to change. System reset shall be executed without requiring the operator to hold the momentary-pushbutton for more than one second.
- j. The front panel of the camera control unit shall have LEDs and switches to provide the following control functions as shown on the plans.

Function	Hardware	Indicator
Zoom (In/Off/Out)	(ON)-OFF-(ON)	2 LED
Focus (Near/Off/Far)	(ON)-OFF-(ON)	2 LED
Pan (Left/Off/Right)	(ON)-OFF-(ON)	2 LED
Tilt (Up/Off/Down)	(ON)-OFF-(ON)	2 LED
Iris (Open/Off/Close)	(ON)-OFF-(ON)	2 LED
Iris override (Manual/Auto)	ON-OFF	1 LED
Option 1 (On/Off)	ON-OFF	1 LED
Option 2 (On/Off)	ON-OFF	1 LED
Option 3 (On/Off)	ON-OFF	1 LED
Option 4 (On/Off)	ON-OFF	1 LED
Option 5 (On/Off)	ON-OFF	1 LED
Option 6 (On/Off)	ON-OFF	1 LED
Option 7 (On/Off)	ON-OFF	1 LED
Option 8 (On/Off)	ON-OFF	1 LED
Alarm (On/Off)	ON-OFF	1 LED
Control (Local/Remote)	ON-OFF	
Reset	(ON)-OFF (momentary pushbutton)	

k.

CCU connector assignments	
C1	4 contact connector
C2	14 contact connector
C3	37 contact connector
C4, C5	DB-25 connectors

C1 -- AC Power	
Position	Function
1	AC +
2	AC -
3	Equipment Ground
4	NA

C2 -- Pan/Tilt			
Pos.	Function	Pos.	Function
1	Pan right	8	Pan feedback
2	Pan left	9	Tilt feedback
3	AC-	10	Preset -VDC
4	Tilt up	11	NA
5	Tilt down	12	AC+
6	AC-	13	AC-
7	Preset +VDC	14	Ground

C3 -- Camera			
Pos.	Function	Pos.	Function
1	Zoom	20	Option 3 N.O.
2	Z/F/I Common	21	Option 3 Common
3	Focus	22	Option 3 N.C.
4	Iris	23	Option 4 N.O.
5	Iris Override Common	24	Option 4 Common
6	Iris Override	25	Option 4 N.C.
7	Preset +VDC	26	Option 5 N.O.
8	Zoom Preset feedback	27	Option 5 Common
9	Focus Preset feedback	28	Option 5 N.C.
10	Preset -VDC	29	Option 6 N.O.
11	LP alarm	30	Option 6 Common
12	LP alarm	31	Option 6 N.C.
13	NA	32	Option 7 N.O.
14	Option 1 N.O.	33	Option 7 Common
15	Option 1 Common	34	Option 7 N.C.
16	Option 1 N.C.	35	Option 8 N.O.
17	Option 2 N.O.	36	Option 8 Common
18	Option 2 Common	37	Option 8 N.C.
19	Option 2 N.C.		

Note:

N.O. = Normally open

N.C. = Normally closed

NA = Not Available

C4, C5 -- Serial communication ports to and from external device.			
Pos.	Function	Pos.	Function
1	NA	14	NA
2	Transmit Data	15	NA
3	Receive Data	16	NA
4	NA	17	NA
5	NA	18	NA
6	NA	19	NA
7	Signal Ground	20	NA
8	NA	21	NA
9	NA	22	NA
10	NA	23	NA
11	NA	24	NA
12	NA	25	NA
13	NA		

Serial cables			
SCA1		SCA2	
DB-25 Pin	DB-25 Pin	DB-25 Pin	DB-25 Socket
2	2	2	2
3	3	3	3
7	7	7	7

Environmental

- a. Each CCU shall operate in an ambient temperature environment of -10°C to 50°C.
- b. Each CCU shall conform to MIL-STD-810D-516.1 and MIL-STD-810D-514.1 shock and vibration test.

CCU messages

- a. Each CCU shall communicate through the C4 serial port with the following communication message codes:

DIREC-TION	MESSAGE	CHARACTER		DATA
		1ST CODE	2ND CODE	
Transmit	Alarm status	A	space	"0"-"7"
Receive	Status query	Q	space	NONE
Receive	Pan stop	p	space	NONE
Receive	Tilt stop	t	space	NONE
Receive	Zoom stop	z	space	NONE
Receive	Focus stop	f	space	NONE
Receive	Iris stop	i	space	NONE
Receive	Pan left	L	space	NONE
Receive	Pan right	R	space	NONE
Receive	Tilt up	U	space	NONE
Receive	Tilt down	D	space	NONE
Receive	Zoom in	I	space	NONE
Receive	Zoom out	O	space	NONE
Receive	Focus near	N	space	NONE
Receive	Focus Far	F	space	NONE
Receive	Iris open	J	space	NONE
Receive	Iris close	K	space	NONE
Receive	Iris manual	M	space	NONE
Receive	Iris auto	m	space	NONE
Receive	Set ID word	C	"1"-"4"	16-ASCII char.
Receive	Home position 0-9	H	"0"-"9"	NONE
Receive	Home position program 0-9	P	"0"-"9"	NONE
Receive	Option on 1-8	S	"1"-"8"	NONE
Receive	Option off 1-8	s	"1"-"8"	NONE
Receive	Enter Echo mode	E	space	NONE
Receive	Exit Echo mode	^]C	This sequence is not in a communication packet	

- b. After receiving the "enter echo" command the CCU shall pass all characters from C5 to C4 and C4 to C5. The CCU shall disable all camera movement.
- c. When the "exit echo" mode sequence is received on C4, the CCU shall return to normal operation.

Serial communications protocol

- a. The communication protocol shall consist of 8 data bits, 1 stop bit and no parity.
- b. Communication handshaking shall use XON/XOFF.
- c. The communication packet shall contain the following items: ADDRESS, CODE, DATA, CHECKSUM, CR. The packet is sent as a string of ASCII printable characters. The ADDRESS, which has its \$80 bit set in order to signal the start of the packet. The CHECKSUM is generated by Exclusive-ORing the ADDRESS, CODE, and DATA. The communication byte count shall be as follows:

ADDRESS	1
CODE	2
DATA	0
CHECKSUM	2
CR	1

- d. The receiver will compute the CHECKSUM. If the computed CHECKSUM is correct the receiver will send ACK, otherwise the receiver will send NAK.

For the purpose of payment, the camera control unit shall include the testing of the camera control unit before the units are to be delivered to the job site for installation.

Payment for the installation of the camera control unit is included in the contract lump sum price paid for traffic operations system at the location involved.

10-3.38 VIDEO ENCODER UNIT

General

- a. A prototype of the video encoder unit (VEU) is not acceptable.
- b. All equipment shall be off the shelf production units.
- c. All equipment shall be new and not previously used.
- d. The Contractor shall provide a manual per each unit ordered.

Acceptable equipment

The VEU shall be compatible and interoperable with the existing video decoder unit (VDU), Enerdyne Technologies Model DEC1000R5. No other VEU/VDU pairs shall be different or deviate from other pairs.

Qualifying specifications

- a. Video encoding --
 - i. The VEU shall replicate the adaptive digital video standard (ADVS) for digital compression and transmission of video images.
 - ii. The VEU shall implement frame sensitive algorithms, joint photographic experts group (JPEG) to perform frame updating. Motion sensitive algorithms motion picture experts group (MPEG) shall not be allowed.
 - iii. The VEU shall be compatible with integrated services digital network (ISDN) basic rate interface at 128 kbps and shall comply with bandwidth on demand interoperability group (BONDING) protocol.
 - iv. The VEU shall be compatible with Switched-56 digital service at 56 kbps.
 - v. The VEU shall be compatible with advanced digital network (ADN) service at 56 kbps.
 - vi. The VEU shall be compatible with T1 service at 1.544 Mbps.
- b. Physical -- The physical size of the VEU shall be as follows:

Weight	9 kg, maximum
Height	135 mm, maximum
Width	483 mm, maximum
Depth	300 mm, maximum

- c. Mounting --
 - i. The VEU shall be mountable in a standard EIA-310 equipment rack.
 - ii. Each VEU shall be designed and mounted in such a way that it is easily accessible for maintenance.
- d. Primary power input and output requirements --
 - i. All electrical power distribution, service and wiring components shall be UL listed or equivalent and meet the requirements of the national electric code as well as these special provisions.

- ii. Power input shall be 100 to 130 VAC at 60 Hz \pm 3 Hz.
- iii. Maximum power requirement shall be 25 W at 120 VAC.

e. Local control facilities --

- i. Local operator control of all essential features of the VEU shall be accomplished by the use of necessary discrete front panel controls and/or switches. Each VEU shall have a front panel status display.
- ii. The VEU shall store operator set default parameters in EEPROM to retain system configuration after loss of power. These parameters shall be loaded into volatile RAM during operation where they may be modified by operator set operational parameters.
- iii. The VEU shall have a front panel status display.

f. Remote control facilities --

- i. The control/status ports shall be EIA-232 with selectable data rates of 1200 to 9600 bps and the connector shall be a DB-25 type.
- ii. The control/status ports shall provide telephone dialing, remote and local diagnostics testing, and system configuration.
- iii. The control/status port shall provide selection of any of the video inputs.
- iv. The control/status port shall provide in-band dialing for all interfaces using the AT and/or V.25 bis command set.
- v. The control/status port of the VEU shall override in-band control of the VEU via the VDU.
- vi. The control/status port shall provide selection of all network interface data rates and/or services.
- vii. The control/status port shall provide user selectable video resolution. Minimum resolution settings shall be 560 (high), 280 (standard), and 140 (low) pixels per line.
- viii. The control/status port shall provide user selection of 480 lines interlaced (frame mode) or 240 lines non-interlaced (field mode).
- ix. The control/status port shall provide user selection of the compression algorithm quantization levels (Q-factor).
- x. The control/status port shall provide cropping of the encoded video image at minimum of 104 percent (overscan), 100 percent, 85 percent, and 63 percent.
- xi. The control/status port shall provide control over image attributes including, but not limited to, color hue, tint, and saturation. Section of monochrome or color of the VEU digitized video stream shall also be possible.

g. Video interface requirements --

- i. The VEU shall be capable of both color and black/white video operation without modification to the hardware. Minimum motion video resolution shall be 560 pixels x 240 lines for the 525 lines, National Television Systems Committee (NTSC) standard, 60 Hz, composite input. Motion handling capability shall be up to 30 frames per second.
- ii. The video interface formats shall be the following:

Composite	525 line NTSC 60 Hz
Component	Y/C: Luminance / Chrominance

- iii. The video input for the VEU shall be compatible with EIA-170 at 75 Ω impedance with Bayonet Nut Connector (BNC) type connectors and shall be provided as a minimum the following:

3 video inputs composite
3 video input Y/C

- iv. All video inputs shall be software selectable from the front panel on the VEU and from the control/status port.

h. Network interface requirements --

- i. The VEU shall have hardware and software selectable network bit rates with the following as a minimum: 56 kbps, 64 kbps, 112 kbps, 128 kbps, 384 kbps, 768 kbps and 1.544 Mbps (T1).
- ii. The VEU shall have three network interfaces: EIA-530A, DS-1 (T1 service), and V.35.

iii. The VEU shall transmit compressed and digitized video at a minimum of 95 percent of the available channel bandwidth, whenever bandwidth is not used by telephone, camera controls and or remote diagnostics.

i. Diagnostic and alarm requirements --

- i. The VEU shall have self-diagnostic features display on the front panel.
- ii. The VEU shall blank video on loss of video input.
- iii. The VEU shall regain video lost due to excessive temperature when the temperature has reduced to 69°C.

j. Telephone interface --

- i. The VEU shall provide an RJ11 telephone jack for voice communication.
- ii. The VEU shall provide 16 kbps bandwidth for telephone within the bandwidth allocated for video only when bandwidth is needed for telephone.

k. Camera control interface --

- i. The camera control interface shall provide a half-duplex clear channel for camera control and status user data with the following requirements:

The port shall communicate at a user selectable data rate from 1200 to 9600 bps, asynchronous.
--

The port shall be EIA-232, and the connector shall be a DB-25 type.

- ii. The VEU shall provide bandwidth for camera control within the bandwidth allocated for video only when bandwidth is needed for camera control/status data transmission.

l. Environmental --

- i. Minimum operating temperature range shall be from -40°C to 70°C ambient, with guaranteed start up at -10°C. An environmental housing with air conditioning will not be allowed.
- ii. Operating humidity shall be from 0 to 95 percent, non-condensing.

Accessory items

The following VEU equipment accessory items shall be supplied by the Contractor as specified in these special provisions:

- 1. Service and Operations manual describing the video VEU as ordered and in accordance with these special provisions.
- 2. EIA-530A cable assembly shall be provided to connect the VEU to the integrated services digital network terminal adapter (ISDN TA) unit with basic rate interface that is specified elsewhere in these special provisions.

For the purpose of payment, the video encoder unit shall include the testing of the video encoder unit before the units are to be delivered to the job site for installation.

Payment for the installation of the video encoder unit is included in the contract lump sum price paid for traffic operations system at the location involved.

10-3.39 BRIDGE CONTROLLER CABINET INSTALLATION

GENERAL.--Each bridge controller cabinet installation shall consist of the following components, function as described in these special provisions, and as shown on the plans:

- 1. One Type 334 Controller Cabinet.
- 2. Circuit breakers as required.
- 3. Conduits and power conductors.

INSTALLATION OF BRIDGE CONTROLLER CABINET.--The work to be done at locations 10, 13, 15, 17 and 19, shall consist of the following:

1. Install Type 334 Controller Cabinet.
2. Install conduits and power conductors from substation power panel to controller cabinet.
3. Install circuit breaker in substation power panel.
4. Terminate power conductors in the substation power panel.
5. Terminate power conductors at the controller cabinet.

The work to be done at Locations 7, 9, 11, 12, 14, 16, 18, and 20 shall consist of the following:

1. Install Type 334 Controller Cabinet.
2. Install conduits and power conductors from utility output service (UOS) to controller cabinet.
3. Terminate power conductors at the UOS.
4. Terminate power conductors at the controller cabinet.

The work to be done at Location 8 shall consist of the following:

1. Install Type 334 Controller Cabinet.
2. Install UOS 2 in Substation 2.
3. Install conduits and power conductors from UOS 2 to controller cabinet.
4. Install conduits and power conductors from substation power panel to UOS 2.
5. Install circuit breaker in substation power panel.
6. Terminate power conductors in the substation power panel.
7. Terminate power conductors at the UOS 2.
8. Terminate power conductors at the controller cabinet.

The Contractor shall secure Type 334 Controller Cabinets to platform floors by 4 each 19-mm x 30-mm bolts (similar spacing as 334 cabinet foundation as shown on ES-3C).

10-3.40 CAMERA POLES

Camera poles shall conform to the provisions in Section 86-2.04, "Standards, Steel Pedestals and Posts," of the Standard Specifications.

10-3.41 SERVICE MANUAL REQUIREMENTS

The Contractor shall provide to the Engineer a minimum of five copies of service manuals for the camera unit, pan/tilt unit, camera control unit (CCU), video encoder unit (VEU), and integrated services digital network terminal adapter (ISDN TA) unit under these special provisions. Each manual shall contain the following sections and sub-sections.

General information section

- a. A list of applicable subassemblies that comprise the specified equipment.
- b. Overall description of the equipment design features (including all enhance features if applicable), performance, and applications.
- c. Equipment specifications summary.
- d. Equipment installation instructions.

Theory of operations section

- a. Theory of operation of the standard equipment, with unique or unusual circuitry described in detail.
- b. Theory of operation that reflects all modifications to the standard equipment.

Maintenance section

- a. Recommended test equipment and fixtures, or minimum operational and performance requirements for appropriate test equipment.
- b. Trouble shooting information and charts.

- c. Removal and installation procedures for replacing assemblies and subassemblies if not obvious or if improper sequencing of steps may result in component damage.

Replacement parts section

- a. Each manual shall contain an equipment replacement parts list including electrical parts, mechanical parts and assemblies.
- b. All semiconductors shall be identified by the supplier's numbers and by JEDEC numbers if applicable.

Diagram section

- a. Schematic diagram(s) identifying all circuit components and showing normal test voltages and levels.
- b. An overall functional block diagram.
- c. Detailed interconnecting diagram(s) showing wiring between modules, circuit boards and major components.
- d. Pictorial circuit board layout diagram(s) showing both component placement and printed wiring detail.
- e. Diagram(s) showing location of circuit boards and other subassemblies.
- f. Exploded view diagram(s) of complex mechanical assemblies.

Physical requirements

- a. All pages, including latest revisions, shall be securely fastened together between protective covers (loose-leaf ring binding is acceptable).
- b. No page shall be subject to fading from exposure to any normal source of ambient lighting (ozalid or equal reproduced pages are not acceptable).

10-3.42 HIGHWAY ADVISORY RADIO SYSTEM

Highway advisory radio (HAR) equipment will be State-furnished as provided under "Materials" of these special provisions. The Contractor shall install the HAR system, including the State-furnished HAR equipment, and the following equipment, specified elsewhere in these special provisions, as described herein and as shown on the plans:

1. One HAR grounding system.
2. One fiberglass HAR pole.
3. One HAR arrestor enclosure.
4. One HAR antenna coaxial cable (ACC).
5. One HAR antenna feeding cable (AFC).
6. Coaxial cable connectors for type ACC and FCC.

GROUNDING SYSTEM.--The grounding system shall consist of single ground rod system as specified in these special provisions and as shown on the plans. All hardware and connectors required to connect the grounding system to the HAR equipment shall be included. The grounding system shall allow the maximum FCC field strength to be achieved on any frequency from 530 kHz to 1710 kHz with 10 W or less of output power.

SINGLE GROUND ROD SYSTEM.--The single ground rod system shall consist of a 12 m ground rod placed in a 150 mm, minimum, vertically drilled hole. The hole shall be backfilled with bentonite slurry.

The ground rod shall be a UL listed ground electrode designed for the purpose. The Contractor shall provide the Engineer a certificate of compliance from the manufacturer in accordance with the provisions of Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for the ground rod and bentonite backfill material. The certificate of compliance shall be provided to the Engineer for approval, prior to ordering or shipping the material.

The ground rod shall be a nominal 54 mm outside diameter hollow tube of Type K copper, with nominal 2.11 mm wall thickness, 12 m in length. A rod formed from two 6 meter sections and joined with an outside threaded copper coupler will be acceptable. The top end of the rod shall have a shop welded ground connection with a 4/0 gage, minimum, copper pigtail. The ends of the rod shall have press-on end caps.

The breather and weep holes on the top and bottom of the rod, as shown on the plans, shall be protected with tape until the installation of the rod. The Contractor shall remove the tapes and provide them to the Engineer before installation.

The drilled hole shall be backfilled with 100 percent bentonite clay slurry and consolidated around the rod. The bentonite slurry shall be placed in the presence of the Engineer. Two working days notice shall be provided to the Engineer prior to backfilling.

The bentonite backfill material shall be a natural volcanic, non-corrosive form of bentonite clay grout. The backfill material shall be capable of absorbing 50 liters of water per 22.78 kg to obtain an optimal 30 percent solids density. The pH value shall be between 8 to 10 with maximum resistivity of 3 -cm at 30 percent solids density.

The ground rod shall be connected to a surge arrester ground lug. The ground wire splice to the pigtail shall be made by a UL listed exothermic (Cadweld, or similar) connection method. Soldering, brazing, or field welding will not be acceptable.

The ground rod shall be filled with non-hazardous Calsolyte to enhance grounding performance. The filler shall hygroscopically extract moisture from the air to activate the electrolytic process, improving ground performance. The ground rod system shall be 100 percent self activating and maintenance free. No additions of chemicals or water solutions shall be required.

PROTECTIVE PULL BOX.--The protective pull box shall be made of reinforced concrete with lift holes and a vented cast iron grate cover to permit air circulation into the "breather" holes of the ground rod(s).

FIBERGLASS HIGHWAY ADVISORY RADIO (HAR) POLE.--Standards will be fiberglass-reinforced thermosetting plastic (FRP) poles as follows:

- a. Fiberglass HAR standards shall consist of round, fiberglass-reinforced thermosetting plastic poles. FRP poles shall be hollow, tapered or with tapered sections, non-conductive and chemically inert.
- b. FRP HAR pole standards shall conform to the details shown on the plans, and shall comply with requirements in the ASSHTO manual titled "Standard Specifications for Structural Supports for Signs, Luminaries, and Traffic Signals" (1985) and ANSI Roadway Lighting Document C136.20, "Fiber-Reinforced Plastic (FRP) Lighting Poles."
- c. FRP HAR standards specified as "Breakaway" types shall also comply with the requirements in the National Cooperative Highway Research Program Report 230, "Recommended Procedures for the Safety Performance Evaluation of Highway Appurtenances." Design wind velocity for HAR standard systems shall be 129 km/hr.
- d. The pole shall withstand the bending strength test load shown in the following table. The pole shall withstand this load with the handhole in compression. The pole shall not exceed a maximum deflection of 13 percent of the length of the pole above the ground line when subjected to the deflection test load shown in the following table.

TEST LOAD TABLE		
Standard Pole Type	Bending Strength Test Load	Deflection Test Load
Type 15, Type 15F (Breakaway)	2407 N	1606 N
Type 21F, Type 21F (Breakaway)	2563 N	1907 N

Test loads shall be applied according to Section 12, "Pole Deflection Measurements," of ANSI C136.20. Poles shall be loaded 305 mm below the tip.

FRP standards shall be the anchor base type unless otherwise indicated.

The manufacturer shall have a testing and quality control program approved by the Transportation Laboratory and shall submit samples of the base plate to the Transportation Laboratory prior to fabricating standards for this contract. Testing and quality control program and base plate samples shall be submitted to:

Transportation Laboratory
P.O. Box 19128
5900 Folsom Boulevard
Sacramento, CA 95819

The Contractor shall provide the Engineer a Certificate of Compliance from the manufacturer in accordance with the provisions of Section 6-1.07, "Certificates of Compliance," of the Standard Specifications. The certificate shall also include a copy of all applicable test reports on the HAR or lighting standards. The test reports shall be signed by the manufacturer's management person responsible for the tests. Said certificate shall also certify that the HAR standards comply with the requirements of the specifications and were manufactured in accordance with the approved testing and quality control program.

POLE CONSTRUCTION.--The pole shall be constructed from ultraviolet-resistant resin which shall be pigmented light gray and be of uniform color throughout the entire body of the pole. The finish of the pole shall be smooth.

Each pole shall have three handholes and handhole covers. The cover over the handhole nearest the base shall bear the name of the manufacturer. The handhole covers shall be securely attached to the pole with tamper-resistant hardware. The handholes shall be located as shown in the plans.

The base shall be bonded to the pole with a suitable adhesive, and coated with an aliphatic-type acrylic-modified polyurethane finish. For new installations, adaptor plates shall not be used to attach the standard to the foundation.

Each standard shall be provided with a removable aluminum or galvanized steel pole top cap.

Each standard shall have an identification plate conforming to the provisions in the second paragraph of Section 86-2.04, "Standards, Steel Pedestals and Posts," of the Standard Specifications. The identification plate shall show the standard type, manufacturer's name, manufacturer's part number and the year of fabrication. If the HAR pole standard is a breakaway type, the identification plate shall include the word "BREAKAWAY". The plate shall be located either on the anchor base or just above the base handhole.

EXTERIOR PROTECTION.--An aliphatic-type acrylic-modified polyurethane coating shall cover the exterior of the fiberglass pole. The coating shall be semi-gloss, highly weather resistant and light gray in color matching the color of the resin and shall have a minimum 76.2 µm dry film thickness. A one-quart can of the coating to match the poles shall be supplied with each order of poles. Adhesion of the polyurethane coating to the pole surface shall be assessed by conducting a test according to ASTM Designation D3359, Method A. Adhesion testing shall be conducted both before and after accelerated weathering evaluation. A scale rating of 5A is required in both tests for adhesion to be deemed satisfactory.

The finished surface of the pole shall be capable of withstanding a minimum of 2500 hours of accelerated weathering when tested in accordance with ASTM Designation: G 53. Lamps shall be UV-B (313 nm wave length). The testing cycle shall be 4 hours UV at 60°C, then 4 hours CON at 40°C.

After testing, the finished surface of the pole shall exhibit the following:

Fiber exposure:	None
Crazing:	None
Checking:	None
Chalking:	Very slight
Change in color:	May dull slightly
Paint adhesion:	5A scale rating, per ASTM D3359, Method A using Permaceel 99 tape.

PACKAGING.--Each pole shall be spiral wrapped in its entirety with a weatherproof wrap for protection during shipping and storage.

ARRESTOR ENCLOSURE.--The arrestor enclosure shall be a NEMA Type 3R with hinged cover, with dimensions of 380 mm x 300 mm x 150 mm, and shall have provisions for padlocking. A 100 mm x 100 mm x 3 mm aluminum plate shall be installed vertically, facing the door, in the enclosure. The Contractor shall terminate the ground conductor with an aluminum-copper NEMA one-bolt hold tongue. The ground conductor and lightning arrestor shall be mounted on the aluminum plate.

ANTENNA COAXIAL CABLE (ACC).--Type ACC shall consist of an RG-8/U single foil single braid flexible coaxial cable with a solid bare copper center conductor, Cellular Polyethylene dielectric, 97 percent tinned copper braid, and 100 percent shield coverage and shall conform to the following requirements:

Electrical Characteristics	
Capacitance	75 pF/m (nominal)
Impedance	50 (nominal)
Velocity of propagation	78% (nominal)
DC loop resistance	0.004 /m (nominal) @ 20° C.

Attenuation at 20° C.	
Frequency (MHz)	Nominal dB/100 m
10.0	0.016
50.0	0.039
100.0	0.052
200.0	0.079

Physical Dimensions	
	Nominal O.D. (mm)
Center conductor	2.62
Dielectric	7.24
Outer jacket	10.29

ANTENNA FEEDING CABLE (AFC).--The AFC shall consist of a No. 12 AWG solid copper conductor. The AFC shall have a length necessary to connect the lighting arrestor and the antenna without causing stress to the cable and shall be terminated with a UG plug and a reducing adapter as specified elsewhere in these special provisions.

After installing the AFC between the arrestor enclosure and the antenna, the Contractor shall seal the 40 mm nipple near the top of the fiberglass pole.

COAXIAL CABLE CONNECTORS (FOR TYPE ACC AND AFC).--Coaxial cable connectors for attaching type ACC and AFC including the reducing adapter shall be UG Standard and meet the following requirements:

Electrical Characteristics	
Impedance:	50 (nominal)
Frequency range:	0 to 300 MHz
Voltage rating:	500 V peak

Mechanical	
Mating:	Standard size: 5/4- 24 threaded coupling. Push-on mates with any standard size threaded receptacle
Method of attachment:	Clamp and crimp.
Composition:	Bodies- Brass or die cast zinc Contacts- brass, silver plated Insulators- TFC, copolymer of styrene, polystyrene, mica-filled phenolic and/or, PBT polyester or equal Plating- ASTRO plate and silver Other metal parts- Brass

Environmental	
Temperature	-55°C to +165°C.
Moisture	Weather resistant design.

HAR SYSTEM INSTALLATION.--The Contractor shall provide a crew with experience installing RF systems similar to the HAR and any work on the transmitter (adjustments) must be performed by, or under the immediate supervision of a person holding a general class radio telephone operators license.

The Contractor shall terminate the power conductors on the terminal block TBS and the telephone cable on the terminal block TB0 of the Type 334 controller cabinet.

GROUNDING SYSTEM TESTING.--The Contractor shall take certified measurements before and after the installation of the grounding system.

The testing shall utilize an earth resistance meter and be conducted in accordance with IEEE Standard 3-point fall of potential method.

The Contractor provide all test equipment, take and document resistivity measurements on the grounding system as shown on the plans and these special provisions and submit them to the Engineer for approval.

CABLE TESTING.--The ACC shall be tested by the Contractor. Any cable found to have faults shall be replaced. The testing shall utilize a time domain reflectometer.

For the purpose of these special provisions, a fault in a length of cable is defined as any of the following:

1. A return loss measurement indicating that there is a short in the cable.
2. A return loss measurement indicating a cut or open circuit in the cable.
3. A visual inspection which reveals exposure or damage to the cable shielding.

HAR SYSTEM TESTING.--After the completion of all work under "HAR SYSTEM INSTALLATION," each system shall be tested by the Contractor.

Minimum test equipment required for the testing shall consist of:

1. Dummy load, 50 .
2. Power meter.
3. Communications monitor.
4. Field strength meter.

The Contractor shall tune the HAR system with the impedance matching network of the coupling unit and by adjusting the stainless steel tip of the antenna.

The HAR system shall be considered tuned when the system's voltage standing wave ratio (VSWR) is at a lowest possible value as directed by the Engineer.

After the system has been tuned, the Contractor shall record and transmit a test message with the output power level of the transmitter set at approximate 10 W or lower. Modulation shall be adjusted between 85 to 95 percent as specified by the FCC for the standard AM broadcast band.

The Contractor shall make actual on-the-air field strength measurements. A sufficient number of points must be selected to determine the distance at which the attenuated field of 2 mV/m exists, as measured with a calibrated standard field strength meter. This may be done in a 5 to 8 radial directions facilitating a plot of a 2 mV/m at a distance of 1.5 km from the antenna. If the measured field exceeds 2 mV/m at a distance of 1.5 km, the transmitter output power must be decreased accordingly and if the measured field is less than 2 mV/m at the same distance then the power may be increased as directed by the Engineer.

At the completion of all HAR system testing as specified in these special provisions, the Contractor shall submit a written report of all measurements to the Engineer for approval. The report shall include a map showing a 2 mV/m contour based on the actual on-the-air field strength measurements. The VSWR, percent modulation and transmitter output power measurements shall be tabulated.

Full compensation for highway advisory radio (not including State-furnished material) shall be considered as included in the contract lump sum price paid for traffic operations system (location 21) and no separate payment will be made therefor.

10-3.43 SHORT-HAUL MODEM

Each short-haul modem (SHM) shall be asynchronous and provide point-to-point communications at distances of 30 meter to 16 km. The SHM shall be 4 wire, full duplex and shall transmit at data rates from 300 bps to 19.2 kbps. The SHM shall operate over private twisted pair, loaded local loops, or the telephone company (TELCO) area data channels. The SHM shall have complete LED indicators for power on and modem status. The SHM shall be equivalent in physical quality and performance of the "Black Box Corporation SHM-B Asynchronous Short-Haul Modem." The SHM shall also meet the following specifications:

1. Physical specifications.--Each SHM shall have maximum dimensions of 40 mm (high) x 12 mm (wide) x 12 mm (deep) shelf mount. Maximum weight shall be 1 kg. The data interface shall be EIA-232. Each SHM shall have a DB-25 jack for DTE interface and a 4-screw terminal block for line interface.
2. Electrical specifications.--Each SHM shall be powered by 115 VAC, 60 Hz and shall consume no more than 5 watts. The SHM shall have built-in optical isolation on receive lines. SHM shall have a local loopback switch for diagnostics. Transmitter output level shall conform to FCC Part 68 Limits and Bell Pub. 43401.

Full compensation for short-haul modem shall be considered as included in the contract lump sum price paid for traffic operations system (Location 5) and traffic operations system (Location 6) and no separate payment will be made therefor.

10-3.44 FIBER OPTIC TRANSMITTER AND RECEIVER SYSTEM

GENERAL.--When the fiber optic transmitter system (FOTS) are connected to the fiber optic receiver system (FORS) via a fiber optic link, they shall support a minimum optical loss budget of 14 dB, including system margin over a single mode fiber. The data channels shall be multiplexed and transmitted digitally with the video channel. The data channels shall support EIA-232 full duplex with data rate capability up to 9.6 kbps. The units shall use a combination of pulse frequency modulation (PFM), frequency modulation (FM), frequency division multiplexing (FDM), frequency shift keying (FSK) and digital techniques. The result of the system shall be high quality, crosstalk free, adjustment free operation over a wide dynamic range. There shall be no variations in the video output level due to fiber attenuation, variation because of LED aging, optical "slip rings", dynamic cable layout, or environmental factors. The units shall be optimized for single-mode 8.3/125 μm fiber operating in the 1300 nm optical window. The optical connectors shall be of the ST-compatible type.

Each transmitter and receiver shall have synchronization and loopback indicators in its front face panel for visual verification of bi-directional operation. The fiber optic transmitters and receivers shall be from the same manufacturer and shall be considered as individual units of measurement.

PERFORMANCE REQUIREMENTS.--The baseband video signal output from the video/data receivers when it is receiving an optical signal from the video/data transmitters at an average power level equal to the video/data receiver sensitivity shall meet the following performance specifications defined and measured in accordance with EIA-250 for Short-Haul Transmission System for End-to-End modified performance.

Output Signal Level	as per EIA- 250
Amplitude vs. Frequency Characteristics	as per EIA- 250
Chrominance to Luminance Gain Inequality	as per EIA- 250
Chrominance to Luminance Delay Inequality	as per EIA- 250
Field Time Waveform Distortion	as per EIA- 250
Line Time Waveform Distortion	as per EIA- 250
Insertion Gain Variation	as per EIA- 250
Differential Gain	as per EIA- 250
Differential Phase	±2 degrees
Signal-to-noise ratio	50 dB weighted
Signal-to-low frequency noise ratio	as per EIA- 250

ENVIRONMENTAL.--The transmitters and receivers shall be fully operational over a temperature range of -30°C to +70°C and shall withstand a humidity range from 0 to 95 percent without condensation.

FOTS.--Each FOTS shall have the capability of transmitting one simplex composite NTSC baseband video channel, three full duplex data channels and one bi-directional audio channel over a single-mode optical fiber. Each FOTS shall accept a composite NTSC video input as well as provide input/output for full duplex data and audio. The FOTS shall utilize cooled 1300 nm laser diodes with at least -14 dBm and the spectral line width of less than or equal to 5 nm.

a. Mechanical.--Each FOTS shall be housed in a compact stand alone enclosure with side flanges and shall be shelf mountable.

b. Power.--Each FOTS shall be powered by unregulated +12 VDC at 370 to 480 mA. An AC to DC wall mount adapter may be used for powering from 120 VAC, 60 Hz.

c. Interfaces.--

1. The video interface shall be via a BNC connector.
2. Each data channel interface shall be via an 8-position, 8-connector modular jack (RJ-45).
3. Each FOTS shall provide an audio interface port compatible with unbalanced and balanced 0 dBm, 600 Ω, 4 wire line. The audio interface shall be via an 8-position, 8-connection modular jack (RJ-45).

4. Each FOTS shall provide a handset port compatible with standard telephone set equipped with carbon microphone. The handset port shall consist of a 4-position, 4-connection modular jack.

FORS.--Each FORS shall have the capability of receiving one simplex composite NTSC baseband video channel, three full duplex data channels and one bi-directional audio channel from a single-mode optical fiber. Each FORS shall provide a composite NTSC video output as well as provide input/output for full duplex data and audio.

a. Mechanical.--Each FORS shall be a plug-in circuit card assembly compatible with the FDU as specified elsewhere in these special provisions.

b. Power.--Each FORS shall be powered by the FDU's 12 VDC power supply drawing from 460 to 520 mA.

c. Interfaces.--

1. The video interface shall be via a BNC connector.
2. Each data interface shall be via an 8-position, 8-connector modular jack (RJ45). A harness with the modular jacks and screw terminal connectors for the audio and data signals shall be provided for each FORS unit. The harness shall be fully compatible with the FDU and FORS as specified in these special provisions. The I/O for each FORS shall correspond to the following configuration on the RJ-45 jack of the harness. Single ended or differential transmission shall be selected by DIP-switches on the FORS.

RJ-45 CONTACTS	EIA-232	EIA-422
1	NC	NC
2	CTRL OUT	NC
3	TXD	TXD-
4	RXD	RXD-
5	GND	RXD+
6	GND	TXD+
7	CTRL IN	NC
8	NC	NC

3. Each FORS shall provide an audio interface port compatible with unbalanced and balanced 0 dBm, 600 , 4 wire line. The audio interface shall be via an 8-position , 8-connection modular jack (RJ-45).
4. Each FORS shall provide a handset port compatible with standard telephone set equipped with carbon microphone. The handset port shall consist of a 4-position, 4-connection modular jack and shall be located on the front panel of each FORS.

The Field testing of the fiber optic transmitter system (FOTS) and fiber optic receiver system (FORS) is covered under "Fiber Optic Communications Trunkline System" elsewhere in these special provisions.

FIBER DISTRIBUTION UNIT (FDU).--The FDU shall consist of a fiber chassis that accepts a minimum of 10 FORS plug-in circuit card assemblies and two power supplies. The FDU shall mount on an EIA-310C rack. The power supplies shall be bridged together (Diode OR'ed) for redundancy. The optical cable shall be fed through the tray from the back of the FDU and connected to the optical ports located near the front of the FORS card.

FOTS AND FORS TESTING.--The Contractor shall be responsible for all test equipment, testing and documentation required to establish approval and acceptance to the production, installation, and operation of the FOTS and FORS.

The Contractor shall have a manufacturer's representative configure a testing set-up, in the HUB, similar to that shown on the plans. This test set-up shall be used to perform all bench testing as required in this project in the presence of the Engineer.

The Contractor shall provide proof of performance testing, to ensure that the FOTS and FORS perform to these special provisions.

The Contractor shall provide the Engineer with the performance test results, in writing, within 10 working days after completion of each test.

For the performance testing of the FOTS and FORS, the following test equipment, or equal in technical specifications, shall be used:

- a. Tektronics NTSC Signal Generator (TSG-100A), Tektronics Video Measurement Set (VM700A), Tektronics NTSC Monochrome TV Monitor, Telecommunications Techniques Corp. Optical Power Meter, Telecommunications Techniques Corp. Bit Error Tester (Firebird 4000), Telecommunications Techniques Corp. Variable Attenuator (Fibertech 200).
- b. Bench Testing: The FOTS and FORS shall be tested with a power meter and light source, to record the transmitter average power (dBm) and receiver sensitivity (dBm). To perform the functional tests, each FOTS and FORS shall be interconnected by a single-mode fiber to form a video link as shown on the plans. The Contractor shall input video test signals simultaneously into each FOTS input and attenuate the optical power measured at the FORS end of the fiber to determine the receiver sensitivity level. The optical signal shall then be connected to the receiver with a monitor connected to the video output. The Contractor shall then qualitatively assess the monitor output and record the results. The signal-to-noise and signal-to-low frequency noise shall be measured and recorded. This is to be repeated for each FOTS and FORS pair as shown on the plans and as specified in these special provisions and as directed by the Engineer. All indicators shall be verified to function correctly.

For the purpose of payment, the fiber optic transmitter shall include the transmitter and testing of the fiber optic transmitter before the units are to be delivered to the job site for installation.

Payment for the installation of the fiber optic transmitter is included in the contract lump sum price paid for traffic operations system at the location involved.

For the purpose of payment, the fiber optic receiver shall include the receiver and testing of the fiber optic receiver before the units are to be delivered to the job site for installation.

Payment for the installation of the fiber optic receiver is included in the contract lump sum price paid for traffic operations system at the location involved.

10-3.45 FIBER OPTIC COMMUNICATION TRUNKLINE CABLE AND FIBER PIGTAIL CABLE INSTALLATION AT TRUNKLINE SPLICE CABINET

The work to be done at each Trunkline Splice Cabinet (TSC), as shown on the plans, shall consist of the following:

1. Install the TSC.
2. Install the splice closure assembly.
3. Splice two segments of the Fiber Optic Communication Trunkline Cable (FCT).
4. Splice the Fiber Optic Pigtail Cable (FPC).
5. Install labels on the splice tray.

The work to be done between the TSC and controller cabinet, as shown on the plans, shall as a minimum consist of installation of FPC.

10-3.46 FIBER OPTIC COMMUNICATION TRUNKLINE CABLE AND FIBER PIGTAIL CABLE INSTALLATION AT CONTROLLER CABINET

The work to be done at each controller cabinet, as shown on the plans, shall consist of the following:

1. Install equipment shelf assembly.
2. Install FPC into the controller cabinet.
3. Install Fiber Optic Transmitter System (FOTS).
4. Label FPC.

The fiber optic link shall be tested and verified, as specified elsewhere in these special provisions, prior to the FOTS and Fiber Optic Receiver System (FORS) installation.

10-3.47 TOLL PLAZA COMMUNICATIONS SYSTEM

The toll plaza communications system shall be defined as shown on the plans, described in these special provisions and listed below between the individual sub-components of the system.

The Contractor shall furnish and install fiber optic communication system equipment with cables and electrical equipment, as shown on the plans, and as follows:

1. Install the following fiber optic communication system equipment with cables and electrical equipment in the existing HUB building and connect to existing HUB equipment:

Fiber Slack Enclosure (FSE).
Fiber Interconnecting Unit (FIU).
Fiber Distribution Unit (FDU).
Serial Patch Panel (SPP).
Fiber Optic Receiver System (FORS).

2. Install Communication Cable Cabinet (CCC-8) in Substation 8 and SCADA cable between CCC-7 (in Substation 7) and CCC-8.
3. Install Trunkline Splice Cabinet (TSC-1), and electrical equipment {Fiber Optic Communication Trunkline Cable (FCT), conduit and pull boxes} between TSC-1 and existing HUB building.

The furnishing of FORS are covered under "Fiber Optic Transmitter and Receiver Systems" elsewhere in these special provisions.

10-3.48 CONCRETE TRESTLE COMMUNICATIONS SYSTEM

The concrete trestle communications system shall be defined as shown on the plans, described in these special provisions and listed below between the individual sub-components of the system.

The Contractor shall furnish and install electrical equipment, as shown on the plans, and as follows:

1. Install trunkline splice cabinets (TSCs) from TSC-2 through TSC-11.
2. Install fiber optic communication trunkline cable (FCT) between TSC-1 and TSC-12.
3. Install Communication Cable Cabinets (CCCs) at Substations 4, 5, 6 and 7.
4. Install supervisory control and data acquisition (SCADA) cable between CCC-3 and CCC-7.
5. Install fiber optic pigtail (FPC) cable between the controller cabinets and TSCs.
6. Install fiber optic transmitter system (FOTS) in the controller cabinets.

Furnishing of the FOTS are covered under "Fiber Optic Transmitter and Receiver Systems" elsewhere in these special provisions.

10-3.49 STEEL BRIDGE COMMUNICATIONS SYSTEM

The steel bridge communications system shall be defined as shown on the plans, described in these special provisions and listed below between the individual sub-components of the system.

The Contractor shall furnish and install electrical equipment, as shown on the plans, as follows:

1. Install trunkline splice cabinets (TSCs) from TSC-12 through TSC-16.
2. Install fiber optic communication trunkline cable (FCT) between TSC-12 and TSC-16.
3. Install Communication Cable Cabinets (CCCs) at Substations 1, 2 and 3.
4. Install supervisory control and data acquisition (SCADA) cable between CCC-1 and CCC-3.
5. Install fiber optic pigtail (FPC) cable between the controller cabinets and TSCs.
6. Install fiber optic transmitter system (FOTS) in the controller cabinets.

Furnishing of the FOTS are covered under "Fiber Optic Transmitter and Receiver Systems" elsewhere in these special provisions.

10-3.50 FIBER OPTIC COMMUNICATIONS SYSTEM GENERAL

FIBER SLACK ENCLOSURE (FSE).--Each FSE shall be manufactured of heavy gage galvanized steel ASTM 526 or 527 with G-60 coating, with a hingeless removable slip up and slip down door, four 41.3 mm slots are located on each side for cable entry and exit, and four tie wrap brackets for securing the cable coil in position. The enclosure shall be coated in orange colored plastic chlorinated rubber based enamel. The FSE shall be designed to be wall mounted. The dimensions of the FSE shall be 610 mm (wide) x 610 mm (high) x 254 mm (deep). The FSE shall be unaffected by acids, alkalines, salts, moisture, or fungus growth.

FIBER INTERCONNECTING UNIT (FIU).--Each FIU shall be EIA-310C rack mounted and shall provide a compact modular unit for the interconnection of fibers between the incoming field cable and the end equipment. The unit shall also house the fan-out kit for the twenty-four fiber strands and shall accommodate twenty-four interconnection points for single-mode fibers. It shall be equipped with rack mounting provisions, with dimensions no more than 350 mm (high) x 90 mm (wide) x 300 mm (deep) and shall weigh no more than 2.5 kg. The FIU shall be designed to control bend radius of fibers, the

cable and the fan-out tubes within the units. The unit shall also include four connector panels with six pre-installed ST compatible inter-connection sleeves, each with ceramic inserts in a composite housing for single-mode fiber.

Fiber Patch Cord.--Each fiber patch cord shall serve as the fiber optic connection between the FIU and the FORS at the fiber distribution unit. The patch cord shall be terminated with ST-Compatible Super Physical Contact (PC) single-mode connector at both ends. The fiber strands shall meet the specifications as those of the FCT and the connectors shall meet the specifications as specified elsewhere in these special provisions. The patch cord shall have a length of ten feet.

TRUNKLINE SPLICE CABINET (TSC).--Each TSC shall be constructed of 14 gage, galvanized steel, coated with aqueous alkyd paint, and weather stripped. It shall be mountable on walls, unistrut bars and concrete foundations. The cabinet shall be capable of supporting a minimum of 20 kg of equipment, in addition to its own weight. The dimensions of the cabinet shall be 900 mm (wide) x 400 mm (deep) x 1200 (high). The top shall overlap the door which itself shall overlap the body, thus providing a weathertight enclosure. The cabinet shall comply with NEMA 3R Standards of protection against highly corrosive environmental conditions. It shall be possible to punch holes of various sizes on different locations on the side, top or bottom walls of the cabinet as needed.

The cabinet shall have double doors lockable with double chrome plated, die cast brass cam locks, with brass combination pins inside. The locks shall have a plastic cover to provide additional protection from the elements, and shall be attached underneath the lock at the time of installation which can easily snap on and off to allow entrance, while still remaining fastened to the lock. It shall require a lock at the top and one at the bottom of the doors for better security. The cabinet shall have recessed flush handles on both doors.

The inside of the cabinet shall include two vertical, slotted mounting brackets and six cross bars. The TSC shall also include four curved brackets, for cable guides, as shown on the plans for holding the cable slack in place and insuring the minimum bending radius of 250 mm for the cable.

SPLICE CLOSURE ASSEMBLY.--

General.--For the purpose of these special provisions, each splice closure assembly shall consist of the splice closure and the splice organizer tray. The same manufacturer shall manufacture these products. The manufacturer shall be in the business of manufacturing fiber optic products for a minimum of five years.

Splice Closure.--Each splice closure shall be waterproof, rodent proof and re-enterable. Each splice closure shall be complete with splice organizer trays, brackets, plugs, clips, cable ties, seals and sealant, as needed and as specified elsewhere in these special provisions, and as shown on the plans, and indicated by the Engineer.

Each splice closure shall be suitable for protecting fiber optic splices in underground and outdoor applications. It shall be resistant to the most severe conditions of moisture vibration and impact cable stress and flexing, and temperature extremes. Each splice closure shall be expandable to handle a minimum of four cables for in line or branch splices, with two cable ports on each end and shall have provisions for landing the central members. No special tools or complicated training procedures shall be required to assemble the closure. The cable entry ports shall accommodate all known trunk and feeder cables varying from 10 mm up to 25 mm diameter. Each splice closure itself shall weigh no more than 8 kg and the dimensions shall not exceed 180 mm (high) x 650 mm (wide) x 420 mm (deep). The material composition of the closure shall be flame retardant, with all external hardware of stainless steel. All material necessary for cable addition and splice case re-assembly shall be readily available in the market for any future maintenance or splice additions. The splice closure shall accommodate one or more splice organizer trays of the type specified, elsewhere in these special provisions.

Location of each splice closure shall be as shown on the plans and described in these special provisions.

Splice Organizer Tray.--Each splice organizer tray shall be designed to hold up to 24 fusion optical single-mode fiber splices and accommodate up to eight buffer tubes holding six fibers each for a total of up to 48 individual 250 mm fibers. The tubes shall be secured with channel snaps so that cable ties are not required. The fibers shall all enter the tray in one corner. Splices shall be secure in place so that they are stable but spread apart for individual access and easy removal. A 102 mm, minimum bend diameter shall be maintained for each fiber in the tray. Each tray shall have fiber retention lips to hold fibers in place to reduce damage. It shall be possible to stack trays onto each other to avoid the need for disassembling trays above or below in order to access a splice tray. Each tray shall be made of flame retardant material. Each splice organizer tray shall be fully compatible and mountable in the splice closure mentioned elsewhere in these special provisions.

EQUIPMENT SHELF ASSEMBLY.--Each equipment shelf assembly shall consist of a linear power supply, a linear power supply cord, two steel double supporting angles per assembly and equipment shelf.

Linear Power Supply. --Each linear power supply shall be regulated, 12 VDC providing a maximum output current of 2.0 A. The linear power supply shall have short circuit protection and shall have line and load regulation. The linear power supply shall have the maximum dimensions of 130 mm (wide) x 90 mm (high) x150 mm (deep) with the maximum weight of 2.5 kg. The linear power supply shall be fully enclosed in a weatherproof, rust resistant metal enclosure. The linear power supply shall have a terminal strip mounted on the front of the enclosure. The terminal strip shall have a safety cover, so that input and output wire connections to the supply will not be exposed. The linear power supply shall be fuse protected on the ac input line. The fuse shall be housed in a front panel mountable fuse holder. The linear power supply shall be shelf mountable. The linear power supply shall meet the following specifications:

AC Input Voltage	120 VAC
Frequency	60 Hz
DC Output Voltage	12 VDC
Output current (max.)	2.0 <u>A</u>
Line Regulation	±0.1%
Load Regulation	±0.2%
Operating Temperature	0° C. to 70° C.

Linear Power Supply Cord.-- Each linear power supply cord shall have a molded polyvinyl chloride (PVC), 3 prong, male grounding plug on one end. The other end shall have a jacket and three conductors stripped back one inch. The conductors shall be 18 AWG stranded. Each cord shall have a PVC insulation jacket with an outside diameter of 6.5 mm. The linear power supply cord shall be rated for 1250 W, 10 A, and 125 VAC. Each linear power supply cord shall be equivalent to a Belden 17534 power cord.

Steel Double Supporting Angle.-- Each steel double support angle shall consist of an upper and lower angle connected together as one piece. The support angles shall extend from the front to the back rail of the Type 334 Controller Cabinet as specified in the "Traffic Signal Control Equipment Specifications," (TSCES), issued by the State of California, Department of Transportation, dated January 1989, and shall serve both as supports and sliding guides for the equipment shelves. The support angles shall prevent the equipment shelf from lifting or falling vertically. The lower angle shall extend 80 mm horizontally and shall be able to support a minimum of 25 kg. The gap opening between the upper and lower angle shall be 6.5 mm. The support angle shall be fully adjustable and screw-mounted on cabinet rails.

Equipment Shelf.--Each equipment shelf shall have overall dimensions of 450 mm (wide) x 500 mm (deep). The shelf shall be 3.2 mm thick and shall be a cold rolled steel or aluminum sheet. The shelf shall fit securely in the double support angles. The shelf shall have ventilation holes, evenly distributed, allowing 40 percent open-air flow through the shelf. Each hole shall not exceed 50 mm square in area. The shelf shall be cadmium-plated or zinc-plated after cutting and drilling.

FIBER OPTIC TRUNKLINE SYSTEM TERMINATIONS.--

General.--For the purpose of these special provisions, the fiber optic trunkline system terminations shall consist of field pigtail cables, patch cords, fan-out kit and connectors. The above mentioned products shall be manufactured by the same manufacturer. The manufacturer shall be in the business of manufacturing fiber optic products for a minimum of five years.

Field Pigtail Cable (FPC).--Each FPC shall be factory assembled using a fiber cable meeting the "FCT" specifications of these special provisions, except that it shall have one fiber strand. One meter of the FPC shall be stripped to the fiber strands and shall be terminated using a fan out kit and following the manufacturer's instructions. The fanout kit shall meet the requirements specified elsewhere in these special provisions. One end of the flexible section of the FPC shall be terminated with a ST-Compatible Super PC that meets the specifications as specified elsewhere in these special provisions. The flexible insert cable jacket shall be yellow in color to designate single-mode.

Connectors.--Connectors shall be of the 2.5 mm ST-Compatible Super PC ferrule type with zirconia ceramic material. The connector body housing and the associated coupler shall be glass reinforced polymer.

The ST connector operating temperature range shall be -40°C to +70°C. Insertion loss shall not exceed 0.4 dB and the return reflection loss shall be at least 40 dB. Connection durability shall be less than a 0.2 dB change per 500 mating cycles per EIA-455-21A (FOTP-21). All terminations shall provide a minimum 25 kg pull out strength. Factory test results shall be documented and submitted to the Engineer, prior to installing any of the connectors.

Fan-Out Kit.--The fan-out kit provides breakout from a single outdoor FCT onto flexible tubes equal to the number of fibers of the FCT. The fan-out flexible tubes shall provide three layers of protection consisting of a Teflon inner tube (into which the fiber is inserted), an aramid yarn strength member, and an outer protective PVC jacket. The kit shall be installed in conformance with the manufacturer's instructions which shall consist of stripping back the cable jacket and threading the specified fiber into the fan-out insert, snapping the fan-out insert into the main body. An outer housing shall be installed to complete the assembly. The fan-out tubing size shall accept 250 mm fibers and it shall be yellow to designate single-mode fiber. The fan-out kit shall be made of non-metallic, high strength, composite material. The ends of each tube shall be terminated with an ST-Compatible Super PC connector that meets the specifications mentioned elsewhere in these special provisions.

FCT INSTALLATION.--Installation procedures shall be in conformance with the procedures specified by the cable manufacturer for the specific cable being installed. Mechanical aids may be used, provided that a tension measuring device is placed in tension to the end of the cable, and the allowable tension does not exceed 80 percent of recommended tension or 22.5 kg, whichever is less.

During installation, the bending radius of the cable shall be maintained at a minimum of twenty times its outside diameter.

FCT cable shall be installed without splices except where specifically allowed on the plans or described in these special provisions. A minimum of 15 meter of slack shall be provided at each TSC, and at the FSE.

The FCT segment between the HUB and TSC-1 shall be factory assembled using the same procedures as those for the FPC. Installation of fan-out kit and terminations of ST-Super PC connectors shall be done at the factory. Terminations assembled by the Contractor shall not be allowed.

SPLICING.--Each FCT splice shall be the fusion type and shall not exceed 0.10 dB loss per splice.

Each field splice shall connect the fibers of the two FCT cable lengths together and up to two pigtails as specified elsewhere in these special provisions. Each splice shall be placed in a splice tray and this splice tray shall then be placed in the splice closure as specified elsewhere in these special provisions. Each splice shall be protected with a thermal shrink sleeve or with RTV silicon sealant.

WARNING TAPE.--Warning tape shall be provided and placed in the trench over each conduit containing FCT, as shown on the plans. The warning tape shall be of the non-detectable type and shall have 16 mm overall thickness. The warning tape shall be 10 mm wide with bold printed black letters of approximately 3/4 inch on bright orange color background, and contain the printed warning "CAUTION BURIED FIBER OPTIC CABLE - CALTRANS (415) 330-6500", repeated at approximately 750 mm intervals.

The printed warning shall be non-erasable and shall be rated to last with the tape for a minimum of 40 years.

The construction of the warning tape shall be such that it will not delaminate when it is wet. It shall be resistant to insects, acid, alkaline and other corrosive elements in the soil. It shall have a minimum of 52 kg tensile strength per 150 mm wide strip and shall have a minimum of 800 percent elongation before breakage.

Full compensation for furnishing and installing the warning tape shall be considered as included in the prices paid for TOS at the location involved and no separate payment will be made therefor.

COLORED CONCRETE BACKFILL.--The concrete backfill for the installation of conduits that will contain FCT cable shall be a medium to dark, red or orange color to clearly distinguish the concrete backfill from other concrete and soil. The concrete shall be pigmented by the addition of commercial quality cement pigment to the concrete mix. The red or orange concrete pigment shall be LM Scofield Company; Orange Chromix Colorant; Davis Colors; or equal.

For trenches in pavement areas, only the top 103 mm of concrete backfill will be required to be pigmented concrete. At the option of the Contractor, the full depth may have the pigment.

Full compensation for furnishing and incorporating the cement pigment to achieve the color required shall be considered as included in the price paid for the TOS at the location involved and no separate payment will be made therefor.

The HUB termination end of the FCT shall be routed through the fiber slack enclosure and terminated with a fanout kit inside the FIU, as specified elsewhere in these special provisions, and as shown on the plans. The FIU shall be rack mounted in the distribution equipment cabinet, as shown on the plans.

Link Labels.--For the purpose of labeling, three different types of fiber strands in the trunkline system shall be classified as follows:

- a. Active Link - a fiber strand which is terminated at both ends of its length.
- b. Dark Section - a fiber strand that is not terminated at either end of its length.
- c. Dark Link - a fiber strand that is terminated at its HUB end but is not terminated at its other end.

Each strand shall be labeled as follows:

A strand ID shall be ten characters as shown below:

Link ID	FIU Position	Buffer Color	Fiber Color	TSC ID
XX	XX	XX	XX	XX

The "FIU Position" field in the strand ID for dark sections shall be "00". The "TSC ID" field in the strand ID for dark links shall be "00".

Examples:

- a. 01-02-BL-OR-03: This strand ID is for active link 01 which is connected to FIU panel position 02. The strand is in a BLue buffer tube and the fiber strand has an ORange jacket. The link is terminated to an FPC in splice cabinet 03.
- b. 11-00-BK-WT-13: This strand ID is for dark section 11. The strand is in a BlacK buffer tube and the fiber strand has an WhiTe jacket. The active link portion of the link is terminated to an FPC in splice cabinet 13.
- c. 21-22-RD-YE-00: This strand ID is for dark link 21 which is connected to FIU panel position 22. The strand is in a ReD buffer tube and the fiber strand has an YELlow jacket.

The strand ID for each fiber strand shall be written with non-erasable ink on the cover of each splice tray.

Link labels shall be attached adjacent to the ST connector on the FPC in the controller cabinet and on the insert-tubes in the FIU on the HUB. Link labels shall be made of a material that will resist abrasion, moisture, oil, solvents and be self laminating, permanently heat bonded in a maximum of 10 seconds at 57°C without noticeable shrinkage, discoloration or distortion with an application range from 10°C to 50°C and operating range of from 4°C to 80°C.

10-3.51 FIBER OPTIC COMMUNICATIONS SYSTEM AND SCADA COMMUNICATIONS CABLE TESTING

The Contractor shall provide all personnel, equipment, instrumentation and materials necessary to perform each test. The Contractor shall arrange and pay to have a registered Electrical Engineer (with a valid registration approved by the State of California) specialized in fiber optic communication field and communication systems. The Engineer shall be notified three working days prior to each test. The notification shall include the exact location or portion of the system to be tested. Documentation of all the test results shall be signed by the Registered Electrical Engineer and shall be submitted to the Engineer for review and approval within five working days after completion of the test involved.

FCT TESTING--Prior to arrival of the cable, the Contractor shall provide detailed test procedures for all field-testing. The procedures shall include the tests involved and how the tests are to be conducted.

Pre-Installation Testing.--Each cable and reel shall be physically inspected on delivery and 100 percent of the fibers shall be attenuation tested to confirm that the cable meets requirements. Test results shall be recorded, dated, compared and filed with the copy accompanying the shipping reel in a weatherproof envelope. Attenuation deviations from the shipping records greater than 5 percent shall be brought to the attention of the Engineer. The cable shall not be installed until completion of this test sequence and the Engineer provides written approval. Copies of traces and test results shall be submitted to the Engineer. If the test results are unsatisfactory, the reel of FCT cable shall be considered unacceptable and all records corresponding to that reel of cable shall be marked accordingly. The unsatisfactory reels of cable shall be replaced with new reels of cable at the Contractor's expense. The new reels of cable shall then be tested to demonstrate acceptability. Copies of the test results shall be submitted to the Engineer.

Post-Installation Testing.--After the fiber optic cable has been pulled and terminated, 100 percent of all the fibers shall be tested with an optical time domain reflectometer (OTDR) for attenuation. Test results shall be recorded, dated, compared with pre-installation test results and filed. Copies of traces and test results shall be submitted to the Engineer. If the OTDR test results are unsatisfactory, the FCT cable segment will be unacceptable. The unsatisfactory segment of cable shall be replaced with a new segment, without additional splices, at the Contractor's expense. The new segment of cable shall then be tested to demonstrate acceptability. Copies of the test results shall be submitted to the Engineer.

Attenuation tests shall be performed with an OTDR capable of recording and displaying anomalies of 0.2 dB, as a minimum. Each fiber strand shall be tested at 1310 nm and 1550 nm. Attenuation readings for each direction shall be recorded on the cable data sheet.

The OTDR shall have a printer capable of producing a verifying test trace with fiber identification, numerical loss values, the date and the operator's name. It shall also have a MS-DOS based 90 mm disk recording capability that has associated software to do comparisons and reproductions on 230 mm x 280 mm paper, via a personal computer.

FCT FIBER OPTIC LINK TESTING.--

Optical Time Domain Reflectometer (OTDR) Testing.--A fiber optic link shall consist of a continuous optical path from the transmitter end to the receiver end, as shown on the plans. Once the FCT, pigtail, patch cord, FIU, and connectors have been installed and a fiber optical link is ready for activation, it shall be tested for attenuation with an OTDR at 1300 and 1550nm. Test results shall be recorded, dated, and submitted to the Engineer. If the OTDR test results are unsatisfactory the link shall be replaced at the Contractor's expense. The new link shall then be tested again to demonstrate acceptability and copies of the test results shall be submitted to the Engineer.

Power Meter and Light Source Testing.--At the conclusion of the final OTDR testing, each link shall be tested end to end with a power meter and light source, in accordance with EIA Optical Test Procedure 171, and in the same wavelengths specified for the OTDR tests. These tests shall be conducted in both directions. Test results shall be recorded and filed with the other recordings of the same link. Test results shall be submitted to the Engineer for approval.

Test Failures.--If during any of these fiber optic link verification tests, the results prove to be unsatisfactory, the link will not be accepted. The unsatisfactory segments of link shall be replaced with a new segment at the Contractor's expense. After the new link has been completed, it shall undergo the same testing procedure to determine acceptability. Copies of the test results shall be submitted to the Engineer. The removal and replacement of a segment of the link shall be interpreted as the removal and replacement of a single contiguous length of FCT, pigtail, connecting splice, connectors. The removal of only the small section containing the failure and therefore introducing new unplanned splices, will not be allowed.

SPLICE TESTING.--At the conclusion of all splices at each location, and before they are enclosed and sealed, all splices shall be tested with the OTDR, in both directions. Splices shall be tested at 1310 nm and at 1550 nm. Individual fusion splice losses shall not exceed 0.10 dB. Measurement results shall be recorded, dated, validated by the OTDR trace printout and filed with the records of the respective cable runs. Copies of traces and test results shall be submitted to the Engineer. If the OTDR test results are unsatisfactory, the splice shall be unacceptable. The unsatisfactory splice shall be replaced at the Contractor's expense. The new splice shall then be tested again to demonstrate acceptability and copies of the test results shall be submitted to the Engineer.

FIBER OPTIC TRUNKLINE SYSTEM TERMINATIONS TESTING.--In developing the pigtails and fiber patch cords, each ST termination (pigtail or patch cord) shall be tested for attenuation loss with the use of an optical power meter and source. In addition, all terminations shall be tested for return reflection loss. These values shall meet the loss requirements specified elsewhere in these special provisions, and shall be recorded on a tag attached to the pigtail or patch cord.

Once assemblies are complete, the manufacturer shall visually verify that all tagging, including loss values, is complete. Then as a final quality control measure, the manufacturer shall do an "end to end" optical power meter/light source test.

The final test results shall be recorded, along with previous individual component values, on a special form assigned to each component. The completed form shall be dated and signed by the Manufacturer's quality control supervisor. One copy of this form shall be attached in a plastic envelope to the assembled item. Copies will be provided separately to the Contractor, and to the Engineer, and shall also be maintained on file by the manufacturer or supplier.

FOTS AND FORS FIELD TESTING.--The Contractor shall perform an operational test to verify that the FOTS and FORS perform to the specified standards when used in conjunction with FIU, FPC and patch cords installed, as shown on the plans, and specified in these special provisions, and as directed by the Engineer. The Contractor shall measure the power level on a dBm scale at the output/input of each FOTS/FORS for each link as shown on the plans and shall submit tabulated results to the Engineer.

The Contractor shall conduct a dynamic bi-directional data transmission test for each of the three data channels in each optical link. The dynamic test shall verify that the transmission quality of each channel supports a bit error rate 1×10^{-9} or better at 9.6 kbps. The test shall be performed while transmitting a video image from the FOTS. The results of this test shall be documented for each channel in each optical link, and submitted to the Engineer. The Contractor shall have the option to submit to the Engineer, for approval, an alternative dynamic test, approved by the fiber optical equipment manufacturer that empirically can be shown to verify the transmission quality stated above.

SCADA COMMUNICATIONS CABLE (SCC) TESTING.-- Each section of SCC shall be tested for continuity, ground and insulation resistance in accordance with Section 86-2.14B, "Field Testing", of the Standard Specifications.

In addition, each section of SCC shall be tested in accordance with REA Standard PE-39 for voice transmission, insulation resistance, loop resistance and attenuation.

Field testing shall be performed before connections to equipment are made and the testing shall be done in the presence of the Engineer.

Tabulated test data shall be submitted to the Engineer for review and approval.

10-3.52 HUB DATA

Furnishing, installing and testing serial patch panels. All other items required for the proper installation and operation of the hub data shall be considered as part of the hub data.

GENERAL.--HUB data shall consist of the following components to function as described in these special provisions and as shown on the plans:

1. Serial patch panels (SPP) -- 2 each.
2. Serial line cords -- 26 each.
3. Serial patch cords -- 32 each.
4. Serial line cord assembly -- 26 each.
5. Serial cable -- 11 each.

SERIAL PATCH PANELS.--The serial patch panels shall be EIA-310C rack mountable and meet the following specifications:

1. Front Interconnection -- The patch cord side shall have 32 (2 rows of 16) 8-position 8-conductor modular jacks with a T568A wiring configuration.
2. Back Interconnection -- The cabling side shall have 32 eight-position, 110 IDC wiring blocks capable of accepting solid or stranded 22 AWG to 26 AWG wires and rated to 200 retermination cycles minimum.
3. Controls -- Sixteen patching switches shall be provided to eliminate the need for patching cords in normal use. The patching switches shall connect the upper and lower ports when switched to the "PATCH" position and disconnect the upper and lower ports when switched to the "OFF" position.
4. Cable Routing and Clamping -- Thirty-two anchors for clamping cables and thirty-two each, 4.8 mm wide cable ties shall be provided in the back. The anchor design shall ensure that cables or cable ties do not protrude from the 89 mm or 2U boundaries in order to avoid physical interference with adjacent equipment.
5. Cover -- A back cover for complete Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) protection shall be provided.

Pin assignment for the patch panels shall be as follows:

Rear View- Ports 1-16:

IDC Block Pin No.	Conductor Color	Pair ID
8	Brown	R4
7	White-Brown	T4
6	White-Blue	T1
5	Blue	R1
4	Orange	R2
3	White-Orange	T2
2	Green	R3
1	White-Green	T3

Rear View- Ports 17-32:

IDC Block Pin No.	Conductor Color	Pair ID
1	White-Green	T3
2	Green	R3
3	White-Orange	T2
6	Orange	R2
4	Blue	R1
5	White-Blue	T1
7	White-Brown	T4
8	Brown	R4

Front View- Ports 1-32:

Port No.	Row	Connector Pin Assignments
1-16	Upper row	1-8 left to right
17-32	Lower row	1-8 left to right

Serial Patch Panels.-- Two serial patch panels containing unshielded modular jacks shall be included. Each patch panel shall be compliant with EIA/TIA-568-A Category 3, Category 4, or Category 5. The patching switches shall simultaneously switch the 8 wires of a port.

PATCH CORDS.--The serial patch cords shall be unshielded twisted pair (UTP) and shall consist of 24 AWG tinned-copper, stranded conductors insulated with high density polyethylene (PE) or polyvinyl chloride (PVC). The insulated conductors shall be tightly twisted into individual pairs and jacketed with PVC. Patch cords shall have an EIA T568A wiring configuration, and a nominal length of 1 m unless otherwise specified on the plans, in these special provisions or by the Engineer.

Patch cords (i.e. UTP patch cable) shall be color coded as follows:

PAIR	COLOR CODE (T//R)	8-position Modular Plug T568A Pin No. (T//R)
1	White/Blue//Blue/White	5//4
2	White/Orange//Orange/White	3//6
3	White/Green//Green/White	1//2
4	White/Brown//Brown/White	7//8

Serial Patch Cords.--The serial patch cords shall consist of 4-pairs of conductors and shall include 8-position 8-conductor modular plugs on both ends. The patch cords shall be EIA/TIA-568 Category 3 compliant and shall meet the following specifications:

DC Resistance (maximum)	28.6 per 300 m at 20° C. (nominal)
Mutual Capacitance	55 pF/m (nominal)
Characteristics Impedance	100 ±15 % from 0.256 MHz to 20 MHz

LINE CORDS.--Line cords shall be unshielded twisted pair (UTP) and shall consist of 24 AWG stranded copper conductors insulated with high density polyethylene (PE) or PVC. The insulated conductors shall be tightly twisted into individual pairs and jacketed with PVC. Line cords shall have a T568A wiring configuration, and a nominal length of 3.7 meters unless otherwise specified on the plans, in these special provisions or by the Engineer.

Line cords for Integrated Services Digital Network (ISDN) and T1/E1 lines shall be color coded as follows:

PAIR	COLOR CODE (T//R)	110 IDC Connector T568A Pin No. (T//R)	8-position Modular Plugs T568A Pin No. (T//R)
1	White/Blue // Blue/White	5//4	5//4
2	White/Orange // Orange/White	3//6	3//6
3	White/Green // Green/White	1//2	1//2
4	White/Brown // Brown/White	7//8	7//8

Serial Line Cord Assembly.-- Each serial line cord assembly shall be EIA/TIA-568 Category 3 compliant. Each line cord assembly shall have 2-pairs of conductors and shall be terminated with one 110P connector on one end, and an RJ45 plug on the other end. The conductors shall be made of stranded copper and shall meet the following specifications:

DC Resistance (maximum)	28.6 per 300 m at 20° C. (nominal)
Mutual Capacitance	55 pF/m (nominal)
Characteristics Impedance	100 ±15 % from 0.256 MHz to 20 MHz

Serial Line Cords.--The serial line cords shall be EIA/TIA-568 Category 3 compliant. The serial line cords used to connect the MTCU system to the serial patch panels shall consist of 2-pairs of conductors and shall include a 110P connector on one end, and a 6-position 6-conductor modular plug on the other end. The conductors shall be made of stranded copper and shall meet the following specifications:

DC Resistance (maximum)	9.5 per 100 meter 20° C. (nominal)
Mutual Capacitance	60 pF/m (nominal)
Characteristics Impedance	100 ±15 % from 0.256 MHz to 20 MHz

One EIA-232, D-Subminiature adapter to convert a male EIA-232 25-pin, D-Subminiature connector to an 8-position, 6-conductor modular jack shall be provided with each serial line cord for connection to the MTCU's female EIA-232 25-Pin, D-Subminiature connector. The adapter shall be configure as follows:

6P6C Modular Jack	DB 25 Connector Pins
3	2
4	3
5	7
6	7

HUB DATA INSTALLATION.--The Contractor shall provide a crew with a minimum of three years of experience installing telecommunications wiring systems and computer networks to perform any work on the HUB data.

The work to be done in HUB data installation, as shown on the plans, shall consist of the following:

Serial distribution system:

1. Install SPPs.
2. Install and connect serial line cords between FDU and SPPs.
3. Install and connect serial line cords assemblies between SPPs and existing MTCU.
4. Install serial cables.
5. Install and connect serial line cables between existing MTCU and VEUs (new existing), existing AVS, existing CCP and existing UPS.

All wiring work in serial distribution systems shall be in compliant with EIA/TIA Standards.

HUB DATA INSTALLATION TESTING.-- The Contractor shall provide all of the test equipment necessary to perform all tests specified in these special provisions. All testing shall be performed in the presence of the Engineer and documented results shall be submitted to the Engineer for approval before the next phase testing is started.

As a minimum, the following equipment, or equal shall be used to test the HUB data:

- a. Telecommunications Techniques Corporation's Firebird 6000 and Wavetek's Lantek Pro XL.

Serial distribution systems: The testing on the serial distribution system shall consist of the phase one testing. All three phases of testing shall be performed on the data distribution system.

Phase one testing: Each pair in the wiring system shall be tested for continuity, polarity, open, short, split, cross twist, and reversed circuits (pairs).

Phase two testing: After the completion of phase one testing, the Contractor shall test every circuit for attenuation and near-end-crosstalk (NEXT). NEXT testing shall be inclusive of all terminations including DPPs, SPPs, patch cords and serial line cords.

Final testing: The Contractor shall perform bit error rate (BER) analysis, timing measurements, and other test associated with the physical layer (OSI layer 1) of each network link as directed by the Engineer. After the transmission impairments testing and the access node has been installed, the Contractor shall configure the customer premises equipment (CPE) to the network and perform network routing tests.

The Contractor shall verify end-to-end connectivity between two end users over a pre-defined permanent virtual circuit. Frames shall be successfully transmitted across the network before the acceptance of the final testing.

10-3.53 HUB ANALOG VIDEO

Furnishing of the video encoder unit and color CCTV monitor described below are paid for and covered elsewhere in these special provisions.

GENERAL.--Hub analog video shall consist of following components, to function as described herein and as shown on the plans:

1. One video encoder unit.
2. One color CCTV monitor .
3. One existing analog video routing switcher unit (AVS).
4. Coaxial cable assemblies as required.

COAXIAL CABLE ASSEMBLY.--Each coaxial cable assembly shall be a standard RG 59/U, 75 coaxial cable, terminated with BNC plug connectors on each end. The cable shall have stress relief PVC boots integrally molded to connector body and cable jacket. The connectors shall be bayonet-lock, two piece crimp type. The cable assembly shall meet the following specifications:

Center conductor	22 AWG solid copper.
Dielectric	solid polyethylene; O.D. = 4 mm nominal.
Shield	Bare copper 95% covered
Jacket	polyvinyl chloride PVC; O.D. =6 mm nominal.
Attenuation	6 dB/33 m at 1 MHz.
Velocity of propagation	66% nominal.
Nominal capacitance	70 pF/mt.
Connector	Nickel plated brass, polyethylene insulator, gold plated contact, tarnish and corrosion resistant.

The length of each coaxial cable assembly shall be as shown on the plans.

INSTALLATION.--The work to be done, as shown in the plans, in general, shall consist of the following:

1. Existing AVS shall remain in place.
2. Install video encoder unit.
3. Install color CCTV monitor .
4. Install and connect coaxial cable assemblies from video encoder unit (VEU) to AVS.
5. Install and connect coaxial cable assemblies from video monitors to AVS.

ACCEPTANCE TEST.--Each coaxial cable assembly shall be tested by the Contractor. Any cable found to have faults shall be replaced. The testing shall utilize a Time Domain Reflectometer (TDR).

For the purpose of these special provisions, a fault in a coaxial cable assembly is defined as any of the following:

1. A return loss measurement indicating that there is a short in the cable.
2. A return loss measurement indicating a cut or open circuit in the cable.
3. A visual inspection which reveals exposure or damage to the cable shielding.

The Contractor shall provide an NTSC signal at the inputs of the AVS and switch it to any of the outputs into a NTSC video monitor. The switching shall be done both manually or using a portable IBM or compatible computer. All tests shall be performed in the presence of the Engineer.

As a minimum, the following equipment shall be used to test the AVS:

1. One portable IBM or compatible computer.
2. One NTSC video monitor.
3. One NTSC generator.

The Contractor shall provide all of the test equipment necessary to perform all tests specified in on these special provisions.

10-3.54 COLOR CCTV MONITOR

Each CCTV monitor shall be color and fully compatible with TV standards; NTSC, PAL and SECAM. Each CCTV monitor shall meet or exceed EIA-170A. A rack-mounting bracket shall be provided to mount two monitors side by side on a 475 mm EIA standard rack.

Each CCTV monitor shall meet the following requirements:

CRT type	225 mm High Resolution (HR) Trinitron Tube, minimum visible picture size 200 mm measured diagonally, 70 degree deflection, AG pitch 0.25 mm
Resolution	Composite video: 450 TV lines measured at center.
Frequency response	6.0 MHz (-3.0dB)
Aperture Correction	-4.0dBs to +6.0dB (@3.0MHz)
Synchronization	AFC time constant 1.0 msec
Normal scan	6% overscan
Underscan	3% Underscan
Horizontal Linearity	Less than 7% (Typical)
Vertical Linearity	Less than 7% (Typical)
Convergence	Central: 0.5 mm (Typical) Corner: 0.5 mm (Typical)
Raster size stability	Horizontal: 1.0% Vertical: 1.5%
High Voltage regulation	3.0% (Cut off to High light)
Color Temperature	6500K
Operating temperature	0 to 35°C
Storage temperature	-10 to 40°C
Humidity	0 to 90%
Power Requirement	AC: 120V, 60Hz
Power Consumption	40W (Typical)
Video Inputs	Line A/Line, Line B: Composite video, Loop-through BNC connector, 1Vp-p±6dB, Sync Negative, Automatic 75-ohm Termination
Component Video input	BNC Connector Red/R-Y: Non-composite: 0.7Vp-p±6dB, Positive, 75-ohms terminated Sync on Green/Green/Y: Composite: 1Vp-p±6dB, Positive, Non-composite: 0.7Vp-p±6dB, positive, 75-ohm terminated Blue/B-Y: Non-composite: 0.7Vp-p±6dB, positive, 75-ohms terminated
External sync	Loop-through BNC Connector 4.0Vp-p±6dB,negative, Automatic 75-ohm termination
Audio Input	Line A/Line: Loop-through BNC connector, -5dBs, high impedance Line B: Loop-through Phono connector, -5dBs, high impedance RGB/Y, R-Y, B-Y: Phono Connector, -5dBs, high impedance
Speaker output	0.5W, 8 ohms, monaural
Physical	Weight: 7.5 kg maximum Dimensions: 212.5 mm(wide) x 212.5 mm(high) x 350 mm(deep)

For the purpose of payment, the color CCTV monitor shall include the monitor and testing of the color CCTV monitor before the units are to be delivered to the job site for installation.

Payment for the installation of the color CCTV monitor is included in the contract lump sum price paid for traffic operations system at the location involved.

10-3.55 UTILITY OUTPUT SERVICE INSTALLATION

GENERAL.--Each utility output service (UOS) installation shall consist of the following components, to function as described herein and as shown on the plans:

1. One UOS.
2. One substation circuit breaker.
3. Conduits, pull boxes, and power conductors.

INSTALLATION OF UOS.--The work to be done at each UOS installation, as shown on the plans, shall consist of the following:

1. Install UOS.
2. Install circuit breaker at the substation as required.
3. Install conduits, pull boxes, and power conductors from substation to the UOS at platform.
4. Secure UOS.

UOS.--Each UOS shall consist of the following components:

1. One 120/240 V primary, 120/240 V secondary single-phase transformer.
2. One enclosure.
3. One 20 A, 2P, 240 V primary circuit breaker.
4. Two 20 A, 1P, 120 V secondary circuit breaker.

UOS 2.--Each UOS 2 shall consist of the following components:

1. One 208 V primary, 120/240 V secondary, single-phase transformer.
2. One enclosure.
3. One 20 A, 2P, 240 V secondary, circuit breaker.

UOS 2 shall be installed at substation 2 (Location 8).

Transformer.--Each transformer shall be of the dry-type, and shall be rated for 2 kVA. Each transformer shall incorporate a 180°C insulation system and shall be designed not to exceed a 115°C temperature rise above 40°C ambient under full load conditions. The transformer shall be enclosed in an UL and NEMA approved steel case. The case shall have mounting brackets and the overall dimensions of the case shall not exceed 330 mm (H) x 150 mm (W) x 150 mm (D). The transformer shall incorporate an electrostatic shield for the attenuation of voltage spikes, line noise, and transients. The transformer must be warranted against defects in materials, workmanship and performance for 10 years from date of manufacture and shall be UL and NEMA-approved. The transformer shall have a visible nameplate with the transformer's rating and wiring diagram mounted on the case.

Enclosure.--Each enclosure shall be an outdoor, heavy-gauge galvanized steel, and NEMA 3R rated. The enclosure shall house the transformer and circuit breakers. The enclosure shall have overall dimensions of 500 mm (H) x 500 mm (W) x 200 mm (D). The enclosure shall include brackets and all hardware for mounting on the platform rail. The enclosure shall be provided with knockout holes for conduit runs as shown on the plans. The enclosure shall have a 16 gauge galvanized steel, continuous hinge with stainless steel pin. The enclosure shall include a steel back panel and all hardware for mounting the transformer and circuit breakers.

Circuit Breakers.--Each circuit breaker shall be an UL-approved, thermal magnetic, common trip, molded case type. Each circuit breaker shall have an interrupting current rating equal to the available short circuit current at its line terminals. Each circuit breaker shall come with all hardware for mounting to the inside back panel of the enclosure.

30 kVA Transformer.--Each 30 kVA transformer, as shown on plans, shall be of the industrial computer-grade and commercial heavy-duty outdoor type. Each 30 kVA transformer shall be totally enclosed, non-ventilated and UL listed. Power rating shall be 30 kVA with single phase 480 V/120 V.

10-3.56 TRAFFIC OPERATIONS SYSTEM EQUIPMENT TESTING

Prior to shipping to the project, the Contractor shall submit the following items to the State of California, Department of Transportation Laboratory, 5900 Folsom Blvd., Sacramento, CA 95819 for acceptance testing:

1. Camera unit
2. Pan and tilt unit
3. Camera control unit (CCU)
4. Video encoder unit (VEU)
5. Analog data station termination (ADST) unit
6. Integrated services digital network terminal adapter (ISDN TA)
7. Extinguishable Message Sign Panels

Approximately 30 days will be required for the testing. The Contractor will be notified upon completion of the testing and shall arrange for delivery of the equipment to a storage location designated by the Contractor. The costs of such testing and the transportation to and from the Laboratory shall be borne by the Contractor.

10-3.57 REMOVING, REINSTALLING OR SALVAGING ELECTRICAL EQUIPMENT

Salvaged electrical materials shall be hauled to Caltrans Electrical Maintenance Station, 30 Rickard Street, San Francisco, CA 94134, Telephone: (415) 330-6509 and stockpiled.

The Contractor shall provide the equipment, as necessary, to safely unload and stockpile the material. A minimum of 2 working days' notice shall be given prior to delivery.

10-3.58 PAYMENT

The contract lump sum price paid for traffic operations system at Locations 1 through 30 shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in installing traffic operations system at said locations, complete in place, including modifications of any existing electrical system, in connection with new TOS equipment except any other bid items listed in this section, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

No fiber optic communications system or SCADA communication cable equipment shall be included in the contract lump sum prices paid for TOS location 6 through location 22.

The contract lump sum price paid for each of the following contract items shall include full compensation for furnishing all labor, materials (except items covered by other bid items), tools, equipment, and incidentals and for doing all the work involved in installing each item, complete in place, including documentation, testing and training, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer:

1. Fiber optic communications system and SCADA communications cable testing
2. Steel bridge communication system
3. Concrete trestle communication system
4. Toll Plaza communications system
5. HUB data
6. HUB analog video

The contract unit price paid for each of the following contract items shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, including testing of the equipment, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer:

1. Analog data station termination unit
2. Camera unit
3. Pan and tilt unit
4. Camera control unit
5. Video encoder unit
6. Integrated services digital network terminal adapter unit
7. Color closed circuit television monitor
8. Fiber optic transmitter
9. Fiber optic receiver
10. Microwave vehicular detection sensor
11. Cluster controller

Full compensation for hauling and stockpiling electrical materials shall be considered as included in the contract price paid for the item requiring the material to be salvaged, and no additional compensation will be allowed therefor.

Full compensation for equipment seismic anchoring shall be considered as included in the contract price paid for the item requiring the material to be installed and no additional compensation will be allowed therefor.

Full compensation for the innerduct, the installation of innerduct and the conduit for fiber optic, SCADA cable and innerduct shall be considered as included in the contract lump sum prices paid for traffic operations system at Locations 6 through 22 and no additional compensation will be allowed therefor.